Luminant

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

July 28, 2022

Illinois Environmental Protection Agency
DWPC – Permits MC #15
Attn: Part 845 Coal Combustion Residual Rule Submittal
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Re: Newton Power Plant Primary Ash Pond; IEPA ID # W0798070001-01

Dear Mr. LeCrone:

In accordance with 35 I.A.C. § 845.200, Illinois Power Generating Company (IPGC) is submitting a construction permit application for the Newton Power Plant Primary Ash Pond (IEPA ID # W0798070001-01). One hardcopy is provided with this submittal.

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

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: W0798070001 CCR Permit Number: Initial Permit Facility Name: Newton Power Plant	For IEPA Use Only

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

Facility, Operator, and Owner Information

1.1	Facility Name		
	Illinois Power Generating Company - Newton Power Plant		
1.2	Illinois EPA CCR Permit Number (if applicable)		
	Initial Permit		
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 6725 North 500th Street		
	County name Jasper	County code (if known)	
	City or town Newton	State IL	Zip Code 62448
1.6	Name of Owner/Operator		
	Illinois Power Generating Company		

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.		
		W0798070001-01 (see Attachment A)	☑	Attached written description
			☐	Attached written description
			☐	Attached written description
			☐	Attached written description
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			☐	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	7-18-2022

Form 2CC

Illinois Environmental Protection Agency
CCR Surface Impoundment Permit Application
Form CCR 2CC – Closure Construction

Bureau of Water ID Number: W0798070001 **CCR Permit Number:** N/A **Facility Name:** Newton 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.
	Primary 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 and C
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.
	Attachment D

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.

Illinois Power Generating Company

Primary Ash Pond CONSTRUCTION PERMIT APPLICATION

July 2022

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ATTACHMENTS

Attachment A	Legal Description (845.210(c))
Attachment B	Groundwater Information
Attachment C	History of Construction Report (845.220(a)(1))
Attachment D	Types of CCR and Chemical Constituents (845.220(a)(2)(A))
Attachment E	Site Location Maps (845.220(a)(3))
Attachment F	Site Plan Map and On-Site Transportation Plan ((845.220(a)(4) and 845.220(a)(2)(E))
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))
Attachment H	Public Notification and Public Meeting Certification (845.220(a)(9))
Attachment I	Closure Prioritization Category Letter (845.220(d)(1))
Attachment J	Post-Closure Care Plan (845.220(d)(5))
Attachment K	Contractor Training Certification (45 ILCS 5/22.59(b)(4))

1. INTRODUCTION

Illinois Power Generating Company (IPGC) is the owner of the coal-fired Newton Power Plant (NPP), also referred to as Newton Power Station, in Jasper County, Illinois. The NPP will be active until 2027, after which electricity production and coal combustion residual (CCR) production will cease and the NPP will become inactive. According to the Illinois Environmental Protection Agency (IEPA), this power station has one CCR surface impoundment, the Primary Ash Pond, initially constructed in 1977. This construction permit application is for closure of the Primary Ash Pond (PAP).

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. 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.

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 PAP was operating as of October 19, 2015 and the PAP was actively receiving CCR at that time. The PAP was therefore initially regulated by 40 C.F.R. Part 257, herein referred to as the CCR Rule [1] and subsequently regulated by Part 845. Multiple previous initial and periodic assessments, investigation plans, and programs were completed for the PAP 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 PAP in **Attachment B**.

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

No post-closure care plan for the PAP was previously approved by the Agency.

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 PAP is provided in **Attachment C**.

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 PAP and analysis of the chemical constituents found within the CCR in the PAP are 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 PAP currently contains approximately 5,000,000 cubic yards (CY) of CCR. Additional CCR will be generated at the NPP between now and the time of closure. Approximately 700,000 CY (950,000 tons) of additional waste material (ash, coal pile residuals, grading soils) that is currently existing at, and was previously generated by, the NPP will be placed in the PAP during closure (see **Section 2.4**), resulting in a maximum CCR capacity of approximately 5,700,000 CY.

<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;

CCR is entering the PAP at a rate of approximately the following rates, per the 2020 Alternative Closure Demonstration:

Bottom Ash Sluice	2.3-MGD
Dry Fly Ash	~27,500-tons/yr
Fly Ash Vacuum	1.4-MGD
Fly Ash Sluice	Discontinued

<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 NPP will cease operation in September of 2027, and the PAP will cease receiving waste at that time.

<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.

The PAP is an active impoundment, currently receiving large waste streams via sluicing. The PAP has established site access roads for operations and management of solids. Existing site access roads will be used as necessary to support closure construction for the PAP. An On-Site Transportation Plan was developed as required by Section 845.220(a)(2)(E) and is provided for the PAP in **Attachment F** 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].

Site Location Maps showing the information required in Section 845.220(a)(3) are provided for the PAP in **Attachments E and F**. The Site Location Maps consist of the most recent USGS quadrangle map (2021) which contains the PAP and 1,000 meters of the surrounding area.

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 [2] for natural and protected areas within 1,000 meters of the PAP. Within Jasper County, a total of 5 sites were identified from the Illinois Natural Areas Inventory and 9 were identified from the Illinois Nature Preserves list. None of the natural areas of preserves fall within 1,000 meters of the PAP.

The IDNR natural heritage database also includes a list of Endangered Species by County [3] and notes that a total of 25 threatened and endangered species are located within Jasper County, including 18 endangered and 7 threatened species. A review of the U.S. Fish and Wildlife Service (USFWS) Threatened & Endangered Species Active Critical Habitat Report [4] identifies no critical habitat located within 1,000 meters of the PAP.

A search of the IDNR Historic and Architectural Resources Geographic Information System (HARGIS) database [5] 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 [6], dated January 17, 1985. Portions of the NPP site are within the historic 100-year flood plain of Newton Lake. The PAP appears to be within the historic floodplain, but the perimeter berms constructed with the pond construction in 1977 altered the limits of the floodplain. It appears the map did not include the PAP in 1985 and has not been updated since that time.

<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 PAP in **Attachment F**. See the drawings in **Attachment G** for more detailed information.

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 PAP will include closing the PAP by leaving CCR in-place and covering it with a final cover system. The PAP is an unlined CCR surface impoundment. There is not an engineered bottom liner system, rather, the underlying materials are primarily characterized as sandy or silty clays and clayey or silty sands, with a perimeter berm constructed of primarily clays.

Closure with a final cover system will include unwatering the PAP by removing impounded water, removing existing outfall structures, regrading existing CCR within the PAP, and constructing a final cover system including a geomembrane, geotextile, cover soil, topsoil, and vegetation. A post-closure stormwater management system including channels and riprap-lined downchutes will direct non-contact stormwater to the newly constructed stormwater pond.

A CCR volume increase of approximately 700,000 cubic yards (CY) will occur as part of consolidating material to the north at the time of closure. Closure will include excavating the estimated 1,917,700 CY of waste material on the south side of the PAP and coal pile residuals and placing it in the north side of the PAP as consolidated fill. No changes in waste streams are expected to occur.

All areas affected by releases of CCR from the CCR surface impoundment will be decontaminated in accordance with 845.740(a). All structures and conveyances used to manage CCR will be placed beneath the final cover system of the PAP, decontaminated, or removed and sent to a licensed landfill.

If the proposed closure-in-place system is approved, a new photovoltaic (PV) solar power facility will be installed on top of the closed ash pond as part of the closure effort. This facility is proposed to be installed in phases to take advantage of areas as they are closed. A total installed capacity of 106.4 megawatts DC and rated capacity of 81.9 megawatts AC is proposed with the closure-in-place project, with interconnection of the solar facility occurring at the existing Newton Power Plant substation.

Additional information on the proposed construction and modification to the PAP is included within the Closure Plan provided in **Attachment G**.

2.5. Plans and Specifications

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

Permit-level design plans are included within the Closure Plan provided for the PAP 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

<u>Section 845.220(a)(7):</u> 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.

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

Hydrogeologic site investigations for the PAP are provided in **Attachment B**.

<u>Section 845.220(a)(7)(B):</u> 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**.

<u>Section 845.220(a)(7)(C):</u> 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

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

I, Mark Roberts, 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.

Printed Name: Mark Roberts, P.E.

7/28/2022

Signature *Date*

Registration Number: 062062011
Expiration Date: 11.30.2023

Seal applies to application and appendices prepared by HDR. This report relies upon data, analyses, and reports prepared by others.

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 as **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 IEPA on May 19, 2021. The PAP was designated as Category 5 CCR surface impoundment. 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**.

Section 845.220(d)(4): Proposed schedule to complete closure; and

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

Section 845.220(d)(5): 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 IPGC will utilize contractors, subcontractors, and installers who are participants in an approved training program, in accordance with 415 Illinois Compiled Statutes (ILCS) 5/22.59(b)(4), is provided in **Attachment K**.

4. REFERENCES

[1] 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.

[2] Illinois Department of Natural Resources, "IDNR Natural Heritage Database," [Online]. Available: https://www2.illinois.gov/sites/naturalheritage/DataResearch/Documents/INAICountyList_mar2022.pdf. [Accessed 31 March 2022].

[3] Illinois Department of Natural Resources, "Illinois Threatened and Endangered Species by County," March 2022. [Online]. Available: https://www2.illinois.gov/sites/naturalheritage/DataResearch/Documents/ETCountyList_mar2022.pdf. [Accessed 31 March 2022].

[4] U.S. Fish & Wildlife Service, "USFWS Threatened & Endangered Species Active Critical Habitat Report," [Online]. Available: https://fws.maps.arcgis.com/home/webmap/viewer.html?webmap=9d8de5e265ad4fe09893cf75b8dbfb77. [Accessed 31 March 2022].

[5] Illinois Department of Natural Resources, "IDNR Historic Preservation Division HARGIS," [Online]. Available: https://www2.illinois.gov/dnrhistoric/Preserve/Pages/HARGIS.aspx. [Accessed 31 March 2022].

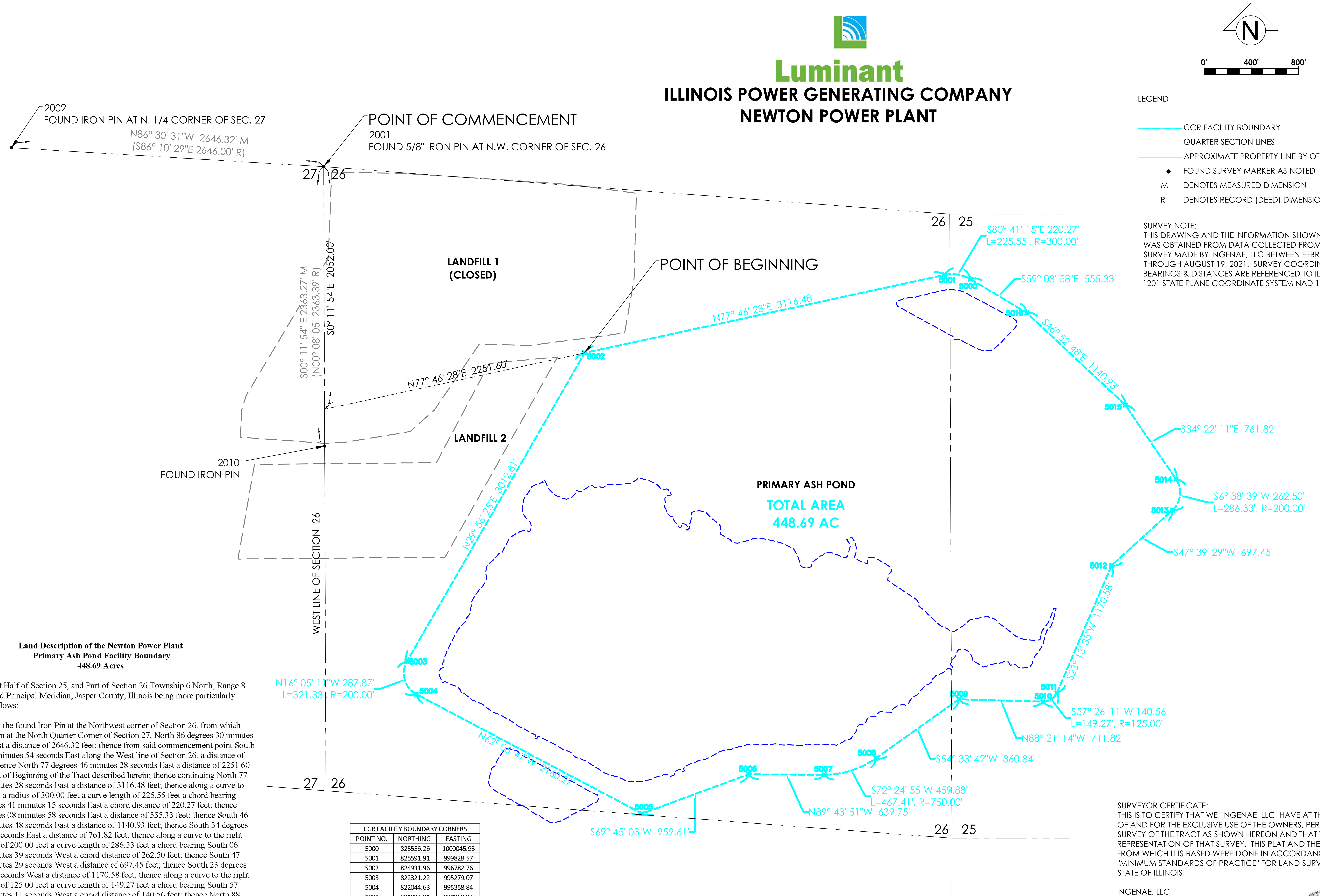
[6] Federal Emergency Management Agency, "FEMA Flood Map Service Center: Welcome!," [Online]. Available: https://msc.fema.gov/portal/home. [Accessed 31 March 2022

Attachment A

Legal Description

Luminant

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT



LEGEND

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

SURVEY NOTE:
THIS DRAWING AND THE INFORMATION SHOWN HERE ON WAS OBTAINED FROM DATA COLLECTED FROM A FIELD SURVEY MADE BY INGENAE, LLC BETWEEN FEBRUARY 12 THROUGH AUGUST 19, 2021. SURVEY COORDINATES, BEARINGS & DISTANCES ARE REFERENCED TO ILLINOIS EAST 1201 STATE PLANE COORDINATE SYSTEM NAD 1983.

Land Description of the Newton Power Plant
Primary Ash Pond Facility Boundary
448.69 Acres

Part of the West Half of Section 25, and Part of Section 26 Township 6 North, Range 8 East of the Third Principal Meridian, Jasper County, Illinois being more particularly described as follows:

Commencing at the found Iron Pin at the Northwest corner of Section 26, from which bears an Iron Pin at the North Quarter Corner of Section 27, North 86 degrees 30 minutes 31 seconds West a distance of 2646.32 feet; thence from said commencement point South 00 degrees 11 minutes 54 seconds East along the West line of Section 26, a distance of 2052.00 feet; thence North 77 degrees 46 minutes 28 seconds East a distance of 2251.60 feet to the Point of Beginning of the Tract described herein; thence continuing North 77 degrees 46 minutes 28 seconds East a distance of 3116.48 feet; thence along a curve to the right having a radius of 300.00 feet a curve length of 225.55 feet a chord bearing South 80 degrees 41 minutes 15 seconds East a chord distance of 220.27 feet; thence South 59 degrees 08 minutes 58 seconds East a distance of 555.33 feet; thence South 46 degrees 52 minutes 48 seconds East a distance of 1140.93 feet; thence South 34 degrees 22 minutes 11 seconds East a distance of 761.82 feet; thence along a curve to the right having a radius of 200.00 feet a curve length of 286.33 feet a chord bearing South 06 degrees 38 minutes 39 seconds West a chord distance of 262.50 feet; thence South 47 degrees 39 minutes 29 seconds West a distance of 697.45 feet; thence South 23 degrees 13 minutes 35 seconds West a distance of 1170.58 feet; thence along a curve to the right having a radius of 125.00 feet a curve length of 149.27 feet a chord bearing South 57 degrees 26 minutes 11 seconds West a chord distance of 140.56 feet; thence North 88 degrees 21 minutes 14 seconds West a distance of 711.82 feet; thence South 54 degrees 33 minutes 42 seconds West a distance of 860.84 feet; thence along a curve to the right having a radius of 750.00 feet a curve length of 467.41 feet a chord bearing South 72 degrees 24 minutes 55 seconds West a chord distance of 459.88 feet; thence North 89 degrees 43 minutes 51 seconds West a distance of 639.75 feet; thence South 69 degrees 45 minutes 03 seconds West a distance of 959.61 feet; thence North 62 degrees 06 minutes 47 seconds West a distance of 2160.27 feet; thence along a curve to the right having a radius of 200.00 feet a curve length of 321.33 feet a chord bearing North 16 degrees 05 minutes 11 seconds West a chord distance of 287.87 feet; thence North 29 degrees 56 minutes 25 seconds East a distance of 3012.81 feet to the Point of Beginning and containing 448.69 Acres.

CCR FACILITY BOUNDARY CORNERS		
POINT NO.	NORTHING	EASTING
5000	825556.26	1000045.93
5001	825591.91	999828.57
5002	824931.96	996782.76
5003	822321.22	995279.07
5004	822044.63	995358.84
5005	821034.21	997268.24
5006	821366.33	998168.55
5007	821363.33	998808.29
5008	821502.27	999246.68
5009	822001.40	999948.04
5010	821980.96	1000659.57
5011	822056.61	1000778.03
5012	823132.32	1001239.67
5013	823602.09	1001755.18
5014	823862.82	1001785.55
5015	824491.64	1001355.48
5016	825271.49	1000522.69

CONTROL MONUMENTATION				
POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
2001	826507.15	994575.12	539.73	FOUND IRON PIN - N. 1/4 CORNER SEC. 27
2002	826668.31	991933.71	538.32	FOUND 5/8" IRON PIN - N.W. CORNER OF SEC. 26
2010	824143.94	994583.30	-	FOUND IRON PIN

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

[signature]

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

DATE

[Seal: STATE OF ILLINOIS, MICHAEL J. GRAMINSKI, 035-002901, PROFESSIONAL LAND SURVEYOR] Sept 20, 2021

IngenAE
502 Earth City Plaza, Suite 120
Earth City, MO 63045
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Submissions / Revisions:	Date:
1	
2	
3	
4	
5	
6	
7	
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10	
11	
12	
13	

Luminant

Project Name & Location:

NEWTON
POWER PLANT
6725 NORTH 500TH STREET
NEWTON, IL 62248

Drawing Name:
CCR FACILITY BOUNDARY EXHIBIT

Date: 09/09/2021
Project No.
Type: SITE
Drawing No. 1
Drawn By: CB
Approved By: MG
Scale: AS NOTED

Luminant

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT

LEGEND

- CCR FACILITY BOUNDARY
- QUARTER SECTION LINES
- APPROXIMATE PROPERTY LINE BY OTHERS
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IngenAE
502 Earth City Plaza, Suite 120
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Submissions / Revisions:	Date:
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Project Name & Location:

NEWTON
POWER PLANT
6725 NORTH 500TH STREET
NEWTON, IL 62248

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Drawing Name:
AERIAL PHOTOGRAPHY

Date: 09/09/2021	Project No.
Type: SITE	Drawing No. 2
Drawn By: CB	
Approved By: MG	
Scale: AS NOTED	

Attachment B

Groundwater Information

Intended for
Illinois Power Generating Company

Date
October 25, 2021

Project No.
1940100806-008

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL Bright ideas. Sustainable change.

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT PRIMARY ASH POND

Project Name	**Newton Power Plant Primary Ash Pond**
Project No.	**1940100806-008**
Recipient	**Illinois Power Generating Company**
Document Type	**Hydrogeologic Site Characterization Report**
Revision	**FINAL**
Date	**October 25, 2021**

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TABLES (WITHIN TEXT)

TABLES (ATTACHED)

FIGURES

APPENDICES

ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
§	Section
35 I.A.C.	Title 35 of the Illinois Administrative Code
40 C.F.R.	Title 40 of the Code of Federal Regulations
CCR	coal combustion residuals
cm/s	centimeters per second
CSM	conceptual site model
bgs	below ground surface
ESRI	Environmental Systems Research Institute
ft/day	feet/day
ft/ft	feet per feet
ft/mi	feet per mile
g	horizontal acceleration
GMP	Groundwater Monitoring Plan
GWPS	Groundwater Protection Standard
HCR	Hydrogeologic Site Characterization Report
HMP	Hydrogeologic Monitoring Plan
HUC	Hydraulic Unit Code
ID	identification
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
ILWATER	ISGS Illinois Water and Related Wells
IPGC	Illinois Power Generating Company
ISGS	Illinois State Geological Survey
ISWS	Illinois State Water Survey
LCU	Lower Confining Unit
LF 1	Phase 1 Landfill
LF 2	Phase 2 Landfill
LVW	Low Volume Wastewater
mg/L	milligrams per liter
NAVD88	North American Vertical Datum of 1988
NID	National Inventory of Dams
No.	number
NPDES	National Pollutant Discharge Elimination System

NPP	Newton Power Plant
NRT	Natural Resource Technology, Inc.
OBG	O’Brien and Gere Engineers, Inc.
PAP	Primary Ash Pond
Part 845	Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845
pcf	pounds per cubic foot
pCi/L	picocuries per liter
PMP	Potential Migration Pathway
PWS	Public Water Supply
Ramboll	Ramboll Americas Engineering Solutions, Inc.
Rapps	Rapps Engineering and Applied Science
RCRA	Resource Conservation and Recovery Act of 1976
SI	surface impoundment
Site	Primary Ash Pond
SSURGO	Soil Survey Geographic
SU	standard units
TDS	total dissolved solids
UCU	upper confining unit
UD	upper drift
USEPA	United States Environmental Protection Agency
USCS	Unified Soil Classification System
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

EXECUTIVE SUMMARY

This Hydrogeologic Site Characterization Report (HCR) for the Primary Ash Pond (PAP) at Newton Power Plant (NPP) expands upon the hydrogeology, groundwater quality data, and conceptual site model (CSM) presented in previous hydrogeologic investigation reports prepared for the PAP. This report has been assembled to satisfy the information and analysis requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) Section (§) 845.620 as summarized in **Table ES-1**. The CSM includes hydrogeologic and groundwater quality data specific to the PAP, which has been collected between 2015 and 2021. The PAP (Vistra identification [ID] number [No.] 501, Illinois Environmental Protection Agency [IEPA] ID No. W0798070001-01, and National Inventory of Dams [NID] No. IL50719) is located at the NPP which is located in Newton, Illinois (**Figure 1-1**).

The PAP is located south of the power plant and situated in a predominantly agricultural area. The PAP is surrounded by Newton Lake on the west, south, and east. Beyond the lake is additional agricultural land. Three coal combustion residuals (CCR) units are present on the NPP property, including the PAP and two landfills: the Phase 1 Landfill (LF 1) is located northwest and west of the PAP, and the Phase 2 Landfill (LF 2) is located west of the PAP. The PAP is located in Section 26 and the western half of Section 25, Township 6 North, Range 8 East.

In addition to the CCR present in the PAP, there are six layers of unlithified material present above the bedrock, these materials were categorized into four hydrostratigraphic units in this report, presented below in descending order:

- **Upper Drift (UD)/Potential Migration Pathway (PMP):** The UD is composed of the low permeability silts and clays of the Peoria Silt and Sangamon Soil and the sandier soils of the Hagarstown Member (*i.e.,* PMP).
  - **Hagarstown Member/PMP:** The Hagarstown Member consists of discontinuous sandier deposits of the UD, where present, and overlies the Vandalia Till.
- **Upper Confining Unit (UCU):** This unit consists of the low permeability clay and silt of the Vandalia Till.
- **Uppermost Aquifer:** This unit is composed of the Mulberry Grove Formation, which onsite has been classified as poorly graded sand, silty sand, clayey sand, and gravel.
- **Lower Confining Unit (LCU):** This unit is comprised of low permeability silt and clay of the Smithboro Till (Smithboro Till) and the Banner Formation.

Groundwater migrates downward through the UD and UCU into the uppermost aquifer. Groundwater in the uppermost aquifer flows from north to south/southwest and converges near a former drainage feature located west of the PAP. Groundwater elevations vary seasonally, although generally less than one foot per year. The surface water elevation at Newton Lake (at location SG02) measured between February 15 and March 9, 2021 ranged from 504.42 to 504.84 feet North American Vertical Datum of 1988 (NAVD88). Groundwater elevations in the uppermost aquifer at downgradient wells were observed around 491 feet NAVD88 (approximately 15 feet lower than the Lake elevation). The separation between measured groundwater elevations and Lake elevations (and observed downward vertical gradients) indicates groundwater does not flow into Newton Lake from the uppermost aquifer.

Part 845 parameters were monitored in uppermost aquifer and PMP monitoring wells as part of groundwater quality evaluations performed between 2015 and present. These data were supplemented with installation and sampling of additional locations in 2021. The results indicate that the following parameters were detected at concentrations greater than the applicable 35 I.A.C. § 845.600 groundwater protection standards (GWPSs) and are considered potential exceedances:

- Arsenic at six uppermost aquifer wells, including downgradient wells APW08, APW09, APW15, and APW16 and background wells APW05 and APW06.
- Chloride at upgradient UD well APW05S and downgradient uppermost aquifer well APW15.
- Cobalt at PMP well APW12.
- Fluoride at downgradient uppermost aquifer well APW15 and APW18.
- Lead at downgradient uppermost aquifer wells APW08, APW11, and APW18.
- Lithium at three PMP wells APW02, APW04, and APW12; one upgradient UD well APW05S; and two downgradient uppermost aquifer wells APW13 and APW14.
- pH values below the lower range of the GWPS were observed at four PMP wells APW02, APW03, APW04, APW12; one background UA well APW06; and two downgradient uppermost aquifer wells APW11 and APW13.
- Radium 226 and 228 combined at downgradient uppermost aquifer well APW16.
- Sulfate at three PMP wells APW02, APW04, and APW12; one upgradient UD well APW05S; and one downgradient uppermost aquifer well APW10
- Thallium at one background well APW06, and two downgradient uppermost aquifer wells APW11 and APW18.
- Total dissolved solids (TDS) at four PMP wells APW02, APW03, APW04, and APW12; and one upgradient UD well APW05S.

Concentration results for the above parameters were compared directly to 35 I.A.C. § 845.600 GWPS to determine potential exceedances. Potential exceedances include results reported during the background groundwater monitoring or prior period that are greater than the GWPS. The results are considered potential exceedances because the results were compared directly to the standard and did not include an evaluation of background groundwater quality and the statistical methodologies proposed in the groundwater monitoring plan (GMP) provided in the Operating Permit application. Exceedances will be determined following IEPA approval of the GMP.

TABLE ES-1. PART 845 REQUIREMENTS CHECKLIST

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

NEWTON POWER PLANT

PRIMARY ASH POND

NEWTON, ILLINOIS

Part 845 Reference	Part 845 Components	Location of Information in HCR
845.620(b)	**The hydrogeologic site characterization shall include but not be limited to the following:**	--
845.620(b)(1)	Geologic well logs/boring logs;	Table 3-1 Figure 3-1 Appendix C
845.620(b)(2)	Climatic aspects of the site, including seasonal and temporal fluctuations in groundwater flow;	Sections 3.2.4 & 3.3.1 Figures 3-3 to 3-4
845.620(b)(3)	Identification of nearby surface water bodies and drinking water intakes;	Sections 3.3.2 & 5.2 Appendix B
845.620(b)(4)	Identification of nearby pumping wells and associated uses of the groundwater;	Section 5.1 Appendix B
845.620(b)(5)	Identification of nearby dedicated nature preserves;	Section 5.3 Appendix B
845.620(b)(6)	Geologic setting;	Section 2 Figures 2-1 to 2-5
845.620(b)(7)	Structural characteristics;	Section 2.4.3 Figure 2-4
845.620(b)(8)	Geologic cross-sections;	Figures 2-6 through 2-8
845.620(b)(9)	Soil characteristics;	Section 2.3 Figure 2-2 Tables 2-1 & 2-4

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TABLE ES-1. PART 845 REQUIREMENTS CHECKLIST
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Part 845 Reference	Part 845 Components	Location of Information in HCR
845.620(b)(10)	Identification of confining layers;	Section 3.2.1
845.620(b)(11)	Identification of potential migration pathways;	Section 3.2.1
845.620(b)(12)	Groundwater quality data;	Section 4.2 Table 4-1
845.620(b)(13)	Vertical and horizontal extent of the geologic layers to a minimum depth of 100 feet below land surface, including lithology and stratigraphy;	Section 2.5 Figures 2-6 to 2-8
845.620(b)(14)	A map displaying any known underground mines beneath a CCR surface impoundment;	Section 2.4.5 Appendix B
845.620(b)(15)	Chemical and physical properties of the geologic layers to a minimum depth of 100 feet below land surface;	Section 2.5 Tables 2-1, 2-2, & 2-4 Appendix E
845.620(b)(16)	Hydraulic characteristics of the geologic layers identified as migration pathways and geologic layers that limit migration, including:	Sections 3.2.4.1, 3.2.5, & 3.2.6 Tables 3-2 to 3-4 Appendix F
845.620(b)(16)(A)	water table depth;	Section 3.2.4 Figures 3-3 & 3-4
845.620(b)(16)(B)	hydraulic conductivities;	Section 3.2.5 Table 3-3 Appendix F

TABLE ES-1. PART 845 REQUIREMENTS CHECKLIST
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Part 845 Reference	Part 845 Components	Location of Information in HCR
845.620(b)(16)(C)	effective and total porosities;	Section 2.5 Table 2-1
845.620(b)(16)(D)	direction and velocity of groundwater flow; and	Sections 3.2.4 & 3.2.6 Tables 3-2 & 3-4 Figures 3-3 & 3-4
845.620(b)(16)(E)	map of the potentiometric surface;	Figures 3-3 & 3-4
845.620(b)(17)	Groundwater classification pursuant to 35 I.A.C. § 620	Section 3.2.7

[O: EDP 08/23/21, U: SSW 9/1/21, C: LDC 09/21/21]

Notes:
35 I.A.C. § 620 = Title 35 of the Illinois Administrative Code, Part 620
HCR = Hydrogeologic Characterization Report
-- = reference to main regulation

1. INTRODUCTION

1.1 Overview

In accordance with requirements of the Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (SIs): 35 I.A.C. § 845 (Part 845) (IEPA, April 15, 2021), Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this HCR on behalf of NPP (**Figure 1-1**), operated by Illinois Power Generating Company (IPGC). This report will apply specifically to the CCR Unit referred to as the PAP. However, information gathered to evaluate other CCR units at the NPP regarding geology, hydrogeology, and groundwater quality is included, where appropriate. The PAP is a 404-acre unlined CCR SI used to manage stormwater runoff, bottom ash, fly ash, low-volume wastewater (LVW) from the plant's two coal-fired boilers. The PAP discharges into the Secondary Pond, which is used to clarify process water prior to discharge in accordance with the plants National Pollutant Discharge Elimination System (NPDES) permit (No. IL0049191) at the NPP. This HCR includes Part 845 content requirements specific to 35 I.A.C. § 845.620(b) (Hydrogeologic Site Characterization) for the PAP at NPP.

1.2 Part 845 Description

CCR is commonly referred to as coal ash, and CCR SIs are commonly referred to as coal ash ponds. Part 845 contains comprehensive rules for the design, construction, operation, corrective action, closure, and post closure care of these SIs. This rule includes GWPSs applicable at the waste boundary at each CCR SI 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, IEPA's rule includes 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 which identifies the specific requirements of 35 I.A.C. § 845.620 is included in **Table ES-1**. The table provides references to sections, tables, and figures included in this document to locate the information that meets specific requirements of 35 I.A.C. § 845.620.

1.3 Previous Investigations and Reports

Numerous hydrogeologic investigations have been performed concerning the CCR Units located at the NPP. The information presented in this HCR includes comprehensive data collection and evaluations from prior hydrogeologic investigation reports (most recent to oldest), including, but not limited to, the following:

- ***Hanson, 2019, Phase 1 Ash Landfill Annual Report, Newton Power Station, Jasper County, Illinois.*** An annual report to provide groundwater and leachate monitoring results for 2019 and proposed activities for 2020, pursuant to 35 I.A.C. § 813.504 and Permit Condition III. Report includes monitoring data, graphical results, and a summary of modifications or changes to the monitoring program.
- ***O'Brien & Gere Engineers, Inc. (OBG), 2017, Hydrogeologic Monitoring Plan, Newton Power Station, Canton, Illinois.*** Although the title refers to Canton, Illinois, the subject of the report is the NPP. The Hydrogeologic Monitoring Plan (HMP) was prepared to provide background information necessary to support the monitoring well network established for development of the Sampling and Analysis Plan requirements of the USEPA Final Rule to

regulate the disposal of CCR as solid waste under Subtitle D of the Resource Conservation and Recovery Act of 1976 (RCRA) for the NPP. The HMP provides site geology and hydrogeology, aquifer properties, and monitoring network placement and rationale.

- ***AECOM, 2016, History of Construction, Newton Power Station, Newton, Illinois.*** This is a construction history compiled to fulfill Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.73(c)(1), which requires that the owner/operator of an existing CCR SI 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, compile a history of construction that contains, to the extent feasible, the information specified in 40 C.F.R. § 257.73(c)(1)(i) through (xii). The history of construction was based on existing documentation; AECOM's document review included record drawings, geotechnical investigations, etc., for the PAP.
- ***Natural Resource Technology, Inc. (NRT), April 10, 2013, Hydrogeological Assessment Report, Revision 1, Newton Energy Center, Jasper County, Illinois.*** In 2009, Ameren (the former owner/operator) commissioned a hydrogeologic study, water well survey, development of a GMP, and an initial groundwater quality assessment. This report summarizes hydrogeologic information pertinent to the Site, evaluates groundwater quality data to determine if groundwater has been affected adversely, and determines the potential for off-site migration and for potential groundwater receptors in the event of such a migration.
- ***Geotechnology, Inc., February 8, 2011, Initiation of Monitoring Report, Ameren, Newton Power Station, Newton, Illinois.*** This report documents the results of the monitoring well installation and groundwater monitoring activities performed at the Site. Three wells were installed, developed, and sampled.
- ***Rapps Engineering and Applied Science (Rapps), November 2009, Site Characterization and Groundwater Monitoring Plan for CCP Impoundment, Ameren Energy Generating Company, Newton Power Station, Jasper County, Illinois.*** Hydrogeologic study and GMP to assess the potential for constituent migration from this impoundment. Includes an assessment of subsurface hydrogeologic conditions at the Site, identification of private, potable water wells and oil and gas wells within 2,500 feet of the facility, public water supply (PWS) wells within 10 miles of the facility, and plans for a groundwater monitoring well network designed to characterize and monitor groundwater quality.
- ***Rapps, 1997, Hydrogeologic Investigation and Groundwater Monitoring Program, Newton Power Station, Jasper County, Illinois.*** Investigation presents site-specific data obtained through the completion of approximately 40 borings, 20 monitoring wells, and review of regional information and an evaluation of subsurface data from nearby residential wells. Part of Application for Landfill Permit.

A GMP is being prepared for the PAP in conjunction with this report and is included in the Operating Permit to which this Report is attached.

1.4 Site Location and Background

The NPP is located in Jasper County in the southeastern part of central Illinois, approximately seven miles southwest of the town of Newton (**Figure 1-1**). The PAP is located in Section 26 and the western half of Section 25, Township 6 North, Range 8 East. The PAP is located south of the power plant and situated in a predominantly agricultural area. The PAP is surrounded by Newton Lake on the west, south, and east. Beyond the lake is additional agricultural land. LF 1 is located northwest and west of the PAP, and LF 2 is located west of the PAP (**Figure 1-2**). The PAP is the subject of this report and will hereafter be referred to as the Site in this document.

1.5 Site History and Unit Description

The PAP was constructed in 1977 and has a design capacity of approximately 9,715 acre-feet. There is also a non-CCR 83.6 acre-feet Secondary Pond located immediately south of the PAP. The PAP has a surface area of 404 acres and the Secondary Pond has an area of 9.3 acres. The PAP currently receives bottom ash, fly ash, and LVW from the plant's two coal-fired boilers. The SI is operated per NPDES Permit No. IL0049191, Outfall 001 (located at the Secondary Pond). Areas within the impoundment were excavated during construction for native materials used to build the containment berms. In 2014, three areas along the interior berm were re-graded and covered with riprap (AECOM, 2016).

2. REGIONAL AND LOCAL GEOLOGY

2.1 Topography

The embankments surrounding the PAP are at an elevation of approximately 550 feet NAVD88 (**Figure 2-1**) with the surrounding areas, Newton Lake, generally at an elevation of around 504 to 505 feet NAVD88. Topographic maps drawn prior to construction indicate the area of the PAP was generally between 500 and 550 feet NAVD88, except for the drainage features in the south-central portion of the PAP. The contours in the area of the drainage feature in the south-central portion of the PAP illustrate lower elevations of approximately 475 to 485 feet NAVD88 (**Appendix A**). Prior to creation of Newton Lake, the elevation of the land surface east and southeast of the PAP was approximately 475 to 480 feet NAVD88.

2.2 Regional Geomorphology

The PAP, as well as all of Jasper County, is located within the Springfield Plain of the Till Plains Sections of the Central Lowlands Province. The Springfield Plain physiographic province is comprised largely of Illinoian glacial drift (Willman et al*.*, 1975). The region is characterized by relatively flat to gently rolling topography. The uppermost geologic materials consist primarily of unconsolidated eolian, slopewash, and fluvial deposits underlain by superglacial and subglacial deposits associated with recent glaciations. The topography of these materials is a function of the underlying bedrock surface on which the material was deposited, and eolian and fluvial processes which have been in effect from their deposition to the present.

The Embarras River and its tributaries drain much of the county and eventually flow into the Wabash River. The southwestern portion of the county, including the NPP, lies within the Little Wabash River Basin. Therefore, all surface drainage from the property flows to the Little Wabash River, which then flows into the Wabash River.

The highest point in Jasper County is at Island Grove, at an elevation of 624 feet NAVD88. The lowest elevation, 440 feet NAVD88, is located at the point on the Crawford County line, which is intersected by the Embarras River. With a total relief of only 184 feet, the surface features of Jasper County are nominal and reflect the moderate amount of erosional modification to the post-glacial topographic surface.

2.3 Soils

Surficial soils at the PAP are shown on **Figure 2-2** and based on Jasper County soil survey data, available in the Soil Survey Geographic (SSURGO) by the United States Department of Agriculture's Natural Resources Conservation Service provided by Environmental Systems Research Institute (ESRI) web hosted layer. Soils surrounding the PAP, not including the Urban Land (#533) within the limits of the NPP, are identified as: Orthents (clayey, sloping) along the western, southern, and eastern boundaries of the PAP; Hickory silt loam (18 to 35 percent slopes) and Ava silt loam (2 to 5 percent slopes) adjacent to Newton Lake; Bluford silt loam, Wynoose silt loam (0 to 2 percent slopes), Racoon silt loam (0 to 2 percent slopes) and Atlas silt loam (5 to 10 percent slopes, eroded) west and northwest of the PAP within agricultural land.

2.4 Regional Geology

2.4.1 Regional Unlithified Deposits

The unlithified geologic deposits in Jasper County, Illinois primarily consists of loess overlying glacial drift from the Illinoian and Pre-Illinoian glaciers. The unlithified deposits in the region are derived from recent river deposition (alluvium), glacial outwash, and glacial till deposits. The hydrogeologic investigation conducted by Rapps (1997) is the basis for much of the descriptions provided below. From the surficial deposits downward, there are eight primary unlithified geologic units in the region consisting of:

- **Cahokia Formation:** Holocene stage deposits in floodplains and channels of modern rivers and streams. Generally, consists of poorly sorted sand, silt, and clay with wood and shell fragments with local deposits of sandy gravel.
- **Peoria Silt:** Wisconsinan Age deposits that commonly occur in upland areas and along valley walls in Illinois. They generally grade from sandy silt in the bluffs of major source river valleys (like the Mississippi Valley) to clayey silt away from the bluffs, where it is commonly thinner and relatively weathered (Hansel and Johnson, 1996). They are typically massive and consist predominantly of windblown silt from the valley floor, with local lenses of well-sorted, fine- to medium-grained sand (Willman and Frye, 1970).
- **Sangamon Soil:** Silt and clay soils formed during the interglacial period between the Illinoian and Wisconsinan Stages as a result of weathering of the upper portion of the Illinoian drift.
- **Hagarstown Member of the Glasford Formation:** Gravel, sand, and gravelly diamicton occurring as ice-contact deposits that commonly occurs as ridged drift in a distinctive belt of linear to curved ridges and knolls. Outwash plains of poorly sorted to well-sorted sand and gravel may be present between the ridges in many places (Killey and Lineback, 1983).
- **Vandalia Till Member of the Glasford Formation:** Sandy/silty till with thin, discontinuous lenses of silt, sand, and gravel (Lineback, 1979; Willman and Frye, 1970).
- **Mulberry Grove Member of the Glasford Formation:** Typically consists of a thin, lenticular unit of gray sandy silt (Willman et al., 1975). It represents the interval between the retreat of the glacier that deposited the Smithboro Member and the advance of the glacier that deposited the Vandalia Till.
- **Smithboro Till Member of the Glasford Formation:** Gray, compact, silty clay diamicton that is less friable than the overlying Vandalia Till, and was deposited by ice sheets moving northwest to southeast across the region (Jacobs and Lineback, 1969).
- **Banner Formation:** Undifferentiated diamictons that rest directly on bedrock and consist mostly of glacial diamictons and intercalated sand and gravel outwash.

The surficial Quaternary geologic deposits in the vicinity of the Site that were mapped on a regional scale are shown on **Figure 2-3**.

2.4.2 Regional Bedrock Geology

The unlithified deposits are underlain by Pennsylvanian age bedrock belonging to the Mattoon Formation. The Mattoon Formation is the youngest formation in the Pennsylvanian System in Illinois. It is underlain by the Bond Formation. The Mattoon Formation has a maximum thickness of more than 600 feet in the central part of the Illinois Basin in Jasper County. It is characterized by a complex sequence of thin limestones, coals, black fissile shales, underclays, thick gray shales, and several well-developed sandstones. The lateral extent of many of the named units has not been determined due to widely scattered outcrops and scarce subsurface data. However, coals and limestone units are considered to be as persistent as those in the underlying Bond Formation (Rapps, 1997).

2.4.3 Structure

The major geologic structural features within Illinois are depicted on **Figure 2-4**. The PAP is situated within the Fairfield Basin, one of the major structural features of the encompassing Illinois Basin. The Fairfield Basin, characterized as a smooth floored inner central deep basin, is bound to the west and northwest by the DuQuoin-Louden Monoclinal Belt, to the north and northeast by the LaSalle Anticlinal Belt, and to the south by the Cottage Grove-Rough Creek-Shawneetown Fault Zone (Buschbach and Kolata, 1991). North of the Rouch Creek Fault System, the strata dip gently to the west at approximately 15 to 20 feet per mile (ft/mi), which parallels the general north-south, asymmetrical syncline structure of the Illinois Basin (Hatch and Affolter, 2002).

2.4.4 Seismic Setting

A review of the available data from the United States Geological Survey (USGS), Illinois State Geological Survey (ISGS), and other available regional structural information was completed by Haley & Aldrich, Inc. (2018) for the Location Restriction Demonstration to address the requirements of 40 C.F.R. § 257.62 (Fault Areas). The review found that the Wabash Valley Fault System is located approximately 40 miles southeast of the PAP (**Figure 2-4**). The Wabash Valley Fault system within Illinois extends laterally for approximately 60 miles in a general north-northeastward to south-southwestward trend. Haley & Aldrich, Inc. (2018) found that the timeframe of the most recent activity on the Wabash Fault System 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 Quaternary period reported within 200 feet of the PAP.

As required by 35 I.A.C. § 845.330, existing and new CCR SIs and lateral expansions of existing SIs must not be located in seismic impact areas, unless owners or operators demonstrate that the SI is designed to resist the maximum horizontal acceleration (g) in lithified earth material. This requirement is identical to that in 40 C.F.R. § 257.63. The definition of a seismic impact zone is “areas having a 2 percent or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitation pull, will exceed 0.10 g in 50 years.” Although the PAP is located within a seismic impact zone, it satisfies the demonstration requirements of 35 I.A.C. § 845.330. The AECOM report titled “CCR Certification Report: Initial Structural Stability Assessment, Initial Safety Factor Assessment, and Initial Flow Design Control System Plan for the Primary Ash Pond at Newton Power Station”, dated October 2016, includes engineering analysis, calculations, and findings that support the requirements of 40 C.F.R. § 257.63 (Haley & Aldrich, Inc., 2018), and, by extension, 35 I.A.C. § 845.330.

2.4.5 Mining Activities

The areas immediately surrounding the facility have never been mined. Based on the directory of coal mines for Jasper County (ISGS, 2021), the nearest coal mines in the vicinity of the PAP are located approximately 6.7 miles to the northeast (**Appendix B**).

2.5 Site Geology

A field investigation was performed in 2021 to collect additional data for the discussion of vertical and horizontal lithology, stratigraphy, chemical properties, and physical properties of geologic layers to a minimum of 100 feet below ground surface (bgs) as specified in 35 I.A.C. § 845.620(b). Field investigation locations are shown on **Figure 2-5**. Boring logs, monitoring well and piezometer construction forms obtained from investigations at the PAP are provided in **Appendix C**.

The Cahokia Formation, described in the regional geology above, occurs in modern river valleys and floodplains. If present, these deposits are expected to occur south of the PAP in areas that are currently beneath the surface water of Newton Lake. The principal types of unlithified materials present above the bedrock in the vicinity of the PAP consist of the following in descending order:

- **CCR and Fill Material:** CCR and reworked surface materials within and adjacent to the various CCR Units.
- **Peoria Silt and Sangamon Soil** (wind-blown deposits and weathered till)**:** Clays and silts, including the Peoria Silt (Loess Unit) in upland areas, underlain by the Sangamon Soil which is comprised of weathered glacial drift.
- **Hagarstown Member:** where present, consists of relatively thin sandy deposits between the clays and silts of the Sangamon Soil and the Vandalia Till.
- **Vandalia Till:** Compacted clay and silt glacial till with varying amounts of sand and gravel (diamicton).
- **Mulberry Grove Member:** Sand, silty sand, and sandy silt/clay units found between the Vandalia Till and the Smithboro Till. These sandy deposits are the first laterally continuous sands observed beneath the PAP.
- **Smithboro Till and Banner Formation:** Thick, gray, compacted silty clay diamicton of the Smithboro Till and the greenish-gray silty clay of the Banner Formation.

Cross-sections showing the subsurface materials encountered at the PAP are included in **Figures 2-6 through 2-8**.

2.5.1 CCR and Fill

CCR is present within most of the PAP at thicknesses between 17 to 19.5 feet thick as observed in XPW01 through XPW04 (**Appendix C**). The lowest bottom-of-ash elevation observed is approximately 486 feet in the center of a former drainage feature oriented north-south through the center of the PAP, whereas ash is potentially highest in elevation at approximately 550 feet along the outer edges of the PAP (**Figure 2-9**)[1]. Note, drawing S-69 (**Appendix A**) indicates the former drainage feature was filled to elevation 508 feet NAVD88 during construction. The bottom of ash surface appears to mirror the former drainage feature. Comparison of the bottom of ash contours and topographic contours indicate CCR fill may be 40 feet or greater within the former drainage feature.

Geotechnical analysis results from six samples collected from ash at soil borings XPW01, XPW03 and XPW04 yielded Unified Soil Classification System (USCS) soil classifications of silty sand and

[1] Base of ash surface is being further evaluated as the construction permit is being developed.

poorly graded sand with silt. Sample locations are shown on **Figure 2-5,** the geotechnical results from the most recent investigation are summarized in **Table 2-1**, and laboratory reports are included in **Appendix D**. Geotechnical results from XPW01, XPW03 and XPW04 indicated the following:

- Average moisture content of 21.3 percent, with a range of 12.6 to 31.1 percent.
- Average total porosity (calculated) of 50 percent, with a range of 38 to 56 percent.
- Average dry density of 84.3 pounds per cubic foot (pcf), with a range of 73.9 to 103.6 pcf.
- Average specific gravity of 2.69, with a range of 2.650 to 2.741.
- Average grain size composition of 14 percent gravel, 60 percent sand, and 26 percent fines (silt and clay). The fines content ranged from 11.8 to 61.3 percent, with a median value of 18.9 percent.
- Geometric mean vertical hydraulic conductivity of 3.11×10^{-4} centimeters per second (cm/s) and ranged from 1.58×10^{-5} to 1.34×10^{-3} cm/s.

Solid samples were collected from XPW01, XPW02, XPW03 and XPW04 by Ramboll in 2021 for chemical analysis. The results of solid samples collected from within the PAP are summarized in **Table 2-2**.

Leachate wells were installed in XPW01, XPW02, XPW03 and XPW04 by Ramboll in 2021, and porewater samples were collected. The results of porewater samples collected from within the PAP are summarized in **Table 2-3**.

2.5.2 Peoria Silt and Sangamon Soil

The Peoria Silt and Sangamon Soil is present within the PAP at thicknesses up to approximately 46 feet as measured in APW15 and ranged from 3 to 46 feet thick as observed in APW05 and APW10 (**Appendix C**). The bottom of this geologic unit is at the lowest elevation of 469.5 feet NAVD88 (APW15) along the southern portion of the PAP while highest in elevation of 543.4 feet NAVD88 in the northwest corner of the PAP (**Figures 2-6 and 2-7**). Generally, the elevation of the bottom of this unit decreases from north to south across the PAP.

Geotechnical analysis results from two samples collected from the Peoria Silt and Sangamon Soil at soil borings APW11 and APW15 yielded USCS soil classifications of lean clay. Sample locations are shown on **Figure 2-5,** the geotechnical results from the most recent investigation are summarized in **Table 2-1**, and laboratory reports are included in **Appendix D**. Geotechnical results from these samples indicated the following:

- Average moisture content of 18.2 percent, with a range of 17.8 to 18.5 percent.
- Average porosity (calculated) of 33 percent, with a range of 32 to 34 percent.
- Average dry density of 110.8 pcf, with a range of from 109.8 to 111.7 pcf.
- Average specific gravity of 2.67 with a range of 2.65 to 2.69.
- Grain size composition of 0.6 percent gravel, 43 percent sand, and 56.5 percent fines (silt and clay).

Soil samples collected from the Peoria Silt and Sangamon Soil (APW11, APW13 and APW15) were also analyzed for chemical parameters. The results of soil samples collected from the Peoria Silt and Sangamon Soil are summarized in **Table 2-4**.

2.5.3 Hagarstown Member

A discontinuous sandy unit, the Hagarstown Member of the Pearl Formation was encountered at elevations ranging from approximately 497 feet NAVD88 (APW08) to 533 feet NAVD88 (APW12). The unit was encountered at thicknesses up to approximately 6.9 feet at APW18, but generally the thickness is less than 2 feet, where present.

Geotechnical analysis results from three samples collected from the Hagarstown Member at soil borings APW12 and APW13 yielded a USCS soil classification of poorly graded sand with silt. Sample locations are shown on **Figure 2-5,** the geotechnical results from the most recent investigation are summarized in **Table 2-1**, and laboratory reports are included in **Appendix D**. Geotechnical results from these samples indicated the following:

- Average moisture content of 14.9 percent, with a range of 8.4 to 21.2 percent.
- Average porosity (calculated) of 36 percent, with a range of 30 to 47 percent.
- Average dry density of 106.1 pcf, with a range of 87.1 to 118.3 pcf.
- Average specific gravity of 2.70, with a range of 2.649 to 2.694.
- Grain size composition of 10.6 percent gravel, 68.4 percent sand, and 21.0 percent fines (silt and clay).

Soil samples collected from the Hagarstown Member (APW12, APW13 and APW15) were also analyzed for chemical parameters. The results of soil samples collected from the Hagarstown Member are summarized in **Table 2-4**.

2.5.4 Vandalia Till

Thick glacial deposits of the Vandalia Till, which are laterally continuous beneath the Site and NPP, were encountered at elevations ranging from 425 feet NAVD88 (APW15) to 530 feet NAVD88 (AWP05). The unit was encountered at thicknesses up to 59 feet at APW07, while the average thickness is 26 feet.

Geotechnical analysis results from five samples collected from the Vandalia Till at soil borings APW14, APW17, SB300/APW18, and SB301 yielded a USCS soil classification of lean clay and silty clay. Sample locations are shown on **Figure 2-5**, the geotechnical results from the most recent investigation are summarized in **Table 2-1**, and laboratory reports are included in **Appendix D**. Geotechnical results from these samples indicated the following:

- Average moisture content of 14 percent, with a range of 12.4 to 16.6 percent.
- Average porosity (calculated) of 31 percent, with a range of 27 to 36 percent.
- Average dry density of 117.1 pcf, with a range of 108.8 to 122.7 pcf.
- Average specific gravity of 2.70, with a range of 2.697 to 2.709.
- Grain size composition of 1.7 percent gravel, 29.1 percent sand, and 69.2 percent fines (silt and clay).

Soil samples collected from the Vandalia Till (APW11, APW12, APW15 and APW17) were also analyzed for chemical parameters. The results of soil samples collected from the Vandalia Till are summarized in **Table 2-4**.

2.5.5 Mulberry Grove Member

Thin to moderately thick (3 to 17 feet), the Mulberry Grove member was encountered at elevations ranging from approximately 417 feet NAVD88 (APW15) to 483 feet NAVD88 (APW10). The unit generally slopes from approximately 483 feet NAVD88 in the northeast portion of the site near APW10 to 462 feet NAVD88 in the southwest portion of the site near APW08. The unit was encountered at thicknesses up to 30 feet at APW17, while the average thickness is approximately 10 feet. At APW12 (**Figure 2-8**) sand and gravel was not encountered at a similar elevation during drilling.

Geotechnical analysis results from five samples collected from the Mulberry Grove Member at soil borings APW13, APW15, APW17, and SB300/APW18 yielded USCS soil classifications of silty sand, poorly graded sand with silt and well graded sand with silt. Sample locations are shown on **Figure 2-5,** the geotechnical results from the most recent investigation are summarized in **Table 2-1**, and laboratory reports are included in **Appendix D**. Geotechnical results from these samples indicated the following:

- Average moisture content of 10.8 percent, with a range of 6.1 to 14.5 percent.
- Average porosity (calculated) of 32 percent, with a range of 30 to 35 percent.
- Average dry density of 113.5 pcf, with a range of 109.6 to 116.8 pcf.
- Average specific gravity of 2.67, with a range of 2.660 to 2.686.
- Grain size composition of 10.4 percent gravel, 69 percent sand, and 20.6 percent fines (silt and clay).

Soil samples collected from the Mulberry Grove Member (APW11, APW13 and APW14) were also analyzed for chemical parameters. The results of soil samples collected from the Mulberry Grove Member are summarized in **Table 2-4**.

2.5.6 Smithboro Till and Banner Formation

Thick glacial till of the Smithboro Till Member and Banner Formation, which are laterally continuous beneath the Site and NPP, was encountered at elevations ranging from approximately 412 feet NAVD88 (APW15) to 475 feet NAVD88 (APW10). The unit was encountered at thicknesses up to 36 feet (APW14), while the average thickness is 32 feet (based upon the two borings that encountered bedrock APW13 and APW14).

Geotechnical analysis results from eight samples collected from the Smithboro Till and Banner Formation at soil borings APW11, APW12, APW14, APW15, SB300/APW18, and SB301 yielded USCS soil classifications of lean clay and silty clay. Sample locations are shown on **Figure 2-5,** the geotechnical results from the most recent investigation are summarized in **Table 2-1**, and laboratory reports are included in **Appendix D**. Geotechnical results from these samples indicated the following:

- Average moisture content of 15.5 percent, with a range of 11.1 to 19.1 percent.
- Average porosity (calculated) of 32 percent, with a range of 29 to 38 percent.

- Average dry density of 115.1 pcf, with a range of 104.6 to 121.3 pcf.
- Average specific gravity of 2.70, with a range of 2.686 to 2.723.
- Grain size composition of 0 percent gravel, 24.2 percent sand, and 75.8 percent fines (silt and clay).

Soil samples collected from the Smithboro Till and Banner Formation (APW11, APW12, APW13, APW14 and APW17) were also analyzed for chemical parameters. The results of soil samples collected from within the PAP are summarized in **Table 2-4**.

2.5.7 Bedrock

Bedrock underlying the PAP is the Pennsylvanian Age Mattoon Formation, which consists of a complex sequence of thin limestones, coals, black fissile shales, underclays, thick gray shales, and several well-developed sandstones. Bedrock was encountered in borings APW13 and APW14 (**Appendix C**). The elevation of the top of bedrock ranged from 445.5 feet NAVD88 (APW13) to 432.9 feet NAVD88 (APW14). The top of bedrock was described as shale in both borings advanced to bedrock.

No bedrock samples were collected for geotechnical testing or chemical analysis. Boring locations are shown on **Figure 2-5**.

3. REGIONAL AND LOCAL HYDROGEOLOGY

3.1 Regional Hydrogeology

Aquifers in the area of the PAP generally fall into two broad categories: (1) unlithified sediments that are glacial or alluvial in origin and contain mostly sand and gravel deposits interbedded with clay and silt; and (2) bedrock aquifers consisting of sandstone and fractured limestone, which vary widely in permeability. To the east of the NPP, water-yielding sandstone formations occur at depths of 100 to 300 feet bgs (Selkregg et al., 1957). Groundwater available from bedrock units is mostly mineralized and rarely used as a source for potable water (Rapps, 2009).

Glacial deposits generally provide enough water for rural and residential water supplies. Sand and gravel deposits within the Glasford Formation and the Pearl Formation have been developed locally for domestic water supplies. Locally occurring discontinuous sand and gravel deposits exist along the bottomlands of Big Muddy Creek, which can sustain domestic and farm groundwater supplies. The water bearing zones at the PAP are the sandy horizons that occur within Mulberry Grove Member of the Glasford Formation and the intermittent sands of the Hagarstown Member of the Pearl Formation.

3.2 Site Hydrogeology

In 2015, a monitoring program consisting of six monitoring wells (APW05, APW06, APW07, APW08, APW09, and APW10) was established to comply with requirements of 40 C.F.R. § 257. In 2021, nine additional monitoring wells (APW05S, and APW11 through APW18) were installed to collect information to meet the requirements of Part 845. Construction details for monitoring wells and piezometers is provided in **Table 3-1** and locations are depicted in **Figure 3-1**. Boring logs, monitoring well and piezometer construction forms are provided in **Appendix C**.

3.2.1 Hydrostratigraphic Units

Materials have been categorized into six hydrostratigraphic units at the PAP based on stratigraphic relationships, geologic composition, and common hydrogeologic properties. The units, listed from surface downward, are summarized as follows:

- **CCR**: CCR consisting of fly and bottom ash within the PAP. CCR may be present from the surface (approximately 545 to 555 feet NAVD88) to a minimum elevation of approximately 475 feet NAVD88. Water elevations measured in piezometers screened within the PAP indicate the phreatic surface ranges from approximately 535 to 547 feet NAVD88, which is higher than surrounding monitoring wells.
- **UD/PMP:** The UD is composed of the low permeability silts and clays of the Peoria Silt and Sangamon Soil and the sandier soils of the Hagarstown Member (*i.e.,* PMP).
  - **Hagarstown Member/PMP**: The Hagarstown Member consists of the discontinuous, sandier deposits of the UD where present and overlies the Vandalia Till.
- **UCU:** The UCU consists of a thick package of the low permeability clay and silt of the Vandalia Till. This unit is a laterally continuous layer between the base of the CCR unit and the top of the uppermost aquifer.
- **Uppermost Aquifer**: The uppermost aquifer is composed of the Mulberry Grove Member, which has been classified as poorly graded sand, silty sand, clayey sand, and gravel.

- **LCU**: The LCU is comprised of low permeability silt and clay of the Smithboro Till Member and the Banner Formation.
- **Bedrock Confining Unit**: Bedrock was classified as shale of the Mattoon Formation in locations it was encountered in soil borings during 2021 investigation activities (APW13 and APW14).

3.2.2 Uppermost Aquifer

The uppermost aquifer includes saturated portions of the Mulberry Grove Member in the vicinity of the PAP. Groundwater monitoring for the uppermost aquifer is focused on this zone because it is continuous, moderate permeability, and likely to indicate potential impacts from the PAP. The top of uppermost aquifer was evaluated with respect to the location restrictions in 2018 (Haley & Aldrich, Inc., 2018) and provided in **Figure 3-2**. The top of the uppermost aquifer is separated from overlying CCR material by the low permeability Vandalia Till which was encountered at thicknesses up to 59 feet and an average thickness of 26 feet (**Figures 2-6 to 2-8**). The base of the uppermost aquifer is the top of the LCU containing the low permeability Smithboro Till and the Banner Formation.

3.2.3 Potential Migration Pathways

The UD consists of low permeability clays and silts of the Peoria Silt, Sangamon Soil, and discontinuous sand lenses of the Hagarstown Member. Monitoring wells APW02, APW03, APW04, APW05S, and APW12 are screened within the sandier deposits of the UD and may be utilized for monitoring shallow PMPs adjacent to the PAP.

3.2.4 Water Table Elevation and Groundwater Flow Direction

The elevations of water within the PAP (as observed in XPW01 through XPW04 and XSG01) are greater than the surrounding areas. The phreatic surface within the PAP between February and August 2021 averaged 542 feet NAVD88, ranging from 546.69 feet NAVD88 in XPW02 (located along the northern portion of the PAP) to 535.40 feet NAVD88 in XSG01 (located along the southern portion of the PAP) (**Figures 3-3 and 3-4)**.

Groundwater flow in the uppermost aquifer is generally from north to south. However, uppermost aquifer wells also display flow converging towards a former surface drainage feature located west of the PAP (**Figure 3-3 and 3-4**) and an area where the uppermost aquifer is lowest in elevation. Groundwater elevations vary seasonally, generally less than one foot per year, while across the PAP they range from approximately 490 to 530 feet NAVD88, although flow directions are generally consistent (historic contour maps are included in **Appendix E**).

Groundwater elevations in PMP wells are above those in the uppermost aquifer and range from approximately 518 feet NAVD88 (APW05S) to 535 feet NAVD88 (APW05S). Groundwater elevations within the UCU, LCU, and bedrock confining unit were not contoured because no wells are screened within these units.

3.2.4.1 Vertical Hydraulic Gradients

Vertical hydraulic gradients were calculated using available groundwater elevation data from February to August 2021 at nested well locations within the UD (*i.e.,* PMP) and uppermost aquifer wells. Vertical hydraulic gradients are presented in **Table 3-2**. The results of the vertical hydraulic gradient calculations for these hydrostratigraphic units are summarized below:

- UD (*i.e.,* PMP) to uppermost aquifer:
  - Gradients calculated between APW05 (uppermost aquifer) and APW05S (PMP) were downward for all events.
  - Gradients calculated between APW10 (uppermost aquifer) and APW04 (PMP) were downward for all events.
  - Gradients calculated between APW09 (uppermost aquifer) and APW03 (PMP) were downward for all events.

These results are consistent with previous vertical gradient calculations (OBG, 2017).

3.2.4.2 Impact of Existing Ponds and Ash Saturation

Water levels collected from XPW01 through XPW04 indicate the phreatic surface is above water levels observed in the uppermost aquifer; however, the groundwater elevation contours of the uppermost aquifer (**Figures 3-3 and 3-4)** illustrate flow towards the south and converges at the former drainage feature along the western edge of the PAP. The absence of a radial component of flow outward indicates the PAP does not significantly impact groundwater flow direction. Furthermore, there is a thick layer of UCU Vandalia Till separating the base of ash and top of uppermost aquifer.

Saturated ash has been observed within the PAP leachate wells (XPW01 through XPW04) located along the northern portion of the unit. The maximum thickness of saturated ash as measured at XPW03 ranged from 11.5 feet in June 2021 to 12.6 feet in February 2021. The minimum thickness of saturated ash as measured at XPW01 ranged from 7.7 feet in July 2021 to 8.2 feet in June 2021. Greater thicknesses of saturated ash are likely in the central portion of the PAP where the former drainage feature was present prior to filling (**Figure 2-9**).

3.2.4.3 Impact of Newton Lake on Groundwater Flow

The surface water elevation at Newton Lake measured from February 15 to March 9, 2021 ranged from 504.42 to 504.84 feet NAVD88 at location SG02 near the outfall from the Secondary Pond. Groundwater flow in the uppermost aquifer generally flows southwest across the PAP with potentiometric surface elevations at downgradient wells around 491 feet NAVD88 (approximately 15 feet lower than the Newton Lake elevation). This separation in groundwater and Lake elevations (and observed downward vertical gradients) indicates groundwater within the uppermost aquifer does not flow into Newton Lake.

Groundwater elevations observed at APW10 are approximately 2-feet higher than surface water in Newton Lake (506 feet NAVD88 versus 504 feet NAVD88). The uppermost aquifer also approaches the former land surface, now beneath Newton Lake, in this area. As illustrated in cross-section B-B' (**Figure 2-7**), the uppermost aquifer may intersect the base of Newton Lake and interact with groundwater upgradient of the PAP.

3.2.5 Hydraulic Conductivities

3.2.5.1 Field Hydraulic Conductivities

Field hydraulic conductivity tests were conducted by Ramboll during the 2021 investigation. The results are summarized in **Table 3-3**, provided in **Appendix F**, and discussed below:

- **CCR**: Results of field hydraulic tests in wells screened within the CCR (XPW01 through XPW04) ranged from 1.0 x 10^{-3} to 2.3 x 10^{-1} cm/s, with a geometric mean of 2.0 x 10^{-2} cm/s.
- **UD**: No field hydraulic conductivity tests were performed by Ramboll in 2021 in wells screened within the Sangamon Soil of the UD. Previous field hydraulic conductivity tests conducted by NRT in 2017 in wells screened within the Sangamon Soil of the UD (APW02, APW03, and APW04) ranged from 5.14 x 10^{-6} to 4.53 x 10^{-5} cm/s, with a geometric mean hydraulic conductivity of 1.5 x 10^{-5} cm/s (OBG, 2017).
- **PMP**: Results of field hydraulic tests in wells screened within the Hagarstown PMP (APW05S and APW12) ranged from 6.1 x 10^{-4} to 1.5 x 10^{-2} cm/s, with a geometric mean hydraulic conductivity of 3.1 x 10^{-3} cm/s.
- **UCU**: No field hydraulic conductivity tests were performed as there are no wells screened within the UCU.
- **Uppermost Aquifer**: Results of field hydraulic tests in wells screened within the uppermost aquifer (APW11, APW13, APW14, APW15, APW16, APW17, and APW18) ranged from 2.0 x 10^{-4} to 1.5 x 10^{-1} cm/s, with a geometric mean of 6.8 x 10^{-3} cm/s. Previous field hydraulic conductivity tests conducted by NRT in 2017 obtained similar results with a geometric mean hydraulic conductivity of 1.2 x 10^{-3} cm/s (OBG, 2017). The highest conductivities are measured in APW15, APW16, and APW17, which is consistent with groundwater flow toward these wells. In addition, the grain-size analyses of the uppermost aquifer materials from two samples collected at APW17 were amongst the highest observed at the Site, with sand and gravel contents of 91.1 and 93.3 percent.
- **LCU**: No field hydraulic conductivity tests were performed as there are no wells screened within the LCU.
- **Bedrock**: No field hydraulic conductivity tests were performed as there are no wells screened within the bedrock unit.

3.2.5.2 Laboratory Hydraulic Conductivities

Falling head permeability tests (ASTM D5084 Method F) were performed in the laboratory on samples collected during the 2021 investigations. Sample locations are shown in **Figure 2-5**. The geotechnical laboratory report is provided in **Appendix D**. The results are summarized in **Table 2-1** and discussed below.

- **CCR**: Eight samples were collected from CCR borings XPW01 through XPW04. However, the two samples collected from XPW02 (8 to 8.5 and 16.5 to 17 feet bgs) were not representative of the ash and are not included in summary of CCR characteristics. Laboratory falling head permeability test results for the six CCR samples indicated a geometric mean vertical hydraulic conductivity of 3.1 x 10^{-4} cm/s with a range of 1.6 x 10^{-5} to 1.3 x 10^{-3} cm/s.
- **UD**: One sample was collected from the Sangamon Soil at borings APW11 and APW15. Laboratory falling head permeability test results in the UD indicated a geometric mean vertical hydraulic conductivity of 5.9 x 10^{-8} cm/s and ranged from 3.1 x 10^{-8} to 8.6 x 10^{-8} cm/s. These values are lower than previous samples collected by NRT in 2017, with a geometric mean hydraulic conductivity of 1.3 x 10^{-5} cm/s (OBG, 2017).
- **PMP**: Three samples were collected from the Hagarstown Member, a PMP within the UD, at borings APW12 and APW13. Laboratory falling head permeability test results for the

Hagarstown Member indicated a geometric mean vertical hydraulic conductivity of 3.5×10^{-5} cm/s and ranged from 1.1×10^{-7} to 9.6×10^{-5} cm/s.

- **UCU**: Four samples were collected from the Vandalia Till at borings APW14, APW17, SB300/APW18, and SB301. Laboratory falling head permeability test results for the UCU samples indicated a geometric mean vertical hydraulic conductivity of 6.7×10^{-8} cm/s and ranged from 3.3×10^{-8} to 9.7×10^{-8} cm/s. These values are similar to a previous investigation completed by Rapps (1997) with hydraulic conductivity values ranging from 6.3×10^{-9} to 2.1×10^{-8} cm/s with a geometric mean hydraulic conductivity of 1.1×10^{-8} cm/s (Rapps, 1997).
- **UA**: Five samples were collected from the Mulberry Grove Formation at borings APW13, APW15, APW17, and APW18. Laboratory falling head permeability test results for the Mulberry Grove Formation indicated a geometric mean vertical hydraulic conductivity of 3.2×10^{-4} cm/s and ranged from 3.5×10^{-6} to 7.2×10^{-4} cm/s.
- **LCU**: Eight samples were collected from the glacial tills of the Smithboro Till at borings APW11, APW12, APW14, APW15, APW18, and SB301. Laboratory falling head permeability test results for the Smithboro Till indicated a geometric mean vertical hydraulic conductivity of 9.3×10^{-8} cm/s and ranged from 2.4×10^{-8} to 2.7×10^{-7} cm/s. No samples were collected from the Banner Formation of the LCU.
- **Bedrock**: No bedrock samples were analyzed.

3.2.6 Horizontal Groundwater Gradients and Flow Velocity

In the vicinity of the PAP, groundwater generally flows from north to south/southwest in the uppermost aquifer. Groundwater elevations and flow directions near the PAP are illustrated in 2021 contour maps (**Figures 3-3 and 3-4**). There is little seasonal variation in groundwater flow direction in the unlithified materials regardless of the lake elevation, as illustrated in **Figures 3-3 and 3-4** (historic contour maps are included in **Appendix E**). Horizontal gradients determined in 2021 across the PAP between wells APW10 and APW17 were very stable around the average of 2.5×10^{-3} feet/feet (ft/ft) with an average groundwater velocity of 1.88 feet per day (ft/day) (**Table 3-4**).

Horizontal gradients determined in 2021 across the northeastern portion of the CCR unit were very stable around the average of 7.1×10^{-3} ft/ft with an average groundwater velocity of 0.04 ft/day (**Table 3-4**).

3.2.7 Groundwater Classification

Per 35 I.A.C. § 620.210, groundwater within the uppermost aquifer at the PAP meets the definition of Class I – Potable Resource Groundwater based on the following criteria:

- Groundwater is located more than 10 feet bgs and within an unconsolidated silty sand and gravel unit which is five feet or more in thickness.
- Hydraulic conductivity exceeds the 1×10^{-4} cm/s criterion (**Table 3-3**).
- Groundwater is not downgradient of or underlying previously mined out areas.

Testing of the unconsolidated materials of the Mulberry Grove Member averaged 21 percent fines, which is greater than the 12 percent fines criterion (Section 2.5.5); however, this was not deemed prohibitive of the Class I Classification.

3.3 Surface Water Hydrology

3.3.1 Climate

Jasper County has a humid and temperate climate with a normal annual total precipitation of approximately 40 inches. Approximately two-thirds of the precipitation falls from April through September and is produced primarily by thunderstorms, with May having the highest average monthly precipitation. The average annual snowfall for the area is approximately 15 inches.

Average climatic data was obtained from the Illinois State Water Survey (ISWS). The data was recorded between 1989 and 2020 from Olney, Illinois, which is located approximately 16.5 miles southeast of the NPP. The data includes monthly maximum and minimum temperatures (degrees Fahrenheit [°F]) and monthly average rainfall calculated from daily values collected over the 31-year period. The data is summarized in **Table A**.

Table A. Average Monthly Temperature Extremes and Precipitation for Olney, IL

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Max Temperature (ºF)	38.8	43.5	54.0	65.6	74.9	83.8	86.4	85.2	79.8	67.9	54.1	42.4	64.7
Min Temperature (ºF)	23.2	26.4	35.0	44.7	54.8	63.4	66.6	64.3	56.4	45.2	35.2	26.9	45.2
Precipitation (inches)	3.10	2.39	3.37	4.23	4.64	3.82	4.04	2.73	2.97	3.66	3.81	3.25	42.0
https://www.isws.illinois.edu/warm/stationmeta.asp?site=OLN&from=wx													

3.3.2 Surface Waters

The major surface water body in the vicinity of the PAP is Newton Lake, an elongated body of water that borders the PAP on three sides (south, east, and west). The southern boundary of the PAP runs parallel to the north shore of the lake and is located approximately 250 to 700 feet from the water's edge (**Figure 1-1**). The surface water elevation measured from February 15 to March 9, 2021 ranged from 504.42 to 504.84 feet NAVD88 at location SG02 near the outfall from the Secondary Pond. Surface water elevations in Newton Lake are not expected to fluctuate greatly as a result of the lake elevation being controlled by a dam to provide cooling water for the NPP.

The phreatic surface within the PAP as measured at XSG01 and XPW01 through XPW04 ranged from 535.4 to 546.69 feet NAVD88 between February and July in 2021. Other surface waters in the vicinity include small freshwater ponds.

Other primary drainage ways in the area are Big Muddy Creek and Wolf Creek, which lie approximately 2.3 miles west and 1.7 miles east of the Site, respectively. In addition, minor streams and drainage channels cut across the drift plain in the area.

4. GROUNDWATER QUALITY

4.1 Summary of Groundwater Monitoring Activities

4.1.1 IEPA Program Monitoring

In accordance with NPDES Permit No. IL0049191 (effective October 1, 2015), samples are collected quarterly from four monitoring wells (G116, APW02, APW03, and APW04) for laboratory and/or field parameters listed in Special Condition No. 19 of the NPDES Permit. Groundwater monitoring results from sampling of these four wells are reported to IEPA annually in accordance with the NPDES Permit. Of the four wells monitored as part of the NPDES Permit monitoring, two wells (APW03 and APW04) are located downgradient of the PAP. The results of NPDES Permit monitoring wells APW03 and APW04 are not included in the discussion in **Section 4.2** as the groundwater samples were not analyzed for total metals.

4.1.2 40 C.F.R. § 257 Program Monitoring and Well Network

The 40 C.F.R. § 257 monitoring well network consists of six groundwater monitoring wells screened in the uppermost aquifer, including two background monitoring wells (APW05 and APW06) and four compliance wells (APW07, APW08, APW09, and APW10). The boring logs, well construction forms, and other related monitoring well forms for the well network are included in **Appendix C** of this HCR. The well locations are shown on **Figure 3-1**.

Groundwater is being monitored at the PAP in accordance with the Detection Monitoring Program requirements specified in 40 C.F.R. § 257.95. Details of the procedures and techniques used to fulfill the groundwater sampling and analysis program requirements are found in the Sampling and Analysis Plan for the PAP (NRT, 2017). Results are discussed in Section 4.2.

Groundwater samples are collected semi-annually and analyzed for the field and laboratory parameters from Appendix III of 40 C.F.R. § 257, summarized in **Table B** below.

Table B. 40 C.F.R. § 257 Groundwater Monitoring Program Parameters

Field Parameters[1]		
Groundwater Elevation	pH	
Appendix III Parameters (Total, except TDS)		
Boron	Chloride	Sulfate
Calcium	Fluoride	TDS

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

4.1.3 Part 845 Well Installation and Monitoring

In 2021, nine additional monitoring wells (APW11, APW12, APW13, APW14, APW15, APW16, APW17, APW18, and APW5S) were installed along the perimeter of the PAP to assess the vertical and horizontal lithology, stratigraphy, chemical properties, and physical properties of geologic layers to a minimum of 100 feet bgs as specified in 35 I.A.C. § 845.620(b). Additionally, four leachate monitoring wells (XPW01, XPW02, XPW03, and XPW04) were installed within the PAP unit to characterize CCR materials and leachate. These locations and samples were discussed in **Section 2.5.1**. The boring logs, well construction forms, and other related monitoring well forms for the well network are included in **Appendix C** of this HCR. The well locations are shown on **Figure 3-1**.

Prospective monitoring wells (APW02, APW03, APW04, APW05, APW05S, APW06, APW11, APW12, APW13, APW14, APW15, APW16, APW17, and APW18) were sampled for eight rounds between February and August 2021 and the results were used to develop this HCR and assess well locations for inclusion in the PAP Part 845 monitoring well network.

Groundwater samples were analyzed for 35 I.A.C. § 845.600 parameters summarized in **Table C** below. Part 845 groundwater monitoring results are included below in **Section 4.2**. A summary of groundwater analytical results is presented in **Table 4-1**.

Table C. Part 845 Groundwater Monitoring Program Parameters

Field Parameters[1]			
pH	Turbidity	Groundwater Elevation	
Metals (Total)			
Antimony	Boron	Cobalt	Molybdenum
Arsenic	Cadmium	Lead	Selenium
Barium	Calcium	Lithium	Thallium
Beryllium	Chromium	Mercury	
Inorganics (Total)			
Fluoride	Sulfate	Chloride	TDS
Other (Total)			
Radium 226 and 228 combined			

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

4.2 Groundwater Monitoring Results and Analysis

Groundwater data collected from the 40 C.F.R. § 257 network monitoring wells between 2015 and 2021 and from the wells installed in 2021 were evaluated with respect to standards included in 35 I.A.C. § 845.600(a)(1). 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). The groundwater analytical results are summarized in **Table 4-1** and discussed in the subsections below. Groundwater elevations and field parameters are included in **Table 4-2**. 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[1].

[1] Potential exceedances include results reported during the eight rounds of baseline groundwater monitoring that are greater than the applicable 35 I.A.C. § 845.600(a)(1) standards. The results are considered potential exceedances because they were compared directly to the standard and did not include an evaluation of background groundwater quality or apply the statistical methodologies proposed in the Groundwater Monitoring Plan (GMP). For simplicity, "GWPS" will be used hereafter in discussing potential exceedances. Exceedances will be determined following IEPA approval of the GMP.

4.2.1 Arsenic

Arsenic was detected at concentrations greater than the GWPS (0.01 milligrams per liter [mg/L]) at six uppermost aquifer wells: downgradient wells APW08, APW09, APW15, and APW16; and background wells APW05 and APW06. Arsenic concentrations in downgradient wells ranged from 0.0039 to 0.022 mg/L. Arsenic concentrations in background wells ranged from 0.003 to 0.022 mg/L.

4.2.2 Chloride

Chloride was detected at concentrations greater than the GWPS (200 mg/L) in upgradient UD well APW05S and downgradient uppermost aquifer well APW15. Chloride concentrations in APW05S ranged from 180 to 550 mg/L. Chloride concentrations in uppermost aquifer well APW15 ranged from 230 to 260 mg/L.

4.2.3 Cobalt

Cobalt was detected at concentrations greater than the GWPS (0.006 mg/L) at PMP well APW12 with concentrations ranging from 0.0032 to 0.0073 mg/L. Concentrations have been below the GWPS for the last four consecutive sampling events.

4.2.4 Fluoride

Fluoride was detected at concentrations greater than the GWPS (4.0 mg/L) at downgradient uppermost aquifer well APW15 during one event (8.16 mg/L) and at APW18 with concentrations ranging from 0.597 to 7.02 mg/L.

4.2.5 Lead

Lead was detected at concentrations greater than the GWPS (0.0075 mg/L) at downgradient uppermost aquifer wells APW08, APW11, and APW18 with concentrations ranging from less than the reporting limit to 0.014 mg/L. Concentrations are less than the GWPS for the last five consecutive events.

4.2.6 Lithium

Lithium was detected at concentrations greater than the GWPS (0.04 mg/L) at three PMP wells APW02, APW04, and APW12; one upgradient UD well APW05S; and two downgradient uppermost aquifer wells APW13 and APW14. Lithium concentrations in the PMP wells ranged from 0.02 to 0.3 mg/L. Lithium concentrations in the upgradient well APW05S ranged from 0.038 to 0.091 mg/L. Lithium concentrations in the downgradient uppermost aquifer wells ranged from 0.024 to 0.054 mg/L.

4.2.7 pH

Groundwater samples collected with pH measurements below the lower range of the GWPS (6.5 standard units [SU]) were observed at four PMP wells APW02, APW03, APW04, APW12, one background well APW06, and two downgradient uppermost aquifer wells APW11 and APW13. Observed pH measurements in these PMP wells ranged from 5.4 to 7.7 SU. Observed pH measurements in the background well ranged from 6.4 to 7.8 SU. Observed pH measurements in these downgradient uppermost aquifer wells ranged from 6.1 to 7.4 SU.

4.2.8 Radium 226 and 228 Combined

Radium 226 and 228 combined was detected at concentrations greater than the GWPS (5 picocuries per liter [pCi/L]) at downgradient uppermost aquifer well APW16 with concentrations ranging from 0.946 to 5.85 pCi/L.

4.2.9 Sulfate

Sulfate can be a primary indicator parameter of CCR leachate impacts on groundwater quality. Sulfate was detected at concentrations greater than the GWPS (400 mg/L) at three PMP wells APW02, APW04, and APW12; upgradient UD well APW05S; and one downgradient uppermost aquifer well APW10. Concentrations of sulfate in these PMP wells ranged from 290 to 3,200 mg/L. Concentrations of sulfate in the upgradient well ranged from 200 to 2,100 mg/L. Concentrations of sulfate in the downgradient uppermost aquifer well (APW10) ranged from 390 to 540 mg/L.

4.2.10 Thallium

Thallium was detected at concentrations greater than the GWPS (0.002 mg/L) at one background well APW06, and two downgradient uppermost aquifer wells APW11 and APW18. Concentrations of thallium in the background well ranged from less than the reporting limit to 0.0025 mg/L. Concentrations of thallium in these downgradient uppermost aquifer wells ranged from less than the reporting limit to 0.0036 mg/L.

4.2.11 Total Dissolved Solids

TDS was detected at concentrations greater than the GWPS (1,200 mg/L) at four PMP wells APW02, APW03, APW04, and APW12; and one upgradient UD well APW05S. Concentrations of TDS at these PMP wells ranged from 540 to 5,300 mg/L. Concentrations at this upgradient well ranged from 3,200 to 3,800 mg/L.

5. EVALUATION OF POTENTIAL RECEPTORS

5.1 Water Well Survey

A potable water well inventory was completed in 2021 utilizing state databases to assess nearby pumping wells, drinking water receptors, and other uses of water in the vicinity of the PAP. The following sources of information were queried to identify well locations, drinking water receptors, and other uses of water within 1,000 meters of the PAP boundary:

- ISGS Illinois Water and Related Wells (ILWATER) Map[2]

A search of the ILWATER Map identified two wells located within 1,000-meters of the PAP (Well Nos. 120790038600 and 120790043600). Both wells are located to the southeast, or side-gradient, of the PAP and are listed as dry and abandoned. The assessment concluded there are no existing off-site water wells, potable or non-potable, that could potentially be impacted by groundwater from the PAP. The water well potential receptors are detailed in **Appendix B**.

5.2 Surface Water

A search was performed utilizing the United States Fish and Wildlife Service (USFWS) Wetlands Mapper[3] and the USGS National Map[4] for surface water bodies within 1,000 meters of the PAP. The predominant surface water body nearest the PAP is Newton Lake. Newton Lake is an approximately 1,648-acre freshwater lake partially encircling the PAP along the east, west, and south sides and at its closest point is approximately 240 feet downgradient from the PAP.

Additional surface water features indicated in the USFWS Wetlands Mapper and USGS National Map include several freshwater ponds ranging from 0.27 acres to 6.16 acres located generally north, west, and south of the PAP, riverine wetlands located north and northwest of the PAP, and an approximately 13.7-acre lake located to the north of the PAP.

The USGS National Map places the PAP within the Weather Creek Watershed (Hydrologic Unit Code [HUC] 051201140504), which is part of the Big Muddy Creek Watershed (HUC 0512011405) and located within the larger Little Wabash subbasin (HUC 05120114). The HUC watershed location is presented in **Appendix B**.

A Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map for Jasper County (Map No. 1709900125B; Effective Date: January 17, 1985 is attached in **Appendix G** and can also be viewed online at: https://www.illinoisfloodmaps.org/dfirm.aspx?county=jasper. No base flood elevation has been established for this region.

5.3 Nature Preserves, Historic Sites, Endangered/Threatened Species

A search of the Illinois Department of Natural Resources (IDNR) Natural Heritage Database[5] for natural areas and protected areas within 1,000 meters of the PAP was performed. No natural or protected areas were identified within 1,000 meters of the PAP (**Appendix B**).

[2] ISGS ILWATER Map: https://prairieresearch.maps.arcgis.com/apps/webappviewer/index.html?id=e06b64ae0c814ef3a4e43a191cb57f87
[3] USFWS Wetlands Mapper: https://www.fws.gov/wetlands/data/mapper.html
[4] USGS National Map: https://apps.nationalmap.gov/viewer/
[5] IDNR Natural Heritage Database: https://www2.illinois.gov/dnr/conservation/NaturalHeritage/Pages/NaturalHeritageDatabase.aspx

The IDNR Natural Heritage Database Threatened and Endangered Species by County[6] lists 25 threatened and endangered species as located within Jasper County, including 18 endangered and 7 threatened species. Habitats for endangered or threatened species are identified at the county level only (**Appendix B**).

Additionally, a search of the IDNR Historic Preservation Division[7] databases for historic sites in the vicinity of the PAP yielded no results within 1,000 meters of the PAP. The Illinois State Archaeological Survey (ISAS)[8] databases that do not require credentials to access were also searched and yielded no results within 1,000 meters of the PAP.

[6] Illinois Threatened and Endangered Species by County: https://www2.illinois.gov/dnr/ESPB/Documents/ET_by_County.pdf
[7] IDNR Historic Preservation Division: https://www2.illinois.gov/dnrhistoric/Pages/default.aspx
[8] ISAS: https://www.isas.illinois.edu/

6. CONCLUSIONS

Hydrogeologic characterization of the PAP was originally developed as part of the *Hydrogeologic Investigation and Groundwater Monitoring Program, Newton Power Station, Jasper County, Illinois* (Rapps, 1997) and most recently updated for this HCR. Results of these hydrogeologic studies were reintroduced in this HCR and updated to include geologic, hydrogeologic, and groundwater quality data collected with a focus on the PAP (Part 845 regulated) CCR Unit and subject of this HCR.

The data were summarized and evaluated for changes in groundwater conditions since the previous investigations; available groundwater quality data for the PAP was compared to the to the Part 845 Standards.

The results of the hydrogeologic and groundwater quality evaluation are:

- There are six types of unlithified material present in the vicinity of the PAP, these include the following in descending order:
  - **CCR and Fill Material:** CCR and reworked surface materials within and adjacent to the various CCR Units.
  - **Peoria Silt and Sangamon Soil** (wind-blown deposits and weathered till)**:** Clays and silts, including the Peoria Silt (Loess Unit) in upland areas, underlain by the Sangamon Soil which is comprised of weathered glacial drift.
  - **Hagarstown Member:** Where present, consists of relatively thin sandy deposits between the clays and silts of the Sangamon Soil and the Vandalia Till.
  - **Vandalia Till Member:** Compacted clay and silt glacial till with varying amounts of sand and gravel (diamicton).
  - **Mulberry Grove Member:** Sand, silty sand, and sandy silt/clay units found between the Vandalia Till and the Smithboro Till. These sandy deposits are the first laterally continuous sands observed beneath the PAP.
  - **Smithboro Till Member and Banner Formation:** Thick, gray compacted silty clay diamicton of the Smithboro Till and the greenish-gray silty clay of the Banner Formation.
- Bedrock underlying the PAP is the Pennsylvanian Age Mattoon Formation, which consists of a complex sequence of thin limestones, coals, black fissile shales, underclays, thick gray shales, and several well-developed sandstones.
- Six hydrostratigraphic units have been identified at the PAP based on stratigraphic relationships and common hydrogeologic characteristics, these include the following in descending order:
  - **CCR**: CCR consisting of fly and bottom ash within the PAP.
  - **UD/PMP**: The UD is composed of the low permeability silts and clays of the Peoria Silt and Sangamon Soil and the sandier soils of the Hagarstown Member (*i.e.,* PMP).
    - **Hagarstown Member/PMP**: The Hagarstown Member consists of the discontinuous, sandier deposits of the UD where present and overlies the Vandalia Till.
  - **UCU**: This unit consists of the low permeability clay and silt of the Vandalia Till.

  - **Uppermost Aquifer**: This unit is composed of the Mulberry Grove Formation, which onsite has been classified as poorly graded sand, silty sand, clayey sand, and gravel.
  - **LCU**: This unit is comprised of low permeability silt and clay of the Smithboro Till and the Banner Formation.
  - **Bedrock Confining Unit**: Bedrock was classified as shale of the Mattoon Formation in locations it was encountered during 2021 investigation activities (APW13 and APW14).
- Groundwater within the uppermost aquifer flows generally from north to south. However, uppermost aquifer wells also display flow converging towards a former surface drainage feature located west of the PAP (resulting in a southwest flow direction). Groundwater elevations vary seasonally, generally less than one foot per year, while across the PAP they range from approximately 490 to 530 feet NAVD88, although flow directions are generally consistent.
- The surface water elevation at Newton Lake measured from February 15 to March 9, 2021 ranged from 504.42 to 504.84 feet NAVD88 at location SG02. Groundwater flow in the uppermost aquifer generally flows southwest across the PAP with potentiometric surface elevations at downgradient wells around 491 feet (approximately 15 feet lower than the lake elevation). This separation in groundwater and Lake elevations (and observed downward vertical gradients) indicates groundwater does not flow into Newton Lake.
- Groundwater velocities in the uppermost aquifer range from 0.04 ft/day in the north and east portion of the site to 1.9 ft/day in the south and west portion of the PAP.
- The phreatic surface within the PAP is higher than groundwater elevations; however, there is a significant thickness of low permeability Vandalia Till (UCU) that separates the base of the unit from the uppermost aquifer. Groundwater flow within the uppermost aquifer does not appear to be influenced by the PAP.
- Based on the detailed geologic information provided, and the hydrogeologic and groundwater quality data, groundwater within the uppermost aquifer at the PAP is classified as Class I – Potable Resource Groundwater.
- Arsenic, chloride, fluoride, lead, lithium, pH, radium 226 and 228 combined, sulfate, and thallium were detected at concentrations/measurements greater than the GWPS in downgradient uppermost aquifer wells. Cobalt, lithium, pH, sulfate, and TDS were detected at concentrations/measurements greater than the GWPS at PMP wells. Arsenic, chloride, lithium, pH, sulfate, thallium, and TDS were detected at concentrations/measurements greater than the GWPS in background monitoring wells.

This HCR satisfies Part 845 content requirements specific to 35 I.A.C. § 845.620(b) (Hydrogeologic Site Characterization) for the PAP at the NPP.

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TABLES

TABLE 2-1. GEOTECHNICAL DATA SUMMARY
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample ID	Field Location ID	Top of Sample (ft bgs)	Bottom of Sample (ft bgs)	HSU	Moisture Content (%)	Dry Density (pcf)	Specific Gravity	Calculated Porosity [1] (%)	Vertical Hydraulic Conductivity (cm/s)	LL	PL	PI	Laboratory USCS	Gravel (%)	Sand (%)	Fines (%)
Sangamon Soil																
APW11	APW11	10	12	UD	17.8	111.7	2.645	32	8.57E-08	28	12	16	CL	1.1	45.1	53.8
APW15	APW15	20	22	UD	18.5	109.8	2.686	34	3.21E-08	33	10	23	CL	0.0	40.8	59.2
Hagarstown Member																
APW12	APW12	20	22	UD/PMP	15.1	118.3	2.694	30	1.07E-07	27	12	15	SC	7.4	46.8	45.8
APW12	APW12	25.5	26	UD/PMP	8.4	113.0	2.654	32	8.43E-06	10	13	NP	SP-SM	24.3	69.5	6.2
APW13	APW13	25	27	UD/PMP	21.2	87.1	2.649	47	9.63E-05	9	10	NP	SP-SM	0.0	88.9	11.1
Vandalia Till Member																
APW14	APW14	45	47	UCU	12.4	119.6	2.706	29	9.65E-08	26	14	12	CL	4.4	32.3	63.3
APW17	APW17	40	42	UCU	16.6	108.8	2.709	36	3.34E-08	26	13	13	CL	1.3	27.6	71.1
SB300	APW18	50	52	UCU	12.9	122.7	2.700	27	7.29E-08	32	12	20	CL	0.8	22.4	76.8
SB301	SB301	48	50	UCU	14.1	117.3	2.697	30	6.63E-08	27	14	13	CL	0.4	34.2	65.4
Mulberry Grove Member																
APW13	APW13	60.5	61	UA	14.5	114.3	2.661	31	2.18E-04	8	13	NP	SM	0.3	75.2	24.5
APW15	APW15	100.5	101	UA	12.1	116.4	2.665	30	3.50E-06	15	12	3	SM	4.4	49.8	45.8
APW17	APW17	71	71.5	UA	7.8	110.2	2.660	34	7.21E-04	5	9	NP	SW-SM	14.3	76.8	8.9
APW17	APW17	90.5	91	UA	6.1	116.8	2.672	30	6.39E-04	6	8	NP	SP-SM	28.2	65.1	6.7
SB300	APW18	61	61.5	UA	13.6	109.6	2.686	35	1.85E-05	5	9	NP	SM	4.7	78.2	17.1
Smithboro Till Member																
APW11	APW11	61	61.5	LCU	17.8	110.5	2.686	34	1.87E-07	27	18	9	CL	0.0	21.4	78.6
APW11	APW11	80	82	LCU	16.5	116.1	2.705	31	2.94E-08	32	14	18	CL	0.0	21	79
APW12	APW12	85	87	LCU	14.4	116.4	2.711	31	2.36E-08	29	14	15	CL	0.3	19.5	80.2
APW14	APW14	55.5	56	LCU	18.0	104.6	2.709	38	2.74E-07	25	15	10	CL	0.0	27.8	72.2
APW15	APW15	105	107	LCU	19.1	107.8	2.695	36	8.20E-08	29	13	16	CL	0.0	23.8	76.2
SB300	APW18	62.5	63	LCU	11.1	124.6	2.659	25	4.32E-06	20	14	6	CL-ML	0.0	42.4	57.6
SB300	APW18	105	107	LCU	14.1	116.4	2.710	31	4.28E-08	28	13	15	CL	0.0	30.7	69.3
SB301	SB301	68.5	69	LCU	13.1	121.3	2.723	29	4.05E-08	23	14	9	CL	0.0	31.3	68.7
SB301	SB301	98	100	LCU	15.7	118.2	2.720	30	6.13E-08	37	15	22	CL	0.0	17.8	82.2
CCR																
XPW01	XPW01	8.5	9	CCR	18.6	87.7	2.675	47	1.71E-04	47	57	NP	SP-SM	37.1	51.1	11.8
XPW01	XPW01	15.5	16	CCR	12.6	84.4	2.741	51	1.58E-05	35	17	18	CL	4.6	34.1	61.3
XPW03	XPW03	6	6.5	CCR	17.4	75.3	2.663	55	1.34E-03	33	27	6	SM	6.8	71.7	21.5
XPW03	XPW03	15.5	16	CCR	16.7	103.6	2.689	38	9.70E-05	12	19	NP	SM	16.4	67.3	16.3
XPW04	XPW04	6.5	7	CCR	31.1	73.9	2.697	56	1.61E-04	41	38	3	SM	1.6	84.5	13.9
XPW04	XPW04	15.5	16	CCR	31.1	80.8	2.650	51	7.83E-05	46	42	4	SM	15.7	51	33.3

TABLE 2-1. GEOTECHNICAL DATA SUMMARY

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample ID	Field Location ID	Top of Sample (ft bgs)	Bottom of Sample (ft bgs)	HSU	Moisture Content (%)	Dry Density (pcf)	Specific Gravity	Calculated Porosity [1] (%)	Vertical Hydraulic Conductivity (cm/s)	LL	PL	PI	Laboratory USCS	Gravel (%)	Sand (%)	Fines (%)
Fill																
XPW02	XPW02	8	8.5	CCR	29.1	92.9	2.691	45	6.07E-08	36	16	20	CL	0.3	44.8	54.9
XPW02	XPW02	16.5	17	CCR	21.8	103.7	2.694	38	7.38E-08	36	14	22	CL	0.0	19.8	80.2

[O: SSW 04/22/21, U:EDP 08/23/21, U: SSW 08/26/21, C: LDC 08/31/21; U: LDC 09/16/21, C: SSW 09/21/21]

Notes:
[1] Porosity calculated as relationship of bulk density to particle density (n = 100[1- (pb/pd)])
% = Percent
bgs = below ground surface
CCR = coal combustion residuals
cm/s = centimeters per second
ft = foot/feet
in = inch
LL = Liquid limit
NP = Non Plastic
pcf = pounds per cubic foot
PI = Plastic Index
PL = Plasticity Limit

HSU = Hydrostratigraphic Unit
LCU = lower confining unit
PMP = potential migration pathway
UA = uppermost aquifer
UCU = upper confining unit
UD = upper drift

USCS = Unified Soil Classification System
CL - Lean Clay
CL-ML = Silty Lean Clay
SC = Clayey Sand
SM = Silty Sand
SP-SM = Poorly Graded Sand with Silt
SW-SM = Well Graded Sand with Silt

TABLE 2-2. ASH ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Depth (ft BGS)	Sample Date	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Boron (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Selenium (mg/kg)	Thallium (mg/kg)
XPW01	6-8	01/20/2021	<4.1	7.5	1800	1.6	260	<1.4	27	12	21	15	0.53	3.3	5.8	<1.4
XPW01	13-15	01/20/2021	<4	12	2400	2	390	<1.3	33	18	24	21	0.74	4.5	8.1	<1.3
XPW02	9-10	01/19/2021	<3	2.6	1900	1.2	94	<1	13	6.7	5	10	<0.2	1.2	<1	<1
XPW02	11.5-13.5	01/19/2021	<4.6	19	570	<1.5	69	<1.5	14	5	6.9	<7.7	<0.31	21	2.1	<1.5
XPW03	7.5-9	01/19/2021	<4.4	7.4	3600	1.8	280	<1.5	31	15	21	16	<0.29	3.6	3	<1.5
XPW03	17-19	01/19/2021	<3.6	27	490	1.3	95	<1.2	22	3.1	6.3	6.7	<0.24	3.4	1.3	<1.2
XPW04	13-15	01/19/2021	<3.4	9.4	1100	1.9	310	<1.1	26	13	21	18	0.69	3.6	5.9	<1.1
XPW04	17-19	01/19/2021	<5.6	9	4100	2.2	320	<1.9	33	15	21	18	<0.37	3.7	3.4	<1.9

Notes:
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method.
BGS = below ground surface
ft = feet
mg/kg = milligrams per kilogram

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TABLE 2-3. POREWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, 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)
XPW01	02/17/2021	<0.003	0.042	0.035	<0.001	9.5	<0.004	62	49	<0.004	<0.008	2.17	<0.001	0.11	0.015	0.66	12.3	0.0059	0.23	19000	<0.001
XPW01	03/09/2021	<0.003	0.049	0.14	<0.001	11	<0.001	63	38	<0.004	<0.002	2.37	<0.001	0.13	0.014	0.59	12.4	0.211	0.21	14000	<0.001
XPW01	03/30/2021	<0.003	0.049	0.064	<0.001	9.9	<0.001	54	32	<0.004	<0.002	2.7	<0.001	0.14	0.011	0.54	12.4	0	0.19	19000	<0.001
XPW01	04/28/2021	<0.003	0.054	0.46	<0.001	10	<0.001	61	33	0.008	0.003	2.61	0.0039	0.074	0.013	0.53	12.3	0.157	0.17	12000	<0.001
XPW01	06/30/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.19	--	--	--
XPW01	07/14/2021	<0.003	0.052	0.039	<0.001	12	<0.001	31	27	<0.004	<0.002	1.92	<0.001	0.15	0.012	0.38	12.2	0.167	0.12	11000	<0.001
XPW02	02/17/2021	<0.003	0.092	0.017	<0.001	2.3	<0.001	15	10	<0.004	<0.002	0.762	<0.001	<0.02	<0.0002	0.093	8.6	0.096	<0.001	160	<0.001
XPW02	03/09/2021	<0.003	0.091	0.024	<0.001	2.5	<0.001	20	9.6	<0.004	<0.002	0.61	<0.001	<0.02	<0.0002	0.097	9.2	0.705	<0.001	150	<0.001
XPW02	03/30/2021	<0.003	0.085	0.05	<0.001	2.4	<0.001	22	9.9	<0.004	<0.002	0.575	<0.001	0.026	<0.0002	0.1	8.9	0.832	<0.001	160	<0.001
XPW02	04/28/2021	<0.003	0.082	0.042	<0.001	2.6	<0.001	25	9.7	<0.004	<0.002	0.637	<0.001	0.023	<0.0002	0.11	9.9	0.668	<0.001	190	<0.001
XPW02	06/30/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.026	--	--	--
XPW02	07/14/2021	<0.003	0.077	0.025	<0.001	2.5	<0.001	21	10	<0.004	<0.002	0.508	<0.001	0.028	<0.0002	0.086	9.7	0.388	<0.001	160	<0.001
XPW03	02/17/2021	<0.003	0.036	0.069	<0.001	1.3	<0.001	42	14	<0.004	<0.002	0.466	<0.001	0.032	<0.0002	0.061	10.9	0.204	0.0023	92	<0.001
XPW03	03/09/2021	<0.003	0.031	0.11	<0.001	1.2	<0.001	47	9.2	<0.004	<0.002	0.569	<0.001	0.024	<0.0002	0.054	10.8	0.576	0.0038	93	<0.001
XPW03	03/30/2021	<0.003	0.014	0.088	<0.001	0.84	<0.001	44	13	<0.004	<0.002	0.384	<0.001	0.025	<0.0002	0.027	10.2	0.451	0.0019	94	<0.001
XPW03	04/28/2021	<0.003	0.035	0.37	<0.001	1.2	<0.001	55	11	0.0055	<0.002	0.598	0.0027	0.029	<0.0002	0.054	11.3	0.613	0.0017	96	<0.001
XPW03	06/30/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.47	--	--	--
XPW03	07/14/2021	<0.003	0.032	0.44	<0.001	1.3	<0.001	72	11	0.0068	0.0021	0.372	0.0036	0.04	<0.0002	0.055	11.2	0.57	0.0019	120	<0.001
XPW04	02/17/2021	<0.003	0.0065	0.13	<0.001	2.5	<0.001	80	62	<0.004	<0.002	0.618	<0.001	0.021	0.00029	0.37	10.8	0.0723	0.055	2200	<0.001
XPW04	03/09/2021	<0.003	0.0067	0.15	<0.001	2.4	<0.001	65	34	<0.004	<0.002	0.602	<0.001	<0.02	<0.0002	0.19	10.0	0.374	0.028	1400	<0.001
XPW04	03/29/2021	<0.003	0.0062	0.3	<0.001	2.1	<0.001	53	31	0.005	<0.002	0.605	<0.001	<0.02	<0.0002	0.059	9.1	0.62	0.0074	600	<0.001
XPW04	04/28/2021	<0.003	0.0071	0.22	<0.001	2.8	<0.001	120	37	<0.004	<0.002	0.628	<0.001	0.02	0.00027	0.52	11.5	0.0889	0.083	3800	<0.001
XPW04	06/30/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.66	--	--	--
XPW04	07/14/2021	<0.003	0.0067	0.089	<0.001	2.3	<0.001	60	34	<0.004	<0.002	0.542	<0.001	<0.02	<0.0002	0.14	10.0	0.36	0.02	1600	<0.001

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TABLE 2-3. POREWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, 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)

Notes:
Field readings are reported with as many significant figures as provided by analytical laboratory.
-- = data not available
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method.
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units

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TABLE 2-4. SOIL ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Geologic Unit	Sample Depth (ft BGS)	Sample Date	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Boron (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Selenium (mg/kg)	Thallium (mg/kg)
APW11	Peoria Silt/Sangamon Soil	8-10	01/23/2021	<3.6	4.3	45	<1.2	<12	<1.2	7.3	9.4	8.5	<6.1	<0.24	<1.2	<1.2	<1.2
APW11	Mulberry Grove Member	62-64	01/23/2021	<3.5	2.8	16	<1.2	<12	<1.2	7.1	4.3	5.7	7.3	<0.23	<1.2	<1.2	<1.2
APW11	Smithboro Till Member	94-96	01/23/2021	<3.6	8.9	86	<1.2	<12	<1.2	9.8	5.7	8.6	<6	<0.24	1.2	<1.2	<1.2
APW12	Hagarstown Member	22-23.5	01/21/2021	<3.6	2.4	46	<1.2	<12	<1.2	13	7.4	8.4	10	<0.24	<1.2	<1.2	<1.2
APW12	Hagarstown Member	23.5-25	01/21/2021	<3.8	1.4	9.7	<1.3	<13	<1.3	<5.1	<2.5	1.7	<6.3	<0.25	<1.3	<1.3	<1.3
APW12	Smithboro Till Member	83-85	01/21/2021	<3.2	22	65	<1.1	<11	<1.1	11	9.4	13	7.8	<0.21	1.3	<1.1	<1.1
APW13	Sangamon Soil	23-25	01/22/2021	<3.1	2.4	41	<1	<10	<1	11	5.5	8.6	10	<0.21	<1	<1	<1
APW13	Mulberry Grove Member	58-60	01/22/2021	<4	4.6	25	<1.3	<13	<1.3	10	6.7	8.6	<6.6	<0.26	2.3	<1.3	<1.3
APW13	Banner Formation	78-80	01/22/2021	<3.1	5.9	57	<1	<10	<1	16	9.7	12	20	<0.21	2.5	<1	<1
APW14	Mulberry Grove Member	48-50	01/23/2021	<3.2	3.7	11	<1.1	<11	<1.1	6.6	3.9	6	6.3	<0.21	1.4	<1.1	<1.1
APW14	Smithboro Till Member	88-90	01/23/2021	<3.2	4.1	83	<1.1	<11	<1.1	12	7.2	15	9.6	<0.21	<1.1	1.2	<1.1
APW15	Hagarstown Member	23-25	01/21/2021	<3	<1	42	<1	<10	<1	5.1	<2	7.5	<5.1	<0.2	<1	<1	<1
APW15	Vandalia Till Member	85-87	01/21/2021	<3	1.8	14	<1	<10	<1	<4	<2	3.2	<5	<0.2	<1	<1	<1
APW15	Smithboro Till Member	102-104	01/22/2021	<3.5	1.8	14	<1.2	<12	<1.2	<4.7	<2.3	3.5	<5.9	<0.23	<1.2	<1.2	<1.2
APW17	Vandalia Till Member	38-40	01/22/2021	<3.1	3.4	21	<1	<10	<1	7.5	5.7	7.7	7	<0.21	1.5	<1	<1
APW17	Mulberry Grove Member	68-70	01/22/2021	<3	1.8	12	<1	<10	<1	<4	<2	2.8	<5	<0.2	<1	<1	<1
APW17	Mulberry Grove Member	88-90	01/22/2021	<3	5.9	37	<1	<10	<1	7.8	10	6.9	<5	<0.2	1.4	<1	<1

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TABLE 2-4. SOIL ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Geologic Unit	Sample Depth (ft BGS)	Sample Date	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Boron (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Selenium (mg/kg)	Thallium (mg/kg)
APW17	Smithboro Till Member	94-96	01/22/2021	<3.5	4.2	75	<1.2	<12	<1.2	8.6	4.6	7.4	7.6	<0.24	<1.2	<1.2	<1.2
XPW02	Fill	9-10	01/19/2021	<3	2.6	1900	1.2	94	<1	13	6.7	5	10	<0.2	1.2	<1	<1
XPW02	Fill	11.5-13.5	01/19/2021	<4.6	19	570	<1.5	69	<1.5	14	5	6.9	<7.7	<0.31	21	2.1	<1.5

Notes:
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method.
BGS = below ground surface
ft = foot or feet
mg/kg = milligrams per kilogram

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TABLE 3-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, 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)
APW02	UD	06/19/2010	533.61	533.61	Top of Riser	529.90	9.70	19.70	520.20	510.20	20.00	509.90	10	2	38.925918	-88.293907
APW03	UD	06/18/2010	532.41	532.41	Top of Riser	528.37	9.70	19.70	518.67	508.67	20.00	508.40	10	2	38.922322	-88.281567
APW04	UD	06/19/2010	525.06	525.06	Top of Riser	521.45	7.70	17.70	513.75	503.75	18.00	503.50	10	2	38.927444	-88.273113
APW05	UA	10/22/2015	544.07	544.07	Top of Riser	541.08	62.64	67.44	478.44	473.64	67.84	473.10	4.8	2	38.933958	-88.280983
APW05S	UD	01/19/2021	543.94	543.94	Top of PVC	541.05	10.00	20.00	531.05	521.05	20.00	518.10	10	2	38.933958	-88.281033
APW06	UA	10/21/2015	546.07	546.07	Top of Riser	542.89	67.67	72.48	475.22	470.41	72.88	468.90	4.8	2	38.933746	-88.286276
APW07	UA	11/05/2015	538.37	538.37	Top of Riser	535.72	77.89	82.70	457.83	453.02	83.10	452.60	4.8	2	38.928233	-88.292076
APW08	UA	10/28/2015	528.97	528.97	Top of Riser	526.26	71.40	81.06	454.86	445.20	81.53	444.30	9.7	2	38.923154	-88.292286
APW09	UA	11/03/2015	531.52	531.52	Top of Riser	528.33	56.66	61.46	471.67	466.87	61.85	466.30	4.8	2	38.922319	-88.281585
APW10	UA	11/06/2015	524.25	524.25	Top of Riser	521.49	40.74	45.54	480.75	475.95	45.94	475.60	4.8	2	38.927435	-88.273127
APW11	UA	01/23/2021	538.63	538.63	Top of PVC	536.05	60.00	65.00	476.05	471.05	65.00	436.10	5	2	38.932811	-88.27545
APW12	UD	02/21/2021	546.29	546.29	Top of PVC	543.33	20.00	30.00	523.33	513.33	30.00	456.30	10	2	38.92975	-88.272058
APW13	UA	01/22/2021	537.99	537.99	Top of PVC	535.16	58.50	63.50	476.66	471.66	63.50	445.20	5	2	38.92566	-88.274416
APW14	UA	01/23/2021	526.29	526.29	Top of PVC	523.85	50.00	55.00	473.85	468.85	55.00	428.90	5	2	38.924057	-88.277994
APW15	UA	01/22/2021	524.69	524.69	Top of PVC	522.06	98.00	103.00	424.06	419.06	103.00	412.10	5	2	38.921593	-88.285226
APW16	UA	01/20/2021	531.18	531.18	Top of PVC	529.16	80.50	85.50	448.66	443.66	85.50	419.20	5	2	38.920317	-88.291291
APW17	UA	01/22/2021	532.52	532.52	Top of PVC	529.84	87.00	92.00	442.84	437.84	92.00	429.80	5	2	38.925916	-88.293928
APW18	UA	01/21/2021	543.27	543.27	Top of PVC	540.55	75.00	80.00	465.55	460.55	80.00	433.60	5	2	38.930979	-88.290122
G48MG	UA	10/20/2015	545.53	545.53	Top of Riser	542.68	71.80	76.65	470.88	466.03	77.06	465.60	4.9	2	38.939248	-88.296012
G202	UA	10/16/1996	539.69	539.69	Top of Riser	536.85	64.00	74.00	472.85	462.85	74.00	462.90	10	2	38.930876	-88.290559
G203	UA	11/15/1996	533.13	533.13	Top of Riser	530.73	62.50	72.50	468.23	458.23	72.50	458.20	10	2	38.928597	-88.292217
G208	UA	10/13/2011	535.03	535.03	Top of Riser	533.19	74.93	94.71	458.26	438.48	94.80	438.20	19.8	2	38.929632	-88.298182
G217S	UD	08/26/1997	537.98	537.98	Top of Riser	535.54	9.00	19.00	526.54	516.54	19.00	510.50	10	2	38.932171	-88.290041

TABLE 3-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, 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)
G217D	UA	12/09/2014	537.92	537.92	Top of Riser	535.51	--	--	--	--	69.30	--	--	--	38.932174	-88.29008
G222	UA	10/25/2011	534.32	534.32	Top of Riser	532.38	64.57	79.24	467.81	453.14	79.30	452.40	14.7	2	38.927194	-88.299669
G223	UA	10/11/2011	533.60	533.60	Top of Riser	531.68	79.09	88.75	452.59	442.93	89.10	442.60	9.7	2	38.93016	-88.293451
G224	UA	10/05/2011	534.31	534.31	Top of Riser	532.31	63.51	73.17	468.80	459.14	73.50	458.30	9.7	2	38.931767	-88.292396
R202	UA	--	--	--	--	--	--	--	--	--	--	--	--	--	38.930879	-88.290581
R217D	UA	09/26/2017	538.18	538.18	Top of Riser	535.60	60.10	65.03	475.50	470.57	65.24	470.40	4.9	2	38.932191	-88.290118
XPW01	CCR	01/20/2021	551.76	551.76	Top of PVC	548.62	7.00	17.00	541.62	531.62	17.00	528.60	10	2	38.932212	-88.285525
XPW02	CCR	01/19/2021	554.43	554.43	Top of PVC	551.97	6.00	16.00	545.97	535.97	16.00	532.00	10	2	38.932343	-88.28289
XPW03	CCR	01/19/2021	553.65	553.65	Top of PVC	550.81	10.00	20.00	540.81	530.81	20.00	530.80	10	2	38.931062	-88.27641
XPW04	CCR	01/19/2021	554.51	554.51	Top of PVC	551.90	10.00	20.00	541.90	531.90	20.00	531.90	10	2	38.929888	-88.274073
XSG01	CCR	--	--	536.17	Staff gauge	--	--	--	--	--	--	--	--	--	38.923218	-88.29067
SG02	SW	--	--	506.89	Staff gauge	--	--	--	--	--	--	--	--	--	38.921234	-88.292057

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 Residual
ft = foot or feet
HSU = Hydrostratigraphic Unit
PVC = polyvinyl chloride
SW = surface water
UA = uppermost aquifer
UD = upper drift
generated 10/05/2021, 4:23:16 PM CDT

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TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER STATION
PRIMARY ASH POND
NEWTON, IL

Date	APW05S Groundwater Elevation (ft NAVD88)	APW05 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	PMP	UA				
2/15/2021	533.90	529.83	4.07	50.01	0.081	down
3/9/2021	533.71	529.61	4.10	50.01	0.082	down
3/29/2021	533.91	529.68	4.23	50.01	0.085	down
4/27/2021	533.56	529.73	3.83	50.01	0.077	down
5/25/2021	533.23	529.51	3.72	50.01	0.074	down
6/15/2021	532.54	529.42	3.12	50.01	0.062	down
6/24/2021	531.93	529.38	2.55	50.01	0.051	down
7/14/2021	532.16	529.33	2.83	50.01	0.057	down
			Middle of screen elevation APW05S			526.05
			Middle of screen elevation APW05			476.04

Date	APW04 Groundwater Elevation (ft NAVD88)	APW10 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	PMP	UA				
2/15/2021	518.19	506.65	11.54	30.40	0.38	down
3/9/2021	519.50	505.10	14.40	30.40	0.47	down
3/29/2021	520.34	506.94	13.40	30.40	0.44	down
4/27/2021	519.87	506.53	13.34	30.40	0.44	down
5/24/2021	519.73	506.35	13.38	30.40	0.44	down
6/15/2021	519.68	506.26	13.42	30.40	0.44	down
6/24/2021	529.51	506.12	23.39	30.40	0.77	down
7/14/2021	519.99	506.59	13.40	30.40	0.44	down
			Middle of screen elevation APW04			508.8
			Middle of screen elevation APW10			478.4

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TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

NEWTON POWER STATION

PRIMARY ASH POND

NEWTON, IL

Date	APW03 Groundwater Elevation (ft NAVD88)	APW09 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	PMP	UA				
2/15/2021	523.58	504.93	18.65	47.00	0.40	down
3/9/2021	524.93	505.10	19.83	47.00	0.42	down
3/29/2021	526.00	505.23	20.77	47.00	0.44	down
4/27/2021	524.25	504.74	19.51	47.00	0.42	down
5/25/2021	523.85	- - -	- - -	- - -	- - -	- - -
6/15/2021	523.41	504.63	18.78	47.00	0.40	down
6/24/2021	523.18	504.48	18.70	47.00	0.40	down
7/14/2021	523.70	505.24	18.46	47.00	0.39	down
			Middle of screen elevation APW03			518.7
			Middle of screen elevation APW09			471.7

[O:SSW 09/09/21; U:SSW 08/31/21; C: LDC 08/31/21]

Notes:

[1] Distance change was calculated using the midpoint of the piezometer screen and water table surface. If the water table surface was above the top of the monitoring well screen, then distance change was calculated using the midpoint of both screens.

[2] Vertical gradients between ±0.0015 are considered flat, and typically have less than 0.02 foot difference in groundwater elevation between wells.

- - - = no data collected on date / no vertical gradient calculated

dh = head change

dl = distance change

ft = foot/feet

LCU = lower confining unit

NAVD88 = North American Vertical Datum of 1988

PMP = potential migration pathway

UA = uppermost aquifer

TABLE 3-3. FIELD HYDRAULIC CONDUCTIVITIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER STATION
PRIMARY ASH POND
NEWTON, ILLINOIS

Well ID	Gradient Position	Bottom of Screen Elevation (ft NAVD88)	Screen Length [1] (ft)	Field Identified Screened Material	Slug Type	Analysis Method	Falling Head (Slug In) K (cm/s)			Rising Head (Slug Out) K (cm/s)			Minimum Hydraulic Conductivity (cm/s)	Maximum Hydraulic Conductivity (cm/s)	Hydraulic Conductivity Geometric Mean (cm/s)
							1	2	3	1	2	3			
Upper Drift Unit/Potential Migration Pathway															
APW5S	U	521.05	10	SP	Solid	C-B-P	8.9E-04	7.4E-04		6.1E-04	8.5E-04		6.1E-04	1.5E-02	3.1E-03
APW12	U	513.33	10	SP	Solid	C-B-P	1.3E-02	9.8E-03		1.3E-02	1.5E-02				
Uppermost Aquifer															
APW11	U	471.05	5	SP-SC/GP	Solid	KGS Model	6.8E-03	5.9E-03		3.5E-03	7.8E-03		2.0E-04	1.5E-01	6.8E-03
APW13	D	471.66	5	SM	Solid	C-B-P	1.6E-03	1.5E-03	3.3E-03	3.8E-03	3.4E-03				
APW14	D	468.85	5	SC	Solid	KGS Model	3.9E-03	4.3E-03		3.2E-04	3.2E-04	2.8E-03			
APW15	D	419.06	5	SP-SM	Solid	KGS Model	4.9E-04	2.0E-04	1.4E-01	1.5E-01	1.5E-01				
APW16	D	443.66	5	SP	Solid	B-Z	1.24E-01	1.41E-01		7.60E-02	7.96E-02				
APW17	D	437.84	5	(SW)g/(SP)g	Solid	C-B-P	1.13E-01	1.15E-02							
APW18	D	460.55	5	(SW)g/SC	Solid	C-B-P	2.67E-04								
Ash Pond															
XPW01	CCR	531.62	10	(SW)g	Solid	Bouwer-Rice	1.8E-01	1.3E-02		2.4E-02	1.4E-02		1.0E-03	2.3E-01	2.0E-02
XPW02	CCR	535.97	10	(SW)g	Solid	Bouwer-Rice	2.0E-03	2.6E-03							
XPW03	CCR	530.81	10	(SW)g/SP	Solid	Bouwer-Rice	5.7E-02	7.2E-02	2.3E-01	1.5E-01	1.2E-01	1.4E-01			
XPW04	CCR	531.90	10	(SW)g	Solid	KGS Model		2.1E-03		1.2E-03	1.0E-03				

[O: SSW 7/1/20; U:SSW 8/20/21; C:LDC 08/31/21]

Notes:

[1] All wells are constructed from 2 inch PVC with 0.01 inch slotted screens.
Test not analyzed/performed
B-Z = Butler-Zhan Test Solution
C-B-P = Cooper-Bredehoeft-Papadopulos Slug Test Solution
CCR = coal combustion residuals
cm/s = centimeters per second
D = downgradient
ft = foot/feet
K = hydraulic conductivity
KGS = Kansas Geological Survey
NAVD88 = North American Vertical Datum of 1988
U = upgradient

USCS = Unified Soil Classification System
GP = Poorly Graded Gravel
SC = Clayey Sand
SM = Silty Sand
SP = Poorly Graded Sand
SP-SC = Poorly Graded Sand to Clayey Sand
SP-SM = Poorly Graded Sand with Silt
(SW)g = Well Graded Sand with Gravel

TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER STATION
PRIMARY ASH POND
NEWTON, IL

$V = K\,i\ /\ n_e$

V = Groundwater Velocity
K = Hydraulic Conductivity [1]
i = hydraulic gradient
n_e = Effective Porosity [2]

East-West Across CCR Unit (APW10 to APW17): Uppermost Aquifer

Distance between Wells (ft): 5941
Hydraulic Conductivity (ft/day): 181
Effective Porosity (%): 24% Assumes: sand and silt

Date	APW10 Groundwater Elevation (ft NAVD88)	APW17 Groundwater Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity [3] (ft/day)
2/15/2021	506.65	492.02	14.63	0.0025	1.86
3/9/2021	506.84	491.74	15.10	0.0025	1.91
3/29/2021	506.94	491.95	14.99	0.0025	1.90
4/27/2021	506.53	491.87	14.66	0.0025	1.86
6/15/2021	506.26	491.57	14.69	0.0025	1.86
6/24/2021	506.12	491.52	14.60	0.0025	1.85
7/14/2021	506.59	491.58	15.01	0.0025	1.90
			Average	0.0025	1.88

North-South Across Northeastern Portion CCR Unit (APW05 to APW10): Uppermost Aquifer

Distance between Wells (ft): 3260
Hydraulic Conductivity (ft/day): 1.4
Effective Porosity (%): 24% Assumes: sand and silt

Date	APW05 Groundwater Elevation (ft NAVD88)	APW10 Groundwater Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity [3] (ft/day)
2/15/2021	529.83	506.65	23.18	0.0071	0.04
3/9/2021	529.61	506.84	22.77	0.0070	0.04
3/29/2021	529.68	506.94	22.74	0.0070	0.04
4/27/2021	529.73	506.53	23.20	0.0071	0.04
5/24/2021	529.51	506.35	23.16	0.0071	0.04
6/15/2021	529.42	506.26	23.16	0.0071	0.04
6/24/2021	529.38	506.12	23.26	0.0071	0.04
7/14/2021	529.33	506.59	22.74	0.0070	0.04
			Average	0.0071	0.04

[O:SSW 7/15/21; U:SSW 8/19/21; C:LDC 8/31/21]

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TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

NEWTON POWER STATION

PRIMARY ASH POND

NEWTON, IL

Notes:

[1] Hydraulic conductivity values used above are average of the individual wells used in each velocity calculation as derived from slug tests completed in August 2015 and March and April 2021 by Ramboll.

[2] Effective porosity used in these calculations was derived from an average between estimated values of 0.20 for silt materials, 0.267 for gravel, 0.07 for clay, and 0.28 for sand from Morris, D.A. and A.I. Johnson, 1967. Summary of hydrologic and physical properties of rock and soil materials as analyzed by the Hydrologic Laboratory of the U.S. Geological Surve, U.S. Geological Survey Water-Supply Paper 1839-D, 42p. and Heath, R.C., 1983. Basic ground-water hydrology, U.S. Geological Survey Water-Supply Paper 2220, 86p. Effective porosity may be as high as maximum total porosity (50%) calculated in Table 2-1.

% = percent

ft= foot/feet

ft/ft = feet per foot

ft/day = feet per day

NAVD88 = North American Vertical Datum of 1988

NM = not measured

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
APW02	01/13/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.9	--	--	--	--	4800
APW02	04/21/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.9	--	--	--	--	5300
APW02	07/15/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	5200
APW02	10/07/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	--	--	5000
APW02	02/17/2021	<0.003	<0.001	0.0084	<0.001	0.091	<0.001	430	84	<0.004	<0.002	<0.25	<0.001	0.079	<0.0002	<0.001	6.6	0.305	<0.001	2900	<0.001	4800
APW02	03/10/2021	<0.003	0.001	0.0091	<0.001	0.14	<0.001	530	120	<0.004	<0.002	<0.25	<0.001	0.11	<0.0002	0.0014	7.0	0.248	<0.001	3200	<0.001	5100
APW02	03/30/2021	<0.003	<0.001	0.0075	<0.001	0.24	<0.001	490	110	<0.004	<0.002	<0.25	<0.001	0.12	<0.0002	<0.001	6.6	0.193	<0.001	3100	<0.001	5200
APW02	04/29/2021	<0.003	<0.001	0.013	<0.001	0.12	<0.001	490	130	<0.004	<0.002	<0.25	<0.001	0.11	<0.0002	<0.001	6.7	0.924	<0.001	1500	<0.001	5100
APW02	05/25/2021	<0.003	<0.001	0.015	<0.001	0.14	<0.001	520	120	<0.004	<0.002	<0.25	<0.001	0.12	<0.0002	0.0011	6.7	1.01	<0.001	3200	<0.001	5200
APW02	06/16/2021	<0.003	<0.001	0.022	<0.001	0.16	<0.001	540	110	<0.004	<0.002	<0.25	<0.001	0.12	<0.0002	<0.001	6.6	0.34	<0.001	3100	<0.001	5000
APW02	06/30/2021	<0.003	<0.001	0.036	<0.001	0.49	<0.001	510	110	<0.004	<0.002	<0.25	<0.001	0.3	<0.0002	<0.001	6.6	0.618	<0.001	3200	<0.001	4900
APW02	07/15/2021	<0.003	<0.001	0.025	<0.001	0.14	<0.001	480	120	<0.004	<0.002	<0.25	<0.001	0.21	<0.0002	<0.001	6.6	0.33	<0.001	3100	<0.001	5400
APW03	01/13/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	--	--	3000
APW03	04/20/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	580
APW03	07/15/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.9	--	--	--	--	580
APW03	10/07/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.3	--	--	--	--	680
APW03	02/18/2021	<0.003	<0.001	0.077	<0.001	0.42	<0.00089	120	8.1	<0.004	<0.002	0.276	0.0013	0.022	0.0006	0.0018	6.7	0.126	<0.001	180	<0.001	620
APW03	03/10/2021	<0.003	<0.001	0.073	<0.001	0.4	<0.001	110	8.7	<0.004	<0.002	<0.25	<0.001	0.024	<0.0002	0.0014	7.2	0.238	<0.001	180	<0.001	720
APW03	03/31/2021	<0.003	<0.001	0.07	<0.001	0.44	<0.001	110	8.6	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	0.0012	6.3	0.246	<0.001	170	<0.001	720
APW03	04/29/2021	<0.003	<0.001	0.068	<0.001	0.4	<0.001	110	8.2	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	0.0019	7.0	0.822	<0.001	170	<0.001	660
APW03	05/25/2021	<0.003	<0.001	0.063	<0.001	0.38	<0.001	110	8	<0.004	<0.002	<0.25	<0.001	0.023	<0.0002	0.0015	7.0	0.369	<0.001	170	<0.001	760
APW03	06/17/2021	<0.003	<0.001	0.081	<0.001	0.45	<0.001	120	8.3	<0.004	<0.002	<0.25	<0.001	0.02	<0.0002	0.0014	7.0	0.461	<0.001	170	<0.001	660

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
APW03	06/30/2021	<0.003	<0.001	0.059	<0.001	0.66	<0.001	110	11	<0.004	<0.002	<0.25	<0.001	0.035	<0.0002	0.0014	7.0	0.0646	<0.001	160	<0.001	600
APW03	07/15/2021	<0.003	<0.001	0.067	<0.001	0.49	<0.001	110	8.5	<0.004	<0.002	<0.25	<0.001	0.03	<0.0002	0.0013	6.9	1.03	<0.001	190	<0.001	710
APW04	01/13/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.2	--	--	--	--	2300
APW04	04/20/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	3100
APW04	07/15/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	2400
APW04	10/07/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	2300
APW04	02/18/2021	<0.003	0.0012	0.021	<0.001	0.033	<0.00089	230	36	<0.004	<0.002	<0.25	0.0014	0.022	0.001	<0.001	6.5	0.391	<0.001	860	<0.001	1700
APW04	03/11/2021	<0.003	0.0012	0.022	<0.001	0.024	<0.001	220	33	<0.004	<0.002	<0.25	0.001	0.024	<0.0002	<0.001	6.9	0.104	<0.001	970	<0.001	1800
APW04	03/31/2021	<0.003	<0.001	0.018	<0.001	0.031	<0.001	210	37	<0.004	<0.002	<0.25	<0.001	0.021	<0.0002	<0.001	6.1	0.0836	<0.001	960	<0.001	2000
APW04	04/29/2021	<0.003	<0.001	0.013	<0.001	0.023	<0.001	220	29	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	<0.001	6.9	0.0843	<0.001	990	<0.001	1800
APW04	05/25/2021	<0.003	0.0014	0.026	<0.001	0.027	<0.001	220	32	<0.004	<0.002	<0.25	0.0014	0.021	<0.0002	<0.001	6.9	0.0127	<0.001	900	<0.001	1800
APW04	06/17/2021	<0.003	0.0012	0.026	<0.001	0.025	<0.001	240	29	<0.004	<0.002	<0.25	<0.001	0.021	<0.0002	<0.001	6.8	0.488	<0.001	950	<0.001	1800
APW04	06/30/2021	<0.003	<0.001	0.032	<0.001	0.21	<0.001	220	27	<0.004	<0.002	<0.25	<0.001	0.045	<0.0002	<0.001	6.8	0.663	<0.001	910	<0.001	1700
APW04	07/15/2021	<0.003	0.0012	0.025	<0.001	0.033	<0.001	210	34	<0.004	<0.002	<0.25	<0.001	0.034	<0.0002	<0.001	6.8	1.29	<0.001	920	<0.001	1900
APW05	12/15/2015	<0.003	0.018	0.19	<0.001	0.099	<0.001	51	48	<0.004	<0.002	0.486	0.0017	0.023	<0.0002	0.023	7.5	0.311	<0.001	15	<0.001	560
APW05	01/20/2016	<0.003	0.017	0.19	<0.001	0.12	<0.001	52	50	<0.004	<0.002	0.409	0.0016	0.017	0.0002	0.023	7.5	0.235	<0.001	15	<0.001	510
APW05	04/27/2016	<0.003	0.021	0.24	<0.001	0.1	<0.001	71	58	<0.004	<0.002	0.494	0.0012	0.02	0.002	0.032	7.7	0.281	0.001	14	<0.001	520
APW05	08/01/2016	<0.003	0.014	0.21	<0.001	0.1	<0.001	49	52	<0.004	<0.002	0.54	<0.001	0.016	<0.0002	0.027	7.5	0.616	<0.001	1.8	<0.001	500
APW05	10/25/2016	<0.003	0.013	0.22	<0.001	0.12	<0.001	50	50	<0.004	<0.002	0.66	<0.001	0.015	<0.0002	0.027	7.6	0.654	<0.001	<1	<0.001	1000
APW05	01/23/2017	<0.003	0.015	0.21	<0.001	0.09	<0.001	45	50	<0.004	<0.002	0.418	<0.001	0.013	<0.0002	0.021	7.4	0.0999	<0.001	<1	<0.001	550
APW05	04/24/2017	<0.003	0.014	0.2	<0.001	0.079	<0.001	44	46	0.004	<0.002	0.437	0.0014	0.015	<0.0002	0.016	7.0	1.19	<0.001	1.2	<0.001	600
APW05	06/13/2017	<0.003	0.016	0.23	<0.001	0.082	<0.001	48	47	<0.004	<0.002	0.508	<0.001	0.014	<0.0002	0.018	7.1	1.32	<0.001	<1	<0.001	540

RAMBOLL

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
APW05	11/17/2017	--	--	--	--	0.099	--	51	43	--	--	0.634	--	--	--	--	6.9	--	--	<1	--	480
APW05	05/18/2018	--	--	--	--	0.1	--	48	48	--	--	0.525	--	--	--	--	7.1	--	--	2.1	--	480
APW05	08/17/2018	--	--	--	--	--	--	54	56	--	--	--	--	--	--	--	7.0	--	--	1.4	--	--
APW05	11/09/2018	--	--	--	--	0.098	--	50	51	--	--	0.427	--	--	--	--	7.0	--	--	5.1	--	500
APW05	02/22/2019	--	--	--	--	0.11	--	50	48	--	--	0.374	--	--	--	--	6.9	--	--	3.5	--	600
APW05	08/22/2019	--	--	--	--	0.12	--	49	50	--	--	<0.25	--	--	--	--	7.0	--	--	2.3	--	530
APW05	02/04/2020	--	--	--	--	0.091	--	51	54	--	--	0.48	--	--	--	--	7.5	--	--	2.3	--	600
APW05	06/11/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	--	--	--
APW05	07/28/2020	--	--	--	--	0.1	--	53	52	--	--	0.544	--	--	--	--	7.7	--	--	1.8	--	530
APW05	02/09/2021	--	--	--	--	0.13	--	54	50	--	--	0.543	--	--	--	--	7.6	--	--	1.3	--	560
APW05	02/17/2021	<0.003	0.003	0.22	<0.001	0.1	<0.001	49	52	<0.004	<0.002	0.479	<0.001	<0.02	<0.0002	0.019	7.2	0.356	<0.001	3.3	<0.001	510
APW05	03/10/2021	<0.003	0.022	0.24	<0.001	0.12	<0.001	55	48	<0.004	<0.002	0.365	<0.001	<0.02	<0.0002	0.011	7.7	0.872	<0.001	1.3	<0.001	530
APW05	03/30/2021	<0.003	0.022	0.27	<0.001	0.092	<0.001	54	49	<0.004	<0.002	0.342	<0.001	<0.02	<0.0002	0.011	7.2	1.31	<0.001	1.3	<0.001	560
APW05	04/28/2021	<0.003	0.018	0.24	<0.001	0.099	<0.001	52	51	<0.004	<0.002	0.514	<0.001	<0.02	<0.0002	0.012	7.5	0.932	<0.001	1.1	<0.001	570
APW05	05/25/2021	<0.003	0.019	0.24	<0.001	0.12	<0.001	54	48	<0.004	<0.002	0.532	<0.001	<0.02	<0.0002	0.012	7.5	1.04	<0.001	1	<0.001	570
APW05	06/17/2021	<0.003	0.022	0.25	<0.001	0.091	<0.001	58	50	<0.004	<0.002	0.516	<0.001	<0.02	<0.0002	0.011	7.7	1.08	<0.001	<1	<0.001	560
APW05	06/30/2021	<0.003	0.021	0.25	<0.001	0.26	<0.001	52	51	<0.004	<0.002	0.441	<0.001	<0.02	<0.0002	0.011	7.6	0.0954	<0.001	1	<0.001	470
APW05	07/15/2021	<0.003	0.022	0.25	<0.001	0.1	<0.001	51	52	<0.004	<0.002	0.386	<0.001	<0.02	<0.0002	0.011	7.8	0.305	<0.001	1.1	<0.001	560
APW05S	02/17/2021	<0.003	<0.001	0.048	<0.001	0.04	<0.001	390	550	<0.004	0.0058	0.345	<0.001	0.043	<0.0002	0.0027	6.6	0.191	<0.001	640	<0.001	3700
APW05S	03/10/2021	<0.003	<0.001	0.051	<0.001	0.13	<0.001	420	190	<0.004	0.0025	0.379	<0.001	0.042	<0.0002	0.0016	7.0	0.195	<0.001	200	<0.001	3600
APW05S	04/29/2021	<0.003	0.0018	0.048	<0.001	0.04	<0.001	420	200	<0.004	<0.002	0.373	<0.001	0.039	<0.0002	0.0014	6.8	0.146	<0.001	2000	<0.001	3800
APW05S	05/25/2021	<0.003	0.0016	0.053	<0.001	0.056	<0.001	420	210	<0.004	<0.002	0.391	<0.001	0.042	<0.0002	0.0014	6.9	0.386	<0.001	2100	<0.001	3500

RAMBOLL

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
APW05S	06/17/2021	<0.003	0.0022	0.051	<0.001	0.043	<0.001	410	190	<0.004	0.0022	0.364	<0.001	0.038	<0.0002	0.0013	6.8	1.58	<0.001	2100	<0.001	3600
APW05S	06/30/2021	<0.003	0.002	0.051	<0.001	0.046	<0.001	380	180	<0.004	0.0022	0.401	<0.001	0.091	<0.0002	0.0011	6.7	0.29	<0.001	1900	<0.001	3200
APW05S	07/15/2021	<0.003	0.0026	0.05	<0.001	0.039	<0.001	370	260	<0.004	0.0027	0.379	<0.001	0.067	<0.0002	0.0011	6.8	0.644	<0.001	2000	<0.001	3800
APW06	12/15/2015	<0.003	0.017	0.16	<0.001	0.073	<0.001	53	26	<0.004	<0.002	0.509	<0.001	0.019	0.00023	0.012	7.5	0.591	0.006	9.9	<0.001	480
APW06	01/20/2016	<0.003	0.0091	0.17	<0.001	0.082	<0.001	53	24	<0.004	<0.002	0.393	<0.001	0.012	<0.0002	0.013	7.4	0.236	<0.001	9.9	<0.001	500
APW06	04/27/2016	<0.003	0.019	0.21	<0.001	0.16	<0.001	64	29	<0.004	<0.002	0.564	0.0012	0.019	<0.0002	0.028	6.5	0.984	<0.001	7.4	<0.001	450
APW06	08/01/2016	<0.003	0.0045	0.2	<0.001	0.078	<0.001	50	27	<0.004	<0.002	0.65	<0.001	0.016	<0.0002	0.0066	7.4	0.69	<0.001	1.2	<0.001	520
APW06	10/25/2016	<0.003	0.0041	0.22	<0.001	0.093	<0.001	50	26	<0.004	<0.002	0.686	<0.001	0.015	<0.0002	0.0087	7.5	0.329	<0.001	<1	<0.001	560
APW06	01/23/2017	<0.003	0.0036	0.21	<0.001	0.076	<0.001	46	26	<0.004	<0.002	0.448	<0.001	0.014	<0.0002	0.0086	6.9	0.316	<0.001	<1	<0.001	530
APW06	04/24/2017	<0.003	0.0042	0.2	<0.001	0.074	0.0012	43	50	<0.004	<0.002	0.47	0.0012	0.015	<0.0002	0.011	7.2	0.859	<0.001	<1	0.0011	540
APW06	06/13/2017	<0.003	0.0057	0.22	0.0025	0.093	0.0017	51	25	<0.004	0.002	0.567	0.0025	0.014	<0.0002	0.014	7.1	0.932	0.0014	2.3	0.0025	460
APW06	11/17/2017	--	--	--	--	0.094	--	50	23	--	--	0.617	--	--	--	--	7.2	--	--	1.9	--	470
APW06	05/18/2018	--	--	--	--	0.087	--	51	25	--	--	0.564	--	--	--	--	7.3	--	--	1.7	--	420
APW06	08/17/2018	--	--	--	--	--	--	52	25	--	--	--	--	--	--	--	7.3	--	--	1.7	--	--
APW06	11/09/2018	--	--	--	--	0.083	--	51	24	--	--	0.459	--	--	--	--	7.2	--	--	2.1	--	440
APW06	02/22/2019	--	--	--	--	0.09	--	45	24	--	--	0.386	--	--	--	--	7.3	--	--	1.7	--	480
APW06	08/23/2019	--	--	--	--	0.11	--	55	26	--	--	0.314	--	--	--	--	7.3	--	--	5.8	--	500
APW06	02/04/2020	--	--	--	--	0.08	--	53	27	--	--	0.483	--	--	--	--	7.5	--	--	<1	--	640
APW06	06/11/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	--	--	--
APW06	07/28/2020	--	--	--	--	0.091	--	55	24	--	--	0.564	--	--	--	--	7.8	--	--	3.2	--	510
APW06	02/09/2021	--	--	--	--	0.087	--	55	24	--	--	0.585	--	--	--	--	7.6	--	--	1.8	--	450
APW06	02/17/2021	<0.003	0.0045	0.24	<0.001	0.086	<0.001	54	23	<0.004	<0.002	0.504	<0.001	<0.02	<0.0002	0.0073	6.4	0.231	<0.001	3.6	<0.001	500

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
APW06	03/10/2021	<0.003	0.0052	0.25	<0.001	0.086	<0.001	58	22	<0.004	<0.002	0.427	<0.001	<0.02	<0.0002	0.0058	7.7	0.594	<0.001	9.2	<0.001	540
APW06	03/30/2021	<0.003	0.0052	0.22	<0.001	0.078	<0.001	56	26	<0.004	<0.002	0.368	<0.001	<0.02	<0.0002	0.0062	7.1	4.9	<0.001	7.7	<0.001	500
APW06	04/29/2021	<0.003	0.0073	0.25	<0.001	0.082	<0.001	62	23	0.0068	0.0027	0.496	0.0032	<0.02	<0.0002	0.0077	7.7	1.55	<0.001	8.5	<0.001	610
APW06	05/25/2021	<0.003	0.0088	0.28	<0.001	0.1	<0.001	68	23	0.011	0.0043	0.55	0.0074	<0.02	<0.0002	0.0085	7.7	0.474	<0.001	7.8	<0.001	490
APW06	06/16/2021	<0.003	0.0081	0.25	<0.001	0.11	<0.001	67	25	0.0076	0.0033	0.545	0.0066	<0.02	<0.0002	0.0083	7.7	1.35	<0.001	6.2	<0.001	520
APW06	06/30/2021	<0.003	0.0078	0.23	<0.001	0.085	<0.001	63	32	0.0058	0.0033	0.481	0.0063	0.03	<0.0002	0.0078	7.6	0.544	<0.001	6.3	<0.001	500
APW06	07/15/2021	<0.003	0.0067	0.23	<0.001	0.083	<0.001	55	27	<0.004	<0.002	0.442	0.0013	<0.02	<0.0002	0.0076	7.5	0.285	<0.001	7.8	<0.001	490
APW07	12/15/2015	<0.003	0.0039	0.35	<0.001	0.073	<0.001	74	69	<0.004	<0.002	0.467	<0.001	<0.01	<0.0002	0.014	7.4	1.16	<0.001	13	<0.001	520
APW07	01/21/2016	<0.003	0.0065	0.4	<0.001	0.052	<0.001	74	79	<0.004	<0.002	0.38	0.0015	<0.01	<0.0002	0.0083	7.4	1.06	<0.001	8.6	<0.001	440
APW07	05/03/2016	<0.003	0.004	0.41	<0.001	0.071	<0.001	85	72	<0.004	<0.002	0.545	<0.001	<0.01	<0.0002	0.0086	7.5	1.74	<0.001	7.5	<0.001	500
APW07	08/01/2016	<0.003	0.0049	0.45	<0.001	0.07	<0.001	86	77	<0.004	<0.002	0.462	<0.001	<0.01	<0.0002	0.006	7.3	1.32	<0.001	2.8	<0.001	490
APW07	10/26/2016	<0.003	0.0058	0.5	<0.001	0.096	<0.001	76	79	<0.004	<0.002	0.425	<0.001	<0.01	<0.0002	0.0054	7.2	2.02	<0.001	<1	<0.001	590
APW07	01/26/2017	<0.003	0.0062	0.45	<0.001	0.082	<0.001	87	77	<0.004	<0.002	0.352	<0.001	<0.01	<0.0002	0.0072	7.2	1.82	<0.001	<1	<0.001	520
APW07	04/24/2017	<0.003	0.0077	0.45	<0.001	0.069	<0.001	87	77	0.0049	<0.002	0.367	0.0022	<0.01	<0.0002	0.0029	7.3	1.26	<0.001	<1	<0.001	600
APW07	06/13/2017	<0.003	0.0087	0.48	<0.001	0.084	<0.001	93	77	<0.004	<0.002	0.425	0.0046	<0.01	<0.0002	0.0039	7.2	1.69	<0.001	<1	<0.001	560
APW07	11/17/2017	--	--	--	--	0.097	--	72	73	--	--	0.508	--	--	--	--	7.2	--	--	3.8	--	530
APW07	05/18/2018	--	--	--	--	0.082	--	97	75	--	--	0.435	--	--	--	--	7.1	--	--	4.9	--	500
APW07	08/18/2018	--	--	--	--	--	--	100	77	--	--	--	--	--	--	--	7.1	--	--	3.2	--	--
APW07	11/09/2018	--	--	--	--	0.08	--	92	71	--	--	0.343	--	--	--	--	7.0	--	--	4.5	--	500
APW07	02/22/2019	--	--	--	--	0.06	--	45	43	--	--	0.734	--	--	--	--	7.2	--	--	66	--	340
APW07	08/23/2019	--	--	--	--	0.075	--	58	46	--	--	0.632	--	--	--	--	7.1	--	--	62	--	350
APW07	02/05/2020	--	--	--	--	0.092	--	100	68	--	--	0.332	--	--	--	--	7.4	--	--	5.7	--	640

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
APW07	06/11/2020	--	--	--	--	--	--	--	68	--	--	--	--	--	--	--	7.3	--	--	--	--	--
APW07	07/28/2020	--	--	--	--	0.086	--	94	77	--	--	0.412	--	--	--	--	7.3	--	--	6.7	--	530
APW07	02/10/2021	--	--	--	--	0.11	--	110	69	--	--	0.372	--	--	--	--	7.0	--	--	6.3	--	540
APW08	12/15/2015	<0.003	0.0083	0.24	<0.001	0.083	<0.001	85	52	<0.004	<0.002	0.441	0.0016	0.013	<0.0002	0.0075	7.4	1.95	<0.001	35	<0.001	560
APW08	01/21/2016	<0.003	0.016	0.3	<0.001	0.06	<0.001	85	59	0.0049	<0.002	0.414	0.0023	0.012	<0.0002	0.0055	7.5	2.27	<0.001	34	<0.001	510
APW08	05/03/2016	<0.003	0.012	0.32	<0.001	0.083	<0.001	100	55	0.0045	<0.002	0.566	0.0021	<0.01	<0.0002	0.0063	7.4	1.88	0.0016	30	<0.001	560
APW08	08/02/2016	<0.003	0.013	0.32	<0.001	0.076	<0.001	94	56	<0.004	<0.002	0.504	<0.001	<0.01	<0.0002	0.0054	7.2	0.857	<0.001	35	<0.001	520
APW08	10/26/2016	<0.003	0.013	0.35	<0.001	0.091	<0.001	84	59	<0.004	<0.002	0.463	<0.001	<0.01	<0.0002	0.0055	7.4	0.812	<0.001	37	<0.001	600
APW08	01/25/2017	<0.003	0.017	0.37	<0.001	0.081	<0.001	100	57	<0.004	<0.002	0.404	<0.001	<0.01	<0.0002	0.0057	7.2	0.499	<0.001	36	<0.001	600
APW08	04/25/2017	<0.003	0.02	0.36	<0.001	0.073	<0.001	100	57	0.016	0.0056	0.418	0.0097	0.017	<0.0002	0.0074	7.5	1.8	<0.001	38	<0.001	590
APW08	06/13/2017	<0.003	0.017	0.39	<0.001	0.092	<0.001	110	57	0.01	0.0043	0.449	0.0075	0.012	<0.0002	0.0081	7.3	2.08	<0.001	38	<0.001	600
APW08	11/17/2017	--	--	--	--	0.11	--	83	50	--	--	0.474	--	--	--	--	7.1	--	--	39	--	490
APW08	05/18/2018	--	--	--	--	0.088	--	92	56	--	--	0.448	--	--	--	--	7.2	--	--	37	--	520
APW08	08/18/2018	--	--	--	--	--	--	82	57	--	--	--	--	--	--	--	7.2	--	--	43	--	--
APW08	11/09/2018	--	--	--	--	0.086	--	110	56	--	--	0.373	--	--	--	--	7.1	--	--	42	--	580
APW08	02/22/2019	--	--	--	--	0.1	--	80	56	--	--	0.393	--	--	--	--	7.2	--	--	46	--	600
APW08	08/23/2019	--	--	--	--	0.1	--	82	59	--	--	0.337	--	--	--	--	7.2	--	--	48	--	570
APW08	02/05/2020	--	--	--	--	0.1	--	120	55	--	--	0.331	--	--	--	--	7.4	--	--	45	--	700
APW08	06/11/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.3	--	--	--	--	--
APW08	07/28/2020	--	--	--	--	0.087	--	110	62	--	--	0.441	--	--	--	--	7.3	--	--	47	--	620
APW08	10/28/2020	--	--	--	--	--	--	--	55	--	--	--	--	--	--	--	7.4	--	--	--	--	--
APW08	02/10/2021	--	--	--	--	0.11	--	110	57	--	--	<0.25	--	--	--	--	7.2	--	--	42	--	550

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
APW09	12/15/2015	<0.003	0.007	0.24	<0.001	0.062	<0.001	54	88	<0.004	<0.002	0.574	0.0011	<0.01	<0.0002	0.021	7.5	0.612	<0.001	25	<0.001	630
APW09	01/20/2016	<0.003	0.0067	0.24	<0.001	0.074	<0.001	57	95	<0.004	<0.002	0.468	0.0044	<0.01	<0.0002	0.023	7.6	0.743	<0.001	27	<0.001	540
APW09	05/03/2016	<0.003	0.008	0.32	<0.001	0.07	<0.001	70	110	<0.004	<0.002	0.746	0.0051	<0.01	<0.0002	0.021	7.6	1.54	<0.001	18	<0.001	590
APW09	08/02/2016	<0.003	0.014	0.41	<0.001	0.073	<0.001	74	130	<0.004	<0.002	0.532	<0.001	<0.01	<0.0002	0.011	7.2	1.137	<0.001	4.2	<0.001	640
APW09	10/26/2016	<0.003	0.016	0.47	<0.001	0.09	<0.001	77	130	<0.004	<0.002	0.528	<0.001	<0.01	<0.0002	0.01	7.6	1.18	<0.001	1.5	<0.001	770
APW09	01/25/2017	<0.003	0.018	0.44	<0.001	0.081	<0.001	79	130	<0.004	<0.002	0.468	<0.001	<0.01	<0.0002	0.0075	7.5	1.78	<0.001	<1	<0.001	740
APW09	04/25/2017	<0.003	0.017	0.38	<0.001	0.078	<0.001	67	120	<0.004	<0.002	0.515	<0.001	<0.01	0.00023	0.0053	7.5	1.07	<0.001	1.1	<0.001	840
APW09	06/13/2017	<0.003	0.0039	0.11	<0.001	0.053	<0.001	42	51	<0.004	<0.002	0.755	<0.001	<0.01	<0.0002	0.016	7.5	0.984	<0.001	48	<0.001	300
APW09	11/18/2017	--	--	--	--	0.08	--	68	84	--	--	0.655	--	--	--	--	7.4	--	--	4.5	--	720
APW09	05/18/2018	--	--	--	--	0.098	--	80	120	--	--	0.467	--	--	--	--	7.4	--	--	1	--	710
APW09	08/17/2018	--	--	--	--	--	--	81	130	--	--	--	--	--	--	--	7.5	--	--	2.4	--	--
APW09	11/09/2018	--	--	--	--	0.055	--	44	44	--	--	0.73	--	--	--	--	7.4	--	--	62	--	300
APW09	02/22/2019	--	--	--	--	0.054	--	38	47	--	--	0.714	--	--	--	--	7.5	--	--	61	--	320
APW09	08/23/2019	--	--	--	--	0.055	--	41	51	--	--	0.621	--	--	--	--	7.4	--	--	51	--	360
APW09	02/19/2020	--	--	--	--	0.1	--	88	130	--	--	0.453	--	--	--	--	7.5	--	--	7.5	--	790
APW09	06/11/2020	--	--	--	--	--	--	--	130	--	--	--	--	--	--	--	7.4	--	--	--	--	870
APW09	07/28/2020	--	--	--	--	0.1	--	84	140	--	--	0.537	--	--	--	--	7.4	--	--	3.2	--	810
APW09	02/11/2021	--	--	--	--	0.11	--	85	140	--	--	0.536	--	--	--	--	7.4	--	--	<10	--	840
APW10	12/16/2015	<0.003	0.0034	0.038	<0.001	0.066	<0.001	120	46	<0.004	<0.002	0.328	<0.001	0.03	<0.0002	0.0094	7.1	0.755	<0.001	430	<0.001	1000
APW10	01/20/2016	<0.003	0.0043	0.042	<0.001	0.077	<0.001	120	48	<0.004	<0.002	<0.25	<0.001	0.021	<0.0002	0.011	7.2	1.16	<0.001	410	<0.001	950
APW10	05/03/2016	<0.003	0.0083	0.04	<0.001	0.065	<0.001	140	46	<0.004	<0.002	0.448	<0.001	0.023	<0.0002	0.01	7.1	0.799	<0.001	410	<0.001	930
APW10	08/02/2016	<0.003	0.0092	0.037	<0.001	0.063	<0.001	140	45	<0.004	<0.002	0.367	<0.001	0.026	<0.0002	0.0091	7.1	0.6	<0.001	410	<0.001	840

RAMBOLL

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
APW10	10/26/2016	<0.003	0.009	0.04	<0.001	0.069	<0.001	120	48	<0.004	<0.002	0.371	<0.001	0.027	<0.0002	0.0093	7.1	0.556	<0.001	470	<0.001	960
APW10	01/25/2017	<0.003	0.01	0.035	<0.001	0.065	<0.001	160	46	<0.004	<0.002	0.258	<0.001	0.023	<0.0002	0.0085	7.1	0.43	<0.001	430	<0.001	1000
APW10	04/25/2017	<0.003	0.0084	0.031	<0.001	0.056	<0.001	120	44	<0.004	<0.002	0.289	<0.001	0.026	<0.0002	0.0071	7.0	0.604	<0.001	410	<0.001	1000
APW10	06/13/2017	<0.003	0.0035	0.027	<0.001	0.077	<0.001	110	46	<0.004	<0.002	0.344	<0.001	0.026	<0.0002	0.0091	6.9	0.897	<0.001	410	<0.001	920
APW10	11/18/2017	--	--	--	--	0.072	--	120	47	--	--	0.414	--	--	--	--	6.9	--	--	390	--	910
APW10	05/18/2018	--	--	--	--	0.08	--	130	51	--	--	0.335	--	--	--	--	7.2	--	--	440	--	900
APW10	08/17/2018	--	--	--	--	--	--	130	51	--	--	--	--	--	--	--	6.9	--	--	420	--	--
APW10	11/09/2018	--	--	--	--	0.078	--	140	47	--	--	0.281	--	--	--	--	7.0	--	--	410	--	900
APW10	02/22/2019	--	--	--	--	0.079	--	110	50	--	--	0.276	--	--	--	--	6.9	--	--	420	--	990
APW10	08/23/2019	--	--	--	--	0.096	--	130	50	--	--	0.359	--	--	--	--	7.0	--	--	390	--	1000
APW10	02/05/2020	--	--	--	--	0.094	--	140	44	--	--	<0.25	--	--	--	--	7.1	--	--	400	--	1200
APW10	06/11/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.2	--	--	--	--	1000
APW10	07/28/2020	--	--	--	--	0.076	--	140	53	--	--	0.356	--	--	--	--	7.1	--	--	410	--	1000
APW10	02/11/2021	--	--	--	--	0.082	--	150	45	--	--	0.362	--	--	--	--	7.4	--	--	410	--	1100
APW10	06/17/2021	<0.003	0.008	0.026	<0.001	0.07	<0.001	150	47	<0.004	<0.002	0.436	<0.001	0.022	<0.0002	0.0074	7.3	0.617	<0.001	540	<0.001	1100
APW10	06/30/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.5	--	--	--	--	1000
APW10	07/29/2021	<0.003	0.0058	0.026	<0.001	0.075	<0.001	150	45	<0.004	<0.002	0.462	<0.001	0.022	<0.0002	0.0071	7.5	0.794	<0.001	410	<0.001	1000
APW11	02/18/2021	<0.003	0.002	0.16	<0.001	0.074	<0.00089	96	47	<0.004	<0.002	0.497	<0.001	0.021	0.00042	0.013	6.1	1.87	<0.001	280	<0.001	780
APW11	03/09/2021	<0.003	0.0046	0.077	<0.001	0.075	<0.001	120	26	0.0086	0.0029	<0.25	0.0076	0.024	<0.0002	0.0078	7.2	0.763	0.001	290	<0.001	940
APW11	03/29/2021	<0.003	0.005	0.071	<0.001	0.15	<0.001	130	26	0.012	0.0048	<0.25	0.014	0.028	<0.0002	0.0059	6.6	2.13	0.0032	270	<0.001	820
APW11	04/28/2021	<0.003	0.0021	0.048	<0.001	0.066	<0.001	120	26	<0.004	<0.002	<0.25	<0.001	0.021	<0.0002	0.0046	7.1	0.477	<0.001	280	<0.001	920
APW11	05/24/2021	<0.003	0.0015	0.05	<0.001	0.083	<0.001	130	27	<0.004	<0.002	<0.25	<0.001	0.024	0.00082	0.005	7.4	0.563	<0.001	300	0.0036	850

RAMBOLL

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
APW11	06/16/2021	<0.003	0.002	0.047	<0.001	0.078	<0.001	130	26	<0.004	<0.002	0.375	<0.001	0.024	<0.0002	0.0048	7.2	2.05	<0.001	290	<0.001	850
APW11	06/30/2021	<0.003	0.0018	0.042	<0.001	0.065	<0.001	120	33	<0.004	<0.002	0.409	<0.001	0.038	<0.0002	0.0044	7.1	0.382	<0.001	280	<0.001	860
APW11	07/15/2021	<0.003	0.0023	0.042	<0.001	0.062	<0.001	120	31	<0.004	<0.002	<0.25	<0.001	0.03	<0.0002	0.0043	7.2	0.474	<0.001	140	<0.001	810
APW12	02/17/2021	<0.003	0.0016	0.058	<0.001	0.27	<0.00089	230	27	<0.004	0.0073	<0.25	<0.001	0.033	0.0019	0.0037	6.2	0.682	<0.001	390	<0.001	1300
APW12	03/09/2021	<0.003	0.0017	0.05	<0.001	0.26	<0.001	230	27	<0.004	0.0073	<0.25	<0.001	0.028	<0.0002	0.0025	6.5	0.367	<0.001	480	<0.001	1300
APW12	03/29/2021	<0.003	0.002	0.046	<0.001	0.29	<0.001	220	28	<0.004	0.0065	<0.25	<0.001	0.029	<0.0002	0.0019	6.0	0.166	<0.001	440	<0.001	1400
APW12	04/28/2021	<0.003	0.0016	0.038	<0.001	0.21	<0.001	210	23	<0.004	0.005	<0.25	<0.001	0.026	<0.0002	0.0012	6.4	0.234	<0.001	390	<0.001	1300
APW12	05/25/2021	<0.003	0.0023	0.038	<0.001	0.29	<0.001	220	23	<0.004	0.0043	<0.25	<0.001	0.029	<0.0002	0.0038	6.5	0.319	<0.001	390	<0.001	1300
APW12	06/16/2021	<0.003	0.0027	0.039	<0.001	0.15	<0.001	210	20	<0.004	0.0034	<0.25	<0.001	0.026	<0.0002	<0.001	6.4	1.88	<0.001	290	<0.001	1100
APW12	06/30/2021	<0.003	0.0019	0.04	<0.001	0.11	<0.001	190	20	<0.004	0.0032	<0.25	<0.001	0.046	<0.0002	<0.001	6.3	0.466	<0.001	310	<0.001	990
APW12	07/15/2021	<0.003	0.0017	0.033	<0.001	0.28	<0.001	210	26	<0.004	0.0032	<0.25	<0.001	0.045	<0.0002	<0.001	6.5	0.667	<0.001	440	<0.001	1300
APW13	02/22/2021	<0.003	0.0043	0.055	<0.001	0.12	<0.001	110	57	<0.004	<0.002	0.503	<0.001	0.042	<0.0002	0.016	7.1	0.429	<0.001	220	<0.001	760
APW13	03/10/2021	<0.003	0.0046	0.054	<0.001	0.11	<0.001	120	71	<0.004	<0.002	0.326	<0.001	0.044	<0.0002	0.017	7.2	0.17	<0.001	210	<0.001	850
APW13	03/31/2021	<0.003	0.0047	0.057	<0.001	0.12	<0.001	110	46	<0.004	<0.002	0.43	<0.001	0.041	<0.0002	0.011	6.4	1.05	<0.001	210	<0.001	880
APW13	04/29/2021	<0.003	0.0046	0.05	<0.001	0.11	<0.001	110	48	<0.004	<0.002	0.327	<0.001	0.032	<0.0002	0.011	7.2	1.44	<0.001	210	<0.001	840
APW13	05/25/2021	<0.003	0.0031	0.051	<0.001	0.12	<0.001	120	64	<0.004	<0.002	0.402	<0.001	0.03	<0.0002	0.0096	7.3	0.966	<0.001	220	<0.001	880
APW13	06/17/2021	<0.003	0.0037	0.051	<0.001	0.1	<0.001	130	53	<0.004	<0.002	0.487	<0.001	0.027	<0.0002	0.0089	7.2	0.281	<0.001	220	<0.001	830
APW13	06/30/2021	<0.003	0.0039	0.051	<0.001	0.11	<0.001	120	45	<0.004	<0.002	0.447	<0.001	0.054	<0.0002	0.0088	7.3	0.546	<0.001	230	<0.001	790
APW13	07/15/2021	<0.003	0.006	0.05	<0.001	0.15	<0.001	110	55	<0.004	<0.002	<0.25	<0.001	0.036	<0.0002	0.0082	7.3	0.328	<0.001	210	<0.001	820
APW14	02/22/2021	<0.003	0.0074	0.14	<0.001	0.11	<0.001	120	55	0.0057	0.0023	0.489	0.0032	0.051	<0.0002	0.014	7.5	0.752	<0.001	320	<0.001	830
APW14	03/10/2021	<0.003	0.0095	0.099	<0.001	0.097	<0.001	130	65	<0.004	<0.002	0.313	0.002	0.044	<0.0002	0.0083	7.4	0.356	<0.001	340	<0.001	970
APW14	03/31/2021	<0.003	0.0098	0.092	<0.001	0.11	<0.001	130	46	<0.004	<0.002	0.363	<0.001	0.034	<0.0002	0.0068	6.5	0.594	<0.001	330	<0.001	1000

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
APW14	04/28/2021	<0.003	0.0053	0.1	<0.001	0.093	<0.001	130	44	<0.004	<0.002	<0.25	<0.001	0.03	<0.0002	0.0081	7.4	0.342	<0.001	320	<0.001	1000
APW14	05/25/2021	<0.003	0.0047	0.098	<0.001	0.11	<0.001	130	43	<0.004	<0.002	0.358	<0.001	0.029	<0.0002	0.0063	7.5	0.658	<0.001	320	<0.001	920
APW14	06/17/2021	<0.003	0.0054	0.086	<0.001	0.089	<0.001	140	45	<0.004	<0.002	0.436	<0.001	0.024	<0.0002	0.0053	7.4	1.26	<0.001	310	<0.001	940
APW14	06/30/2021	<0.003	0.0061	0.082	<0.001	0.097	<0.001	150	49	<0.004	<0.002	0.371	<0.001	0.047	<0.0002	0.0053	7.5	1.05	<0.001	330	<0.001	860
APW14	07/15/2021	<0.003	0.0055	0.07	<0.001	0.12	<0.001	130	53	<0.004	<0.002	<0.25	<0.001	0.032	<0.0002	0.0046	7.4	0.695	<0.001	330	<0.001	970
APW15	02/23/2021	<0.003	0.02	0.56	<0.001	0.14	<0.001	93	260	<0.004	<0.002	0.544	0.0011	<0.02	<0.0002	0.0089	7.0	1.43	<0.001	<1	<0.001	1100
APW15	03/10/2021	<0.003	0.022	0.61	<0.001	0.13	<0.001	100	250	<0.004	<0.002	1.65	0.0012	<0.02	<0.0002	0.016	7.2	2.88	<0.001	<1	<0.001	1100
APW15	03/31/2021	<0.003	0.016	0.63	<0.001	0.16	<0.001	100	240	0.005	0.0021	1.44	0.003	<0.02	<0.0002	0.013	6.5	1.76	<0.001	<1	<0.001	1100
APW15	04/28/2021	<0.003	0.021	0.6	<0.001	0.13	<0.001	96	230	<0.004	<0.002	1.81	<0.001	<0.02	<0.0002	0.015	7.2	1.17	<0.001	<1	<0.001	1200
APW15	05/24/2021	<0.003	0.017	0.57	<0.001	0.15	<0.001	98	230	<0.004	<0.002	1.68	<0.001	<0.02	<0.0002	0.012	7.3	1.87	<0.001	<1	<0.001	1000
APW15	06/17/2021	<0.003	0.017	0.6	<0.001	0.13	<0.001	95	240	<0.004	<0.002	3.18	<0.001	0.022	<0.0002	0.012	7.3	2.54	<0.001	<1	<0.001	1000
APW15	06/30/2021	<0.003	0.017	0.6	<0.001	0.13	<0.001	98	230	<0.004	<0.002	2.89	<0.001	0.022	<0.0002	0.0098	7.1	2.46	<0.001	<1	<0.001	1000
APW15	07/14/2021	<0.003	0.016	0.6	<0.001	0.16	<0.001	96	130	<0.004	<0.002	8.16	<0.001	<0.02	<0.0002	0.0094	7.2	2.23	<0.001	<1	<0.001	1200
APW16	02/23/2021	<0.003	0.014	0.62	<0.001	0.14	<0.001	92	71	<0.004	<0.002	0.629	<0.001	<0.02	<0.0002	0.0036	7.4	2.08	<0.001	1.9	<0.001	780
APW16	03/10/2021	<0.003	0.015	0.66	<0.001	0.15	<0.001	99	71	<0.004	<0.002	0.755	<0.001	<0.02	<0.0002	0.0044	7.5	2.17	<0.001	<1	<0.001	750
APW16	03/30/2021	<0.003	0.013	0.66	<0.001	0.17	<0.001	97	71	<0.004	<0.002	0.886	<0.001	<0.02	<0.0002	0.0033	7.0	0.946	<0.001	<1	<0.001	740
APW16	04/28/2021	<0.003	0.0083	0.62	<0.001	0.12	<0.001	96	75	<0.004	<0.002	0.742	<0.001	<0.02	<0.0002	0.0015	7.4	1.55	<0.001	<1	<0.001	750
APW16	05/24/2021	<0.003	0.0074	0.61	<0.001	0.15	<0.001	100	74	<0.004	<0.002	0.639	<0.001	<0.02	<0.0002	0.0012	7.6	1.19	<0.001	<1	<0.001	810
APW16	06/16/2021	<0.003	0.0077	0.57	<0.001	0.14	<0.001	100	73	<0.004	<0.002	0.735	<0.001	<0.02	<0.0002	<0.001	7.4	2.05	<0.001	<1	<0.001	720
APW16	06/30/2021	<0.003	0.0083	0.55	<0.001	0.13	<0.001	96	59	<0.004	<0.002	0.766	<0.001	<0.02	<0.0002	<0.001	7.0	5.85	<0.001	<1	<0.001	610
APW16	07/15/2021	<0.003	0.0088	0.56	<0.001	0.13	<0.001	95	77	<0.004	<0.002	0.55	<0.001	<0.02	<0.0002	<0.001	7.4	2.91	<0.001	<1	<0.001	690
APW17	02/23/2021	<0.003	0.0033	0.54	<0.001	0.091	<0.001	100	64	<0.004	<0.002	0.944	<0.001	<0.02	<0.0002	0.0085	7.4	0.821	<0.001	34	<0.001	680

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
APW17	03/10/2021	<0.003	0.0026	0.57	<0.001	0.083	<0.001	110	60	<0.004	<0.002	0.677	<0.001	<0.02	<0.0002	0.0066	7.7	0.849	<0.001	30	<0.001	650
APW17	03/30/2021	<0.003	0.0014	0.63	<0.001	0.086	<0.001	110	57	<0.004	<0.002	0.374	<0.001	<0.02	<0.0002	0.0052	7.1	0.259	<0.001	31	<0.001	620
APW17	04/29/2021	<0.003	0.003	0.6	<0.001	0.088	<0.001	120	55	<0.004	<0.002	0.468	<0.001	<0.02	<0.0002	0.0055	7.4	1.51	<0.001	36	<0.001	630
APW17	05/24/2021	<0.003	0.0035	0.59	<0.001	0.087	<0.001	110	88	<0.004	<0.002	0.474	<0.001	<0.02	<0.0002	0.005	7.4	1.36	<0.001	40	<0.001	670
APW17	06/16/2021	<0.003	0.0058	0.62	<0.001	0.088	<0.001	120	54	<0.004	<0.002	0.593	<0.001	<0.02	<0.0002	0.0048	7.4	3.11	<0.001	40	<0.001	640
APW17	06/30/2021	<0.003	0.0074	0.61	<0.001	0.084	<0.001	110	49	<0.004	<0.002	0.548	<0.001	<0.02	<0.0002	0.0048	7.4	2.6	<0.001	41	<0.001	630
APW17	07/15/2021	<0.003	0.0083	0.61	<0.001	0.091	<0.001	110	31	<0.004	<0.002	0.412	<0.001	<0.02	<0.0002	0.0049	7.4	1.55	<0.001	<25	<0.001	650
APW18	02/23/2021	<0.003	0.0043	0.18	<0.001	0.12	<0.001	49	79	0.0085	0.0034	1.43	0.0079	<0.02	<0.0002	0.033	7.9	2.72	<0.001	26	<0.001	560
APW18	03/10/2021	<0.003	0.0032	0.36	<0.001	0.11	<0.001	62	42	0.0066	0.0024	6.38	0.0048	<0.02	<0.0002	0.015	7.8	1.88	<0.001	12	<0.001	610
APW18	03/30/2021	<0.003	0.0025	0.34	<0.001	0.15	<0.001	60	35	<0.004	<0.002	7.02	0.0023	<0.02	<0.0002	0.012	7.3	0.912	<0.001	9.4	0.0016	580
APW18	04/29/2021	<0.003	0.0019	0.34	<0.001	0.14	<0.001	60	40	<0.004	<0.002	0.617	0.0018	<0.02	<0.0002	0.016	7.6	2.4	<0.001	<1	<0.001	490
APW18	05/24/2021	<0.003	0.0014	0.35	<0.001	0.11	<0.001	59	35	<0.004	<0.002	0.597	<0.001	<0.02	<0.0002	0.0095	7.6	1.91	<0.001	<1	<0.001	650
APW18	06/16/2021	0.0035	0.0043	0.36	0.0033	0.19	0.0034	64	29	0.0042	0.0036	6.67	0.0035	<0.02	0.00047	0.0096	7.6	2.12	0.0038	4.8	0.0022	550
APW18	06/30/2021	<0.003	<0.001	0.36	<0.001	0.11	<0.001	60	28	<0.004	<0.002	3.23	<0.001	<0.02	<0.0002	0.0048	7.6	1.73	<0.001	2.2	<0.001	450
APW18	07/15/2021	<0.003	0.0015	0.33	<0.001	0.12	<0.001	64	31	<0.004	<0.002	4.67	<0.001	<0.02	<0.0002	0.0051	7.6	2.2	<0.001	1.9	<0.001	520

Notes:
Detected at concentration greater than the GWPS
-- = data not available
GWPS = Groundwater Protection Standard
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method. Estimated concentrations below the reporting limit and associated qualifiers are not provided since they are not utilized in statistics to determine exceedances above Part 845 standards.
35 I.A.C. 845.600 = Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, 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)
APW02	01/13/2015	--	--	6.9	6190	--	--
APW02	04/21/2015	--	--	6.9	5320	--	--
APW02	07/15/2015	--	--	7.0	1653	--	--
APW02	10/07/2015	--	--	6.7	4290	--	--
APW02	02/17/2021	6.88	90.3	6.6	5409	5.9	22.1
APW02	03/10/2021	2.11	62.6	7.0	4714	12.4	57.5
APW02	03/30/2021	1.91	82	6.6	3158	13.6	20800
APW02	04/29/2021	1.10	164	6.7	5417	17.8	13.9
APW02	05/25/2021	1.10	116	6.7	5536	29.6	57
APW02	06/16/2021	0.57	52.9	6.6	5574	30.0	62.9
APW02	06/30/2021	0.86	82.3	6.6	5523	22.8	19
APW02	07/15/2021	0.51	57.6	6.5	5543	29.6	8.04
APW03	01/13/2015	--	--	7.4	1132	--	--
APW03	04/20/2015	--	--	7.0	988	--	--
APW03	07/15/2015	--	--	6.9	1212	--	--
APW03	10/07/2015	--	--	7.3	1047	--	--
APW03	02/18/2021	6.74	225	6.7	1132	7.9	140
APW03	03/10/2021	2.67	30.7	7.2	1041	12.6	55.8
APW03	03/31/2021	1.17	28.9	6.3	949.5	10.1	51.8
APW03	04/29/2021	0.92	114	7.0	1104	19.6	8.47
APW03	05/25/2021	1.10	132	7.0	1132	29.6	15.8
APW03	06/17/2021	0.81	166	7.0	1114	22.8	26.5
APW03	06/30/2021	0.85	37.8	7.0	1115	25.4	7.56
APW03	07/15/2021	0.78	-28.6	6.9	1121	35.0	124
APW04	01/13/2015	--	--	7.2	2980	--	--
APW04	04/20/2015	--	--	7.0	2880	--	--
APW04	07/15/2015	--	--	7.0	1431	--	--
APW04	10/07/2015	--	--	7.0	2510	--	--
APW04	02/18/2021	1.81	217	6.5	2396	6.9	293
APW04	03/11/2021	0.44	224	6.9	2387	10.6	62.9
APW04	03/31/2021	0.35	55	6.1	2005	10.8	63.4
APW04	04/29/2021	0.43	140	6.9	2297	19.0	8.29
APW04	05/25/2021	0.42	166	6.9	2313	22.7	56.7
APW04	06/17/2021	0.53	169	6.8	2330	27.0	31.4
APW04	06/30/2021	1.10	141	6.8	2339	26.4	25.9
APW04	07/15/2021	0.74	78.1	6.8	2333	33.9	227
APW05	12/15/2015	0	-57	7.5	1040	13.4	14.4
APW05	01/20/2016	0	-51	7.5	1030	12.6	44.6
APW05	04/27/2016	0	27	7.7	1120	14.3	15
APW05	08/01/2016	0	-64	7.5	1100	18.0	2.5
APW05	10/25/2016	0	-83	7.6	1070	16.8	0
APW05	01/23/2017	0	-143	7.4	1050	13.6	0
APW05	04/24/2017	0	-101	7.0	1060	17.3	0
APW05	06/13/2017	0	-88	7.1	1050	17.5	35.5

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TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, 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)
APW05	11/17/2017	0	-60	6.9	1080	12.7	24.2
APW05	05/18/2018	0	-61	7.1	1140	15.6	22.6
APW05	08/17/2018	0	-69	7.0	1025	15.2	22
APW05	11/09/2018	0	-56	7.0	1100	14.7	27.1
APW05	02/22/2019	0	-60	6.9	1071	11.4	34.6
APW05	08/22/2019	0	-60	7.0	1021	17.3	67.3
APW05	02/04/2020	0.83	-119	7.5	971.9	11.3	2.97
APW05	06/11/2020	1.20	-124	7.4	856	15.0	4.5
APW05	07/28/2020	1.20	-146	7.7	924.7	19.0	3.57
APW05	02/09/2021	0.19	-129	7.6	996	11.2	39.9
APW05	02/17/2021	1.33	192	7.2	1086	7.6	0
APW05	03/10/2021	0.15	-129	7.7	975.9	13.6	16.5
APW05	03/30/2021	0.69	-71.9	7.2	980.3	13.6	1.08
APW05	04/28/2021	0.60	-65	7.5	867	15.9	6.7
APW05	05/25/2021	0.95	61.8	7.5	976	17.9	1.89
APW05	06/17/2021	0.34	-150	7.7	946	18.8	0.81
APW05	06/30/2021	0.29	-160	7.5	977	19.0	1.02
APW05	07/15/2021	0.25	-140	7.8	995	16.7	3.96
APW05S	02/17/2021	0.69	202	6.6	4672	6.5	0
APW05S	03/10/2021	0.24	16.3	7.0	4186	12.5	0
APW05S	04/29/2021	0.45	4.7	6.8	4339	18.0	14.2
APW05S	05/25/2021	0.93	-37	6.9	4306	30.3	40.2
APW05S	06/17/2021	0.73	-8.8	6.8	3977	28.6	20.5
APW05S	06/30/2021	0.81	2.8	6.7	3967	27.6	32.6
APW05S	07/15/2021	0.73	-35.6	6.8	3933	32.6	9.27
APW06	12/15/2015	0	-5	7.5	915	13.2	1000
APW06	01/20/2016	0	58	7.4	990	11.9	77.4
APW06	04/27/2016	0	-61	6.5	896	14.4	0.3
APW06	08/01/2016	0	-80	7.4	1010	17.1	0
APW06	10/25/2016	0	-73	7.5	971	15.3	0
APW06	01/23/2017	0	-109	6.9	938	13.2	0
APW06	04/24/2017	0	-94	7.2	961	17.6	0
APW06	06/13/2017	0	-83	7.1	914	16.5	19.8
APW06	11/17/2017	0	-79	7.2	860	12.1	17.2
APW06	05/18/2018	0	-67	7.3	902	14.4	12.3
APW06	08/17/2018	0	-73	7.3	910	15.0	22.7
APW06	11/09/2018	0	-82	7.2	938	15.7	28.3
APW06	02/22/2019	0	-71	7.3	942	11.9	34.7
APW06	08/23/2019	0	-58	7.3	873	17.5	14.9
APW06	02/04/2020	2.20	-125	7.5	889.5	11.2	3.04
APW06	06/11/2020	1.30	-125	7.4	807	15.2	24.6
APW06	07/28/2020	0.66	-164	7.8	880.8	18.3	5.59
APW06	02/09/2021	1.40	-110	7.6	859.8	9.0	0.91
APW06	02/17/2021	0.19	-41	6.4	937.9	4.6	0

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, 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)
APW06	03/10/2021	0.23	-131	7.7	779.1	14.4	25.7
APW06	03/30/2021	0.31	-69.7	7.1	893.1	15.5	0
APW06	04/29/2021	0.36	-130	7.7	925	15.8	111
APW06	05/25/2021	0.29	-138	7.7	939	24.4	225
APW06	06/16/2021	0.47	-127	7.7	928	22.8	315
APW06	06/30/2021	0.78	-120	7.6	925	23.8	276
APW06	07/15/2021	0.75	-148	7.5	926	27.7	41.9
APW07	12/15/2015	1.71	-40	7.4	1060	12.0	55.1
APW07	01/21/2016	0	-110	7.4	1130	10.5	185
APW07	05/03/2016	0	-94	7.5	1210	13.5	179
APW07	08/01/2016	0	-114	7.3	1130	19.4	26
APW07	10/26/2016	0	-69	7.2	1110	17.9	5.7
APW07	01/26/2017	0	-136	7.2	1110	11.0	0
APW07	04/24/2017	0	-112	7.3	1130	17.2	0
APW07	06/13/2017	0	-94	7.2	1060	17.1	39.5
APW07	11/17/2017	0	-71	7.2	1120	12.5	47
APW07	05/18/2018	0	-88	7.1	1090	15.4	47.9
APW07	08/18/2018	0	-88	7.1	1000	15.0	41.1
APW07	11/09/2018	0	-92	7.0	993	13.9	33
APW07	02/22/2019	0	-92	7.2	1012	11.6	34
APW07	08/23/2019	0	-74	7.1	879	17.0	27.4
APW07	02/05/2020	0.39	-137	7.4	247.7	10.3	77.6
APW07	06/11/2020	0.16	-164	7.3	1112	15.1	51
APW07	07/28/2020	1.40	-104	7.3	1083	18.8	3.3
APW07	02/10/2021	2.30	-10.5	7.0	806.2	9.4	72.6
APW08	12/15/2015	0	38	7.4	1140	12.7	105
APW08	01/21/2016	0	-93	7.5	1150	11.0	83.3
APW08	05/03/2016	0	-93	7.4	1055	13.3	168
APW08	08/02/2016	0	-87	7.2	1160	17.9	5
APW08	10/26/2016	0	-76	7.4	1180	17.2	2.1
APW08	01/25/2017	0	-121	7.2	1140	14.2	0
APW08	04/25/2017	0	-103	7.5	1160	17.0	1000
APW08	06/13/2017	0	-108	7.3	1090	17.4	1000
APW08	11/17/2017	0	-102	7.1	1020	12.5	1000
APW08	05/18/2018	0	-96	7.2	940	16.2	890
APW08	08/18/2018	0	-101	7.2	993	15.0	100
APW08	11/09/2018	0	-109	7.1	857	13.8	1000
APW08	02/22/2019	0	-99	7.2	955	11.8	1000
APW08	08/23/2019	0	-98	7.2	1004	17.1	1000
APW08	02/05/2020	1.10	-130	7.4	1150	11.5	114
APW08	06/11/2020	0.54	-127	7.3	1163	15.1	30
APW08	07/28/2020	1.30	-101	7.3	1138	16.8	9.2
APW08	10/28/2020	1.00	-94.2	7.4	1148	14.2	17.9
APW08	02/10/2021	1.70	-103	7.2	1045	10.3	104

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TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, 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)
APW09	12/15/2015	0	11	7.5	1150	13.0	11.7
APW09	01/20/2016	0	72	7.6	1040	11.3	49.6
APW09	05/03/2016	0	56	7.6	988	13.9	67.7
APW09	08/02/2016	0	-106	7.2	1460	17.2	0
APW09	10/26/2016	0	-77	7.6	1450	15.9	0
APW09	01/25/2017	0	-140	7.5	1470	14.8	0
APW09	04/25/2017	0	-74	7.5	1420	18.4	0
APW09	06/13/2017	0	-67	7.5	1390	17.1	27.4
APW09	11/18/2017	0	-78	7.4	1420	13.0	34.1
APW09	05/18/2018	0	-71	7.4	1490	15.2	35.1
APW09	08/17/2018	0	-69	7.5	1265	15.0	40
APW09	11/09/2018	0	-72	7.4	1240	16.7	48.5
APW09	02/22/2019	0	-65	7.5	1285	11.7	50.3
APW09	08/23/2019	0	-60	7.4	1180	16.6	29
APW09	02/19/2020	0.86	-151	7.5	1456	13.5	10.1
APW09	06/11/2020	0.60	-152	7.4	1516	15.7	389
APW09	07/28/2020	0.47	-136	7.4	1467	18.9	19.9
APW09	02/11/2021	2.00	-28.1	7.4	1208	9.4	31.8
APW10	12/16/2015	1.93	-29	7.1	1610	13.3	1000
APW10	01/20/2016	0	-21	7.2	1430	12.5	1000
APW10	05/03/2016	0	-19	7.1	1326	13.4	33.3
APW10	08/02/2016	0	-18	7.1	1640	17.4	0
APW10	10/26/2016	0	38	7.1	1600	14.5	0
APW10	01/25/2017	0	-73	7.1	1570	13.6	0
APW10	04/25/2017	0	0	7.0	1610	15.6	0
APW10	06/13/2017	0	12	6.9	1620	15.8	36.5
APW10	11/18/2017	0	34	6.9	1480	12.4	43
APW10	05/18/2018	0	29	7.2	1600	14.7	48.5
APW10	08/17/2018	0	57	6.9	1468	15.1	41.2
APW10	11/09/2018	0	78	7.0	1340	14.9	46.8
APW10	02/22/2019	0	61	6.9	1510	11.9	41.1
APW10	08/23/2019	0	69	7.0	1520	17.2	30.7
APW10	02/05/2020	0.50	14.7	7.1	356	10.6	4.57
APW10	06/11/2020	1.10	-207	7.2	1563	16.1	1.4
APW10	07/28/2020	0.21	-153	7.1	1546	20.8	1.6
APW10	02/11/2021	3.00	46.7	7.4	1594	5.9	168
APW10	06/17/2021	1.70	79.6	7.3	1501	20.4	2.24
APW10	06/30/2021	1.50	140	7.5	1531	16.2	5.8
APW10	07/29/2021	2.80	132	7.5	4100	19.1	0
APW11	02/18/2021	0.14	125	6.1	1285	9.8	0
APW11	03/09/2021	0.37	-56.2	7.2	1460	15.0	174
APW11	03/29/2021	0.23	2.6	6.6	1130	14.4	1760
APW11	04/28/2021	2.00	-51.6	7.1	1297	16.7	96.4
APW11	05/24/2021	3.10	-82.4	7.4	1337	16.5	11.3

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, 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)
APW11	06/16/2021	2.60	-41.2	7.2	1320	19.9	14.8
APW11	06/30/2021	3.10	-37.2	7.1	381.5	17.4	3.65
APW11	07/15/2021	4.10	-24.4	7.2	1318	16.9	5.12
APW12	02/17/2021	0.16	27.2	6.2	1917	10.2	0
APW12	03/09/2021	0.15	45.5	6.5	2115	13.6	6.38
APW12	03/29/2021	0.20	117	6.0	1752	13.4	12.2
APW12	04/28/2021	0.92	11.2	6.4	1537	15.5	22.6
APW12	05/25/2021	0.84	49.5	6.5	1571	17.6	44.5
APW12	06/16/2021	2.40	9.9	6.4	268.4	22.4	10.7
APW12	06/30/2021	1.10	115	6.3	1546	17.6	3.59
APW12	07/15/2021	0.40	22.8	6.5	1870	17.1	3.16
APW13	02/22/2021	0.25	-102	7.1	1544	13.4	25.7
APW13	03/10/2021	0.31	-80.2	7.2	1336	13.8	28.7
APW13	03/31/2021	1.13	-9.4	6.4	1392	12.7	28.8
APW13	04/29/2021	1.40	-96.2	7.2	1399	15.9	8.6
APW13	05/25/2021	3.50	-95.6	7.3	1390	19.1	12.4
APW13	06/17/2021	1.90	-75.3	7.2	1399	18.9	1.69
APW13	06/30/2021	2.10	-78.8	7.3	1393	18.2	0
APW13	07/15/2021	1.50	-90	7.3	1237	16.9	3.97
APW14	02/22/2021	0.95	-113	7.5	1646	12.8	173
APW14	03/10/2021	0.29	-104	7.4	1251	13.7	57.1
APW14	03/31/2021	0.16	-46.7	6.5	1236	13.5	40.4
APW14	04/28/2021	0.99	-120	7.4	1504	17.0	51.6
APW14	05/25/2021	2.00	-145	7.5	1300	20.1	24.9
APW14	06/17/2021	2.60	-97.8	7.4	1313	17.3	19.3
APW14	06/30/2021	1.80	-123	7.5	1290	17.4	11.3
APW14	07/15/2021	0.73	-144	7.4	1533	19.5	4.81
APW15	02/23/2021	0.44	-98.5	7.0	2095	12.9	80.4
APW15	03/10/2021	1.03	-108	7.2	1648	14.9	134
APW15	03/31/2021	0.13	-61.8	6.5	184.7	13.3	126
APW15	04/28/2021	0.16	-122	7.2	2041	16.2	506
APW15	05/24/2021	1.70	-128	7.3	1955	18.8	23.5
APW15	06/17/2021	0.22	-136	7.3	2030	19.9	6.01
APW15	06/30/2021	0.90	-133	7.1	1926	18.2	7.5
APW15	07/14/2021	1.20	-142	7.2	1662	19.4	5.18
APW16	02/23/2021	3.16	-71.4	7.4	1162	12.1	9.52
APW16	03/10/2021	0.18	-132	7.5	1316	13.6	0
APW16	03/30/2021	0.22	-99.5	7.0	1318	13.5	0
APW16	04/28/2021	1.30	-129	7.4	1350	15.1	10.6
APW16	05/24/2021	2.40	-132	7.5	1375	16.2	38.9
APW16	06/16/2021	0.88	-123	7.4	1338	16.6	23.9
APW16	06/30/2021	0.88	-119	7.0	1331	16.8	7.06
APW16	07/15/2021	0.80	-143	7.4	1421	19.4	9.03
APW17	02/23/2021	2.55	-22.5	7.4	901.8	12.6	22.6

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

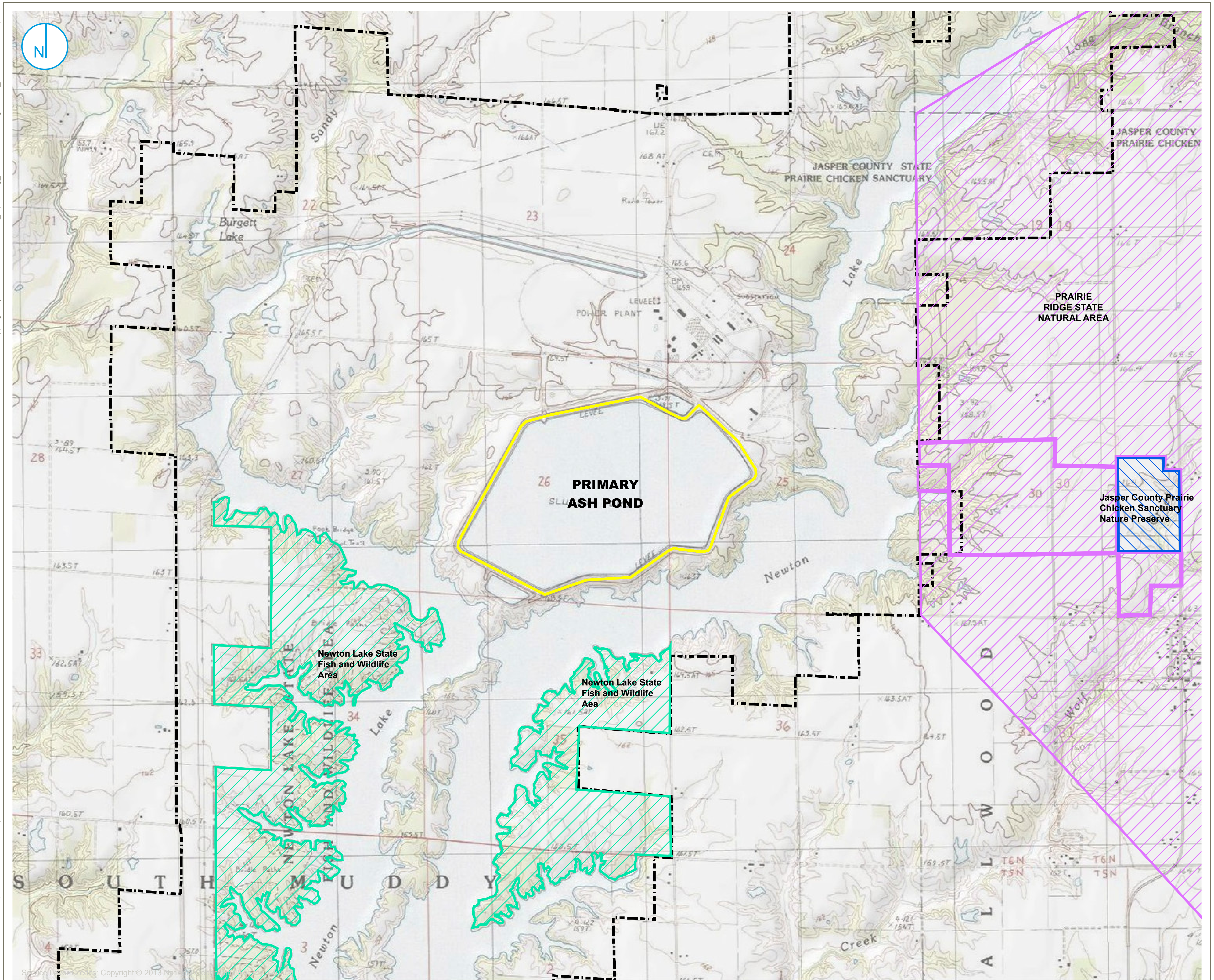
Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
APW17	03/10/2021	1.60	-132	7.7	951.8	13.8	0
APW17	03/30/2021	0.29	-87.2	7.1	1202	14.1	0
APW17	04/29/2021	3.40	-126	7.4	1042	16.3	9.5
APW17	05/24/2021	2.30	197	7.4	1206	20.8	29.5
APW17	06/16/2021	1.80	-130	7.4	1122	21.3	1.13
APW17	06/30/2021	1.30	-138	7.4	1206	19.7	3.13
APW17	07/15/2021	1.50	-110	7.4	1210	18.5	1.81
APW18	02/23/2021	1.94	-141	7.9	941.7	13.6	430
APW18	03/10/2021	0.80	-150	7.8	930.2	13.8	241
APW18	03/30/2021	0.49	-110	7.3	626.2	13.8	247
APW18	04/29/2021	1.50	-154	7.6	920	16.0	61.3
APW18	05/24/2021	2.30	120	7.6	1029	19.3	208
APW18	06/16/2021	0.75	-171	7.5	995	22.2	4.58
APW18	06/30/2021	0.41	-182	7.6	1011	21.6	8.28
APW18	07/15/2021	0.42	-154	7.6	1010	19.6	27.7

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

generated 10/05/2021, 3:58:55 PM CDT

RAMBOLL

FIGURES



PART 845 REGULATED UNIT FACILITY BOUNDARY
JASPER COUNTY PRAIRIE CHICKEN SANCTUARY NATURE PRESERVE
NEWTON LAKE STATE FISH AND WILDLIFE AREA
PRAIRIE RIDGE STATE NATURAL AREA
PROPERTY BOUNDARY

0 1,000 2,000 Feet

SITE LOCATION MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 1-1

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure 1-1_Site Location Map.mxd

PROJECT: 169000XXXX | DATED: 10/19/2021 | DESIGNER: STOLZSD

PART 845 REGULATED UNIT FACILITY BOUNDARY
SITE FEATURE
PROPERTY BOUNDARY

0 500 1,000 Feet

SITE MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 1-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure 1-2_Site Map.mxd

PROJECT: 169000XXXX | DATED: 10/19/2021 | DESIGNER: STOLZSD

10-FOOT ELEVATION CONTOUR
2-FOOT ELEVATION CONTOUR
PART 845 REGULATED UNIT FACILITY BOUNDARY
SITE FEATURE
PROPERTY BOUNDARY

NOTE

ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988

SOURCE

INGENAE SURVEY, 2021

0 400 800 Feet

TOPOGRAPHIC MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT PRIMARY ASH POND

NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 2-1

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure 2-1_Topo Map.mxd

PROJECT: 169000XXXX | DATED: 10/19/2021 | DESIGNER: STOLZSD

PART 845 REGULATED UNIT FACILITY BOUNDARY

SITE FEATURE

NRCS SOIL SURVEY MAP UNIT BOUNDARY

MAP UNIT SYMBOL	MAP UNIT NAME
533	Urban land
866	Dumps, slurry
109A	Racoon silt loam, 0 to 2 percent
12A	Wynoose silt loam, 0 to 2 percent
13A	Bluford silt loam, 0 to 2 percent
13B2	Bluford silt loam, 2 to 5 percent slopes, eroded
14B	Ava silt loam, 2 to 5 percent slopes
14C2	Ava silt loam, 5 to 10 percent slopes, eroded
2A	Cisne silt loam, 0 to 2 percent
3333A	Wakeland silt loam, 0 to 2 percent slopes, frequently flooded
48A	Ebbert silt loam, 0 to 2 percent
581B2	Tamalco silt loam, 2 to 5 percent slopes, eroded
7C2	Atlas silt loam, 5 to 10 percent slopes, eroded
7C3	Atlas silty clay loam, 5 to 10 percent slopes, severely eroded
805C	Orthents, clayey, sloping
8F	Hickory silt loam, 18 to 35 percent
912A	Hoyleton-Darmstadt silt loams, 0 to 2 percent slopes
M-W	Miscellaneous water
W	Water

SOURCE:
NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

0 400 800 Feet

SOIL SURVEY MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

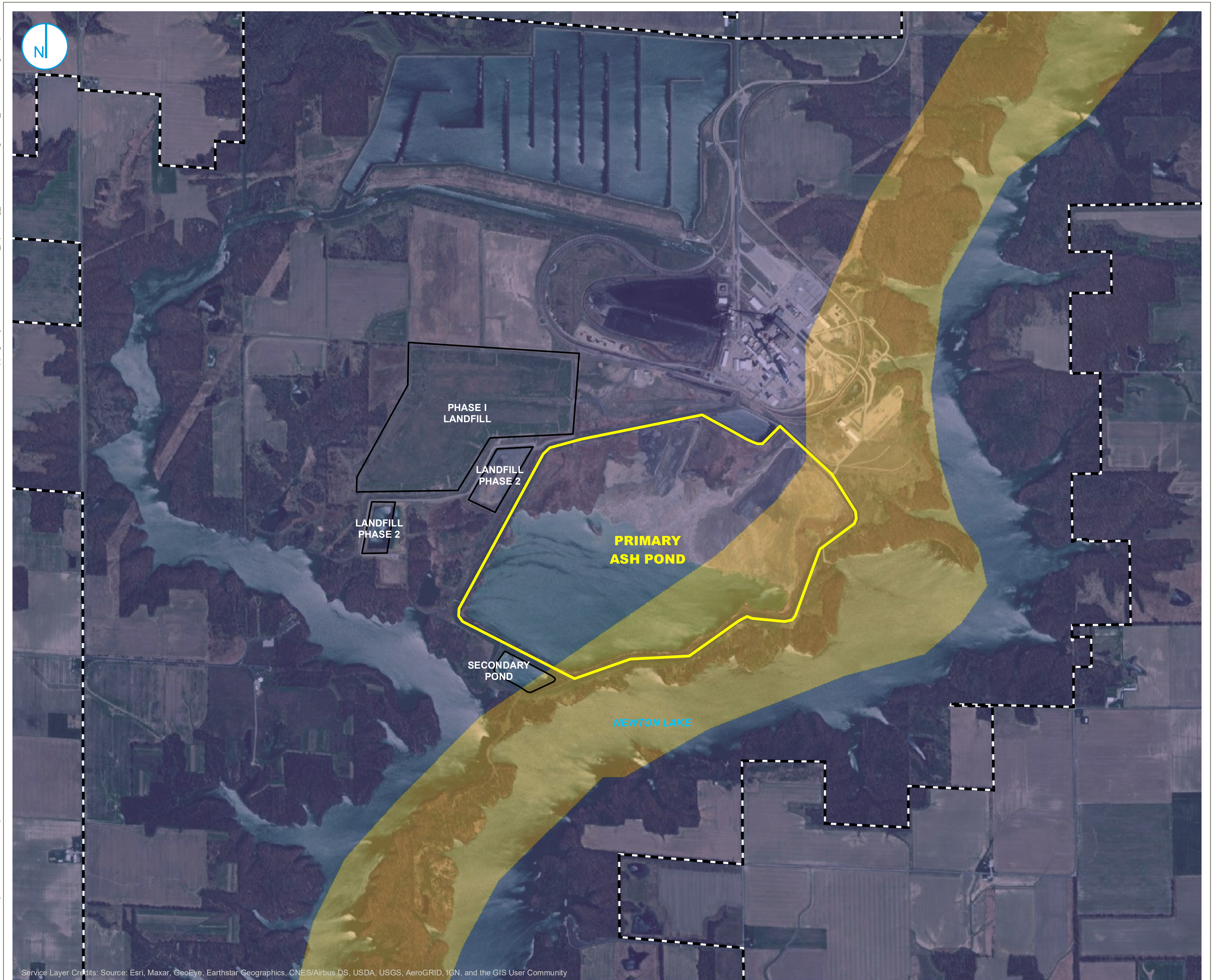
FIGURE 2-2

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure 2-2_Soil Survey.mxd

PROJECT: 169000XXXX | DATED: 10/19/2021 | DESIGNER: STOLZSD



PART 845 REGULATED UNIT FACILITY BOUNDARY
SITE FEATURE
CAHOKIA ALLUVIUM (INCLUDES ALLUVIAL FAN FACIES)
VANDALIA TILL MEMBER
PROPERTY BOUNDARY

SOURCE
ILLINOIS STATE GEOLOGICAL SURVEY (ISGS)

0 750 1,500 Feet

SURFICIAL GEOLOGIC DEPOSITS

HYDROGEOLOGIC SITE
CHARACTERIZATION REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

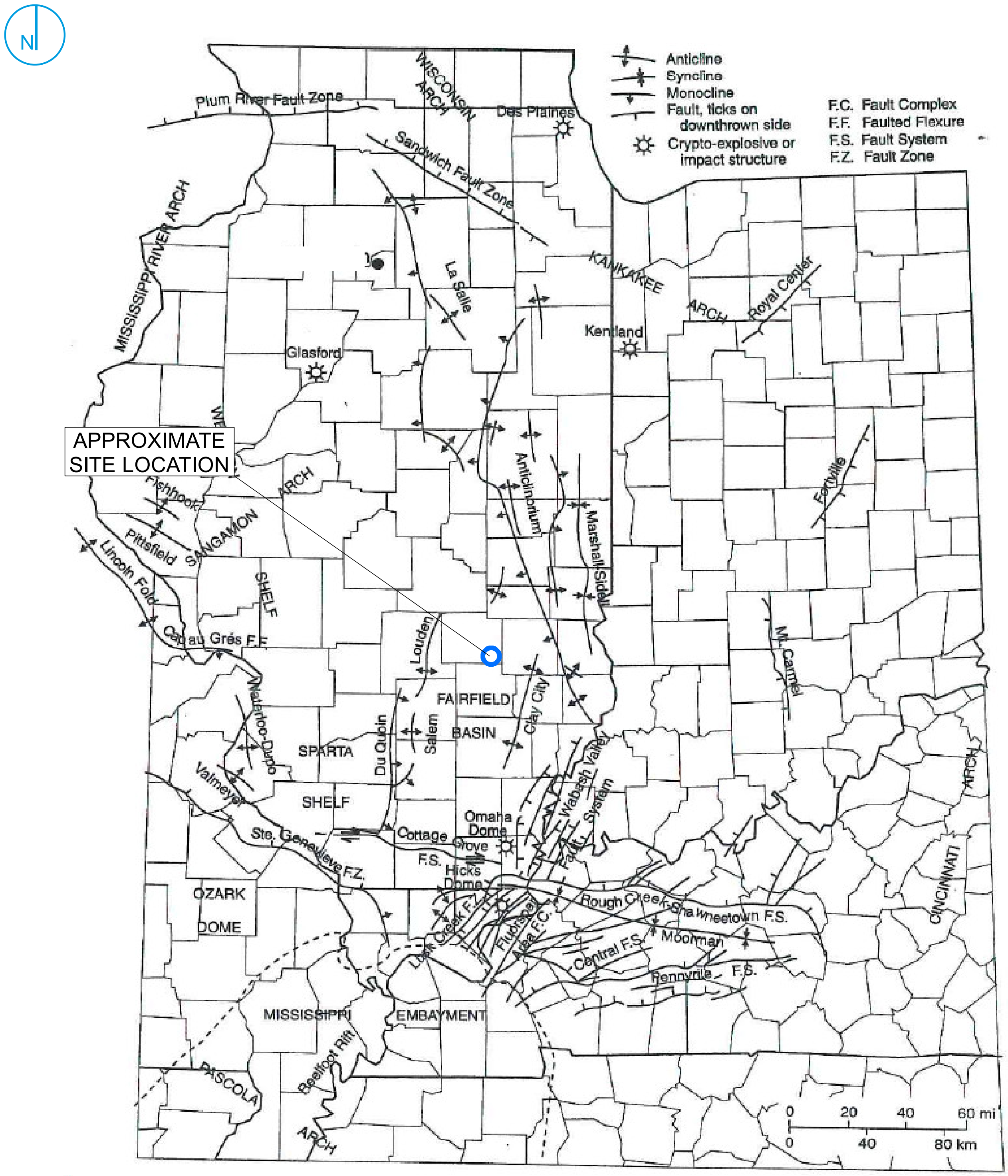
FIGURE 2-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 10/19/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure 2-3_Surficial Geologic Deposits.mxd



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: 9/1/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure 2-4_Major Structural Features of Illinois.mxd

MAJOR STRUCTURAL FEATURES OF ILLINOIS

DRAFT

FIGURE 2-4

PRIVILEGED AND CONFIDENTIAL
PREPARED AT THE REQUEST OF COUNSEL

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure 2-5_Field Investigation Locations.mxd

PROJECT: 169000XXXX | DATED: 10/19/2021 | DESIGNER: STOLZSD

MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
SOIL BORING
PART 845 REGULATED UNIT FACILITY BOUNDARY
SITE FEATURE

0 400 800 Feet

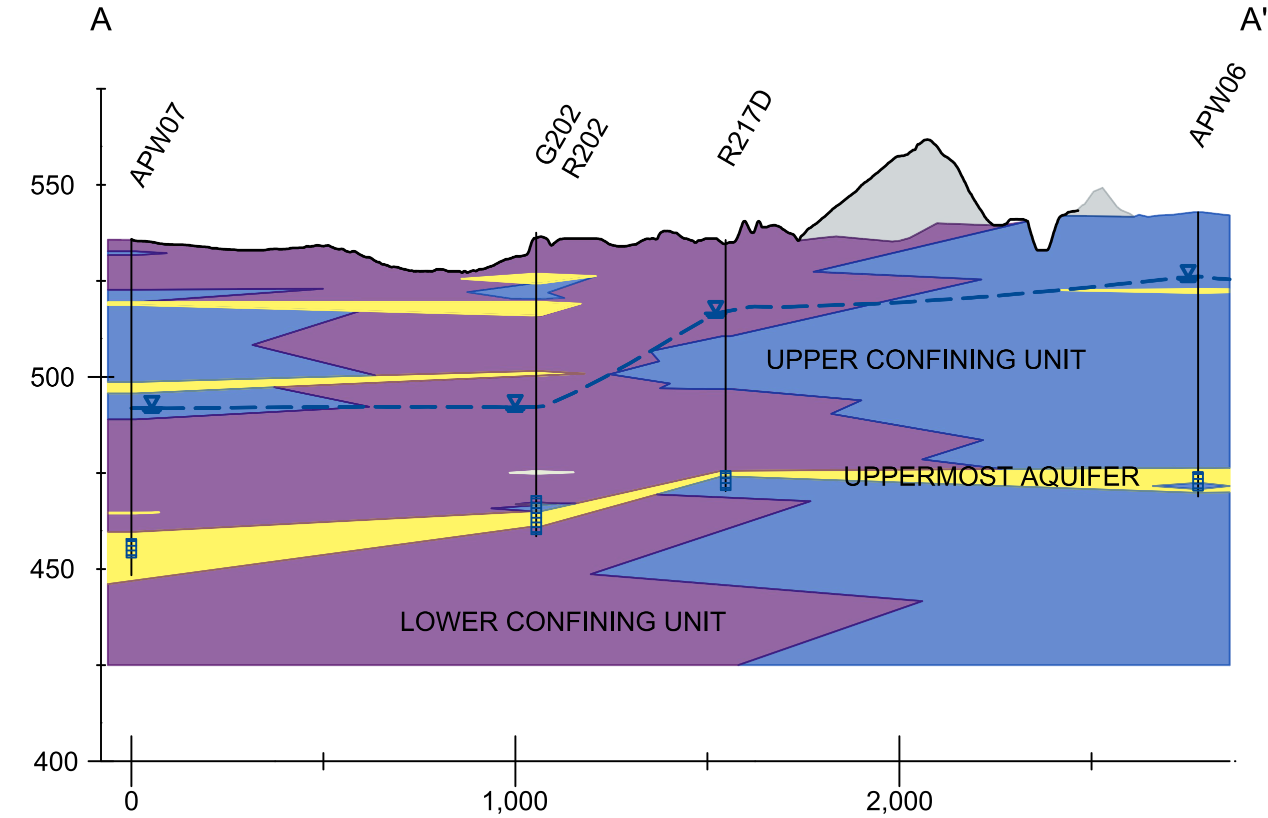
FIELD INVESTIGATION LOCATIONS

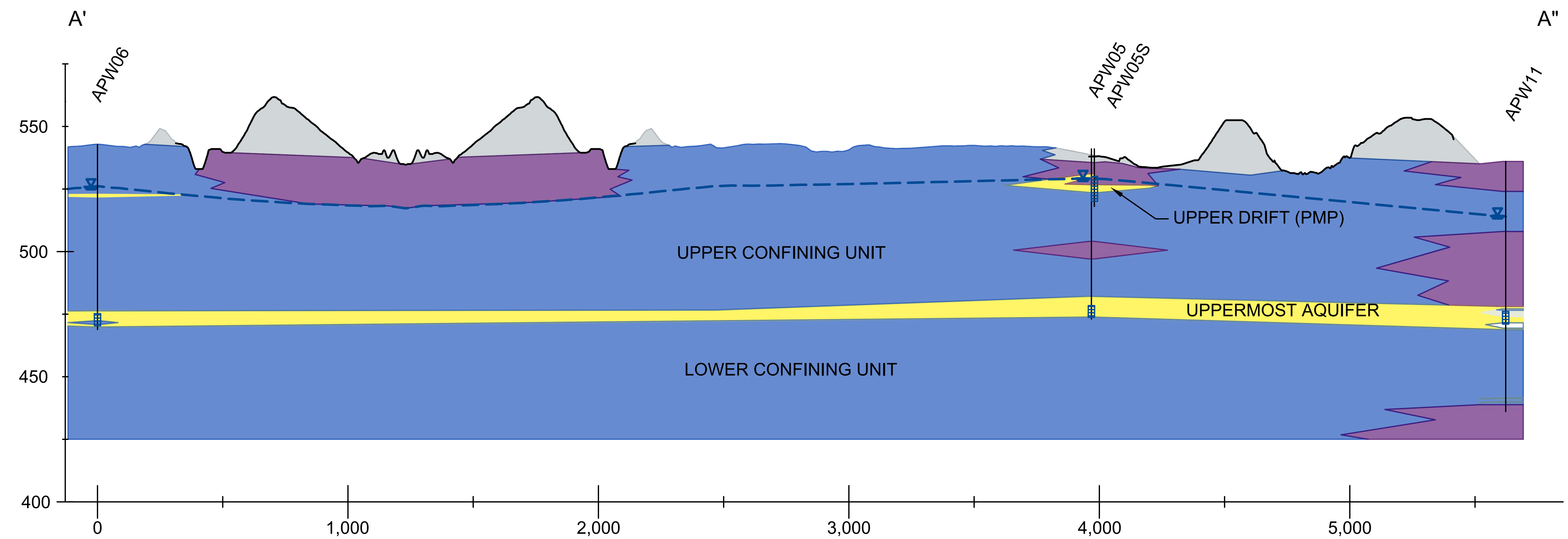
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

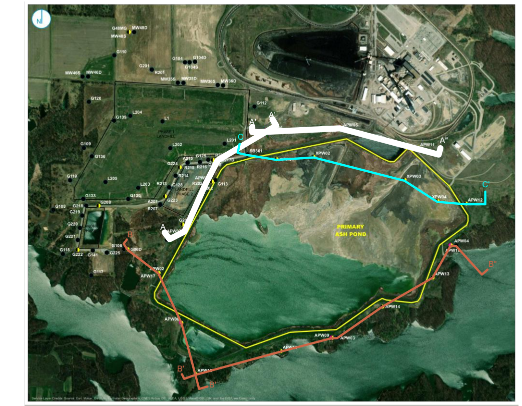
FIGURE 2-5

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL







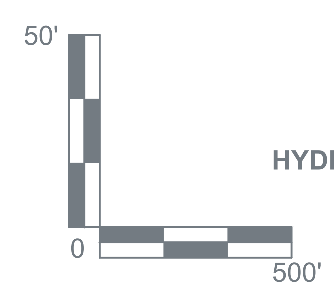
NOTES

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 June 24, 2021.
5. PMP = potential migration pathway

PROJECT: ####

LEGEND

- FILL
- CLAY (CL/CH)
- SILT (ML)
- SAND (SP/SM/SW)
- GRAVEL (GP/GW)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPERMOST AQUIFER GROUNDWATER ELEVATION



GEOLOGIC CROSS SECTION
A-A' & A'-A"

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

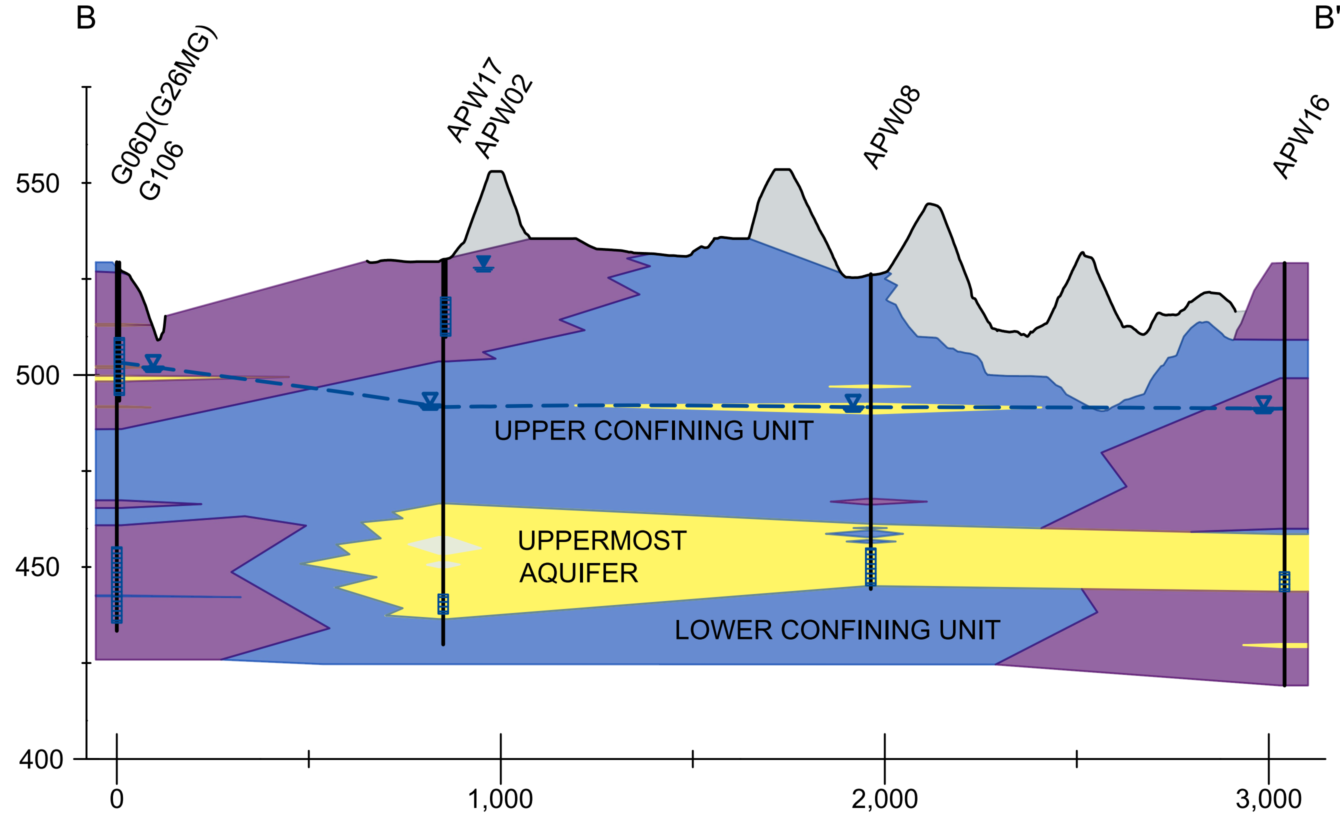
PRIMARY ASH POND

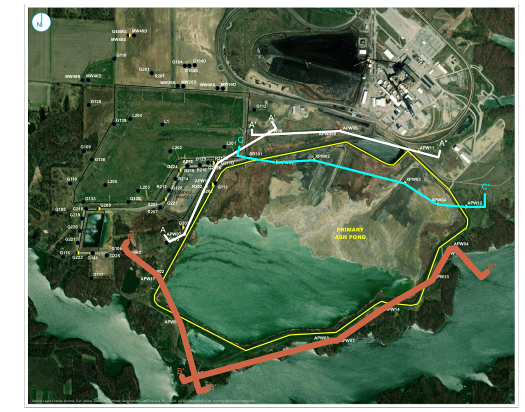
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 2-6

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

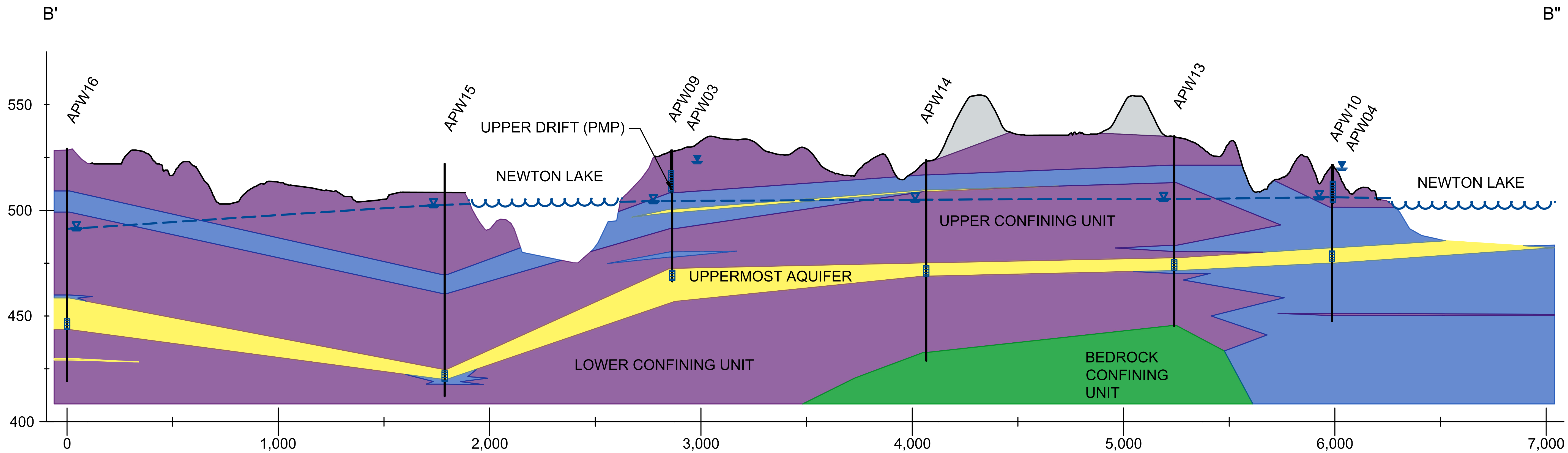
RAMBOLL





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 June 24, 2021.
5. PMP = potential migration pathway



LEGEND

- FILL
- CLAY (CL/CH)
- SILT (ML)
- SAND (SP/SM/SW)
- GRAVEL (GP/GW)
- BEDROCK / WEATHERED BEDROCK (SHALE)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPERMOST AQUIFER GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)

50'
0
500'

GEOLOGIC CROSS SECTION
B-B' & B'-B"

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

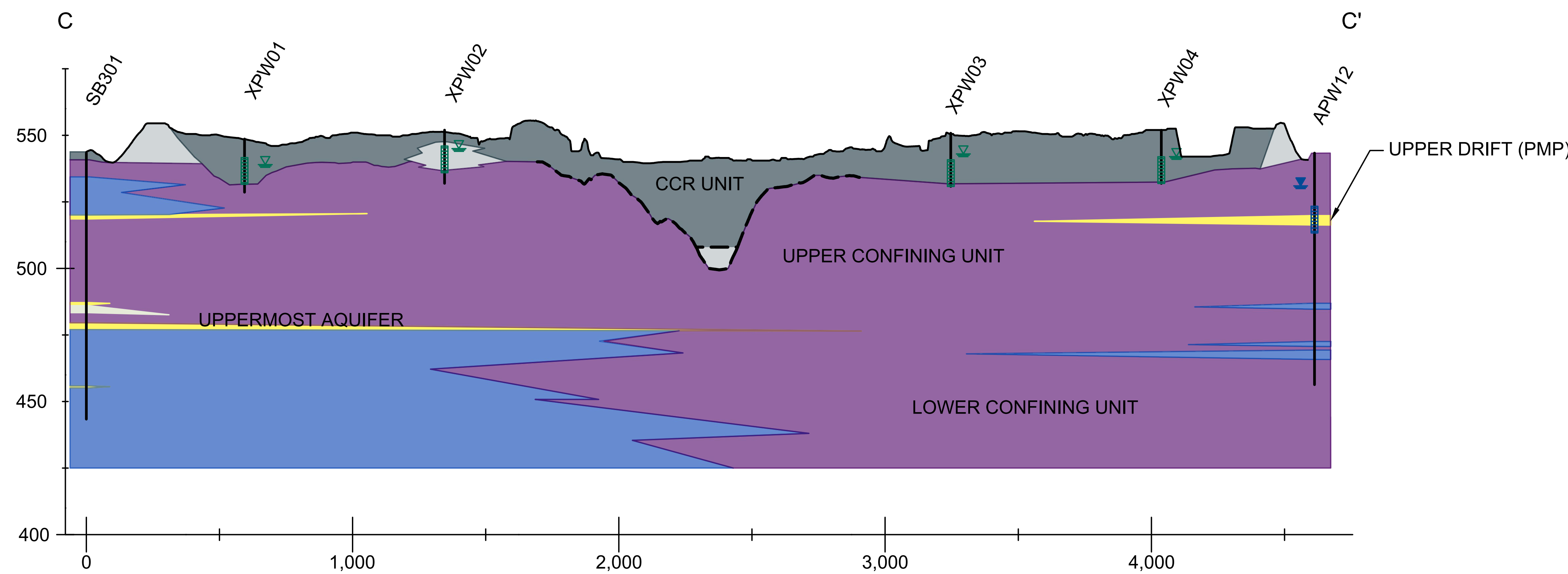
FIGURE 2-7

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

PROJECT: ####

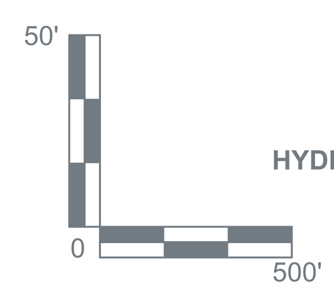
NOTES

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. Base of CCR Unit is based on historic land surface contours. This surface is being further evaluated as the construction permit is being developed.
5. Groundwater elevations measured on June 24, 2021.
6. PMP = potential migration pathway



LEGEND

- COAL COMBUSTION RESIDUALS (CCR)
- FILL
- CLAY (CL/CH)
- SILT (ML)
- SAND (SP/SM/SW)
- GRAVEL (GP/GW)
- WELL SCREEN INTERVAL
- POREWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)



GEOLOGIC CROSS SECTION
C-C'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

PRIMARY ASH POND

NEWTON POWER PLANT

NEWTON, ILLINOIS

FIGURE 2-8

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: ####

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure 2-9_Bottom of Ash Map.mxd

PROJECT: 169000XXXX | DATED: 10/19/2021 | DESIGNER: STOLZSD

SOIL BORING AND BOTTOM OF ASH ELEVATION

10 FOOT HISTORIC ELEVATION CONTOUR

2 FOOT HISTORIC ELEVATION CONTOUR

CONSTRUCTION DRAWING S-69 INDICATES DRAINAGE FEATURE WAS TO BE FILLED TO MAX ELEVATION 508 PRIOR TO OPERATION OF THE UNIT.

PART 845 REGULATED UNIT FACILITY BOUNDARY

SITE FEATURE

PROPERTY BOUNDARY

NOTES

1. CONTOUR LINES ARE A HISTORIC LAND SURFACE. THIS SURFACE IS BEING FURTHER EVALUATED AS THE CONSTRUCTION PERMIT IS BEING DEVELOPED.

0 400 800 Feet

BOTTOM OF ASH MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 2-9

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure 3-1_Monitoring Well Location Map.mxd

PROJECT: 169000XXXX | DATED: 10/19/2021 | DESIGNER: STOLZSD

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
PART 845 REGULATED UNIT FACILITY BOUNDARY
SITE FEATURE

MONITORING WELL LOCATIONS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 3-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure 3-2_Top of Uppermost Aquifer.mxd

PROJECT: 169000XXXX | DATED: 10/19/2021 | DESIGNER: STOLZSD

MONITORING WELL
UPPERMOST AQUIFER ELEVATION (2-FOOT INTERVAL)
PART 845 REGULATED UNIT FACILITY BOUNDARY
SITE FEATURE
PROPERTY BOUNDARY

NOTES:
* = NOT USED FOR CONTOURING
ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

TOP OF AQUIFER CONTOURS GENERATED IN 2018 (HALEY & ALDRICH, INC., 2018) FOR 40 C.F.R. § 257; CONTOURS HAVE NOT BEEN MODIFIED USING BORING DATA COLLECTED IN 2021, ALTHOUGH THE SEPARATION DISTANCE BETWEEN THE TOP OF UPPERMOST AQUIFER AND BOTTOM OF ASH IS CONSISTENT.

0 400 800 Feet

TOP OF UPPERMOST AQUIFER

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 3-2

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE

NOTES:
1. ELEVATIONS IN PARENTHESES WERE NOT USED FOR CONTOURING.
2. NM = NOT MEASURED
3. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988

0 400 800 Feet

UPPERMOST AQUIFER GROUNDWATER ELEVATION CONTOURS APRIL 27, 2021

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 3-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure 3-3_GWE_Contours_20210427.mxd

PROJECT: 169000XXXX | DATED: 10/19/2021 | DESIGNER: STOLZSD

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE

NOTES:

1. ELEVATIONS IN PARENTHESIS WERE NOT USED FOR CONTOURING.
2. NM = NOT MEASURED
3. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988

0 400 800 Feet

UPPERMOST AQUIFER GROUNDWATER ELEVATION CONTOURS JULY 14, 2021

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 3-4

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

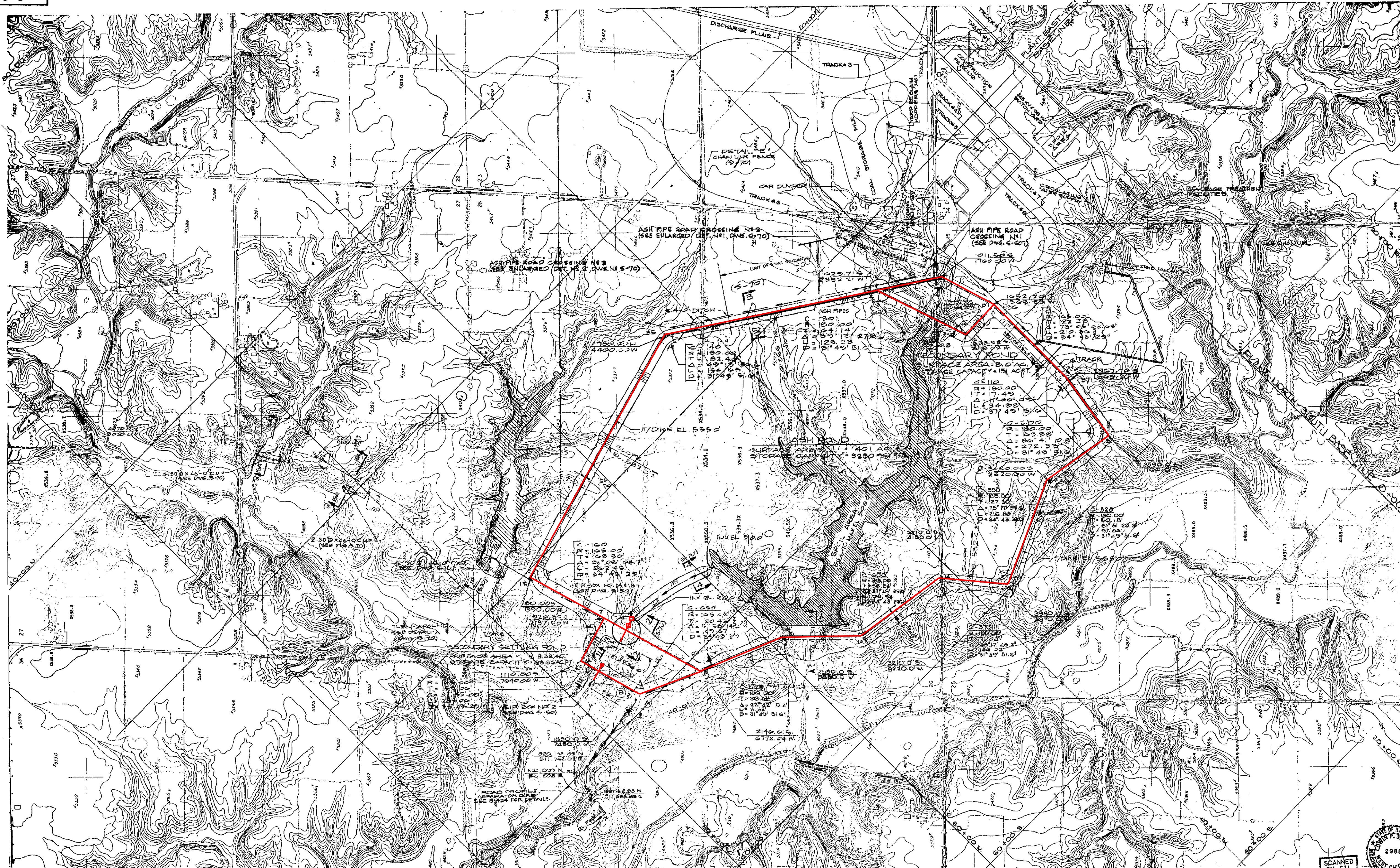
Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure 3-4_GWE_Contours_20210714.mxd

PROJECT: 169000XXXX | DATED: 10/19/2021 | DESIGNER: STOLZSD

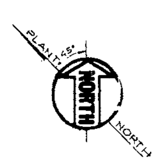
APPENDICES

APPENDIX A
HISTORIC TOPOGRAPHIC MAP S-69

69-S



POINT No.	SIDE	CURVE No.	R	T	Δ	L	D
8	ASH POND		100	52.87'	49°43' 13.6"	86.78	57°17' 45.60"
8	SECONDARY ASH POND		65'	140.29'	130°16' 46.4"	147.80	88°08' 51.69"
21	LAKESIDE (A)		165'	49.55	33°25' 06.4"	96.27	34°43' 29.00"
21	LAKESIDE (B)		65'	70.49'	94°36' 00.0"	107.32	88°08' 51.69"
36	ASH POND (A)		57.5'	57.50	90°00' 00.0"	90.27	99°38' 41.53"
36	SECONDARY (B) POND		57.5	77.59	106°54' 52.35"	107.24	99°38' 41.53"
39	SECONDARY POND		57.5	61.37	140°46' 29.17"	141.21	99°58' 41.53"



NOTES

7. THE WATER LEVEL IN ASH POND SHALL BE MAINTAINED AT AN ELEVATION 10'-0" ABOVE THE SEDIMENT LEVEL FOR ENVIRONMENTAL PURPOSES.

NOTES

1. FOR GENERAL NOTES SEE DWG. S-14.
2. ALL WORK SHOWN IN THIS DRAWING SHALL BE DONE BY SUPERSTRUCTURE CONTRACTOR IN ACCORDANCE WITH JOB SPEC. A-3022.
3. ALL EXTERIOR SIDE SLOPES OF DIKE BELOW ELEV. 510.0' THAT IS TO BE CONSTRUCTED BEFORE LAKE FILLING. SHALL BE PROVIDED WITH 24" STONE RIPRAP ON 24" SAND AND GRAVEL FILTER BEDDING AS SHOWN ON DWG. S-70. AND ALL DIKE CONSTRUCTION SHALL BE DONE IN ACCORDANCE WITH JOB SPEC. A-3017 AND A-3022.
4. ALL DIKE TOPS AND SIDE SLOPES AND ALL EXTERNAL DITCHES SHALL BE PROVIDED WITH 4" TOPSOIL AND SEEDED IN ACCORDANCE WITH JOB SPEC. A-3017 AND A-3022.
5. EXISTING LOW AREAS SHALL BE FILLED WITH SPOILMATERIAL AS REQUIRED FOR SPOIL DISPOSAL SPOILS SHALL BE PLACED IN LAYERS AND GRADED PROPERLY FOR DRAINAGE.
6. REMOVED "HOLD" FROM SO_2 POND AREAS FOR CLEARING. SLOPE STAKING & CROSS- SECTIONING ONLY.

REFERENCE DRAWINGS

S-19	SITE CONTOURS AND DEVELOPMENT PLAN SHEET 4.
S-39	GRADING AND DRAINAGE PLAN. PLANT AREA SHEET 2.
S-40	GRADING AND DRAINAGE PLAN. PLANT AREA SHEET 3.
S-50	WEIR BOX STRUCTURES AT PRIMARY AND SECONDARY SETTLING PONDS.
S-70	ASH POND DIKE PROFILE DETAILS & SECTION
S-507	GRADING & DRAINAGE PLAN- PLANT AREA- SHT7.

ASH POND & SO_2 DISPCSAL POND
NEWTON POWER STATION UNIT 1
CENTRAL ILL PUBLIC SERVICE CO.
NEWTON, ILLINOIS

SCALE 1" = 400'-0" & U.N.
DRAWN B. SAUCHEZ 8-6-74
CHECKED C.R. Bhattacharya 8-6-74
ENGINEER A.J. Shah 8-6-74

SARGENT & LUNDY ENGINEERS CHICAGO

SCANNED BY S&L

STATE OF ILLINOIS EDWIN P. SHIRES 2988 WEST CHICAGO REGISTERED STRUCTURAL ENGINEER

DRAWING NO. S-69

APPENDIX B
INFORMATION PERTINENT TO 35 I.A.C. § 845.220(A)(3)

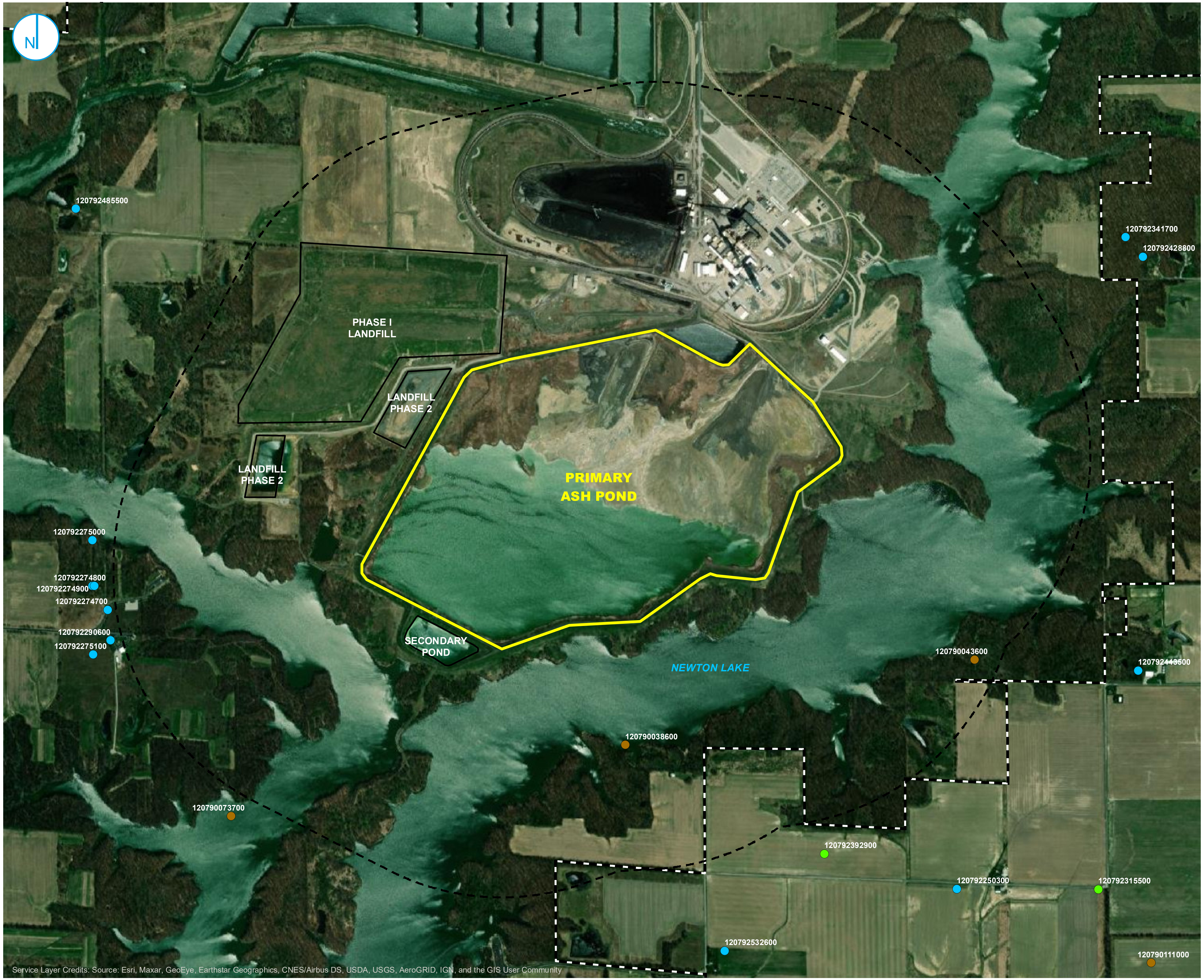
SUMMARY OF POTENTIAL RECEPTORS WITHIN 1,000 METERS
DESKTOP STUDY
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, IL

Category	Number of Receptors Identified Within 1,000 Meters	Number of Receptors Identified Downgradient of Unit	Notes
Wells	2	0	Sidegradient; Wells are listed as dry/abandoned.
Surface Water Features	12	2	
Historic Sites	0	0	
Natural Sites	0	0	
Threatened or Endangered Species	25	10	Data provided only at a county level.
Mines	0	0	Nearest mine is 6.7 miles northeast.
Oil Sites	0	0	

[O: CJC 06/02/21; C: LDC 09/15/21]

RAMBOLL

WATER WELL SURVEY



DRY
WATER
N/A
PART 845 REGULATED UNIT FACILITY BOUNDARY
1000 METER UNIT BUFFER
SITE FEATURE
PROPERTY BOUNDARY

SOURCE: IL WELLS

0 625 1,250 Feet

DRINKING WATER INTAKES, PUMPING WELLS, AND USES OF WATER

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE B-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure B-2_Drinking Water Intakes Uses of Water.mxd

PROJECT: 169000XXXX | DATED: 10/19/2021 | DESIGNER: STOLZSD

WELLS WITHIN 1,000 METERS
DESKTOP STUDY
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, IL

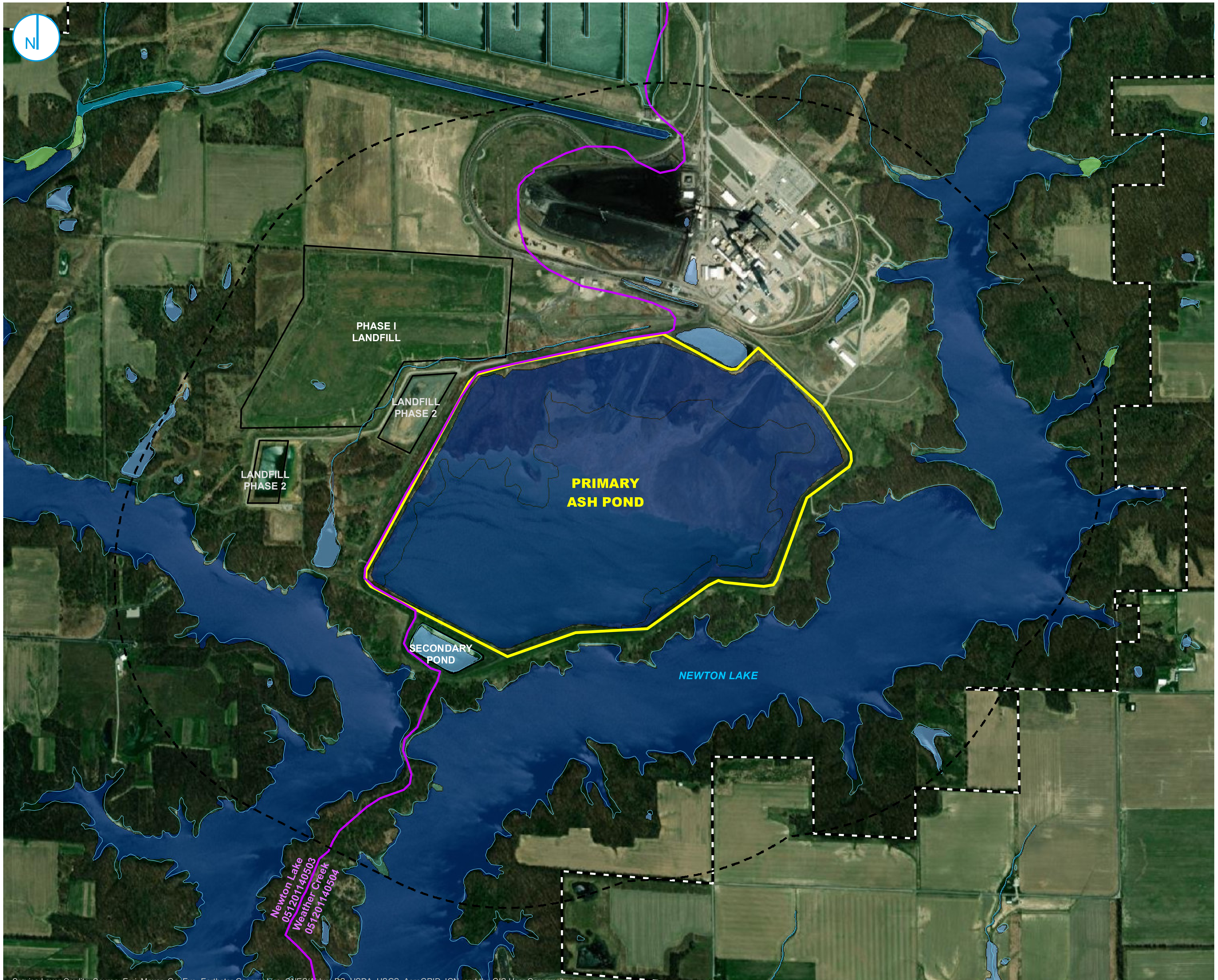
Well Number	Date Constructed	Ground Elevation (ft NAVD88)	Screen Top Depth (FT BGS)	Screen Bottom Depth (ft BGS)	Screen Length (ft)	Screen Diameter (inches)	Well Depth (ft BGS)	Total Boring Depth (ft BGS)	Latitude (DD)	Longitude (DD)	Hydraulic Position Designation (B/Sd/U/D)	Notes
120790038600	5/27/1948	---	---	---	---	---	---	---	38.918277	-88.281956	Sd	
120790043600	7/13/1950	---	---	---	---	---	---	---	38.921356	-88.265738	Sd	

[O: CJC 06/02/21; C: LDC 09/15/21]

Notes:
--- = no data
B = background
BGS = below ground surface
D = downgradient
DD = decimal degrees
ft = foot/feet
LCU = lower confining unit
Sd= Sidegradient
U = upgradient
NAVD88 = North American Vertical Datum of 1988, GEOID 12A

RAMBOLL

SURFACE WATERS



SURFACE WATERBODY
WATERSHED BOUNDARY (HUC 12)

NATIONAL WETLANDS INVENTORY

FRESHWATER EMERGENT WETLAND
FRESHWATER FORESTED/SHRUB WETLAND
FRESHWATER POND
LAKE
OTHER
RIVERINE
PART 845 REGULATED UNIT FACILITY BOUNDARY
1000 METER UNIT BUFFER
SITE FEATURE
PROPERTY BOUNDARY

SOURCES: USGS, USFWS

0 625 1,250 Feet

SURFACE WATERBODIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE B-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure B-3_Surface Waterbodies.mxd

PROJECT: 169000XXXX | DATED: 10/19/2021 | DESIGNER: STOLZSD

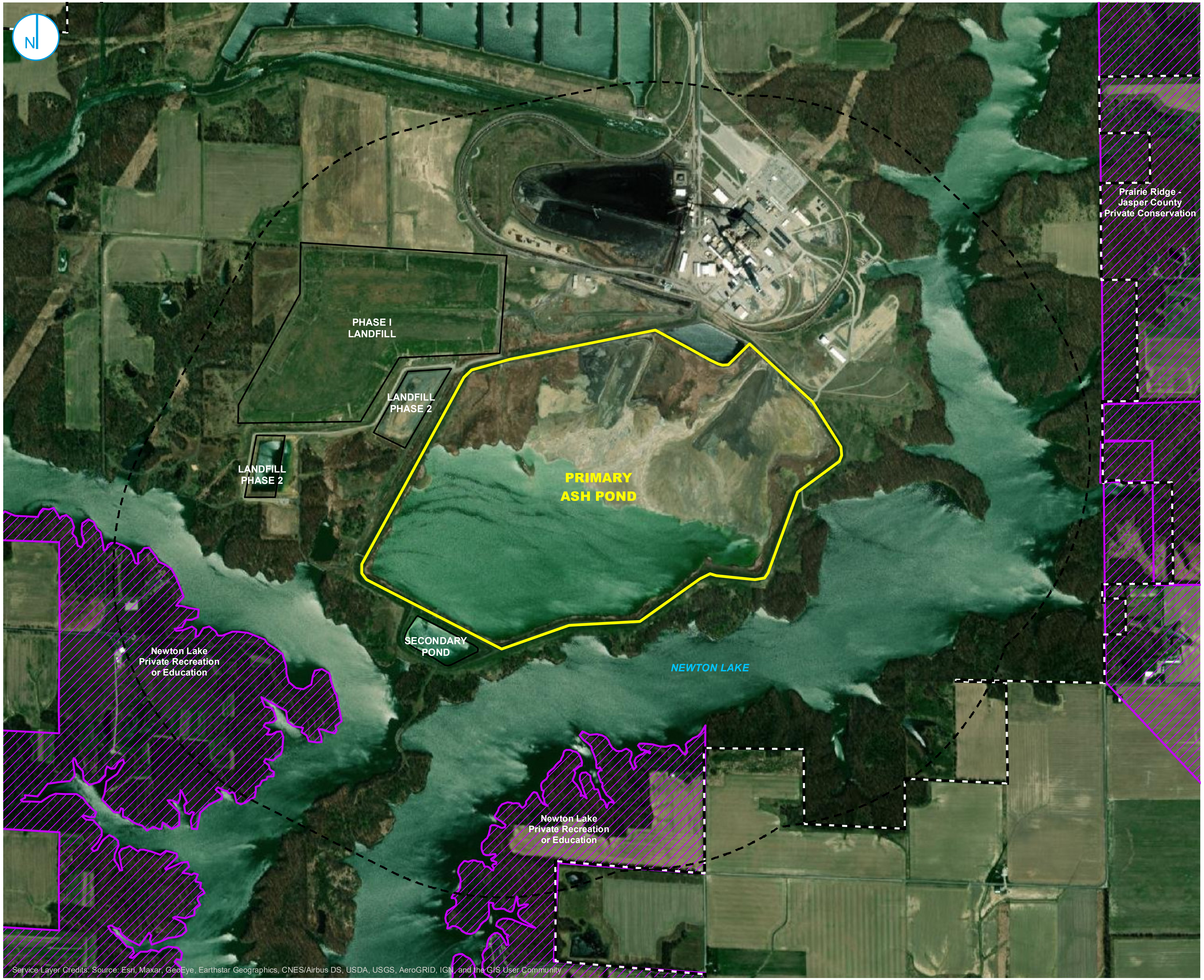
SURFACE WATER FEATURES WITHIN 1,000 METERS
DESKTOP STUDY
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, IL

HUC	Surface Water ID	Distance from Unit (ft)	Distance from Unit (meters)	Physical Orientation to Unit	Hydraulic Orientation to Unit	Classification Code	Size (acres)
--	Freshwater Pond	45	14	NE	Upgradient	PUBGh	6.16
--	Freshwater Pond	2610	795	SE	Sidegradient	PUBGh	2.28
--	Freshwater Pond	3250	991	NW	Upgradient	PUBGh	4.07
--	Freshwater Pond 2	153	47	SW	Downgradient	PUBGh	5.79
--	Freshwater Pond 3	958	292	NE	Upgradient	PUBGh	0.92
--	Freshwater Pond 4	720	219	N	Upgradient	PUBGx	0.99
--	Freshwater Pond 5	440	134	W	Upgradient	PUBGh	3.7
--	Freshwater Pond 6	1600	488	NW	Upgradient	PUBGh	0.27
--	Lake	2780	847	N	Upgradient	L1UBHx	13.72
--	Lake Newton	240	73	S	Downgradient	L1UBHh	1647.98
--	Riverine Wetland	123	37	N	Upgradient	R4SBC	2.26
--	Riverine Wetland 2	142	43	N/NW	Upgradient	R4SBC	2.26

[O: CJC 06/02/21; C: LDC 09/15/21]

Notes:
-- = not applicable
ft = foot/feet
bgs = below ground surface
HUC = Hydrologic Unit Code
N = north
W = west
SE = southeast

NATURE PRESERVES, HISTORIC SITES, ENDANGERED / THREATENED SPECIES



Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure B-4_Nature Preserves.mxd

PROJECT: 169000XXXX | DATED: 10/19/2021 | DESIGNER: STOLZSD

PROTECTED
PART 845 REGULATED UNIT FACILITY BOUNDARY
1000 METER UNIT BUFFER
SITE FEATURE
PROPERTY BOUNDARY

SOURCES: USGS - PAD-US, USFWS

0 625 1,250 Feet

NATURE PRESERVES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE B-3

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

JASPER COUNTY THREATENED AND ENDANGERED SPECIES

DESKTOP STUDY

NEWTON POWER PLANT

PRIMARY ASH POND

NEWTON, IL

Scientific Name	Common Name	Status	Number of Occurances	Last Observed
Ammocrypta pellucida	Eastern Sand Darter	LT	9	8/5/2019
Apalone mutica	Smooth Softshell	LT	2	8/31/2017
Asio flammeus	Short-eared Owl	LE	2	12/23/2014
Bartramia longicauda	Upland Sandpiper	LE	1	5/22/2013
Botaurus lentiginosus	American Bittern	LE	1	6/3/2013
Circus hudsonius	Northern Harrier	LE	3	2/6/2016
Coccyzus erythropthalmus	Black-billed Cuckoo	LT	1	6/25/1998
Emydoidea blandingii	Blanding's Turtle	LE	1	5/18/1998
Etheostoma histrio	Harlequin Darter	LE	1	9/18/1967
Festuca paradoxa	Cluster Fescue	LT	1	6/30/1999
Ixobrychus exilis	Least Bittern	LT	2	5/26/2017
Lanius ludovicianus	Loggerhead Shrike	LE	3	6/7/2017
Laterallus jamaicensis	Black Rail	LE	1	6/20/2012
Nyctanassa violacea	Yellow-crowned Night-Heron	LE	1	5/24/1995
Papaipema eryngii	Eryngium Stem Borer	LT	1	7/8/2020
Penstemon tubaeflorus	Tube Beard Tongue	LE	3	5/27/2019
Rallus elegans	King Rail	LE	1	6/7/2016
Sabatia campestris	Prairie Rose Gentian	LE	1	7/30/2019
Schoenoplectus purshianus	Pursh's Bulrush	LE	1	2012
Silene regia	Royal Catchfly	LE	1	5/12/2015
Spiranthes vernalis	Spring Ladies' Tresses	LE	3	8/5/2019
Sternula antillarum	Least Tern	LE	1	6/13/2004
Terrapene ornata	Ornate Box Turtle	LT	2	4/6/2020
Tracaulon arifolium	Halberd-leaved Tearthumb	LE	1	8/14/1985
Tympanuchus cupido	Greater Prairie-Chicken	LE	2	7/10/1905

[O: CJC 06/02/21; C: LDC 09/15/21]

Notes:
-- = not provided/cannot be determined
LE = listed endangered
LT = listed threatened

APPENDIX C
BORING LOGS AND WELL CONSTRUCTION LOGS

BORING AND WELL LOCATION MAP

BORING LOGS

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Newton Power Station		APW11

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	1/23/2021	1/23/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
APW11	Feet (NAVD88)	536.05 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 825,195.28 N, 1,000,717.50 E Ⓔ/ W
1/4 of 1/4 of Section 25, T 6 N, R 8 E
Lat 38° 55' 58.09"
Long -88° 16' 31.6"
Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Jasper	IL	Newton

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	120 113		0–10	0 - 0.4' **CLAYEY SILT** ML/CL, grayish brown (10YR 5/2) to brownish yellow (10YR 6/6), roots (5-15%), gravel (0-5%), no dilatancy, medium toughness, low plasticity, wet.	ML/CL									CS= Core Sample
				0.4 - 10' **LEAN CLAY:** CL, gray (10YR 6/1), strong brown (7.5YR 5/8) mottling (15-30%), brown (10YR 3/3), silt (15-30%), sand (0-5%), organic material (0-5%), no dilatancy, low toughness, medium plasticity, wet to moist.	CL									
2 SH	24 24		10–12	10 - 12' **LEAN CLAY:** CL.	CL					17.8	28	16	53.8	SH= Shelby Tube

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

Signature [signature]

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

RAMBOLL

Boring Number APW11

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	96 96		12–22.3	12 - 22.3' **SILT WITH SAND:** (ML)s, brown (10YR 5/3), clay (5-15%), gravel (0-5%), cohesive, low toughness, non-plastic to low plasticity, moist.	(ML)s									
			15	15' brown (10YR 4/3), clay (5-15%), gravel (5-15%), low to medium toughness.										
			18	18' sand seams (0-5%) 1/16" diameter.										
4 CS	120 120		20											
			22.3–28	22.3 - 28' **SILT:** ML, yellowish brown (10YR 5/4), grayish brown (10YR 5/2) mottling (0-5%), strong brown (7.5YR 5/6) mottling (0-5%), clay (15-30%), sand (0-5%), gravel (0-5%), no dilatancy, medium toughness, low plasticity.	ML									
			28–32	28 - 58' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), grayish brown (10YR 5/2) mottling (0-5%), strong brown (7.5YR 5/6) mottling (0-5%), silt (15-30%), sand (0-5%), gravel (0-5%), no dilatancy, low toughness, medium to high plasticity.	CL									
5 CS	120 120		30											

Boring Number APW11

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	28 - 58' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), grayish brown (10YR 5/2) mottling (0-5%), strong brown (7.5YR 5/6) mottling (0-5%), silt (15-30%), sand (0-5%), gravel (0-5%), no dilatancy, low toughness, medium to high plasticity. *(continued)*										
			34	33.2' - 34.4' gray (10YR 5/1) mottling (5-15%), sand (5-15%).										
			35	34.4' - 40' sand (5-15%).										
			36											
			37											
			38											
			39											
6 CS	120 120		40											
			41											
			42		CL									
			43											
			44											
			45											
			46											
			47											
			48											
			49	48.6' dark grayish brown (10YR 4/2), olive gray (5Y 4/2) mottling (5-15%), dark grayish brown (2.5Y 4/2) mottling (5-15%), dark reddish brown (5YR 3/4) mottling (0-5%),.										
7 CS	120 120		50											
			51											
			52											

RAMBOLL

Boring Number APW11

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
			53–58	28 - 58' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), grayish brown (10YR 5/2) mottling (0-5%), strong brown (7.5YR 5/6) mottling (0-5%), silt (15-30%), sand (0-5%), gravel (0-5%), no dilatancy, low toughness, medium to high plasticity. *(continued)* 55.7' - 56.9' dark gray (10YR 4/1) to (7.5YR 4/1).	CL									
			58	58 - 58.9' **SILTY SAND:** SM, grayish brown (10YR 5/2), gravel (5-15%), dense, moist.	SM									
			59	58.9 - 59.5' **SILT WITH SAND:** (ML)s, grayish brown (10YR 5/2), dark yellowish brown (10YR 4/6) mottling (0-5%), clay (15-30%), gravel (0-5%), low toughness, low plasticity.	(ML)s									
8 MC	24 20		59.5	59.5 - 60' **POORLY-GRADED GRAVEL:** GP, grayish brown (10YR 5/2), subrounded to subangular, fine gravel, sand (30-45%), silt (15-30%), moist.	GP					17.8	27	9	78.6	MC= Modified California Sample
			60	60 - 62' **LEAN CLAY:** CL.	CL									
9 CS	96 96		62	62 - 64.5' **POORLY-GRADED SAND WITH CLAY:** SP-SC, dark gray (10YR 4/1), subrounded, fine sand, dense, wet.	SP-SC									
			64.5	64.5 - 66.6' **CLAYEY SILT** ML/CL, dark gray (10YR 4/1), sand (0-5%), gravel (0-5%), no dilatancy, medium toughness, low to medium plasticity, moist.	ML/CL									
			66.6	66.6 - 67.2' **POORLY-GRADED SAND WITH CLAY:** SP-SC, dark gray (10YR 4/1), subrounded, fine sand, gravel (5-15%), dense, wet.	SP-SC									
10 CS	120 120		67.2–72	67.2 - 80' **CLAYEY SILT** to **SILTY CLAY:** ML/CL, dark gray (10YR 4/1), sand (0-5%), gravel (0-5%), no dilatancy, high toughness, medium plasticity, moist.	ML/CL									

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
			73–79	67.2 - 80' **CLAYEY SILT** to **SILTY CLAY:** ML/CL, dark gray (10YR 4/1), sand (0-5%), gravel (0-5%), no dilatancy, high toughness, medium plasticity, moist. *(continued)*	ML/CL									
11 SH	24 24		80–81	80 - 82' **LEAN CLAY:** CL.	CL					16.5	32	18	79	
12 CS	96 96		82–85	82 - 93.5' **CLAYEY SILT** to **SILTY CLAY:** ML/CL, dark gray (10YR 4/1), sand (0-5%), gravel (0-5%), no dilatancy, high toughness, medium plasticity, moist.	ML/CL									
			86	86' olive (5Y 4/4), dark yellowish brown (10YR 4/6) mottling (5-15%), dark gray (10YR 4/1) mottling (0-5%), black (10YR 2/1) mottling (0-5%).										
			87	87.4' olive gray (5Y 4/2), dark gray (10YR 4/1) mottling (15-30%), organic material (0-5%).										
			88	88.5' dark gray (10YR 4/1), olive gray (5Y 4/2) mottling (5-15%), olive brown (2.5Y 4/4) mottling (0-5%).										
			89	89.7' olive (5Y 4/4).										
13 CS	120 120		90–92	90.2' olive gray (5Y 4/2), organic material (0-5%).										

Boring Number APW11

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
			93	82 - 93.5' **CLAYEY SILT** to **SILTY CLAY:** ML/CL, dark gray (10YR 4/1), sand (0-5%), gravel (0-5%), no dilatancy, high toughness, medium plasticity, moist. *(continued)* 92' - 92.2' layer of organic material.	ML/CL									
			94	93.5 - 94' **SANDY SILT:** s(ML), dark gray (10YR 4/1), reddish brown (5YR 4/4) mottling (5-15%), clay (5-15%), gravel (0-5%), cohesive, non-plastic, moist.	s(ML)									
				94 - 94.5' **SILT:** ML, olive gray (5Y 4/2).	ML									
			95	94.5 - 94.7' **CLAYEY SAND:** SC, dark gray (10YR 4/1), wet.	SC									
			96	94.7 - 96' **SANDY SILT:** s(ML), dark gray (10YR 4/1), reddish brown (5YR 4/4) mottling (5-15%), clay (5-15%), gravel (0-5%), cohesive, non-plastic, moist.	s(ML)									
				96 - 96.2' **POORLY-GRADED SAND WITH CLAY:** SP-SC, dark gray (10YR 4/1), loose, moist.	SP-SC									
			97	96.2 - 97' **SILT:** ML, dark gray (10YR 4/1), clay (5-15%), sand (5-15%), no dilatancy to slow dilatancy, low toughness, medium plasticity.	ML									
			98	97 - 97.2' **SILT:** ML, very dark grayish brown (10YR 3/2), dry.	ML									
			99	97.2 - 100' **LEAN CLAY:** CL, dark gray (10R 4/1), silt (5-15%), organic material (0-5%), no dilatancy, high toughness, medium to high plasticity, moist.	CL									
			100	100' End of Boring.										

SOIL BORING LOG INFORMATION

RAMBOLL

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Newton Power Station		APW12

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Russ Gordon Cascade Drilling	1/21/2021	2/21/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
APW12	Feet (NAVD88)	543.33 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 824,081.13 N, 1,001,683.34 E Ⓔ/ W
1/4 of 1/4 of Section 25, T 6 N, R 8 E

Lat 38° 55' 47.07"
Long -88° 16' 19.39"

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

Facility ID	County	State	Civil Town/City/ or Village
	Jasper	IL	Newton

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	60 / 37		0	0 - 0.4' **LEAN CLAY:** CL, dark brown (10YR 3/3), sand (0-5%), roots (0-5%), moist.	CL									CS= Core Sample
			0.4	0.4 - 6.4' **SANDY LEAN CLAY:** s(CL), yellowish brown (10YR 5/6), gravel (0-5%), stiff, low plasticity, moist.	s(CL)				2					
									1.5					
2 CS	60 / 43								1.5					
			6.4	6.4 - 11.8' **LEAN CLAY:** CL, yellowish brown (10YR 5/6), gray and yellowish brown mottling (0-5%), sand (0-5%), stiff medium plasticity.	CL				1.5					
									1.5					
3 CS	60 / 60								1					
			11.8	11.8 - 20' **LEAN CLAY:** to **SILTY CLAY:** CL, yellowish brown (10YR 5/6), gray and yellowish brown mottling (0-5%), gravel (0-5%), sand (0-5%), very stiff, medium plasticity, moist.	CL				2					
									2.5					
									2					
4 CS	60 / 60		15	15' hard, gray and yellowish brown mottling (15-25%).					2.5					

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

Signature: [signature]

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

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
			17 18 19	11.8 - 20' **LEAN CLAY:** to **SILTY CLAY:** CL, yellowish brown (10YR 5/6), gray and yellowish brown mottling (0-5%), gravel (0-5%), sand (0-5%), very stiff, medium plasticity, moist. *(continued)*	CL				4.5 4.5 4.5 4.5					
5 SH	24 24		20 21	20 - 22' **CLAYEY SAND:** SC.	SC					15.1	27	15	45.8	SH= Shelby Tube
6 CS	36 36		22 23	22 - 23.5' **SANDY LEAN CLAY:** s(CL), yellowish brown (10YR 5/6), silt (15-25%), gravel (0-5%), hard, low plasticity, wet.	s(CL)				4.5					
			24	23.5 - 25' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/6), fine to medium sand, gravel (0-5%), silt (0-5%), wet.	SP									
7 MC	24 24		25 26	25 - 27' **POORLY-GRADED SAND WITH SILT:** SP-SM.	SP-SM					8.4	10		6.2	MC= Modified California Sample
8 CS	36 36		27 28 29	27 - 29.2' **SILTY CLAY:** CL/ML, yellowish brown (10YR 5/6), sand (15-25%), gravel (15-25%), hard, low plasticity, dry.	CL/ML				4.5					
9 CS	60 60		30 31 32 33 34	29.2 - 35' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1), gravel (15-25%), sand (0-5%), hard, low plasticity, dry. 32.6' - 34' sand (15-25%).	CL/ML				4.5					
10 CS	60 60		35 36 37 38 39	35 - 55' **SILTY CLAY:** CL/ML, yellowish brown (10YR 5/6), yellowish brown and gray mottling (0-5%), gravel (15-25%), sand (0-25%), hard, low plasticity, dry.	CL/ML				4.5 4.5 4.5					
11 CS	60 60		40 41 42	41.7' - 43.2' gravel (15-45%).					4.5					

Boring Number APW12

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
			43	35 - 55' **SILTY CLAY:** CL/ML, yellowish brown (10YR 5/6), yellowish brown and gray mottling (0-5%), gravel (15-25%), sand (0-25%), hard, low plasticity, dry. *(continued)*	CL/ML				4.5					
12 CS	60 60		45						4.5					
			47						4.5					
			49						4.5					
13 CS	60 60		51						4.5					
			52						4.5					
14 CS	60 60		55	55 - 56.4' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1), yellowish brown mottling (0-5%), sand (0-5%), hard, medium plasticity, moist.	CL/ML				4.5					
			56.4	56.4 - 58.6' **SILT:** ML, dark gray (10YR 4/1), clay (15-25%), sand (0-5%), moist.	ML									
			58.4	58.4' - 58.6' layer of clayey sand.										
			59	58.6 - 70.8' **LEAN CLAY:** to **SILTY CLAY:** CL, dark gray (10YR 4/1), gravel (15-25%), sand (0-5%), hard, low plasticity, dry.	CL				4.5					
15 CS	60 60		61						4.5					
			63						4.5					
16 CS	60 60		65						4.5					
			67						4.5					

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
17 CS	60 60		70	58.6 - 70.8' **LEAN CLAY:** to **SILTY CLAY:** CL, dark gray (10YR 4/1), gravel (15-25%), sand (0-5%), hard, low plasticity, dry. *(continued)*	CL				4.5					
			71–72	70.8 - 72.6' **SILT:** ML, dark gray (10YR 4/1), sand (0-5%), dry to moist.	ML									
			73	72.6 - 74' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1), sand (0-5%), gravel (0-5%), hard, low plasticity, dry.	CL/ML									
18 CS	60 60		74–77	74 - 77.5' **SILT:** ML, dark gray (10YR 4/1), sand (0-5%), dry.	ML									
19 CS	60 60		78–84	77.5 - 85' **SILTY CLAY:** CL/ML, gray (10YR 4/1), sand (0-5%), gravel (0-5%), dry.	CL/ML									
20 SH	24 24		85–86	85 - 87' **LEAN CLAY:** CL.	CL					14.4	29	15	80.2	
			87	87' End of Boring.										

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Newton Power Station		APW13

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Russ Gordon Cascade Drilling	1/22/2021	1/22/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
APW13	Feet (NAVD88)	535.16 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 822,591.02 N, 1,001,013.30 E Ⓔ/ W
1/4 of 1/4 of Section 25, T 6 N, R 8 E

Lat 38° 55' 32.35"
Long -88° 16' 27.88"

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

Facility ID	County	State	Civil Town/City/ or Village
	Jasper	IL	Newton

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 60		0–0.4	0 - 0.4' **SILTY SAND:** SM, dark brown (10YR 3/3), clay (15-25%), moist.	SM									CS= Core Sample
			0.4–2.3	0.4 - 2.3' **SILTY CLAY:** CL/ML, yellowish brown (10YR 5/6), gray mottling (0-5%), sand (0-5%), gravel (0-5%), firm to stiff, medium plasticity, moist.	CL/ML				1					
			2.3–6.2	2.3 - 6.2' **SILTY CLAY:** to **LEAN CLAY:** CL/ML, yellowish brown (10YR 5/6), sand (0-5%), gravel (0-5%), stiff, low plasticity, moist.	CL/ML				2					
2 CS	60 60								2					
			6.2–8.7	6.2 - 8.7' **SANDY LEAN CLAY:** (CL)g, yellowish brown (10YR 5/6), gravel (0-5%), stiff, low plasticity, moist. 6.5' yellowish brown and gray mottling (15-25%).	(CL)g				1.5 1.5 1.5					
			8.7–10	8.7 - 10' **SILTY CLAY:** to **LEAN CLAY:** CL/ML, yellowish brown (10YR 5/6), sand (0-5%), gravel (0-5%), stiff, low plasticity, moist.	CL/ML				1.5					
3 CS	60 60		10–13.8	10 - 13.8' **SANDY LEAN CLAY:** (CL)g, yellowish brown (10YR 5/6), gravel (15-25%), hard, low plasticity, moist. 10.8' - 11.1' layer of clayey sand.	(CL)g				2 4.5					
4 CS	60 60		13.8–16	13.8 - 22.1' **SILT:** ML, dark gray (10YR 4/1), clay (0-25%), sand (0-5%), gravel (0-5%), hard, dry.	ML									

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

Boring Number APW13

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
			17	13.8 - 22.1' **SILT:** ML, dark gray (10YR 4/1), clay (0-25%), sand (0-5%), gravel (0-5%), hard, dry. *(continued)*	ML									
			18	17.8' clay (0-5%).										
5 CS	60 60		20											
			22						4.5					
			22	22.1 - 25' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1), gravel (0-5%), sand (0-5%), hard, low plasticity, dry.	CL/ML									
6 SH	24 24		25	25 - 27' **POORLY-GRADED SAND WITH SILT:** SP-SM.	SP-SM					21.2	9		11.1	SH= Shelby Tube
7 CS	36 36		27	27 - 31.2' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1), gravel (0-5%), sand (0-5%), hard, low plasticity, dry. 27.8' - 28' layer of sand, moist.	CL/ML				4.5					
			29						4.5					
8 CS	60 60		30											
			31	31.2 - 35' **SILTY CLAY:** CL/ML, yellowish brown (10YR 5/6), yellowish brown and gray mottling (0-5%), gravel (15-25%), sand (0-5%), hard, low plasticity, dry.	CL/ML				4.5					
			33						4.5					
9 CS	60 60		35	35 - 51.7' **SILTY CLAY:** CL/ML, brown (10YR 5/3), gravel (0-5%), sand (0-5%), hard, low plasticity, dry.	CL/ML									
			37	37.2' - 38.3' gray mottling (15-25%).										
10 CS	60 60		40	40' very stiff to hard, medium plasticity.										
			41						3					
			42						3.5					

Boring Number APW13

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
			43	35 - 51.7' **SILTY CLAY:** CL/ML, brown (10YR 5/3), gravel (0-5%), sand (0-5%), hard, low plasticity, dry. *(continued)*					4.5					
			44						3.5					
11 CS	60 60		45						4.5					
			46						4.5					
			47		CL/ML				3.5					
			48						3.5					
			49						4.5					
12 CS	60 60		50						4.5					
			51						4.5					
			52	51.7 - 54.6' **SILT:** ML, brown (10YR 5/3), gray mottling (15-25%), sand (0-5%), gravel (0-5%).										
			53		ML									
			54											
13 CS	60 60		55	54.6 - 57.6' **SILTY CLAY:** CL/ML, brown (10YR 5/3), sand (0-5%), gravel (0-5%), hard, low plasticity.					4.5					
			56		CL/ML									
			57											
			58	57.6 - 60' **SILTY SAND:** SM, brown (10YR 5/3), fine sand, clay (0-5%), wet.										
			59		SM									
14 MC	24 24		60	60 - 62' **SILTY SAND:** SM.						14.5	8		24.5	MC= Modified California Sample
			61		SM									
15 CS	96 96		62	62 - 63.7' **SILTY SAND:** SM, brown (10YR 5/3), fine sand, clay (0-5%), wet. 62.5' - 63.1' layer of silt.										
			63		SM									
			64	63.7 - 65' **SILT:** ML, brown (10YR 5/3), sand (0-5%), clay (0-5%), dry.	ML									
			65	65 - 67.6' **LEAN CLAY:** CL, dark gray (10YR 4/1), silt (15-25%), sand (0-5%), stiff to very stiff, medium plasticity, dry.					2					
			66		CL				2					
			67											
			68	67.6 - 89.7' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1), gravel (15-25%), sand (15-25%), hard, low plasticity, dry.	CL/ML				4.5					
			69											

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Boring Number APW13

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
16 CS	120 120		70	67.6 - 89.7' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1), gravel (15-25%), sand (15-25%), hard, low plasticity, dry. *(continued)* 70' dark green mottling, gravel (0-5%).	CL/ML				4.5					
			71						4.5					
			72											
			73						4.5					
			74											
			75						4.5					
			76											
			77						4.5					
			78											
			79						4.5					
17 CS	120 120		80											
			81											
			82											
			83											
			84											
			85											
			86											
			87											
			88											
			89											
			90	89.7 - 90' **SHALE:** BDX (SH), black (10YR 2/1). 90' End of Boring.	BDX (SH)									

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Newton Power Station		APW14	
Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade Drilling	1/23/2021	1/23/2021	Mini Sonic
Common Well Name: APW14	Final Static Water Level: Feet (NAVD88)	Surface Elevation: 523.85 Feet (NAVD88)	Borehole Diameter: 6.0 inches
Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒ State Plane 822,006.47 N, 999,995.70 E Ⓔ/ W 1/4 of 1/4 of Section 25, T 6 N, R 8 E	Lat 38° 55' 26.58" Long -88° 16' 40.76"	Local Grid Location Feet ☐N ☐S Feet ☐E ☐W	
Facility ID	County: Jasper	State: IL	Civil Town/City/ or Village: Newton

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 51		0–7.1	0 - 7.1' **SILTY CLAY:** CL/ML, yellowish brown (10YR 5/4), yellowish brown (10YR 5/6) mottling (10-20%), gray (10YR 5/1) mottling (0-5%), sand (0-5%), gravel (0-5%), very stiff, no dilatancy, medium toughness, medium plasticity, moist.	CL/ML				3 (1 ft); 3.5 (3 ft); 2.5 (5 ft); 0.5 (7 ft)					CS= Core Sample
2 CS	60 53		5											
			7.1–10.6	7.1 - 10.6' **SILTY SAND:** s(ML), yellowish brown (10YR 5/6), clay (5-10%), soft, slow dilatancy, low toughness, low plasticity, moist.	s(ML)									
3 CS	60 57		10											
			10.6–12	10.6 - 14.2' **CLAYEY SILT** ML/CL, brown (10YR 5/3), sand (5-10%), gravel (0-5%), hard, no dilatancy, medium toughness, low plasticity, dry.	ML/CL				4.5					

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

Boring Number APW14

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	10.6 - 14.2' **CLAYEY SILT** ML/CL, brown (10YR 5/3), sand (5-10%), gravel (0-5%), hard, no dilatancy, medium toughness, low plasticity, dry. *(continued)*	ML/CL				4					
			14	14.2 - 15' **SILTY SAND:** SM, yellowish brown (10YR 5/6), subrounded to rounded, medium to fine sand, loose, moist.	SM									
4 CS	60 57		15	15 - 45' **LEAN CLAY:** CL, gray (10YR 5/1), silt (15-25%), sand (5-10%), gravel (0-5%), hard, no dilatancy, medium toughness, medium plasticity, dry to moist.					4					
			16											
			17						4.5					
			18											
			19						4.5					
5 CS	120 104		20	20' yellowish brown (10YR 5/6) mottling (15-20%).										
			21						3.5					
			22											
			23						3					
			24		CL									
			25						3.5					
			26											
			27						4					
			28											
			29						4.5					
6 CS	60 60		30	30' silt stringers 1mm to 3mm diameter in fractures.										
			31						4.5					
			32											

Boring Number APW14

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	15 - 45' **LEAN CLAY:** CL, gray (10YR 5/1), silt (15-25%), sand (5-10%), gravel (0-5%), hard, no dilatancy, medium toughness, medium plasticity, dry to moist. *(continued)*					4.5					
			34											
7 CS	60 60		35						4.5					
			36											
			37						4.5					
			38											
			39		CL				4.5					
8 CS	60 60		40											
			41						4.5					
			42											
			43						4.5					
			44											
9 SH	24 24		45	45 - 47' **LEAN CLAY:** CL.	CL					12.4	26	12	63.3	SH= Shelby Tube
			46											
10 CS	96 94		47	47 - 48.7' **LEAN CLAY:** CL, gray (10YR 5/1), yellowish brown (10YR 5/6) mottling (15-20%), silt (15-25%), sand (5-10%), gravel (0-5%), hard, no dilatancy, medium toughness, medium plasticity, dry to moist.	CL				4.5					
			48											
			49	48.7 - 55' **CLAYEY SAND:** to **SANDY LEAN CLAY WITH GRAVEL:** SC, dark grayish brown (10YR 4/2), subrounded to rounded, medium sand, dense, moist.	SC				4.5					
			50											
			51						2.25					
			52											

Boring Number APW14

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
			53–55	48.7 - 55' **CLAYEY SAND:** to **SANDY LEAN CLAY WITH GRAVEL:** SC, dark grayish brown (10YR 4/2), subrounded to rounded, medium sand, dense, moist. *(continued)*	SC									
11 MC	24 24		55–57	55 - 57' **LEAN CLAY:** CL.	CL					18	25	10	72.2	MC= Modified California Sample
12 CS	96 96		57	57 - 91' **LEAN CLAY:** CL, gray (10YR 5/1), yellowish brown (10YR 5/6) mottling (0-5%), silt (15-25%), sand (5-10%), gravel (0-5%), organic material (0-5%), very stiff to hard, no dilatancy, medium toughness, medium plasticity, dry.	CL				3.75					
			59						4.25					
			61						4.25					
			63						4.25					
13 CS	120 120		65						4					
			67						2.25					
			69						4.5					
			71						4.5					
			72											

Boring Number APW14

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	57 - 91' **LEAN CLAY:** CL, gray (10YR 5/1), yellowish brown (10YR 5/6) mottling (0-5%), silt (15-25%), sand (5-10%), gravel (0-5%), organic material (0-5%), very stiff to hard, no dilatancy, medium toughness, medium plasticity, dry. *(continued)*	CL				4.5					
			74											
14 CS	120 120		75						4.5					
			76											
			77						4.5					
			78											
			79						4					
			80											
			81						4.25					
			82											
			83						2.5					
			84	83.7' greenish gray (GLEY1 6/5GY) mottling (10-15%), yellowish brown (10YR 5/6) mottling (10-15%), stiff.										
15 CS	60 46		85						2.75					
			86											
			87						3					
			88											
			89						3.5					
16 CS	60 56		90											
			91	91 - 95' **Weathered SHALE Bedrock** BDX (SH), gray (10YR 6/1) to grayish brown (10YR 5/2).	BDX (SH)				4.5					
			92											

Boring Number APW14

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
			93 94 95	91 - 95' **Weathered SHALE Bedrock** BDX (SH), gray (10YR 6/1) to grayish brown (10YR 5/2). *(continued)*	BDX (SH)									
				95' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Newton Power Station		APW15

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade Drilling	1/21/2021	1/22/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
APW15	Feet (NAVD88)	522.06 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 821,107.90 N, 997,938.87 E (E)/ W
1/4 of 1/4 of Section 26, T 6 N, R 8 E

Lat 38° 55' 17.71"
Long -88° 17' 6.79"

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

Facility ID	County	State	Civil Town/City/ or Village
	Jasper	IL	Newton

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 54		0	0 - 6.3' **FILL, LEAN CLAY:** CL, brown (10YR 5/3), silt (15-25%) sand (0-5%), stiff, no dilatancy, low toughness, medium plasticity, moist.	(FILL) CL									CS= Core Sample
			1						1.75					
			3						1.75					
2 CS	60 40		5											
			6.3	6.3 - 20' **LEAN CLAY:** CL, dark gray (10YR 4/1), silt (15-25%) sand (0-5%), gravel (0-5%), organic material (0-5%), very stiff to stiff, no dilatancy, medium toughness, medium plasticity, moist.	CL									
			7						2.25					
			9						4					
3 CS	60 50		10											
			11						1					
			12											

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

Signature: [signature]

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

Boring Number APW15

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	6.3 - 20' **LEAN CLAY:** CL, dark gray (10YR 4/1), silt (15-25%) sand (0-5%), gravel (0-5%), organic material (0-5%), very stiff to stiff, no dilatancy, medium toughness, medium plasticity, moist. *(continued)*					2.5					
4 CS	60 54		15		CL				1.5					
			17						2.25					
			19	19.2' brown (10YR 4/3), yellowish brown (10YR 5/6) mottling (10-15%), stiff.					2.5					
5 SH	24 23		20	20 - 22' **LEAN CLAY:** CL.	CL					18.5	33	23	59.2	SH= Shelby Tube
6 CS	96 96		22	22 - 23.5' **LEAN CLAY:** CL, brown (10YR 4/3), yellowish brown (10YR 5/6) mottling (10-15%), stiff, no dilatancy, medium toughness, medium plasticity, moist.	CL				1.25					
			23						1					
			24	23.5 - 26.7' **SANDY LEAN CLAY:** s(CL), brown (10YR 5/3), gray (10YR 5/1) mottling (5-10%), stiff, slow dilatancy, low toughness, medium plasticity, moist.	s(CL)				3.75					
			27	26.7 - 39.2' **LEAN CLAY:** CL, brown (10YR 5/3), yellowish brown (10YR 5/6) mottling (10-15%), gray (10YR 5/1) mottling (5-10%), sand (5-10%), gravel (0-5%), cobbles (0-5%), very stiff to hard, no dilatancy, medium toughness, medium plasticity, dry to moist.	CL				4.5					
			29						4.5					
6 CS	60 49		30	30' hard, dry.										
			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	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	26.7 - 39.2' **LEAN CLAY:** CL, brown (10YR 5/3), yellowish brown (10YR 5/6) mottling (10-15%), gray (10YR 5/1) mottling (5-10%), sand (5-10%), gravel (0-5%), cobbles (0-5%), very stiff to hard, no dilatancy, medium toughness, medium plasticity, dry to moist. *(continued)*					4.5					
			34											
7 CS	60 49		35		CL				4.5					
			36											
			37						4.5					
			38											
			39						4.5					
8 CS	60 60		40	39.2 - 52.5' **LEAN CLAY:** CL, dark gray (10YR 4/1), no mottling, organic material (0-5%), sand (5-10%), gravel (0-5%), cobbles (0-5%), hard, no dilatancy, medium toughness, medium plasticity, dry, silt stringers 1mm to 3mm diameter fracture planes.										
			41						4.5					
			42											
			43						4.5					
			44											
9 CS	60 60		45						4.5					
			46		CL									
			47						4.5					
			48											
			49						4.5					
10 CS	60 60		50											
			51						4.5					
			52											

Boring Number APW15

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
			53	52.5 - 61.4' **SILT:** ML, dark gray (10YR 4/1), clay (15-25%), hard, no dilatancy, medium toughness, non-plastic, dry.	ML				4.5					
11 CS	60 57		55						4.5					
			57						4.5					
			59						4.5					
12 CS	60 52		60											
			61						4.5					
			62	61.4 - 97.2' **LEAN CLAY:** CL, dark gray (10YR 4/1), silt (15-25%), sand (0-10%), gravel (0-5%), organic material (0-5%), stiff to very stiff, no dilatancy, medium toughness, medium plasticity, moist to dry.	CL									
			63						2.75					
13 CS	60 60		65						2.75					
			67						2.25					
			69						2					
14 CS	60 60		70											
			71						2.5					
			72											

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Boring Number APW15

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	61.4 - 97.2' **LEAN CLAY:** CL, dark gray (10YR 4/1), silt (15-25%), sand (0-10%), gravel (0-5%), organic material (0-5%), stiff to very stiff, no dilatancy, medium toughness, medium plasticity, moist to dry. *(continued)*					2.5					
			74											
15 CS	60 53		75						2					
			76											
			77						2.5					
			78											
			79						2.25					
16 CS	60 60		80											
			81						2.25					
			82		CL									
			83						4.5					
			84	83.8' - 83.9' layer of silty sand, moist.										
17 CS	60 60		85	85' - 85.4' later of silty sand, moist.					2.75					
			86											
			87						2.5					
			88											
			89						2.75					
18 CS	60 60		90											
			91						2.5					
			92											

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Boring Number APW15

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
19 CS	60 60		93–97	61.4 - 97.2' **LEAN CLAY:** CL, dark gray (10YR 4/1), silt (15-25%), sand (0-10%), gravel (0-5%), organic material (0-5%), stiff to very stiff, no dilatancy, medium toughness, medium plasticity, moist to dry. *(continued)*	CL				2.75					
			98–99	97.2 - 100' **POORLY-GRADED SAND WITH SILT:** SP-SM, dark gray (10YR 4/1), subrounded to rounded, medium to fine sand, loose, wet.	SP-SM									
20 SH	24 24		100–101	100 - 102' **SILTY SAND:** SM.	SM					12.1	15	3	45.8	
21 CS	36 36		102–104	102 - 104.3' **SANDY SILT:** s(ML), gray (10YR 5/1), firm, slow dilatancy, low toughness, non-plastic, wet.	s(ML)				1					
			104.3–105	104.3 - 105' **LEAN CLAY:** CL, dark gray (10YR 4/1), sand (5-10%), gravel (0-5%), organic material (0-5%), stiff to very stiff, no dilatancy, medium toughness, medium plasticity, moist.	CL									
22 MC	24 24		105–106	105 - 107' **LEAN CLAY:** CL.	CL					19.1	29	16	76.2	MC= Modified California Sample
23 CS	36 36		107–109	107 - 110' **LEAN CLAY:** CL, dark gray (10YR 4/1), sand (5-10%), gravel (0-5%), organic material (0-5%), stiff to very stiff, no dilatancy, medium toughness, medium plasticity, moist.	CL				2.25 2.5					
			110	110' End of Boring.										

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Newton Power Station		APW16

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade Drilling	1/19/2021	1/20/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
APW16	Feet (NAVD88)	529.16 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 820,642.46 N, 996,213.53 E (E)/W
1/4 of 1/4 of Section 35, T 6 N, R 8 E

Lat 38° 55' 13.12"
Long -88° 17' 28.63"

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

Facility ID	County	State	Civil Town/City/ or Village
	Jasper	IL	Newton

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 48		0	0 - 20' **SILTY CLAY:** CL/ML, yellowish brown (10YR 5/4), gray (10YR 5/1) mottling (0-5%), sand (0-5%), gravel (0-5%), firm to stiff, slow dilatancy, medium to low toughness, medium plasticity, moist.	CL/ML									CS= Core Sample
			1						0.75					
			3						1.75					
2 CS	60 60		5	5' very dark grayish brown (10YR 3/2) mottling (0-5%), yellowish brown (10YR 5/6) mottling (0-5%), silt stringers 1mm diameter (5-10%), very stiff, dry.					2					
			7						3.5					
			9						3.75					
3 CS	60 60		10	10' hard.										
			11						4.5					
			12											

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

Signature [signature]

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

Boring Number APW16

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	0 - 20' **SILTY CLAY:** CL/ML, yellowish brown (10YR 5/4), gray (10YR 5/1) mottling (0-5%), sand (0-5%), gravel (0-5%), firm to stiff, slow dilatancy, medium to low toughness, medium plasticity, moist. *(continued)*					4.5					
			14											
4 CS	60 60		15	15' grayish brown (10YR 5/2), yellowish brown (10YR 5/6) mottling (5-10%).					4.5					
			16		CL/ML									
			17						4.5					
			18											
			19						4.5					
5 CS	120 65		20	20 - 30' **SILT:** ML, brown (10YR 5/3), yellowish brown (10YR 5/6) mottling (5-10%), sand (5-10%), gravel (0-5%), hard, no dilatancy, high toughness, low plasticity, dry.										
			21						4.5					
			22											
			23						4.5					
			24											
			25		ML				4.5					
			26											
			27						4.5					
			28											
			29						4.5					
6 CS	60 57		30	30 - 69.2' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1), sand (5-10%), gravel (0-5%), cobbles (0-5%), hard to very stiff, no dilatancy, medium toughness, medium plasticity, dry to moist.										
			31		CL/ML				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	30 - 69.2' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1), sand (5-10%), gravel (0-5%), cobbles (0-5%), hard to very stiff, no dilatancy, medium toughness, medium plasticity, dry to moist. *(continued)*					4.25					
			34											
7 CS	60 60		35						4					
			36											
			37						4.5					
			38											
			39						4.5					
8 CS	60 60		40											
			41						4.5					
			42	41.5' organic material (0-5%), wood (0-5%).	CL/ML									
			43						4.5					
			44											
9 CS	60 60		45						4.5					
			46											
			47						4.25					
			48											
			49						4.25					
10 CS	60 60		50											
			51						4.5					
			52											

Boring Number APW16

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	30 - 69.2' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1), sand (5-10%), gravel (0-5%), cobbles (0-5%), hard to very stiff, no dilatancy, medium toughness, medium plasticity, dry to moist. *(continued)*	CL/ML				4.5					
			54											
11 CS	60 60		55						4.5					
			56											
			57						3.75					
			58											
			59						3.75					
12 CS	60 60		60											
			61						4.5					
			62											
			63						3.75					
			64											
13 CS	180 45		65						2.25					
			66											
			67						1.25					
			68											
			69						0.25					
			70	69.2 - 70.6' **SILT WITH SAND:** (ML)s, gray (10YR 6/1), soft, rapid dilatancy, low toughness, non-plastic, wet.	(ML)s									
			71	70.6 - 85.6' **POORLY-GRADED SAND:** SP, gray (10YR 5/1), subrounded to rounded, medium to coarse sand, gravel (0-5%), loose, wet.	SP									
			72											

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
				70.6 - 85.6' **POORLY-GRADED SAND:** SP, gray (10YR 5/1), subrounded to rounded, medium to coarse sand, gravel (0-5%), loose, wet. *(continued)*										
			73											
			74											
			75											
			76											
			77											
			78											
			79		SP									
14 CS	60 60		80											
			81											
			82											
			83											
			84											
15 CS	120 120		85	85' gravel (10-15%).										
				85.6 - 99.2' **LEAN CLAY:** CL, gray (10YR 5/1), silt (5-15%), sand (5-10%), gravel (0-5%), very stiff, no dilatancy, medium toughness, medium plasticity, moist.										
			86											
			87						3.5					
			88											
			89		CL				2.75					
			90											
			91						3.25					
			92											

RAMBOLL

Boring Number APW16

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
			93	85.6 - 99.2' **LEAN CLAY:** CL, gray (10YR 5/1), silt (5-15%), sand (5-10%), gravel (0-5%), very stiff, no dilatancy, medium toughness, medium plasticity, moist. *(continued)*					3.25					
			94											
16 CS	60 48		95						3.5					
			96		CL									
			97						2.5					
			98											
			99						2.25					
				99.2 - 100' **POORLY-GRADED SAND:** SP, dark gray (10YR 4/1), subrounded to rounded, coarse sand, loose, wet.	SP									
17 CS	120 120		100	100 - 110' **LEAN CLAY:** CL, gray (10YR 5/1), silt (5-15%), sand (5-10%), organic material (0-10%), gravel (0-5%), very stiff, no dilatancy, medium toughness, medium plasticity, moist.										
			101						2					
			102											
			103						1.75					
			104											
			105		CL				2					
			106											
			107						2					
			108											
			109						2					
			110	110' End of Boring.										

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Newton Power Station		APW17

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	1/22/2021	1/22/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
APW17	Feet (NAVD88)	529.84 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 822,681.14 N, 995,462.29 E (E)/ W
1/4 of 1/4 of Section 26, T 6 N, R 8 E
Lat 38° 55' 33.27"
Long -88° 17' 38.12"
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Jasper	IL	Newton

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	120 120			0 - 0.3' **POORLY-GRADED SAND WITH SILT:** SP, yellowish brown (10YR 5/8), subrounded, fine sand, roots (15-30%), clay (5-15%), gravel (5-15%), loose, wet.	SP									CS= Core Sample
			1–4	0.3 - 4' **LEAN CLAY WITH SAND:** (CL)s, yellowish brown (10YR 5/8), grayish brown (10YR 5/2) mottling (15-30%), gravel (0-5%), roots (0-5%), rapid dilatancy, low toughness, low to medium plasticity, wet.	(CL)s									
			4–12	4 - 12.3' **LEAN CLAY:** CL, yellowish brown (10YR 5/6), dark yellowish brown (10R 4/4) mottling (0-5%), silt (15-30%), sand (5-15%), gravel (0-5%), roots (0-5%), organic material (0-5%), slow dilatancy, medium toughness, low plasticity, moist. 7.5' dry. 11.6' - 11.8' layer of gravel with clay, wet. 12.2' layer of sand for 1/8".	CL									
2 CS	120 108		10											
			13–15	12.3 - 26.3' **SILTY CLAY:** CL/ML, dark grayish brown (10YR 4/2), strong brown (10YR 5/8) mottling (5-15%), sand (0-5%), no dilatancy, medium toughness, low plasticity, dry sand seams 1/16" (0-5%).	CL/ML									

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, 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	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			16, 17	12.3 - 26.3' **SILTY CLAY:** CL/ML, dark grayish brown (10YR 4/2), strong brown (10YR 5/8) mottling (5-15%), sand (0-5%), no dilatancy, medium toughness, low plasticity, dry sand seams 1/16" (0-5%). *(continued)* 16.5' white (10YR 8/1) for 1/16".										
3 CS	240 240		18–26		CL/ML									
			26, 27	26' - 26.3' layer of silt, yellowish brown (10YR 5/4) to (10YR 5/6), sand (5-15%), dry.										
			27–40	26.3 - 40' **CLAYEY SILT** ML/CL, dark grayish brown (10YR 4/2), yellowish brown (10YR 5/4) mottling (5-15%), sand (5-15%), gravel (0-5%), no dilatancy, high toughness, non-plastic to low plasticity, dry to moist.	ML/CL									

Boring Number APW17

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
4 SH	24 21		41	40 - 42' **LEAN CLAY:** CL.	CL					16.6	26	13	71.1	SH= Shelby Tube
5 CS	96 96		42 - 43	42 - 43' **CLAYEY SILT** ML/CL, dark grayish brown (10YR 4/2), yellowish brown (10YR 5/4) mottling (5-15%), sand (5-15%), gravel (0-5%), no dilatancy, high toughness, non-plastic to low plasticity, dry to moist.	ML/CL									
			44	43 - 44.5' **CLAYEY SILT** ML/CL, dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2), sand (5-15%), gravel (0-5%), no dilatancy, high toughness, non-plastic to low plasticity, dry to moist.	ML/CL									
			45 - 46	44.5 - 46.3' **SILT WITH SAND:** (ML)s, gray (10YR 5/1) to grayish brown (10YR 5/2), clay (5-15%), moist.	(ML)s									
6 CS	120 118		47 - 58	46.3 - 58' **CLAYEY SILT** ML/CL, dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2), sand (5-15%), gravel (0-5%), no dilatancy, high toughness, non-plastic to low plasticity, dry to moist.	ML/CL									
7 CS	120 120		59 - 63	58 - 63.3' **SILT WITH SAND:** (ML)s, dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2), clay (5-15%), gravel (0-5%), non-cohesive to cohesive, no dilatancy, medium to high toughness, non-plastic to low plasticity, moist.	(ML)s									
			64 - 65	63.3 - 64.7' **WELL-GRADED SAND:** SW, gray (10YR 5/1), subangular to subrounded, gravel (5-15%), clay (5-15%), wet.	SW									

Boring Number APW17

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
			64.7–65.5	64.7 - 65.5' **POORLY-GRADED SAND WITH SILT:** SP, gray (10YR 5/1) to grayish brown (10YR 5/2), subrounded, fine to medium sand, gravel (5-15%), wet. *(continued)*	SP							
			65.5–70	65.5 - 70' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, gray (10YR 5/1), subangular to subrounded, gravel (5-15%), clay (0-5%), cobbles (0-5%), moist to wet. 68.5' - 69' cobbles (5-15%). 69.6' very dark gray (10YR 3/1).	(SW)g							
8 MC	24 24		70–72	70 - 72' **WELL-GRADED SAND WITH SILT:** SW-SM.	SW-SM			7.8	3.8	9	8.9	MC= Modified California Sample
9 CS	216 216		72–76.4	72 - 76.4' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, gray (10YR 5/1), subrounded to rounded gravel, cobbles (5-15%), clay (5-15%), dense, wet.	(GW)s							
			76.4–78.6	76.4 - 78.6' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, gray (10YR 5/1), cobbles (0-5%), dense, wet.	(SW)g							
			78.6–79.9	78.6 - 79.9' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, gray (10YR 5/1) to grayish brown (10YR 5/2), subrounded to rounded gravel, cobbles (5-15%), clay (5-15%), dense, wet.	(GW)s							
			79.9–86.8	79.9 - 86.8' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, grayish brown (10YR 5/2), clay (0-5%), cobbles (0-5%), dense, wet to moist.	(SW)g							
			86.8–88	86.8 - 88' **POORLY-GRADED SAND WITH GRAVEL:** (SP)g, grayish brown (10YR 5/2), rounded to subrounded, medium to coarse sand, clay (0-5%), loose, wet.	(SP)g							
			88–90	88 - 90' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, silt (5-15%), loose, wet to moist.	(SW)g							

Boring Number APW17

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
10 MC	24 24		90–92	90 - 92' **POORLY-GRADED SAND WITH SILT:** SP-SM.	SP-SM					6.1	6		6.7	
11 CS	72 72		92–93.4	92 - 93.4' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, silt (5-15%), loose, wet to moist.	(SW)g									
			93.4–98	93.4 - 98' **SILT:** ML, dark gray (10YR 4/1) to gray (10YR 5/1), very dark gray (10YR 3/1) mottling (0-5%), clay (15-30%), sand (5-15%), gravel (0-5%), organic material (0-5%), no dilatancy, high toughness, low plasticity, moist.	ML									
12 SH	24 24		98–100	98 - 100' **SILT:** ML, Not Analyzed.	ML									
			100	100' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Newton Power Station		APW18

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	1/20/2021	1/21/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
APW18	Feet (NAVD88)	540.55 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 824,525.91 N, 996,544.05 E (E)/ W
1/4 of 1/4 of Section 26, T 6 N, R 8 E

Lat 38° 55' 51.5"
Long -88° 17' 24.42"

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

Facility ID	County	State	Civil Town/City/ or Village
	Jasper	IL	Newton

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	120 113			0 - 0.3' **FILL, SILT:** ML, dark grayish brown (10R 4/2), roots (15-30%), sand (5-15%), wet.	(FILL) ML									CS= Core Sample
			1 2 3	0.3 - 3.4' **SILTY SAND:** SM, yellowish brown (10YR 5/6), dark grayish brown (10YR 4/2) mottling (15-30%), fine sand, gravel (0-5%), roots (0-5%), dense, moist.	SM									
			4 5 6 7 8 9 10	3.4 - 11' **LEAN CLAY WITH SAND:** (CL)s, yellowish brown (10YR 5/6), dark grayish brown (10YR 4/2) mottling (5-15%), strong brown (7.5YR 5/8) mottling (5-15%), slow dilatancy, low toughness, low to medium plasticity, moist.	(CL)s									
2 CS	120 113		11 12	11 - 12.5' **CLAYEY SAND:** SC, dark yellowish brown (10YR 4/6), rounded, fine sand, gravel (0-5%), wet.	SC									

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

Signature: [signature]

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

Boring Number APW18

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
				11.6' medium sand.										
			13	12.5 - 13.9' **LEAN CLAY WITH SAND:** (CL)s, yellowish brown (10YR 5/6), slow dilatancy, low toughness, low to medium plasticity, wet.	(CL)s									
			14–16	13.9 - 16.8' **SILT:** ML, dark grayish brown (10YR 4/2), clay (15-30%), sand (5-15%), gravel (0-5%), no dilatancy, low to medium toughness, low plasticity, dry.	ML									
			17	16.8 - 17.6' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/6), rounded, fine sand, clay (5-15%), moist.	SP									
			18–19	17.6 - 20' **SILT:** ML, dark grayish brown (10YR 4/2), yellowish brown (10YR 5/6) mottling (0-5%), very dark grayish brown (10YR 3/2) mottling (0-5%), clay (15-30%), sand (5-15%), gravel (0-5%), no dilatancy, low to medium toughness, low plasticity, dry.	ML									
3 CS	120 120		20	20 - 20.9' **WELL-GRADED SAND:** SW, yellowish brown (10YR 5/6), clay (5-15%), gravel (0-5%), wet.	SW									
			21–23	20.9 - 23.2' **CLAYEY SILT** ML/CL, dark grayish brown (10YR 4/2), yellowish brown (10YR 5/6) mottling (0-5%), very dark grayish brown (10YR 3/2) mottling (0-5%), clay (15-30%), sand (5-15%), gravel (0-5%), no dilatancy, low to medium toughness, low plasticity, moist.	ML/CL									
				23.2 - 23.7' **WELL-GRADED SAND:** SW, subrounded, fine sand, gravel (5-15%), silt (5-15%), moist.	SW									
			24–28	23.7 - 28.9' **LEAN CLAY:** CL, dark gray (10YR 4/1), sand (5-15%), gravel (0-5%), no dilatancy, medium toughness, high plasticity, moist. 28.2' sand (0-5%).	CL									
4 CS	120 120		29–32	28.9 - 50' **CLAYEY SILT** ML/CL, dark gray (10YR 4/1), sand (5-15%), gravel (0-5%), no dilatancy, high toughness, medium plasticity, dry.	ML/CL									

Boring Number APW18

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
			33–39	28.9 - 50' **CLAYEY SILT** ML/CL, dark gray (10YR 4/1), sand (5-15%), gravel (0-5%), no dilatancy, high toughness, medium plasticity, dry. *(continued)*										
5 CS	120 120		40–49		ML/CL									
6 SH	24 24		50–52	50 - 52' **LEAN CLAY:** CL.	CL					12.9	32	20	76.8	SH= Shelby Tube

Boring Number APW18

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
7 CS	96 96		53–58	52 - 58.2' **CLAYEY SILT** ML/CL, dark gray (10YR 4/1), sand (5-15%), gravel (0-5%), no dilatancy, high toughness, medium plasticity, dry.	ML/CL									
			59	58.2 - 60' **POORLY-GRADED SAND:** SP, gray (10YR 6/1) to light gray (10YR 7/1), subrounded, fine to medium sand, gravel (0-5%), silt (0-5%), loose, dry to moist.	SP									
8 MC	24 12		60–61	60 - 62' **SILTY SAND:** SM.	SM					13.6	5		17.1	MC= Modified California Sample
9 MC	24 16		62–63	62 - 64' **SILTY CLAY:** CL/ML.	CL/ML					11.1	20	6	57.6	
10 CS	72 72		64–67	64 - 67.5' **SANDY SILT:** s(ML), dark grayish brown (10YR 4/2), clay (0-5%), non-cohesive, moist.	s(ML)									
			68–69	67.5 - 70' **SILT:** ML, dark gray (10YR 4/1), clay (15-30%), sand (5-15%), gravel (0-5%), medium to high toughness, low plasticity, moist to wet.	ML									
11 SH	24 11		70–72	70 - 72' **SILT:** ML, Not Analyzed.	ML									

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Boring Number APW18

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 CS	96 92			72 - 72.4' **SILT:** ML, dark grayish brown (10YR 4/2), clay (15-30%), sand (5-15%), gravel (0-5%), medium to high toughness, low plasticity, moist to wet.	ML									
			73	72.4 - 76.7' **CLAYEY SAND:** SC, rounded, fine sand, dense, wet.	SC									
			74											
			75											
			76											
			77	76.7 - 79.4' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, subrounded to subangular, silt (0-5%), moist.	(SW)g									
			78											
			79	79.4 - 80' **SILT:** ML, dark gray (10YR 4/1), clay (15-30%), sand (5-15%), gravel (0-5%), medium to high toughness, low plasticity, moist to wet.	ML									
13 CS	120 72		80	80 - 80.7' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, subrounded to subangular, silt (0-5%), wet.	(SW)g									
			81	80.7 - 94.2' **SILT:** ML, dark gray (10YR 4/1), clay (15-30%), sand (5-15%), gravel (0-5%), medium to high toughness, low plasticity, moist.	ML									
			82											
			83											
			84											
			85											
			86											
			87											
			88											
			89											
14 CS	180 180		90											
			91											
			92											

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
			93, 94	80.7 - 94.2' **SILT:** ML, dark gray (10YR 4/1), clay (15-30%), sand (5-15%), gravel (0-5%), medium to high toughness, low plasticity, moist. *(continued)*	ML									
			95, 96, 97, 98, 99, 100, 101, 102, 103, 104	94.2 - 105' **CLAYEY SILT** ML/CL, dark gray (10YR 4/1) to dark grayish brown (10YR 4/2), sand (5-15%), gravel (5-15%), slow dilatancy, medium toughness, low plasticity, moist. 97.4' grayish brown (10YR 5/2), reddish gray (5YR 5/2) mottling (0-5%), yellowish brown (10YR 5/6) mottling (0-5%).	ML/CL									
15 SH	24 24		105, 106	105 - 107' **LEAN CLAY:** CL.	CL					14.1	28	15	69.3	
			107	107' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Newton Power Station		APW5S

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	1/19/2021	1/19/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
APW5S	Feet (NAVD88)	541.05 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 825,612.15 N, 999,129.20 E (E)/W
1/4 of 1/4 of Section 26, T 6 N, R 8 E
Lat 38° 55' 2.22"
Long -88° 16' 51.7"
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Jasper	IL	Newton

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	120 115			0 - 0.7' **FILL, LEAN CLAY:** CL, very dark gray (10YR 3/1), yellowish brown (10YR 5/4) mottling (30-45%), roots (5-15%), sand (5-15%), gravel (0-5%), very stiff, no dilatancy, low to medium toughness, low plasticity, wet.	(FILL) CL									CS= Core Sample
			1						3.25					
			2	0.7 - 5.5' **FILL, LEAN CLAY:** CL, yellowish brown (10YR 5/4), gray (10YR 5/1) mottling (0-5%), sand (0-5%), gravel (0-5%), very stiff to stiff, no dilatancy , medium toughness, low plasticity, moist.										
			3	2.8' - 2.9' black (10YR 2/1), black (2.5Y 2.5/1) mottling (0-5%), coal (0-5%). 3.1' strong brown (7.5YR 5/6), gray (10YR 5/1) mottling (0-5%), black (10YR 2/1) mottling (0-5%), sand (5-15%), gravel (0-5%).	(FILL) CL				3.25					
			4											
			5						3.25					
			6	5.5 - 6.3' **LEAN CLAY:** CL, grayish brown (10YR 5/2) to brown (10YR 5/3), light olive brown (2.5Y 5/6) mottling (15-30%), stiff, no dilatancy, low toughness, medium plasticity, moist. 5.9' no mottling.	CL									
			7	6.3 - 14.3' **LEAN CLAY WITH SAND:** (CL)s, gray (10YR 5/1), organic material (0-5%), stiff to firm, no dilatancy, low toughness, medium plasticity, moist.					2					
			8											
			9		(CL)s				2.25					
2 CS	36 36		10											
			11						2					
			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, Milwaukee, WI 53204 Tel: (414) 837-3607 Fax: (414) 837-3608

Boring Number APW5S

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
3 CS	120 94		13, 14	6.3 - 14.3' **LEAN CLAY WITH SAND:** (CL)s, gray (10YR 5/1), organic material (0-5%), stiff to firm, no dilatancy, low toughness, medium plasticity, moist. *(continued)* 12.4' yellowish brown (10YR 5/6), gravel (0-5%).	(CL)s				0.75					
			15, 16, 17	14.3 - 17.5' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/6) , subrounded to rounded, fine sand, clay (5-15%), gravel (0-5%), moist.	SP									
			18, 19, 20, 21, 22, 23	17.5 - 23' **SILT:** ML, yellowish brown (10YR 5/6) to dark gray (10YR 4/1), strong brown (7.5YR 4/6) mottling (5-15%), very dark gray (7.5YR 3/1) mottling (0-5%), clay (5-15%), sand (5-15%), gravel (0-5%), very stiff to hard, no dilatancy, medium to high toughness, low plasticity. 19.4' yellowish brown (10YR 5/6), gray (10YR 5/1) mottling (0-5%).	ML				4.5, 4, 3.5					
				23' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name: Newton Power Station		License/Permit/Monitoring Number:	Boring Number: SB301	
Boring Drilled By: Name of crew chief (first, last) and Firm: Dave Gordon, Cascade Drilling		Date Drilling Started: 1/19/2021	Date Drilling Completed: 1/20/2021	Drilling Method: Mini Sonic
Common Well Name:		Final Static Water Level: Feet (NAVD88)	Surface Elevation: 543.39 Feet (NAVD88)	Borehole Diameter: 6.0 inches
Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒ State Plane 825,067.09 N, 997,264.71 E (E)/W; 1/4 of 1/4 of Section 25, T 6 N, R 8 E		Lat ° ' " Long ° ' "	Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W	
Facility ID:	County: Jasper	State: IL	Civil Town/City/ or Village: Newton	

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 99		0	0 - 2.6' **FILL, POORLY-GRADED SAND WITH GRAVEL:** (SP)g, black (10YR 2/1), loose.	(FILL) (SP)g									CS= Core Sample
			1.8	1.8' - 2.2' layer of clay, dark grayish brown (10YR 4/2), silt (15-30%), sand (5-15%), low toughness, low plasticity, moist.										
			2.6	2.6 - 6.5' **SILTY CLAY:** CL/ML, brown (10YR 5/3) to light olive brown (2.5Y 5/3), olive (5Y 4/3) mottling (15-30%), dark olive gray (5Y 3/2) mottling (0-5%), sand (0-5%), gravel (0-5%), roots (0-5%), stiff to very stiff, no dilatancy, low toughness, low plasticity, moist.	CL/ML				1.75					
			4.5	4.5' medium toughness.					3.5					
			6.5	6.5 - 9' **LEAN CLAY:** CL, gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling (5-15%), silt (15-30%), sand (0-5%), gravel (0-5%), very stiff, no dilatancy, low to medium toughness, medium plasticity, moist.	CL				3.25					
			9	9 - 23.3' **SILT:** ML, grayish brown (10YR 5/2), gray (10YR 5/1) mottling (0-5%), dark gray (10YR 4/1) mottling (0-5%), hard, no dilatancy, high toughness, low plasticity, dry.	ML				3.5					
2 CS	120 114		10						4.5					

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

Signature: [signature]

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

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	9 - 23.3' **SILT:** ML, grayish brown (10YR 5/2), gray (10YR 5/1) mottling (0-5%), dark gray (10YR 4/1) mottling (0-5%), hard, no dilatancy, high toughness, low plasticity, dry. *(continued)*	ML				4.5					
			15						4.5					
			17						4.5					
			19						4.5					
3 CS	120 120		20											
			21						4.5					
			23						4.5					
			24	23.3 - 24.8' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/6), subrounded to rounded, fine sand, silt (0-5%), loose, moist to dry.	SP									
			25	24.8 - 48' **LEAN CLAY:** CL, dark gray (10YR 4/1), silt (15-30%), sand (0-5%), gravel (0-5%), hard, no dilatancy, high toughness, medium to high plasticity, dry to moist, gravel and sand increase to (5-15%) with depth.	CL				4.5					
			27						4.5					
			29						4.5					
4 CS	96 96		30											
			31						4.5					
			32											

Boring Number SB301

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	24.8 - 48' **LEAN CLAY:** CL, dark gray (10YR 4/1), silt (15-30%), sand (0-5%), gravel (0-5%), hard, no dilatancy, high toughness, medium to high plasticity, dry to moist, gravel and sand increase to (5-15%) with depth. *(continued)*										
5 CS	120 120		38											
			40		CL									
6 SH	24 20		48	48 - 50.						14.1	27	13	65.4	SH= Shelby Tube
7 CS	96 60		50	50 - 56.2' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2) to light olive brown (2.5Y 5/4), sand (5-15%), gravel (5-15%), hard, no dilatancy, high toughness, medium to high plasticity, dry.	CL/ML									
			52											

Boring Number SB301

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
			53–56	50 - 56.2' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2) to light olive brown (2.5Y 5/4), sand (5-15%), gravel (5-15%), hard, no dilatancy, high toughness, medium to high plasticity, dry. *(continued)*	CL/ML									
			57	56.2 - 57' **POORLY-GRADED SAND:** SP, gray (10YR 5/1), rounded to subrounded, fine to medium sand, gravel (0-5%), dense, moist.	SP									
				57 - 57.4' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2) to light olive brown (2.5Y 5/4), sand (5-15%), gravel (5-15%), hard, no dilatancy, high toughness, medium to high plasticity, moist.	CL/ML									
8 MC	24 24		58	57.4 - 58' **WELL-GRADED GRAVEL WITH CLAY AND SAND:** (GW-GC)s, subangular to subrounded gravel, dense, wet.	(GW-GC)s									MC= Modified California Sample
			59	58 - 60.										
9 CS	96 96		60–63	60 - 63.8' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2) to light olive brown (2.5Y 5/4), sand (5-15%), gravel (5-15%), hard, no dilatancy, high toughness, medium to high plasticity, dry.	CL/ML									
			64–66	63.8 - 66.4' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, dark grayish brown (10YR 4/2), subrounded sand, clay (5-15%), clay nodules (0-5%), loose, wet.	(SW)g									
			67	66.4 - 68' **SILT:** ML, dark grayish brown (10YR 4/2), gravel (0-5%), sand (0-5%), low toughness, non-plastic, moist.	ML									
10 MC	24 24		68–69	68 - 70.						13.1	23	9	68.7	
11 CS	60 60		70–72	70 - 87.5' **SILT:** ML, dark grayish brown (10YR 4/2), gravel (0-5%), sand (0-5%), low toughness, non-plastic, moist.	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
12 CS	60 43		73–87	70 - 87.5' **SILT:** ML, dark grayish brown (10YR 4/2), gravel (0-5%), sand (0-5%), low toughness, non-plastic, moist. *(continued)*	ML									
13 CS	120 120													
			88	87.5 - 88.3' **SILTY SAND:** SM, dark grayish brown (10YR 4/2), dense.	SM									
			89	88.3 - 90' **SILT:** ML, dark grayish brown (10YR 4/2), gravel (0-5%), sand (0-5%), low toughness, non-plastic, moist.	ML									
14 SH	24 0		90–92	90 - 92.										

Boring Number SB301

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
15 CS	96 96		92–95.3	92 - 95.3' **SILT:** ML, dark grayish brown (10YR 4/2), gravel (0-5%), sand (0-5%), low toughness, non-plastic, moist.	ML									
			95.3–96.8	95.3 - 96.8' **SANDY SILT:** s(ML), gray (10YR 5/1) to grayish brown (10YR 5/2), cohesive, high to medium toughness, non-plastic, moist.	s(ML)									
			96.8–98	96.8 - 98' **SILT:** ML, dark grayish brown (10YR 4/2), gravel (0-5%), sand (0-5%), low toughness, non-plastic, moist.	ML									
16 SH	24 24		98–100	98 - 100.						15.7	37	22	82.2	
			100	100' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Newton Power Station		XPW01

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Russ Gordon Cascade Drilling	1/20/2021	1/20/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
XPW01	Feet (NAVD88)	548.62 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 824,975.39 N, 997,851.62 E Ⓔ/ W
1/4 of 1/4 of Section 26, T 6 N, R 8 E

Lat 38° 55' 55.93"
Long -88° 17' 7.87"

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

Facility ID	County	State	Civil Town/City/ or Village
	Jasper	IL	Newton

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 60		0	0 - 6' ASH, gray (10YR 5/1), silt sized grains, fine sand (0-5%), gravel (0-5%), dry.	(FILL) ASH									CS= Core Sample
2 CS	36 36		5	5 - 6' cobbles.	(FILL)									
			6	6 - 8' ASH, gray (10YR 5/1), silt sized grains, fine sand (0-5%), gravel (0-5%), dry.	(FILL) ASH									
3 MC	24 24		8	8 - 10' ASH, sand and silt sized grains.	(FILL) ASH				87.7	18.6	47		11.8	MC= Modified California Sample
4 CS	60 60		10	10 - 15' ASH, gray (10YR 5/1), sand with gravel sized grains, slag-like material (0-5%), wet.	(FILL) ASH									

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

Signature: [signature]

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

Boring Number 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)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13, 14	10 - 15' ASH, gray (10YR 5/1), sand with gravel sized grains, slag-like material (0-5%), wet. *(continued)*	(FILL) ASH									
5 MC	24 24		15, 16	15 - 17' ASH, clay sized grains.	(FILL) ASH				84.4	12.6	35	18	61.3	
									0.5					
6 CS	36 36		17	17 - 18' **LEAN CLAY:** CL, gray (10YR 5/1), medium plasticity, orange mottling (0-5%), medium stiff, moist.	CL									
			18, 19	18 - 20' **SILTY CLAY:** CL/ML, yellowish brown (10YR 5/6), subrounded fine gravel (0-5%), low plasticity, hard, moist.	CL/ML				4.5					
			20	20' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Newton Power Station		XPW02

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Russ Gordon Cascade Drilling	1/19/2021	1/19/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
XPW02	Feet (NAVD88)	551.97 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 825,023.53 N, 998,601.28 E Ⓔ/ W
1/4 of 1/4 of Section 26, T 6 N, R 8 E
Lat 38° 55' 56.41"
Long -88° 16' 58.38"
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Jasper	IL	Newton

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 60		0–4.4	0 - 4.4' ASH, brown (10YR 5/3), silt and sand sized grains , slag-like material (0-5%), fine to coarse gravel (0-5%), dry.	(FILL) ASH									CS= Core Sample
			4.4–5	4.4 - 5' **FILL, LEAN CLAY:** CL, very dark gray (10YR 3/1), gravel (0-5%), coal (0-5%), low plasticity, hard.	(FILL) CL				4					
2 MC	24 24		5–7	5 - 7' not analyzed.										MC= Modified California Sample
3 MC	24 24		7–9	7 - 9' **FILL, LEAN CLAY:** CL, very dark gray (10YR 3/1), gravel (0-5%), coal fragments (0-5%), low plasticity, hard.	(FILL) CL				92.9	29.1	36	20	54.9	
4 CS	12 12		9–	9 - 13.5' **FILL, WELL-GRADED SAND WITH GRAVEL:** (SW)g, brown (10YR 5/3), fine to coarse sand, fine to coarse gravel (15-25%), coal (0-5%), wet.	(FILL) (SW)g									
5 CS	60 60													

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

Signature: [signature]

Firm Ramboll
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Fax: (414) 837-3608

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13	9 - 13.5' **FILL, WELL-GRADED SAND WITH GRAVEL:** (SW)g, brown (10YR 5/3), fine to coarse sand, fine to coarse gravel (15-25%), coal (0-5%), wet. *(continued)* 12.8 - 13.8' shale fragments (20-30%).	(FILL) (SW)g									
			14	13.5 - 15' **FILL, CLAYEY SILT** ML/CL, very dark gray (10YR 3/1), organic material (15-25%), very fine to fine sand (0-5%), wet.	(FILL) ML/CL									
6 MC	24 24		15, 16	15 - 17' **FILL, LEAN CLAY:** CL, very dark gray (10YR 3/1).	(FILL) CL				103.7	21.8	36	22	80.2	
7 CS	36 36		17, 18	17 - 19' **LEAN CLAY:** CL, very dark gray (10YR 3/1), medium plasticity, medium stiff, moist.	CL				0.5					
			19, 20	19 - 20' **LEAN CLAY:** CL, grayish brown (10YR 5/2), fine to coarse gravel (0-5%), low plasticity, very stiff, moist.	CL				2.5					
				20' End of Boring.										

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Newton Power Station		XPW03

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Russ Gordon Cascade Drilling	1/19/2021	1/19/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
XPW03	Feet (NAVD88)	550.81 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 824,558.16 N, 1,000,444.81 E Ⓔ/ W
1/4 of 1/4 of Section 25, T 6 N, R 8 E

Lat 38° 55' 51.8"
Long -88° 16' 35.06"

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

Facility ID	County	State	Civil Town/City/ or Village
	Jasper	IL	Newton

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 60		0–5	0 - 5' ASH, gray (10YR 5/1), silt sized grains, very fine to fine sand (5-15%), slag-like material (5-10%), dry. 3.5' moist.	(FILL) ASH									CS= Core Sample
2 MC	24 24		5–7	5 - 7' ASH, sand and silt sized grains. 5.5' moist to wet.	(FILL) ASH				75.3	17.4	33	6	21.5	MC= Modified California Sample
3 CS	36 36		7–9	7 - 9' ASH, gray (10YR 5/1), silt sized grains, wet.	(FILL) ASH									
			9–10	9 - 10' ASH, light gray (10YR 7/1), gravel sized grains, angular, fine to coarse gravel, coarse sand (0-5%), wet.	(FILL) ASH									
4 CS	60 60		10–12	10 - 13.6' ASH, grayish brown (10YR 5/2), sand to gravel sized grains, fine to coarse sand, fine to coarse gravel (15-25%), coal (0-5%), wet.	(FILL) ASH									

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

Signature [signature]

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

Boring Number XPW03

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	10 - 13.6' ASH, grayish brown (10YR 5/2), sand to gravel sized grains, fine to coarse sand, fine to coarse gravel (15-25%), coal (0-5%), wet. *(continued)*	(FILL) ASH									
			14	13.6 - 14.7' ASH, gray (10YR 5/1), sand sized grains, fine to medium sand, fine to coarse gravel (0-5%), coal (0-5%), wet.	(FILL) ASH									
5 MC	24 18		15	14.7 - 15' ASH, gray (10YR 5/1), silt sized grains, very fine to fine sand (0-5%), wet.	(FILL) ASH				103.6	16.7	12		16.3	
			16	15 - 17' ASH, sand and silt sized grains.	(FILL) ASH									
6 CS	36 36		17, 18	17 - 19' ASH, gray (10YR 5/1), silt sized grains, very fine to coarse sand (0-5%), fine gravel (0-5%) , wet.	(FILL) ASH									
			19, 20	19 - 20' **SILTY CLAY:** CL/ML, yellowish brown (10YR 5/6), subrounded fine gravel (0-5%), low plasticity, very stiff, moist.	CL/ML				2					
				20' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Newton Power Station		XPW04

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Russ Gordon Cascade Drilling	1/19/2021	1/19/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
XPW04	Feet (NAVD88)	551.90 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 824,130.99 N, 1,001,110.06 E Ⓔ/W
1/4 of 1/4 of Section 25, T 6 N, R 8 E
Lat 38° 55' 47.57"
Long -88° 16' 26.64"
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Jasper	IL	Newton

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 60		0–5	0 - 5' ASH, gray (10YR 5/1), silt sized grains, very fine to fine sand (0-5%), fine to coarse gravel (0-5%), dry.	(FILL) ASH									CS= Core Sample
2 MC	12 4		5–6	5 - 6.										MC= Modified California Sample, 4" of concrete recovered in MC
3 MC	24 24		6–8	6 - 8' ASH, sand and silt sized grains. 7' moist.	(FILL) ASH				73.9	31.1	41	3	13.9	
4 CS	24 24		8–12	8 - 12' ASH, gray (10YR 5/1), silt sized grains, very fine to fine sand (0-5%), fine to coarse gravel (0-5%), moist.	(FILL) ASH									
5 CS	60 60													

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

Signature: [signature]

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

Boring Number 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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13 14	12 - 15' ASH, gray (10YR 5/1), sand to gravel sized grains, very fine to fine sand (0-5%), fine to coarse gravel (0-5%), moist. 12.5' wet.	(FILL) ASH									
6 MC	24 24		15 16	15 - 17' ASH, sand and silt sized grains.	(FILL) ASH				80.8	31.1	46	4	33.3	
7 CS	36 36		17 18 19	17 - 19.5' ASH, gray (10YR 5/1), sand to gravel sized grains, very fine to fine sand (0-5%), fine to coarse gravel (0-5%), wet.	(FILL) ASH									
			20	19.5 - 20' **LEAN CLAY WITH SAND:** (CL)s, brown (10YR 5/3), fine to medium sand (15-25%), fine gravel (0-5%), wet. 20' End of Boring.	(CL)s									

Surface Elevation: 529.93

Datum: msl

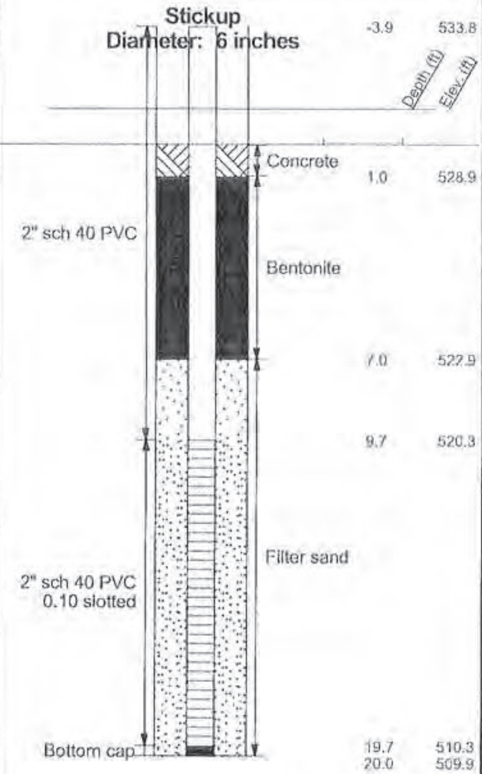
Completion Date: 6/19/10

Northing: 822688.04

Easting: 995465.25

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Soft, brown, silty CLAY - CL			
4	Stiff, brown, sandy CLAY - CL			
7	Hard, brown, sandy CLAY with gravel - CL ▽			
13	Hard, dark gray CLAY and glacial till - CH			
20	Boring terminated at 20 feet.			

WELL DIAGRAM



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

GROUNDWATER DATA

ENCOUNTERED AT 8.5 FEET ▽

DRILLING DATA

4 1/4" AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

MVU DRILLER KCR LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: RBP	App'vd. by: DTK
Date: 6/29/10	Date: 2-7-11	Date: 2-7-11

GEOTECHNOLOGY INC FROM THE GROUND UP

Ameren Power Plant
Newton, Illinois

LOG OF BORING: APW-2

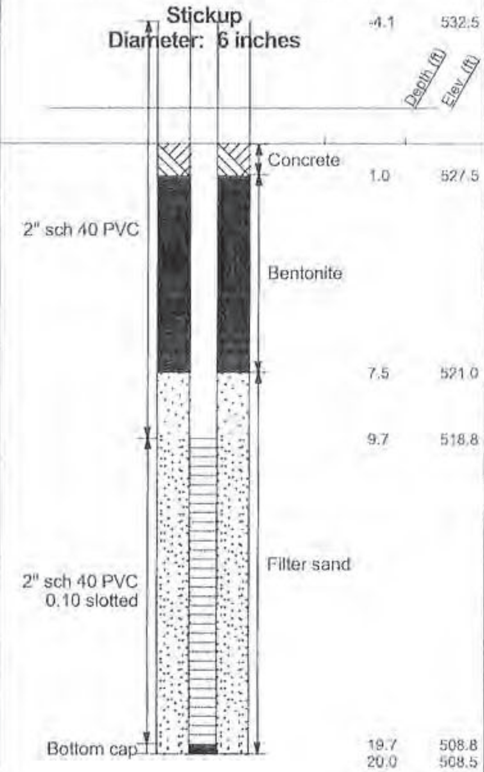
Project No. J017150.01

Surface Elevation: 528.47 Completion Date: 6/18/10

Datum msl Northing: 821379.76 Easting: 998975.74

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Soft, brown, silty CLAY - CL			
6	Soft, brown, sandy CLAY with gravel - CL			
9	Hard, brown, sandy CLAY with gravel - CL			
13	Hard, brownish-gray, sandy CLAY with gravel - CL			
20	Boring terminated at 20 feet.			

WELL DIAGRAM



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

LOG OF BORING 2002 WL J017150.01ENV - AMEREN-NEWTON.GPJ GTINC 0538301.GPJ 2/22/11

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

4 1/4" AUGER __ HOLLOW STEM

WASHBORING FROM __ FEET

MVU DRILLER KCR LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: RSS	App'vd. by: DTK
Date: 6/29/10	Date: 2/7/11	Date: 2-7-11

GEOTECHNOLOGY INC FROM THE GROUND UP

Ameren Power Plant
Newton, Illinois

LOG OF BORING: APW-3

Project No. J017150.01

Surface Elevation: **521.56**

Datum **msl**

Completion Date: **6/19/10**

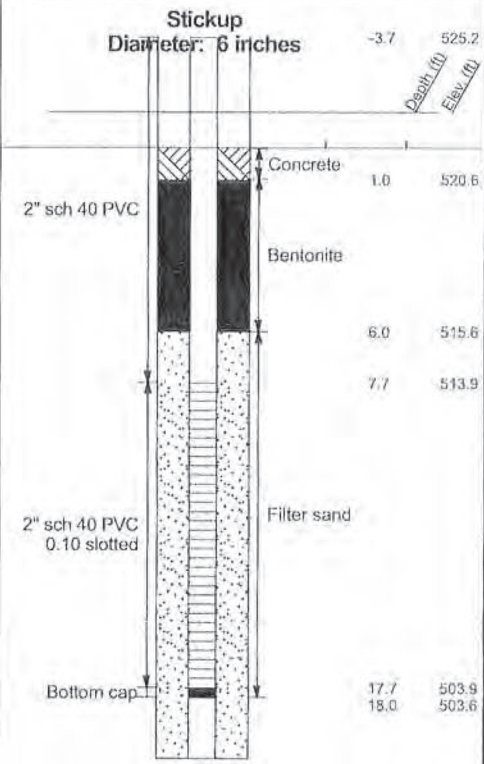
Northing: **823246.45**

Easting: **1001379.56**

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Soft, brown, silty CLAY - CL			
7	Soft, brown, sandy CLAY - CL ▽			
12	Stiff, brown, sandy CLAY with gravel - CL			
18	Boring terminated at 18 feet.			

Depth scale: 5, 10, 15, 20, 25, 30, 35

WELL DIAGRAM



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

LOG OF BORING 2002 WL J017150.01ENV - AMEREN-NEWTON.GPJ GTINC 0638301.GPJ 2/22/11

GROUNDWATER DATA

ENCOUNTERED AT 8 FEET ▽

DRILLING DATA

4 1/4" AUGER __ HOLLOW STEM

WASHBORING FROM __ FEET

MVU DRILLER KCR LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: RJS	App'vd. by: DK
Date: 6/29/10	Date: 2-7-11	Date: 2-7-11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Newton, Illinois

LOG OF BORING: APW-4

Project No. J017150.01

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/22/2015
Finish: 10/22/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW5
Well ID: APW5
Surface Elev: 541.57 ft. MSL
Completion: 68.00 ft. BGS
Station: 7,758.02N
9,318.19E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 58.00 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type
1A	60/60 *100%*	DP		7		*3.00*
1B				13		*2.50*
2A	60/60 *100%*	DP		25		*3.25*
2B				22		*2.25*
3A	60/60 *100%*	DP		19		*1.50*
3B				19		*3.00*
4A	36/36 *100%*	DP		9		*2.00*
5A	23/24 *96%*	SS	*14-28 40-50* N=68	9		*4.50*

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
0 – ~0.9	Very dark grayish brown (10YR3/2), dry, very stiff, SILT with little clay and trace very fine- to medium-grained sand, roots.		
~0.9 – ~3.2	Yellowish brown (10YR5/6), dry, very stiff, SILT with little clay and few very fine- to medium-grained sand.	540	
~3.2 – ~6.4	Yellowish brown (10YR5/6) with 10% gray (10YR6/1) mottles, moist, very stiff, silty CLAY with few very fine- to medium-grained sand and trace small gravel.	538, 536	
~6.4 – ~9.6	Gray (10YR5/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, very stiff, CLAY with some silt, trace very fine- to fine-grained sand.	534	
~9.6 – ~10.2	Dark grayish brown (10YR4/2), moist, stiff, CLAY with little silt and trace very fine- to fine-grained sand.	532	
~10.2 – ~11.8	Gray (10YR6/1), moist, medium dense, very fine- to fine-grained SAND and SILT with little clay.	530	
~11.8 – ~16.2	Gray (10YR5/1) with 5% yellowish brown (10YR5/6) mottles, moist, very stiff, silty CLAY with few fine- to coarse-grained sand and trace small gravel.	528, 526	
~16.2 – 18	Yellowish brown (10YR5/6) with 15% grayish brown (10YR5/2) mottles, moist, stiff, SILT with little clay and trace fine- to coarse-grained sand and small gravel.	524	
18 – 20	Brown (10YR5/3), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.	522	

NOTE(S): APW5 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/22/2015
Finish: 10/22/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW5
Well ID: APW5
Surface Elev: 541.57 ft. MSL
Completion: 68.00 ft. BGS
Station: 7,758.02N 9,318.19E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 58.00 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
6A	21/24 *88%*	SS	*11-26 21-14* N=47	9		*4.50*		Brown (10YR5/3), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel. *[Continued from previous page]*	520	
7A	24/24 *100%*	SS	*5-5 8-13* N=13	16		*4.25*	22	Brown (10YR5/3) with 5% gray (10YR6/1) and 5% yellowish brown (10YR5/6) mottles, moist, hard, SILT with some clay and trace very fine- to fine-grained sand and small gravel.	518	
8A	22/24 *92%*	SS	*18-31 43-27* N=74	9		*4.50*	24	Brown (10YR5/3), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.	516	
9A	21/24 *88%*	SS	*4-5 11-11* N=16	14		*2.75*	26		514	
10A	22/24 *92%*	SS	*3-6 9-12* N=15	15		*3.75*	28	Brown (10YR5/3) with 5% gray (10YR6/1) and 5% yellowish brown (10YR5/6) mottles, moist, hard, SILT with some clay and trace very fine- to fine-grained sand and small gravel.	512	
11A	24/24 *100%*	SS	*4-7 13-16* N=20	14		*4.50*	30		510	
12A	24/24 *100%*	SS	*4-7 11-17* N=18	16		*4.50*	32	Dark gray (10YR4/1), moist, hard, SILT with some clay, few very fine- to coarse-grained sand and trace small gravel.	508	
13A	24/24 *100%*	SS	*5-9 12-15* N=21	18		*4.50*	34	Light olive brown (2.5Y5/3) with 5% gray (10YR5/1) mottles, moist, hard, SILT with little clay and trace very fine- to medium-grained sand.	506	
14A	24/24 *100%*	SS	*4-8 11-14* N=19	16		*4.50*	36		504	
15A	24/24 *100%*	SS	*5-13 16-23* N=29	12		*4.50*	38	Olive brown (2.5Y4/3) with 10% gray (N6/1) mottles, moist, hard, silty CLAY with little fine- to coarse-grained sand and trace small gravel.	502	
							40			

NOTE(S): APW5 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/22/2015
Finish: 10/22/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW5
Well ID: APW5
Surface Elev: 541.57 ft. MSL
Completion: 68.00 ft. BGS
Station: 7,758.02N 9,318.19E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 58.00 - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type
16A	24/24 *100%*	SS	*6-13 16-30* N=29	12		*4.50*
17A	24/24 *100%*	SS	*5-10 13-22* N=23	15		*4.50*
18A	24/24 *100%*	SS	*7-13 17-25* N=30	13		*4.50*
19A	24/24 *100%*	SS	*6-13 20-28* N=33	13		*4.50*
20A	24/24 *100%*	SS	*5-10 16-21* N=26	13		*4.50*
21A	24/24 *100%*	SS	*6-10 18-21* N=28	13		*4.50*
22A	24/24 *100%*	SS	*7-14 19-26* N=33	13		*4.50*
23A	24/24 *100%*	SS	*6-10 17-24* N=27	13		*4.50*
24A	24/24 *100%*	SS	*12-16 28-36* N=44	11		*4.50*
25A	24/24 *100%*	SS	*2-6 12-15* N=18	23		
25B				15		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
to 44	Olive brown (2.5Y4/3) with 10% gray (N6/1) mottles, moist, hard, silty CLAY with little fine- to coarse-grained sand and trace small gravel. *[Continued from previous page]*	
44 – ~57.2	Olive brown (2.5Y4/3) with 10% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.	
~57.2 – 58	Olive gray (5Y5/2) with 40% olive brown (2.5Y4/4) mottles, moist, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.	
58 – ~59	Greenish gray (10G5/1) with 40% olive gray (5Y4/2) mottles, moist, medium dense, SILT with few clay and trace very fine- to fine-grained sand.	
~59 – 60	Very dark gray (10YR3/1), wet, medium dense, very fine- to coarse-grained SAND with few silt.	

Depth scale: 42, 44, 46, 48, 50, 52, 54, 56, 58, 60
Elevation scale: 500, 498, 496, 494, 492, 490, 488, 486, 484, 482

Borehole Detail | Remarks

NOTE(S): APW5 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/22/2015
Finish: 10/22/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW5
Well ID: APW5
Surface Elev: 541.57 ft. MSL
Completion: 68.00 ft. BGS
Station: 7,758.02N
9,318.19E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 58.00 - During Drilling
▼ =
▽ =

SAMPLE			TESTING							
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
26A	19/24 *79%*	SS	*3-19 34-48* N=53	13				Very dark gray (10YR3/1), wet, very dense, very fine- to coarse-grained SAND with few silt.	480	
27A	20/24 *83%*	SS	*22-38 33-34* N=71	16			62		478	
28A	22/24 *92%*	SS	*18-28 31-33* N=59	14			64		476	
29A	24/24 *100%*	SS	*21-27 24-23* N=51	16			66			
29B				14		*4.50*	68	Dark gray (10YR4/1), moist, hard, SILT with little clay and few very fine- to coarse-grained sand.	474	

End of boring = 68.0 feet

NOTE(S): APW5 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/20/2015
Finish: 10/21/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW6
Well ID: APW6
Surface Elev: 543.38 ft. MSL
Completion: 74.00 ft. BGS
Station: 7,688.54N
7,811.93E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 14.00 - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type
1A	60/60 *100%*	DP		15		*4.00*
1B				26		*3.00*
2A	60/60 *100%*	DP		18		*2.50*
2B				18		*1.00*
3A	60/60 *100%*	DP		27		*1.50*
3B				21		*1.50*
4A	12/12 *100%*	DP		10		
5A	22/24 *92%*	SS	*15-29 41-50* N=70	8		*4.50*
6A	21/24 *88%*	SS	*14-30 40-50* N=70	8		*4.50*

Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	Gray (10YR6/1), dry, very stiff, SILT with few clay and trace very fine- to coarse- grained sand, trace roots.			
	Brown (10YR5/3) with 5% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, dry, very stiff, SILT with few clay and very fine- to coarse-grained sand, trace small gravel, trace roots.			
	Gray (10YR5/1) with 35% dark yellowish brown (10YR4/6) mottles, moist, very stiff, CLAY with little silt and trace very fine- to fine-grained sand.			
	Gray (10YR5/1) with 40% dark yellowish brown (10YR3/6) mottles, moist, very stiff, SILT with little clay and trace very fine- to medium-grained sand.			
	Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, stiff, SILT with some clay and few very fine- to medium-grained sand.			
	Dark yellowish brown (10YR4/6) with 25% gray (10YR5/1) mottles, moist, stiff, CLAY with some silt and few very fine- to medium-sand.			
▼ 14	Dark yellowish brown (10YR3/4), wet, soft, fine- to coarse grained sandy CLAY with little silt.			
	Brown (10YR4/3), moist, stiff, SILT with little clay and few very fine- to coarse-grained sand.			
	Grayish brown (10YR5/2) with 15% dark gray (10YR4/1) mottles, dry, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.			

Depth scale (ft. BGS): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20
Elevation scale (ft. MSL): 542, 540, 538, 536, 534, 532, 530, 528, 526, 524

NOTE(S): APW6 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/20/2015
Finish: 10/21/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW6
Well ID: APW6
Surface Elev: 543.38 ft. MSL
Completion: 74.00 ft. BGS
Station: 7,688.54N
7,811.93E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 14.00 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) / *% Recovery*	Type	*Blows / 6 in* / N - Value / **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* / Failure Type
7A	15/17 *88%*	SS	*16-46 50/5"*	9		*4.50*
8A	12/24 *50%*	SS	*14-37 45-50* N=82	7		*4.50*
9A	24/24 *100%*	SS	*8-17 23-32* N=40	10		*4.50*
10A	24/24 *100%*	SS	*10-22 26-36* N=48	11		*4.50*
11A	24/24 *100%*	SS	*10-18 23-26* N=41	10		*4.50*
12A	24/24 *100%*	SS	*6-13 17-23* N=30	13		*4.50*
13A	24/24 *100%*	SS	*5-7 12-19* N=19	17		*4.50*
14A	24/24 *100%*	SS	*5-9 13-19* N=22	16		*4.50*
15A	24/24 *100%*	SS	*5-10 15-22* N=25	15		*4.50*
16A	24/24 *100%*	SS	*5-9 15-22* N=24	15		*4.50*

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
~20.2–21.1	Brown (10YR5/3), moist, very dense, silty, very fine- to medium-grained SAND with trace small gravel.	522
21.1–24.6	Brown (10YR5/3), dry, hard, SILT with little clay and few very fine- to coarse-grained sand.	520
24.6–32.8	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.	518, 516, 514, 512
32.8–34.5	Dark gray (10YR4/1) with 30% dark greenish gray (10Y4/1) mottles, moist, hard, SILT with some clay, few very fine- to coarse-grained sand and trace small gravel.	510
34.5–40	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small to large gravel.	508, 506, 504

Depth scale: 22, 24, 26, 28, 30, 32, 34, 36, 38, 40

Borehole Detail | Remarks

NOTE(S): APW6 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/20/2015
Finish: 10/21/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW6
Well ID: APW6
Surface Elev: 543.38 ft. MSL
Completion: 74.00 ft. BGS
Station: 7,688.54N
7,811.93E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 14.00 - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type
17A	21/24 *88%*	SS	*4-14 18-25* N=32	12		*4.25*
18A	24/24 *100%*	SS	*8-12 16-22* N=28	15		*4.50*
19A	22/24 *92%*	SS	*7-11 15-18* N=26	16		*4.25*
20A	22/24 *92%*	SS	*7-16 26-45* N=42	13		*4.50*
21A	21/24 *88%*	SS	*11-19 30-37* N=49	13		*4.50*
22A	19/24 *79%*	SS	*5-13 26-38* N=39	14		
23A	24/24 *100%*	SS	*12-18 29-40* N=47	13		*4.50*
24A	24/24 *100%*	SS	*7-18 30-37* N=48	13		
25A	24/24 *100%*	SS	*11-18 27-38* N=45	14		*4.50*
26A	24/24 *100%*	SS	*10-15 23-33* N=38	17		*4.50*

Depth ft. BGS	Lithologic Description
40.0–46.3	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small to large gravel. *[Continued from previous page]*
46.3–54.6	Olive gray (5Y4/2) with 20% dark gray (10YR4/1) mottles, moist, hard, SILT with little clay and trace very fine- to coarse- grained sand and small gravel.
54.6–56.7	Dark gray brown (2.5Y4/2) with 15% dark gray (10YR4/1) mottles, moist, hard, SILT with little clay and trace very fine- to coarse-grained sand.
56.7–58.0	Olive brown (2.5Y4/3) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay and trace very fine- to medium-grained sand.
58.0–60.0	Olive brown (2.5Y4/3) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay and trace very fine- to coarse-grained sand and small gravel.

Depth scale (ft. BGS): 42, 44, 46, 48, 50, 52, 54, 56, 58, 60
Elevation scale (ft. MSL): 502, 500, 498, 496, 494, 492, 490, 488, 486, 484

Borehole Detail | Remarks

NOTE(S): APW6 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/20/2015
Finish: 10/21/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW6
Well ID: APW6
Surface Elev: 543.38 ft. MSL
Completion: 74.00 ft. BGS
Station: 7,688.54N
7,811.93E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 14.00 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
27A	24/24 *100%*	SS	*5-4 21-32* N=25	13		*4.50*	62	Olive brown (2.5Y4/3) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay and trace very fine- to coarse-grained sand and small gravel. *[Continued from previous page]*		482	
28A	24/24 *100%*	SS	*7-18 23-31* N=41	12		*4.50*	64	Dark gray (10YR4/1) with 5% dark olive brown (2.5Y3/3) mottles, moist, hard, SILT with little clay and trace very fine- to coarse-grained sand and small gravel.		480	
29A	24/24 *100%*	SS	*7-14 18-30* N=32	13		*4.25*	66	Dark gray (10YR4/1), moist, hard, SILT with little clay and trace very fine- to coarse-grained sand and small gravel.		478	
30A	24/24 *100%*	SS	*13-21 33-33* N=54	14			68	Dark gray (10YR4/1), wet, very dense, silty, very fine- to coarse-grained SAND with trace small gravel.		476	
31A	16/23 *70%*	SS	*3-27 49-50/5"* N=76	13			70			474	
32A	20/23 *87%*	SS	*6-29 38-50/5"* N=67	22			72	Gray (10YR5/1), wet, very dense, SILT with few very fine- to fine-grained sand.		472	
								Dark gray (10YR4/1), wet, very dense, silty, very fine- to medium-grained SAND with trace small gravel.			
33A	20/24 *83%*	SS	*26-28 34-37* N=62	12		*4.50*	74	Dark gray (10YR4/1), moist, hard, SILT with little clay and few very fine- to coarse-grained sand.		470	

End of boring = 74.0 feet

NOTE(S): APW6 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/3/2015
Finish: 11/5/2015
WEATHER: Sunny, warm, lo-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: APW7a
Well ID: APW7
Surface Elev: 536.21 ft. MSL
Completion: 83.10 ft. BGS
Station: 5,688.85N
6,151.60E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							0–2.9	Yellowish brown (10YR5/6), moist, medium, CLAY with some silt and trace very fine- to fine-grained sand, roots.		536, 534	
							2.9–4.1	Light gray (10YR7/2), moist, medium, SILT with few very fine-grained sand and trace roots.			
							4.1–7.0	Gray (10YR5/1) with 30% yellowish brown (10YR5/8) mottles, moist, medium, CLAY with some silt, trace very fine-grained sand, and trace roots.		532, 530	
							7.0–13.1	Gray (10YR5/1) with 30% yellowish brown (10YR5/8) mottles, moist, medium, CLAY with some silt and trace very fine- to medium-grained sand, trace small gravel, and trace roots.		528, 526, 524	
							13.1–16.2	Yellowish brown (10YR5/4), moist, hard, SILT with few clay, little very fine- to coarse-grained sand, and trace small to medium gravel.		522	
							16.2–17.0	Yellowish brown (10YR5/6), wet, dense, fine- to coarse-grained SAND with little silt.		520	
							17.0–18.0	Gray (10YR5/1), moist, hard, SILT with few clay, little very fine- to very coarse-grained sand, and trace small to medium gravel.			
							18.0–20	Yellowish brown (10YR5/6) with 20% gray (10YR5/1) mottles, dry, hard, SILT with few clay, little very fine- to very coarse-grained sand, and trace small to medium gravel.		518	

NOTE(S): APW7 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/3/2015
Finish: 11/5/2015
WEATHER: Sunny, warm, lo-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: APW7a
Well ID: APW7
Surface Elev: 536.21 ft. MSL
Completion: 83.10 ft. BGS
Station: 5,688.85N
6,151.60E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
								Yellowish brown (10YR5/6) with 20% gray (10YR5/1) mottles, dry, hard, SILT with few clay, little very fine- to very coarse-grained sand, and trace small to medium gravel. *[Continued from previous page]*		516	
							22	Yellowish brown (10YR5/6) with 20% gray (10YR5/1) mottles, dry, hard, SILT with few clay, little very fine- to very coarse-grained sand, and trace small to medium gravel, horizontal and vertical fractures with dark brown (10YR3/3) oxidized faces.		514	
							24	Gray (10YR5/1), moist, hard, SILT with few clay, little very fine- to very coarse-grained sand, and trace small to medium gravel, horizontal and vertical fractures with dark brown (10YR3/3) oxidized faces.		512	
							26			510	
							28			508	
							30			506	
							32	Gray (10YR5/1), moist, hard, SILT with few clay, little very fine- to very coarse-grained sand, and trace small to medium gravel.		504	
							34			502	
							36			500	
								Gray (10YR5/1), moist, dense, very fine- to fine-grained SAND with trace silt.			
							38	Gray (10YR5/1), moist, dense, very fine- to very coarse-grained SAND with trace silt and small gravel.		498	
								Gray (10YR5/1), moist, dense, very fine- to fine-grained SAND with trace silt.			
							40				

NOTE(S): APW7 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/3/2015
Finish: 11/5/2015
WEATHER: Sunny, warm, lo-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

HANSON

BOREHOLE ID: APW7a
Well ID: APW7
Surface Elev: 536.21 ft. MSL
Completion: 83.10 ft. BGS
Station: 5,688.85N 6,151.60E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

Number	Recov / Total (in) % Recovery	Type	Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							40–46.7	Gray (10YR5/1), moist, hard, CLAY with some silt, little very fine- to very coarse-grained sand, trace small gravel, and trace wood fragments.			
							46.7–60	Gray (10YR5/1), moist, hard, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small gravel, trace wood fragments.			

Depth scale (ft. BGS): 42, 44, 46, 48, 50, 52, 54, 56, 58, 60
Elevation scale (ft. MSL): 496, 494, 492, 490, 488, 486, 484, 482, 480, 478

NOTE(S): APW7 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/3/2015
Finish: 11/5/2015
WEATHER: Sunny, warm, lo-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: APW7a
Well ID: APW7
Surface Elev: 536.21 ft. MSL
Completion: 83.10 ft. BGS
Station: 5,688.85N
6,151.60E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) % Recovery	Type	TESTING: Blows / 6 in N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							60–71	Gray (10YR5/1), moist, hard, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small gravel, trace wood fragments. *[Continued from previous page]*		476–465	
							71–71.3	Gray (10YR5/1), moist, dense, very fine- to very coarse-grained SAND with some clay and silt.			
							71.3–76	Gray (10YR5/1), moist, hard, CLAY with some silt, little very fine- to very coarse-grained sand, trace small gravel, and trace wood fragments.			
							76–80	Gray (10YR5/1), wet, loose, very fine- to very coarse-grained SAND with trace small gravel.		460–456	

Depth scale: 62, 64, 66, 68, 70, 72, 74, 76, 78, 80
Elevation scale: 476, 474, 472, 470, 468, 466, 464, 462, 460, 458

NOTE(S): APW7 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/3/2015
Finish: 11/5/2015
WEATHER: Sunny, warm, lo-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

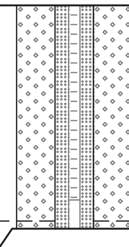
HANSON

BOREHOLE ID: APW7a
Well ID: APW7
Surface Elev: 536.21 ft. MSL
Completion: 83.10 ft. BGS
Station: 5,688.85N
6,151.60E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE			TESTING									
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							82	Gray (10YR5/1), wet, loose, very fine- to very coarse-grained SAND with trace small gravel. *[Continued from previous page]*		456 454	
								Bluish black (10B2.5/1), wet dense, very fine- to very coarse-grained SAND with little silt and trace small gravel.			



End of boring = 83.1 feet

NOTE(S): APW7 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
1A	60/60 *100%*	DP		13		*4.50*	0–0.6	Black (10YR2/1), moist, very stiff, SILT with little clay and trace very fine- to medium-grained sand, roots.		
1B				21		*3.00*	0.6–2.5	Yellowish brown (10YR5/4) with 30% light gray (10YR7/2) mottles, dry, hard, SILT with little clay and trace very fine- to medium-grained sand.		
2A	60/60 *100%*	DP		18		*2.50*	2.5–8.2	Grayish brown (10YR5/2) with 15% dark yellowish brown (10YR4/6) and 10% black (10YR2/1) mottles, moist, very stiff, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.		
2B				28		*2.00*	8.2–10	Grayish brown (10YR5/2) with 15% dark yellowish brown mottles, moist, stiff, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.		
3A	20/24 *83%*	DP		8		*2.00*	10–14	Brown (10YR5/3) with 20% dark yellowish brown (10YR5/6) mottles, dry, stiff, SILT with little clay and trace very fine- to coarse-grained sand.		Rock in shoe of sampler.
4A	0/17 *0%*	SS	*23-43* *50/5"*							
5A	21/24 *88%*	SS	*13-20* *24-28* N=44	10		*4.50*	14–20	Dark gray (10YR4/1), moist, hard, SILT with little clay, trace very fine- to coarse-grained sand and small gravel.		
6A	24/24 *100%*	SS	*7-14* *20-48* N=34	11		*4.50*				
7A	24/24 *100%*	SS	*14-21* *26-32* N=47	10						

Depth scale (ft. BGS): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20
Elevation scale (ft. MSL): 526, 524, 522, 520, 518, 516, 514, 512, 510, 508

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

HANSON

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N 6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type
8A	24/24 100%	SS	7-13 19-23 N=32	11		4.50
9A	24/24 100%	SS	7-14 19-27 N=33	11		4.50
10A	24/24 100%	SS	8-15 30-37 N=45	11		4.50
11A	24/24 100%	SS	8-16 24-33 N=40	11		4.50
12A	24/24 100%	SS	9-31 33-30 N=64	11		
12B				12		4.50
13A	24/24 100%	SS	10-23 40-35 N=63	11		4.50
14A	21/24 88%	SS	16-16 29-50 N=45	10		4.50
15A	20/24 83%	SS	9-24 34-41 N=58	13		
16A	22/24 92%	SS	16-18 29-35 N=47	11		4.50
17A	21/24 88%	SS	10-17 21-31 N=38	11		4.50

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
to ~29.0	Dark gray (10YR4/1), moist, hard, SILT with little clay, trace very fine- to coarse-grained sand and small gravel. *[Continued from previous page]*	506, 504, 502, 500, 498
~29.0–29.7	Gray (10YR5/1), moist, dense, silty, very fine- to medium-grained SAND.	
~29.7–33.7	Dark gray (10YR4/1), moist, hard SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.	496, 494
33.7–36.3	Dark gray (10YR4/1), wet, very dense, silty, very fine- to coarse-grained SAND with trace small gravel.	492
36.3–40	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.	490, 488

Depth scale: 22, 24, 26, 28, 30, 32, 34, 36, 38, 40

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type
18A	24/24 *100%*	SS	*9-16 26-32* N=42	11		*4.50*
19A	24/24 *100%*	SS	*10-16 23-34* N=39	12		*4.50*
20A	24/24 *100%*	SS	*10-15 26-44* N=41	13		*4.50*
21A	24/24 *100%*	SS	*12-21 32-48* N=53	12		*4.50*
22A	24/24 *100%*	SS	*11-17 22-31* N=39	13		*4.50*
23A	24/24 *100%*	SS	*10-13 21-32* N=34	13		*4.50*
24A	24/24 *100%*	SS	*8-13 50-26* N=63	13		*4.50*
25A	24/24 *100%*	SS	*8-11 19-28* N=30	14		*4.25*
26A	24/24 *100%*	SS	*10-12 18-26* N=30	13		*4.50*
27A	22/24 *92%*	SS	*7-10 15-22* N=25	21		*4.50*

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
40–59.3 (42, 44, 46, 48, 50, 52, 54, 56, 58)	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel. *[Continued from previous page]*	486, 484, 482, 480, 478, 476, 474, 472, 470	
59.3–60	Olive gray (5Y4/2), moist, hard, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.	468	

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type
28A	20/24 *83%*	SS	*7-15 19-20* N=34	14		*4.50*
29A	21/24 *88%*	SS	*7-8 11-16* N=19	11		*3.75*
30A	21/24 *88%*	SS	*6-13 14-11* N=27	14		*4.00*
30B				10		
31A	18/24 *75%*	SS	*4-3 4-3* N=7	28		
31B				15		*3.25*
32A	20/24 *83%*	SS	*1-3 3-2* N=6	17		
32B				28		
33A	15/24 *63%*	SS	*woh-2 6-6* N=8	17		
34A	16/24 *67%*	SS	*9-11 15-20* N=26	9		
35A	15/24 *63%*	SS	*16-21 23-24* N=44	9		
36A	14/24 *58%*	SS	*11-20 25-24* N=45	11		
37A	15/24 *63%*	SS	*20-25 24-25* N=49	10		

Depth ft. BGS	Lithologic Description
to 62	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.
62 – 65	Dark gray (10YR4/1), moist, very stiff, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.
65 – 66	Gray (10YR6/1), wet, medium dense, silty, very fine- to coarse-grained SAND with trace small to large gravel.
66	Dark gray (10YR4/1), moist, very stiff, SILT with little clay and few very fine- to coarse-grained sand.
66 – 67	Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND with trace small gravel and trace wood fragments.
67 – 68	Dark gray (10YR4/1), moist, very stiff, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel, trace wood fragments.
68 – 69	Dark gray (10YR4/1), wet, loose, SILT with little very fine- to fine-grained sand.
69	Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND.
69 – 70	Dark gray (10YR4/1), wet, loose, SILT with little very fine- to fine-grained sand, trace wood fragments.
70 – 72	Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND, trace wood fragments.
72 – 73	Dark gray (10YR4/1), wet, medium dense, silty, very fine- to coarse-grained SAND with trace small gravel.
73 – 74	Dark gray (10YR4/1), wet, medium dense, silty, very fine- to coarse-grained SAND with few small to large gravel.
74 – 76	Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with few small to large gravel.
76 – 80	Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with trace small gravel.

Elevation ft. MSL: 466, 464, 462, 460, 458, 456, 454, 452, 450, 448

Remarks:

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.	**CONTRACTOR:** Bulldog Drilling, Inc.		
Site: Newton Energy Center	**Rig mfg/model:** CME-550X ATV Drill	**BOREHOLE ID:** APW8	
Location: Newton, Illinois	**Drilling Method:** 4¼" HSA, macro-core sampler, split spoon sampler	**Well ID:** APW8	
Project: 15E0030		**Surface Elev:** 526.75 ft. MSL	
DATES: Start: 10/27/2015	**FIELD STAFF: Driller:** C. Dutton	**Completion:** 82.00 ft. BGS	
Finish: 10/28/2015	**Helper:** C. Jones	**Station:** 3,839.59N	
WEATHER: Sunny, breezy, warm, lo-80s	**Eng/Geo:** S. Keim	6,082.37E	

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
38A	18/24 *75%*	SS	*26-26 26-31* N=52	8				Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with trace small gravel. *[Continued from previous page]*		446	
38B				11		*4.50*	82	Dark gray (10YR4/1), moist, hard, SILT with little clay and few very fine- to coarse-grained sand.			

End of boring = 82.0 feet

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/2/2015
Finish: 11/3/2015
WEATHER: Foggy, mild, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler

FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: APW9
Well ID: APW9
Surface Elev: 528.82 ft. MSL
Completion: 62.00 ft. BGS
Station: 3,519.59N
9,125.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 27.00 - During Drilling
▼ = 26.10 - 11/3/15
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1	0/60 *0%*	BD					0–20	Blind drill - see APW3 boring log for lithology, sample, and testing data		528–510	
2	0/60 *0%*	BD									
3	0/60 *0%*	BD									
4	0/60 *0%*	BD									

NOTE(S): APW9 installed in borehole.
Lithology, sample, and testing data can be found on APW-3 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/2/2015
Finish: 11/3/2015
WEATHER: Foggy, mild, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: APW9
Well ID: APW9
Surface Elev: 528.82 ft. MSL
Completion: 62.00 ft. BGS
Station: 3,519.59N
9,125.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 27.00 - During Drilling
▼ = 26.10 - 11/3/15
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
5A	24/24 *100%*	SS	*10-13 21-28* N=34	10		*4.25*	22	Gray (10YR5/1), moist, hard, SILT with some very fine-grained sand, little clay, and trace small to medium gravel. Vertical and horizontal fractures with yellowish brown (10YR5/8) faces.	508	
6A	24/24 *100%*	SS	*13-15 21-29* N=36	10		*4.50*	24		506	
7A	2/24 *8%*	SS	*15-28 33-39* N=61	11		*4.50*	26	Gray (10YR5/1), moist, hard, SILT with some very fine-grained sand, little clay, and trace small to medium gravel.	504	Rock in shoe of sampler.
8A	23/23 *100%*	SS	*9-15 39-50/5"* N=54	11					502	
8B				11			28	Gray (10YR5/1), wet, dense, very fine- to very coarse-grained SAND with some silt, few clay and trace small to medium gravel.		
9A	24/24 *100%*	SS	*12-22 28-27* N=50	11					500	
9B				12		*4.50*	30			
10A	24/24 *100%*	SS	*14-22 32-44* N=54	11		*4.50*	32		498	
11A	23/24 *96%*	SS	*8-16 24-35* N=40	11		*4.50*	34	Gray (10YR5/1), moist, hard, SILT with little clay and very fine-grained sand and trace small gravel.	496	
12A	16/24 *67%*	SS	*12-25 35-32* N=60	12		*4.50*	36		494	
13A	24/24 *100%*	SS	*6-12 24-25* N=36	11		*4.50*	38		492	
14A	24/24 *100%*	SS	*4-7 16-32* N=23	14		*4.50*	40	Gray (10YR5/1) moist, stiff, CLAY with some silt, little very fine-grained sand and trace small gravel.	490	

NOTE(S): APW9 installed in borehole.
Lithology, sample, and testing data can be found on APW-3 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/2/2015
Finish: 11/3/2015
WEATHER: Foggy, mild, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: APW9
Well ID: APW9
Surface Elev: 528.82 ft. MSL
Completion: 62.00 ft. BGS
Station: 3,519.59N
9,125.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 27.00 - During Drilling
▼ = 26.10 - 11/3/15
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
15A	24/24 *100%*	SS	*5-11 19-23* N=30	14		*4.50*	40–43.1	Gray (10YR5/1) moist, stiff, CLAY with some silt, little very fine-grained sand and trace small gravel, trace wood fragments.		
16A	24/24 *100%*	SS	*4-8 14-29* N=22	15		*4.50*				
16B				12			43.1–45	Light olive brown (2.5Y5/3), moist, stiff, CLAY with some silt, few very fine- to very coarse-grained sand, and trace small gravel.		
17A	24/24 *100%*	SS	*8-17 24-34* N=41	11		*4.50*	45–48	Light olive brown (2.5Y5/3) with 30% yellowish brown (10YR5/8) mottles, moist, stiff, CLAY with some silt, few very fine- to very coarse-grained sand, and trace small gravel.		
18A	24/24 *100%*	SS	*7-13 20-29* N=33	12		*4.50*				
19A	24/24 *100%*	SS	*6-12 18-24* N=30	12		*4.50*	48–50.5	Grayish brown (2.5Y5/2) with 10% gray (2.5Y5/3) mottles, moist, hard, SILT with little very fine- to very coarse-grained sand, few clay and trace small to large gravel.		
20A	24/24 *100%*	SS	*7-12 17-22* N=29	15		*4.50*	50.5–56	Yellowish brown (10YR5/6) with 25% gray (10YR6/1) mottles, moist, stiff, CLAY with some silt, little very fine-medium-grained sand, and trace small gravel.		
21A	24/24 *100%*	SS	*5-11 12-18* N=23	14		*4.25*				
22A	23/23 *100%*	SS	*6-14 24-50/5"* N=38	13		*4.50*				
22B				13			56–56.6	Dark gray (10YR4/1), moist, dense, very fine- to fine-grained SAND with few silt.		
23A	24/24 *100%*	SS	*7-15 21-30* N=36	13			56.6–58	Gray (10YR5/1), wet, loose, very fine- to very coarse-grained SAND with trace small gravel.		
24A	18/24 *75%*	SS	*13-38 43-40* N=81	15			58–60	Gray (10YR5/1), wet, loose, very fine- to coarse-grained SAND.		

Depth scale: 42, 44, 46, 48, 50, 52, 54, 56, 58, 60 ft. BGS. Elevation scale: 488, 486, 484, 482, 480, 478, 476, 474, 472, 470 ft. MSL.

NOTE(S): APW9 installed in borehole.
Lithology, sample, and testing data can be found on APW-3 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.	**CONTRACTOR:** Bulldog Drilling, Inc.		
Site: Newton Energy Center	**Rig mfg/model:** CME-550X ATV Drill	**BOREHOLE ID:** APW9	
Location: Newton, Illinois	**Drilling Method:** 4¼" HSA, split spoon sampler	**Well ID:** APW9	
Project: 15E0030		**Surface Elev:** 528.82 ft. MSL	
DATES: Start: 11/2/2015	**FIELD STAFF: Driller:** J. Gates	**Completion:** 62.00 ft. BGS	
Finish: 11/3/2015	**Helper:** C. Clines	**Station:** 3,519.59N	
WEATHER: Foggy, mild, lo-50s	**Eng/Geo:** R. Hasenyager	9,125.33E	

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 27.00 - During Drilling
▼ = 26.10 - 11/3/15
▽ =

SAMPLE			TESTING									
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
25A	24/24 *100%*	SS	*4-18* *25-30* N=43	21				Gray (10YR5/1), wet, loose, very fine- to coarse-grained SAND. *[Continued from previous page]*		468	
								Gray (10YR5/1), moist, stiff, CLAY with some silt and trace very fine-grained sand.			
25B				16			62	Gray (10YR5/1), wet, dense, SILT and very fine-grained SAND.			

End of boring = 62.0 feet

NOTE(S): APW9 installed in borehole.
Lithology, sample, and testing data can be found on APW-3 Field Boring Log.

Surface Elevation: 528.47

Datum: msl

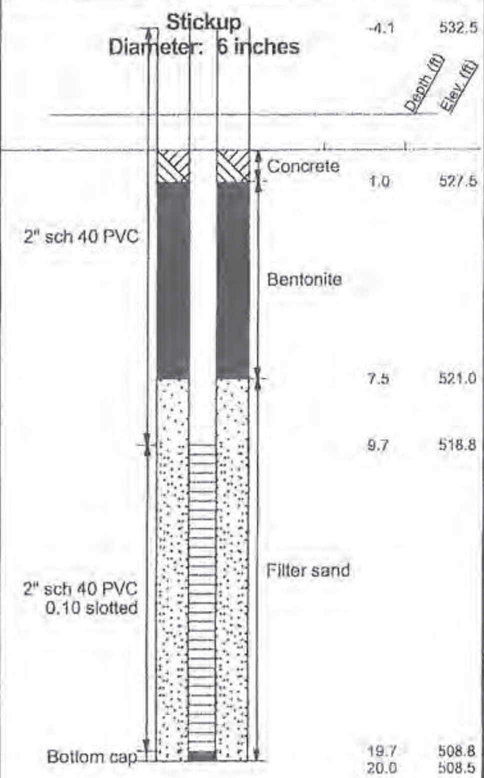
Completion Date: 6/18/10

Northing: 821379.76

Easting: 998975.74

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Soft, brown, silty CLAY - CL			
6	Soft, brown, sandy CLAY with gravel - CL			
9	Hard, brown, sandy CLAY with gravel - CL			
13	Hard, brownish-gray, sandy CLAY with gravel - CL			
20	Boring terminated at 20 feet.			

WELL DIAGRAM



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

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

4 1/4" AUGER __ HOLLOW STEM

WASHBORING FROM __ FEET

MVU DRILLER KCR LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA | Checked by: JRS | App'vd. by: DTK

Date: 6/29/10 | Date: 2/7/11 | Date: 2-7-11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Newton, Illinois

LOG OF BORING: APW-3

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01ENV - AMEREN-NEWTON.GPJ GTINC 0638301.GPJ

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							2			520	
							4			518	
							6			516	
							8			514	
							10	Blind drill - see APW4 boring log for lithology, sample, and testing data		512	
							12			510	
							14			508	
							16			506	
							18			504	
							20			502	

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
∇ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							22	Yellowish brown (10YR5/6) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		500	
							24, 26, 28, 30	Yellowish brown (10YR5/4) with 5% dark yellowish brown (10YR4/6) and 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		498, 496, 494, 492	
							32, 34, ▼ 36, 38	Brown (10YR5/3) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		490, 488, 486, 484	
							40	Brown (10YR5/3), wet, very dense, silty, very fine- to medium-grained SAND with trace small gravel.		482	

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							42			480	
								Brown (10YR5/3), wet, very dense, silty, very fine- to medium-grained SAND with trace small gravel. *[Continued from previous page]*			
							44			478	

End of boring = 45.94 feet

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/9/2015
Finish: 11/10/2015
WEATHER: Sunny, mild, lo-60s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: G06D
Well ID: G06D
Surface Elev: 529.69 ft. MSL
Completion: 96.00 ft. BGS
Station: 5,328.80N
4,925.99E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	SAMPLE: Recov / Total (in) *% Recovery*	SAMPLE: Type	TESTING: *Blows / 6 in* N - Value **RQD**	TESTING: Moisture (%)	TESTING: Dry Den. (lb/ft³)	TESTING: Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1	0/60 *0%*	BD					0–5	Blind drill - see G106 boring log for lithology, sample, and testing data		528, 526, 524	
2	0/60 *0%*	BD					5–10			522, 520	
3	0/60 *0%*	BD					10–15			518, 516	
4	0/60 *0%*	BD					15–20			514, 512, 510	

NOTE(S): G06D installed in borehole.
Lithology, sample, and testing data can be found on G106 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/9/2015
Finish: 11/10/2015
WEATHER: Sunny, mild, lo-60s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler

FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: G06D
Well ID: G06D
Surface Elev: 529.69 ft. MSL
Completion: 96.00 ft. BGS
Station: 5,328.80N
4,925.99E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/60 *0%*	BD					22			508	
5	0/60 *0%*	BD					24, 26, 28	Blind drill - see G106 boring log for lithology, sample, and testing data *[Continued from previous page]*		506, 504, 502	
6	0/60 *0%*	BD					30, 32, 34			500, 498, 496	
7	0/12 *0%*	BD								494	
8							36				
9A	24/24 *100%*	SS	*3-8 12-15* N=20	13		*3.75*		Gray (10YR5/1), moist, stiff, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small gravel.			
								Gray (10YR5/1), wet, loose, very fine- to medium-grained SAND.		492	
10A	14/24 *58%*	SS	*6-11 19-22* N=30	14		*4.00*	38	Gray (10YR5/1), moist, stiff, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small gravel.		490	
							40				

NOTE(S): G06D installed in borehole.
Lithology, sample, and testing data can be found on G106 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/9/2015
Finish: 11/10/2015
WEATHER: Sunny, mild, lo-60s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler

FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: G06D
Well ID: G06D
Surface Elev: 529.69 ft. MSL
Completion: 96.00 ft. BGS
Station: 5,328.80N
4,925.99E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type
11A	24/24 *100%*	SS	*3-7 13-16* N=20	12		*4.50*
12A	24/24 *100%*	SS	*3-7 11-12* N=18	13		*4.50*
13A	24/24 *100%*	SS	*6-8 12-14* N=20	14		*4.50*
14A	3/24 *13%*	SS	*13-14 16-20* N=30	13		
15A	23/24 *96%*	SS	*3-7 11-14* N=18	13		*4.50*
16A	24/24 *100%*	SS	*5-9 11-15* N=20	15		*4.00*
17A	21/24 *88%*	SS	*10-14 12-15* N=26	13		*3.75*
18A	23/24 *96%*	SS	*4-7 10-14* N=17	14		*3.25*
19A	24/24 *100%*	SS	*2-4 9-12* N=13	15		*3.25*
20A	24/24 *100%*	SS	*3-7 10-14* N=17	13		*3.50*

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
42	Gray (10YR5/1), moist, hard, CLAY with some silt, few very fine- to medium-grained sand, and trace small gravel.	488
44	Gray (10YR5/1), moist, hard, SILT with some clay, little very fine- to very coarse-grained sand, and trace small gravel, trace wood fragments.	486
46		484
48		482
50		480
52	Gray (10YR5/1), moist, hard, SILT with some clay, little very fine- to very coarse-grained sand, and trace small to medium gravel, trace wood fragments.	478
54		476
56		474
58		472
60		470

Borehole Detail | Remarks

NOTE(S): G06D installed in borehole.
Lithology, sample, and testing data can be found on G106 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/9/2015
Finish: 11/10/2015
WEATHER: Sunny, mild, lo-60s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler

FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: G06D
Well ID: G06D
Surface Elev: 529.69 ft. MSL
Completion: 96.00 ft. BGS
Station: 5,328.80N
4,925.99E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type
21A	24/24 *100%*	SS	*4-8 11-16* N=19	13		*4.25*
22A	24/24 *100%*	SS	*2-6 10-14* N=16	14		*3.75*
23A	24/24 *100%*	SS	*6-10 16-21* N=26	13		*4.50*
24A	24/24 *100%*	SS	*4-8 11-14* N=19	13		*4.50*
25A	24/24 *100%*	SS	*2-6 8-9* N=14	15		*3.60*
26A	24/24 *100%*	SS	*1-4 8-9* N=12	17		*2.75*
27A	24/24 *100%*	SS	*woh-4 5-8* N=9	18		*2.25*
28A	24/24 *100%*	SS	*woh-3 5-8* N=8	17		*1.50*
29A	24/24 *100%*	SS	*wor-1 5-7* N=6	18		*1.50*
30A	24/24 *100%*	SS	*1-4 5-8* N=9	19		*1.00*

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
to 62	Gray (10YR5/1), moist, hard, SILT with some clay, little very fine- to very coarse-grained sand, and trace small to medium gravel, trace wood fragments. *[Continued from previous page]*	468
62–64	Gray (10YR5/1), moist, hard, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small to medium gravel, trace wood fragments.	466
64–	Gray (10YR5/1), moist, hard, SILT with some clay, little very fine- to very coarse-grained sand, and trace small to medium gravel, trace wood fragments.	464, 462
	Gray (10YR5/1), moist, stiff, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small gravel, trace wood fragments.	460, 458
	Gray (10YR5/1), moist, medium, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small gravel, trace wood fragments.	456, 454, 452
–80	Gray (10YR5/1), moist, soft, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small gravel, trace wood fragments.	450

Depth scale: 62, 64, 66, 68, 70, 72, 74, 76, 78, 80

Borehole Detail | Remarks

NOTE(S): G06D installed in borehole.
Lithology, sample, and testing data can be found on G106 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/9/2015
Finish: 11/10/2015
WEATHER: Sunny, mild, lo-60s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: G06D
Well ID: G06D
Surface Elev: 529.69 ft. MSL
Completion: 96.00 ft. BGS
Station: 5,328.80N
4,925.99E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type
31A	24/24 *100%*	SS	*woh-3* *5-8* N=8	19		*0.75*
32A	24/24 *100%*	SS	*1-4* *6-8* N=10	18		*1.25*
33A	24/24 *100%*	SS	*woh-4* *6-8* N=10	19		*1.00*
34A	24/24 *100%*	SS	*woh-4* *9-10* N=13	16		*1.00*
34B				18		
35A	24/24 *100%*	SS	*4-9* *7-8* N=16	19		*1.25*
36A	24/24 *100%*	SS	*woh-2* *5-6* N=7	20		*0.75*
37A	24/24 *100%*	SS	*woh-2* *5-7* N=7	19		*0.75*
38A	24/24 *100%*	SS	*woh-3* *5-8* N=8	19		*0.75*

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
80–86.7	Gray (10YR5/1), moist, soft, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small gravel, trace wood fragments. *[Continued from previous page]*	
86.7–87.3	Gray (10YR5/1), moist, dense, SILT and very fine-grained SAND with trace very coarse-grained sand.	
87.3–90	Gray (10YR5/1), moist, soft, CLAY with some silt, little very fine- to coarse-grained sand, and trace small gravel, trace wood fragments.	
90–96	Gray (10YR5/1), moist, soft, CLAY with some silt, trace very fine- to coarse-grained sand, and trace small gravel, trace wood fragments.	

Depth scale: 82, 84, 86, 88, 90, 92, 94, 96
Elevation scale: 448, 446, 444, 442, 440, 438, 436, 434

End of boring = 96.0 feet

Remarks

NOTE(S): G06D installed in borehole.
Lithology, sample, and testing data can be found on G106 Field Boring Log.

CIPS NEWTON POWER STATION | BORING G-106 | SHEET 1 of 1

DATE STARTED 8/1/90 | DATE COMPLETED 8/1/90 | LOGGED BY RAB | SURFACE EL. 529.0

DRILLING CONTRACTOR: BROTCKE ENG. | DRILL METHOD: H.S. AUGER

Depth (ft)	N-Value	SOIL/ROCK DESCRIPTION	VAPOR CONCENTRATION (ppm) 10^0 10^1 10^2 10^3	COMMENTS
0	22	Brn. clayey SILT, tr. roots, blocky, dry.		
	20, 18	Brn. sandy silty CLAY, tr. pebbles, sl. moist, blocky.		
	33	Mottled gray & brn. silty sandy CLAY, tr. pebbles, moist.		
10	50, 72	Brn. sandy CLAY, tr. pebbles, vert. med. sand filled fract., so. mn & iron oxid., moist.		
	50	Brn. coarse SAND.		
20	80, 43, 59, 45	Gray brn. sandy silty CLAY, tr. pebbles, coal frag., oxid. vert. fract., hard.		
	9	Gray coarse – v. coarse SAND.		∇
	63	Gray sandy silty CLAY, tr. pebbles, moist.		
30		Coarse – v. coarse SAND grading downward to gravel.		
	39, 33	Gray sandy silty CLAY, tr. pebbles, unweathered.		
		End of Boring = 36.0'		
40				

SOIL/ROCK BORING DATA

HANSON ENGINEERS INCORPORATED

PAC 11-19-90 REVIEWED DATE

RKC 11-19-90 APPROVED DATE

CIPS
NEWTON POWER STATION
NEWTON, ILLINOIS

JOB NO. 89S5008A

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/19/2015
Finish: 10/20/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: G48MG
Well ID: G48MG
Surface Elev: 543.17 ft. MSL
Completion: 77.06 ft. BGS
Station: 9,706.71N
5,052.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
								Grayish brown (10YR5/2), moist, very soft, silty CLAY, trace roots.			
								Grayish brown (10YR5/2) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY, slight trace roots.		542	
							2				
										540	
							4	Brown (10YR5/3) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.			
										538	
							6				
								Gray (10YR5/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.		536	
							8	Gray (10YR5/1) with 40% dark yellowish brown (10YR4/6) mottles, very moist, soft, silty CLAY with trace sand and slight trace gravel.		534	
							10	Yellowish brown (10YR5/4) with 10% gray (10YR6/1) mottles, soft, wet, sandy CLAY with slight trace gravel.			
								Yellowish brown (10YR5/4) with 10% gray (10YR5/1) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.		532	
							12	Dark gray (10YR4/1) with 30% brown (10YR4/3) mottles, slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		530	
							14	Dark gray (10YR4/1) with 20% dark grayish brown (10YR4/2) mottles, slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		528	
							16				
								Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		526	
							18				
										524	
							20				

NOTE(S): G48MG installed in borehole.
Sample and testing data can be found on B-48 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/19/2015
Finish: 10/20/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: G48MG
Well ID: G48MG
Surface Elev: 543.17 ft. MSL
Completion: 77.06 ft. BGS
Station: 9,706.71N
5,052.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							22–25.8	Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel. *[Continued from previous page]*		522, 520, 518	
							25.8–26.4	Dark gray (10YR4/1), moist, firm, silty CLAY with slight trace sand and gravel.			
							26.4–27	Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		516	
							27–30.5	Dark gray (10YR4/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.		514	
							30.5–37.3	Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		512, 510, 508, 506	
							37.3–40	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.		504	

Depth scale: 22, 24, 26, 28, 30, 32, 34, 36, 38, 40

NOTE(S): G48MG installed in borehole.
Sample and testing data can be found on B-48 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/19/2015
Finish: 10/20/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: G48MG
Well ID: G48MG
Surface Elev: 543.17 ft. MSL
Completion: 77.06 ft. BGS
Station: 9,706.71N
5,052.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							40–43.8	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel. *[Continued from previous page]*		502, 500	
							43.8–44.4	Dark gray (10YR4/1), slightly moist, firm, SILT with slight trace sand.			
							44.4–52	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.		498, 496, 494, 492	
							52–52.5	Olive gray (5Y4/2), slightly moist, firm, silty CLAY with slight trace sand and gravel.			
							52.5–54.4	Dark greenish gray (10Y4/1) with 20% greenish gray (10Y6/1) mottles, slightly moist, hard, silty CLAY with trace sand and slight trace gravel.		490	
							54.4–57	Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, hard, silty CLAY with slight trace sand and gravel.		488	
							57–60	Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel.		486, 484	

Depth scale: 42, 44, 46, 48, 50, 52, 54, 56, 58, 60

NOTE(S): G48MG installed in borehole.
Sample and testing data can be found on B-48 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: AEG Newton Power Station
Site: Gypsum Management Facility
Location: Newton, Jasper Co., IL
Project: 07E0150A 3000
DATES: Start: 5/12/2009
Finish: 5/14/2009
WEATHER: Sunny, warm, windy, (mid-60's)

CONTRACTOR: Skinner Limited
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: T. Skinner
Helper: T. Skinner/J. Austin
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: B48
Well ID: n/a
Surface Elev: 542.9 ft. MSL
Completion: 103.5 ft. BGS
Station: 9,703.88N
5,042.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ =
▽ =

Number	Recov / Total (in) % Recovery	Type	Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type
13A	24/24 100%	ss	8-13 17-17 N=30	10.1		12.36 Sh
14A	18/18 100%	ss	7-11 14 N=25	10.1		10.47 Sh
15A	18/18 100%	ss	7-11 13 N=24	9.9		9.31 Sh
16A	24/24 100%	ss	5-7 12-14 N=19	11.4		11.06 Sh
16B				16.3		2.13 BSh
17A	18/18 100%	ss	4-6 11 N=17	11.2		6.79 Sh
18A	18/18 100%	ss	5-9 16 N=25	11.4		9.70 Sh
19A	24/24 100%	ss	4-8 14-19 N=22	10.4		10.47 Sh
20A	18/18 100%	ss	6-13 17 N=30	11.4		
21A	18/18 100%	ss	7-13 19 N=32	11.3		10.28 Sh
22A	24/24 100%	ss	7-12 19-22 N=31	10.3		11.44 Sh
23A	18/18 100%	ss	6-12 19 N=31	11.5		10.86 Sh
24A	18/18 100%	ss	7-11 19 N=30	12.7		5.24 Sh

Depth ft. BGS	Lithologic Description
to ~26	Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel. [Continued from previous page]
~26–26.3	Dark gray (10YR4/1), moist, firm, silty CLAY with slight trace sand and gravel.
~26.3–26.9	Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.
~26.9–30.5	Dark gray (10YR4/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.
~30.5–37.3	Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.
~37.3–40	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.

Depth ft. BGS: 22, 24, 26, 28, 30, 32, 34, 36, 38, 40

Elevation ft. MSL: 522, 520, 518, 516, 514, 512, 510, 508, 506, 504

Borehole Detail | Remarks

NOTE(S): Borehole abandoned using bentonite grout.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/19/2015
Finish: 10/20/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: G48MG
Well ID: G48MG
Surface Elev: 543.17 ft. MSL
Completion: 77.06 ft. BGS
Station: 9,706.71N
5,052.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
								Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel. *[Continued from previous page]*		482	
							62	Light olive gray (5Y5/2), very moist, very soft, sandy CLAY with slight trace gravel.			
							64	Light olive gray (5Y5/2) with 10% greenish gray (5GY5/1) mottles, slightly moist, firm, silty CLAY with trace sand and slight trace gravel.		480	
							66, 68	Greenish gray (10Y5/1) with 10% olive gray (5Y4/2) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel.		478, 476	
								Greenish gray (10G5/1) with 5% dark yellowish brown (10YR4/6) mottles, moist, dense, SILT with slight trace sand.		474	
							70	Dark greenish gray (10GY4/1), slightly moist, very hard, clayey SILT with trace sand and slight trace gravel.		472	
							72	Dark greenish gray (10GY4/1), wet, very dense, silty, medium- to coarse-grained SAND with slight trace gravel.		470	
							74	Dark greenish gray (10GY4/1), wet, very dense, silty, coarse-grained SAND and gravel.		468	
							76	Dark gray (10YR4/1), wet, very dense, silty, medium- to coarse-grained SAND with slight trace gravel.			

End of boring = 77.06 feet

NOTE(S): G48MG installed in borehole.
Sample and testing data can be found on B-48 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: AEG Newton Power Station
Site: Gypsum Management Facility
Location: Newton, Jasper Co., IL
Project: 07E0150A 3000
DATES: Start: 5/12/2009
Finish: 5/14/2009
WEATHER: Sunny, warm, windy, (mid-60's)

CONTRACTOR: Skinner Limited
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: T. Skinner
Helper: T. Skinner/J. Austin
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: B48
Well ID: n/a
Surface Elev: 542.9 ft. MSL
Completion: 103.5 ft. BGS
Station: 9,703.88N
5,042.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ =
▽ =

Number	Recov / Total (in) / % Recovery	Type	Blows / 6 in / N - Value / RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) / Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL
1A	13/18 72%	SS	woh-2 3 N=5	25.8			0–0.5	Grayish brown (10YR5/2), moist, very soft, silty CLAY, trace roots.	542
2A	17/18 94%	SS	2-3 4 N=7	22.0		3.88 Sh	0.5–2.7	Grayish brown (10YR5/2) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY, slight trace roots.	540
3A	17/18 94%	SS	2-4 4 N=8	15.7		1.90 Sh	2.7–6.8	Brown (10YR5/3) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	538
4A	24/24 100%	SS	woh-1 2-3 N=3	20.5		1.78 BSh			
5A	18/18 100%	SS	1-1 2 N=3	22.7		1.40 Sh	6.8–8.0	Gray (10YR5/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	536
6A	24/24 100%	SS	1-2 3-3 N=5	18.3		1.27 Sh	8.0–10.0	Gray (10YR5/1) with 40% dark yellowish brown (10YR4/6) mottles, very moist, soft, silty CLAY with trace sand and slight trace gravel.	534
7-1	23/24 96%	SH					10.0–10.9	Yellowish brown (10YR5/4) with 10% gray (10YR6/1) mottles, soft, wet, sandy CLAY with slight trace gravel.	
7-2				19.9			10.9–12.0	Yellowish brown (10YR5/4) with 10% gray (10YR5/1) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.	532
7-3				15.0					
7-4				19.5					
8A	18/18 100%	SS	8-13 17 N=30	10.2		8.92 Sh	12.0–13.7	Dark gray (10YR4/1) with 30% brown (10YR4/3) mottles, slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	530
9A	18/18 100%	SS	6-12 17 N=29	9.7		5.62 Sh	13.7–15.2	Dark gray (10YR4/1) with 20% dark grayish brown (10YR4/2) mottles, slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	528
10A	24/24 100%	SS	7-14 20-20 N=34	9.0		7.18 Sh	15.2–20	Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	526
11A	18/18 100%	SS	6-14 15 N=29	8.5		9.89 Sh			524
12A	18/18 100%	SS	5-12 14 N=26	10.2		11.25 Sh	20		

Remarks:

NOTE(S): Borehole abandoned using bentonite grout.

FIELD BORING LOG

HANSON

CLIENT: AEG Newton Power Station
Site: Gypsum Management Facility
Location: Newton, Jasper Co., IL
Project: 07E0150A 3000
DATES: Start: 5/12/2009
Finish: 5/14/2009
WEATHER: Sunny, warm, windy, (mid-60's)

CONTRACTOR: Skinner Limited
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: T. Skinner
Helper: T. Skinner/J. Austin
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: B48
Well ID: n/a
Surface Elev: 542.9 ft. MSL
Completion: 103.5 ft. BGS
Station: 9,703.88N 5,042.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ =
▽ =

Number	Recov / Total (in) % Recovery	Type	Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type
25A	24/24 100%	SS	8-12 22-26 N=34	11.5		10.47 Sh
26A	18/18 100%	SS	7-12 18 N=30	11.7		7.76 Sh
27A	18/18 100%	SS	7-15 18 N=33	13.1		
27B				10.9		11.64 Sh
28A	24/24 100%	SS	8-10 16-21 N=26	13.7		
29A	18/18 100%	SS	7-10 16 N=26	14.5		5.82 Sh
30A	18/18 100%	SS	4-9 13 N=22	14.1		2.52 B
31-1	19/24 79%	SH				
31-2				14.0		
31-3						
31-4						
32A	18/18 100%	SS	7-13 19 N=32	12.9		10.28 Sh
32B				12.5		8.92 Sh
33A	18/18 100%	SS	5-10 16 N=26	14.9		2.13 BSh
33B				14.6		6.59 Sh
34A	24/24 100%	SS	6-10 16-19 N=26	15.5		3.88 Sh
35A	18/18 100%	SS	2-7 14 N=21	18.2		1.94 BSh
36A	18/18 100%	SS	3-7 14 N=21	13.8		5.04 BSh

Depth ft. BGS	Lithologic Description
to ~44	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel. *[Continued from previous page]*
~44–44.3	Dark gray (10YR4/1), slightly moist, firm, SILT with slight trace sand.
~44.3–52	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.
~52–52.3	Olive gray (5Y4/2), slightly moist, firm, silty CLAY with slight trace sand and gravel.
~52.3–54.4	Dark greenish gray (10Y4/1) with 20% greenish gray (10Y6/1) mottles, slightly moist, hard, silty CLAY with trace sand and slight trace gravel.
~54.4–57	Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, hard, silty CLAY with slight trace sand and gravel.
~57–60	Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel.

Depth scale (ft. BGS): 42, 44, 46, 48, 50, 52, 54, 56, 58, 60
Elevation scale (ft. MSL): 502, 500, 498, 496, 494, 492, 490, 488, 486, 484

Borehole Detail | Remarks

NOTE(S): Borehole abandoned using bentonite grout.

FIELD BORING LOG

CLIENT: AEG Newton Power Station
Site: Gypsum Management Facility
Location: Newton, Jasper Co., IL
Project: 07E0150A 3000
DATES: Start: 5/12/2009
Finish: 5/14/2009
WEATHER: Sunny, warm, windy, (mid-60's)

CONTRACTOR: Skinner Limited
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: T. Skinner
Helper: T. Skinner/J. Austin
Eng/Geo: S. Suzanna Simpson

HANSON

BOREHOLE ID: B48
Well ID: n/a
Surface Elev: 542.9 ft. MSL
Completion: 103.5 ft. BGS
Station: 9,703.88N
5,042.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
37-1				16.5		1.75 BSh		Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel. *[Continued from previous page]*		
37-2	19/24 *79%*	SH		12.7		3.50 None		Light olive gray (5Y5/2), very moist, very soft, sandy CLAY with slight trace gravel.	482	
37-3				15.0						
37-4							62			
38A	18/18 *100%*	SS	*8-13 15* N=28	14.5		3.10 B		Light olive gray (5Y5/2) with 10% greenish gray (5GY5/1) mottles, slightly moist, firm, silty CLAY with trace sand and slight trace gravel.	480	
39A	18/18 *100%*	SS	*6-9 15* N=24	12.8		5.04 BSh	64		478	
40A	24/24 *100%*	SS	*4-9 13-15* N=22	13.6		5.43 Sh	66	Greenish gray (10Y5/1) with 10% olive gray (5Y4/2) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel.	476	
41A	18/18 *100%*	SS	*12-13 14* N=27	13.2		4.07 BSh	68		474	
42A	16/17 *94%*	SS	*6-32 28/5"*	15.2				Greenish gray (10G5/1) with 5% dark yellowish brown (10YR4/6) mottles, moist, dense, SILT with slight trace sand.		
43A	3/3 *100%*	SS	*60/3"*	15.4			70	Dark greenish gray (10GY4/1), slightly moist, very hard, clayey SILT with trace sand and slight trace gravel.	472	
44A	13/14 *93%*	SS	*28-47 15/2"*	16.7			72	Dark greenish gray (10GY4/1), wet, very dense, silty, medium- to coarse-grained SAND with slight trace gravel.	470	
45A	16/17 *94%*	SS	*31-33 27/5"*	13.6			74	Dark greenish gray (10GY4/1), wet, very dense, silty, coarse-grained SAND and gravel.	468	
46A	12/15 *80%*	SS	*20-38 22/3"*	15.3			76	Dark gray (10YR4/1), wet, very dense, silty, medium- to coarse-grained SAND with slight trace gravel.	466	
47A	18/18 *100%*	SS	*3-11 17* N=28	13.9		5.62 B	78	Dark gray (N4/1), moist, firm, silty CLAY with slight trace sand and gravel.		
48A	17/18 *94%*	SS	*5-10 14* N=24	14.9		5.24 BSh	80	Dark gray (N4/1), slightly moist, firm, silty CLAY with slight trace sand and gravel.	464	

NOTE(S): Borehole abandoned using bentonite grout.

FIELD BORING LOG

HANSON

CLIENT: AEG Newton Power Station
Site: Gypsum Management Facility
Location: Newton, Jasper Co., IL
Project: 07E0150A 3000
DATES: Start: 5/12/2009
Finish: 5/14/2009
WEATHER: Sunny, warm, windy, (mid-60's)

CONTRACTOR: Skinner Limited
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: T. Skinner
Helper: T. Skinner/J. Austin
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: B48
Well ID: n/a
Surface Elev: 542.9 ft. MSL
Completion: 103.5 ft. BGS
Station: 9,703.88N
5,042.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ =
▽ =

Number	Recov / Total (in) % Recovery	Type	Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
49A	24/24 100%	SS	5-7 12-14 N=19	15.5		5.04 BSh	82	Dark gray (N4/1), slightly moist, firm, silty CLAY with slight trace sand and gravel. *[Continued from previous page]*	462	
50A	18/18 100%	SS	4-8 10 N=18	15.4		5.24 BSh	84		460	
51A	18/18 100%	SS	4-9 10 N=19	15.7		5.04 B			458	
52-1 52-2 52-3	18/18 100%	SH		14.3			86		456	
53A	24/24 100%	SS	9-12 21-26 N=33	13.9		6.21 B	88	Dark gray (N4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.		
54A	18/18 100%	SS	6-11 17 N=28	13.8		6.79 Sh	90	Dark gray (N4/1), slightly moist, firm, silty CLAY with slight trace sand and gravel.	454	
55A	24/24 100%	SS	6-12 15-24 N=27	13.6		7.37 Sh	92		452	
56A	18/18 100%	SS	5-8 12 N=20	13.9		3.88 Sh			450	
57A	18/18 100%	SS	5-12 19 N=31	13.4		6.21 Sh	94		448	
58A	24/24 100%	SS	4-18 20-22 N=38	12.5			96	Dark gray (N4/1), very moist, dense, silty, fine- to coarse-grained SAND with slight trace gravel.		
58B				13.4		5.82 BSh		Dark gray (N4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.	446	
59A	16/16 100%	SS	16-33 27/4"	16.0				Dark gray (N4/1), wet, dense, silty, fine- to medium-grained SAND with slight trace gravel.		
59B				15.7		3.69 Sh	98	Dark gray (N4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.		
								Dark gray (N4/1), wet, dense, silty, very fine- to medium-grained SAND with slight trace gravel.	444	
60A	18/18 100%	SS	16-21 15 N=36	12.6				Dark gray (N4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.		
60B							100			

NOTE(S): Borehole abandoned using bentonite grout.

FIELD BORING LOG

HANSON

CLIENT: AEG Newton Power Station
Site: Gypsum Management Facility
Location: Newton, Jasper Co., IL
Project: 07E0150A 3000
DATES: Start: 5/12/2009
Finish: 5/14/2009
WEATHER: Sunny, warm, windy, (mid-60's)

CONTRACTOR: Skinner Limited
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: T. Skinner
Helper: T. Skinner/J. Austin
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: B48
Well ID: n/a
Surface Elev: 542.9 ft. MSL
Completion: 103.5 ft. BGS
Station: 9,703.88N
5,042.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
61A	24/24 100%	SS	7-12 18-25 N=30	13.4		6.59 Sh		Dark gray (N4/1), slightly moist, firm, silty CLAY with slight trace sand and gravel.		442	
62A	17/18 94%	SS	12-18 22 N=40	15.3		3.88 BSh	102	Dark gray (N4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.		440	

EOB = 103.5 feet bgs

NOTE(S): Borehole abandoned using bentonite grout.

CIPS NEWTON POWER STATION	BORING G-106	SHEET 1 of 1

DATE STARTED 8/1/90	DATE COMPLETED 8/1/90	LOGGED BY RAB	SURFACE EL. 529.0
DRILLING CONTRACTOR: BROTCKE ENG.		DRILL METHOD: H.S. AUGER	

Depth (ft)	N-Value	SOIL/ROCK DESCRIPTION	VAPOR CONCENTRATION (ppm) 10^0 10^1 10^2 10^3	COMMENTS	Depth (ft)
0	22	Brn. clayey SILT, tr. roots, blocky, dry.			0
	20, 18	Brn. sandy silty CLAY, tr. pebbles, sl. moist, blocky.			
	33	Mottled gray & brn. silty sandy CLAY, tr. pebbles, moist.			
10	50, 72, 50	Brn. sandy CLAY, tr. pebbles, vert. med. sand filled fract., so. mn & iron oxid., moist.			10
		Brn. coarse SAND.			
20	80, 43, 59, 45	Gray brn. sandy silty CLAY, tr. pebbles, coal frag., oxid. vert. fract., hard.			20
	9	Gray coarse – v. coarse SAND.		▽	
	63	Gray sandy silty CLAY, tr. pebbles, moist.			
30		Coarse – v. coarse SAND grading downward to gravel.			30
	39, 33	Gray sandy silty CLAY, tr. pebbles, unweathered.			
		End of Boring = 36.0'			
40					40

SOIL/ROCK BORING DATA

HANSON ENGINEERS INCORPORATED

PAC REVIEWED 11-19-90 DATE
RKC APPROVED 11-19-90 DATE

CIPS
NEWTON POWER STATION
NEWTON, ILLINOIS

JOB NO. 89S5008A

RAPPS

ENGINEERING and APPLIED SCIENCE

BORING LOG

2387 WEST MONROE - SPRINGFIELD IL 62704 - (217)787-2118

Client: CIPS-NEWTON Project: WELL INSTALLATION Boring No: G202

Drilling Firm: PROFESSIONAL SERVICE IND. Drilling Method: 4-1/4 ID HSA Surface Elev. 537.24

Logged By: MSS Checked By: Date Started: 10-16-96 Completed: 10-16-96

DEPTH	Material Description, Classification System UNIFIED	Sampling: Tube No.	Type	% Rec.	Tests: OVM (ppm)	Qu t/sf PEN	Moist	Comments	Well	DEPTH
0	Fill Material: Drilled through built drilling pad	1	5.0' CME continuous sampler	0		NA	NA			0
5	(10.0)	2		0		NA	NA			5
10	Brown-gray silty SAND (SM) w/clay & trace pebbles (12.5)	3		30		NA, 0.25, NA	moist, wet			10
	Brown-clayey SILT (ML) w/ sand & pebbles (16.5)									
15	Gray silty CLAY (ML-CL) w/pebbles (18.0)	4		30		NA, NA, NA, NA	moist, moist	Very weathered		15
	Brown coarse SAND (SM) w/silt (20.8)									
20	Gray silty CLAY (ML-CL) w/pebbles	5		60		4.5+, 4.5+, 4.5+	dry			20
25		6		100		4.5+, 4.5+, 4.5+, 4.5+	moist, moist			25
30										30

Water Level NA of NA hrs.
Water Level NA of NA hrs.

N 6649.68, E 6587.20

RAPPS

ENGINEERING and APPLIED SCIENCE

BORING LOG

2387 WEST MONROE - SPRINGFIELD IL 62704 - (217)787-2118

Client: CIPS-NEWTON Project: WELL INSTALLATION Boring No: G202
Drilling Firm: PROFESSIONAL SERVICE IND. Drilling Method: 4-1/4 ID HSA Surface Elev. 537.24
Logged By: MSS Checked By: ______ Date Started: 10-8-96 Completed: 10-8-96

Material Description — Classification System UNIFIED

Depth	Material Description	Tube No.	Type	% Rec.	OVM (ppm)	Qu t/sf PEN	Moist	Comments	Well
30–35	Gray silty CLAY (ML-CL) w/pebbles (to 31.3); Brownish Gray CLAY (CH) w/silt (31.3–32.3); Gray silty CLAY (ML-CL) w/pebbles (32.3–36.0)	7	5.0' CME continuous sampler	100		4.5+, 4.5+, 3.0, 4.5+, 4.5+	moist, wet, moist		
35–40	Gray silty SAND (SM) (36.0–36.5); Gray silty CLAY (ML-CL) w/pebbles (from 36.5)	8		100		4.5+, NA, 4.5+, 4.5+, 4.5+	wet, moist		
40–45	Gray silty CLAY (ML-CL) w/pebbles	9		90		4.5+, 4.5+, 4.5+, 4.5+, 4.5+	moist, moist		
45–50		10		100		4.5+, 3.75, 4.5+, 4.5+, 4.5+	moist, moist		
50–55		11		100		4.5+, 4.5+, 4.5+, 4.5+, 4.5+	moist, moist		
55–60		12		100		4.5+, 4.5+, 4.5+, 4.5+, 4.5+	moist, moist		

Water Level NA of NA hrs.
Water Level NA of NA hrs.

N 6649.68, E 6587.20

RAPPS

ENGINEERING and APPLIED SCIENCE

2387 WEST MONROE - SPRINGFIELD IL 62704 - (217)787-2118

BORING LOG

Client: CIPS–NEWTON Project: WELL INSTALLATION Boring No: G202

Drilling Firm: PROFESSIONAL SERVICE IND. Drilling Method: 4–1/4 ID HSA Surface Elev. 537.24

Logged By: MSS Checked By: ____ Date Started: 10–16–96 Completed: 10–16–96

Material Description — Classification System: UNIFIED

Depth	Material Description	Tube No.	Type	% Rec.	OVM (ppm)	Qu t/sf PEN	Moist	Comments
60–61.4	Gray silty CLAY (ML–CL) w/pebbles — 61.4	13	5.0' CME continuous sampler	100		4.5+		
61.4–62.0	Gray GRAVEL (GM) w/silt — 62.0					4.5+	wet	
62.0–69.5	Gray silty CLAY (ML–CL) w/pebbles					4.5+		
						4.5+	wet	
						4.5+		
65		14		100		4.5+		
						4.5+	wet	
						4.5+	wet	
	— 69.5					4.5+		
69.5–70.0	Gray fine sandy SILT (SM)					NA		Blind drill: Augers plugged w/SILT–SAND
70	End Of Boring @70.0'							

Water Level NA of NA hrs.
Water Level NA of NA hrs.

N 6649.68, E 6587.20

RAPPS

BORING LOG

ENGINEERING and APPLIED SCIENCE
2387 WEST MONROE - SPRINGFIELD IL 62704 - (217)787-2118

Client: CIPS-NEWTON   Project: WELL INSTALLATION   Boring No: G203
Drilling Firm: PROFESSIONAL SERVICE IND.   Drilling Method: 4-1/4 ID HSA   Surface Elev. 530.97
Logged By: MSS   Checked By: ______   Date Started: 10-15-96   Completed: 10-15-96

Material Description — Classification System UNIFIED

Depth	Material Description	Tube No.	Type	% Rec.	OVM (ppm)	Qu t/sf PEN	Moist	Comments	Well
0–3.5	Tan, mottled reddish clayey SILT (MH) 3.5	1	5.0' CME continuous sampler	75		4.5+, 4.5+, 4.0, 2.75	dry, moist	Very soft	
3.5–11.5	Gray, mottled brown silty CLAY (MH-CH) w/trace coarse sand & pebbles 11.5	2		100		1.75, 1.0, 0.75, 1.75, 2.5	moist, moist		
11.5–21.5	Brown silty clay (CL-ML) w/coarse sand & pebbles 21.5	3		60		NA, NA, 2.5, 2.75	dry, dry		
		4		70		NA, NA, NA, NA	dry, dry		
21.5–23.0	Brown SAND (SM) w/silt, poorly sorted 23.0	5		70		4.0, 4.0, NA, 4.5+	dry, dry		
23.0–28.0	Gray, mottled brown silty CLAY (CL) w/pebbles 28.0	6		95		4.5+, 4.5+, 4.25, 4.5, 4.5+	moist, dry		
28.0–30	Gray silty CLAY (CL-ML) w/pebbles								

Water Level NA of NA hrs.
Water Level NA of NA hrs.

N 5821.29, E 6113.10

RAPPS

ENGINEERING and APPLIED SCIENCE

2387 WEST MONROE - SPRINGFIELD IL 62704 - (217)787-2118

BORING LOG

Client: CIPS–NEWTON
Project: WELL INSTALLATION
Boring No: G203

Drilling Firm: PROFESSIONAL SERVICE IND.
Drilling Method: 4-1/4 ID HSA
Surface Elev. 530.97

Logged By: MSS
Checked By:
Date Started: 10-15-96
Completed: 10-15-96

Material Description — Classification System: UNIFIED

Depth (ft)	Material Description
30–33.2	Gray silty CLAY (ML–CL) w/pebbles
33.2–34.5	Gray fine grain SAND (SM) w/silt
34.5–36.5	Brownish gray silty CLAY (CL) w/pebbles
36.5–57.5	Gray silty CLAY (ML–CL) w/pebbles
57.5–58.0	Gray fine SAND (SM) w/silt
58.0–60	Gray silty CLAY (ML–CL) w/pebbles

Depth (ft)	Tube No.	Type	% Rec.	OVM (ppm)	Qu t/sf PEN	Moist	Comments	Well
30–35	7	5.0' CME continuous sampler	100		4.5+, 4.5+, 4.5+, 4.5	dry, dry		
35–40	8	5.0' CME continuous sampler	100		4.0, 4.5, 4.5+, 4.5	dry, dry		
40–45	9	5.0' CME continuous sampler	100		4.5+, 4.5+, 4.5+, 4.5+	dry, dry		
45–50	10	5.0' CME continuous sampler	100		4.5+, 4.5+, 4.5+, 4.5+	dry, dry		
50–55	11	5.0' CME continuous sampler	100		4.5+, 4.5+, 4.5+, 4.5+, 4.5+	moist, moist		
55–60	12	5.0' CME continuous sampler	100		4.5+, 4.5+, 4.5+, 4.5+, 4.5+	moist, moist		

Water Level NA of NA hrs.
Water Level NA of NA hrs.

N 5821.29, E 6113.10

RAPPS

ENGINEERING and APPLIED SCIENCE

BORING LOG

2387 WEST MONROE - SPRINGFIELD IL 62704 - (217)787-2118

Client: CIPS-NEWTON Project: WELL INSTALLATION Boring No: G203

Drilling Firm: PROFESSIONAL SERVICE IND. Drilling Method: 4-1/4 ID HSA Surface Elev. 530.97

Logged By: MSS Checked By: ______ Date Started: 10-15-96 Completed: 10-15-96

DEPTH	Material Description (Classification System UNIFIED)	Sampling: Tube No.	Sampling: Type	Sampling: % Rec.	Tests: OVM (ppm)	Tests: Qu t/sf PEN	Tests: Moist	Comments	Well	DEPTH
60	Gray silty CLAY (ML-CL) w/pebbles — 65.6	13	5.0' CME continuous sampler	100		4.5+, 4.5+, 4.0, 4.5, 4.5+	moist, moist			60
65	Gray fine SAND (SM) w/silt — 66.4	14		80		3.0, 4.0, NA	wet, wet			65
	Gray fine SAND-SILT (SM) w/trace gravel — 70.0									
70	Blind Drill: Auger plugged & redrilled to 73.0'									70
	End Of Boring @73.0'									
75										75
80										80
85										85
90										90

Water Level NA of NA hrs.
Water Level NA of NA hrs.

N 5821.29, E 6113.10

Illinois Environmental Protection Agency

Field Boring Log

Site ID No. 0798085001 Federal ID No. ______

Site Name: Newton Power Station Landfill Phase II

Quadrangle: Latona Sec. 27 T. 6N R. 8E

~~UTM (or State~~ Plant ~~Plane)~~ Coord. N. (X) 6208.18 E. (Y) 4417.18

Latitude: ______ Longitude: ______

Boring Location: South side of Area 3

Drilling Equipment: CME 550

County: Jasper

Boring No. B208 Monitoring Well No. G208

Surface Elevation: 533.06 Completion Depth: 95'

Auger Depth: 95' Rotary Depth: NA

Date: Start: 10/11/11 Finish: 10/13/11

Personnel

G - Ken Miller
D - Todd Skinner
H - Justin Lance
H - Scott Walsh

Elev.	Description of Material	Graphic Log	Depth In Feet	Sample No.	Sample Type	Sample Recovery (X)	Penetrometer	N Values (Blow Counts)	OVA or HNU Readings	REMARKS
	Clayey fill									
	Brown mottled gray silty clay (ML-CL); Trace sand & gravel; Moist; Firm			1	5' CS	100 %				
528.06			5	2	5' CS	100 %				
523.06			10	3	5' CS	100 %				
518.06	Gray silty clay (ML-CL); Trace sand & gravel; Dry; Very firm to hard		15	4	5' CS	100 %				
513.06	Brown silty sand (SM) to sand (SW); Some gravel; Moist		20							
	Med. gray silty clay (ML-CL) w/ gravel; Trace sand; Moist; Very firm to hard			5	5' CS	100 %				
508.06			25	6	5' CS	100 %				
503.06			30	7	5' CS	60 %				
498.06			35	8	5' CS	80 %				Fe staining
493.06			40	9	2' SS	100 %				Drove split spoon to remove obstruction
	Gray fine sand (SP); Wet			10	5' CS	30 %				
488.06			45	11	5' CS	100 %				

Illinois Environmental Protection Agency

Field Boring Log

Site ID No. 0798085001 Federal ID No. ______

Site Name: Newton Power Station Landfill Phase II

Quadrangle: Latona Sec. 27 T. 6N R. 8E

~~UTM (or State Plane)~~ Plant Coord. N. (X) 6208.18 E. (Y) 4417.18

Latitude: ° ' " Longitude: ° ' "

Boring Location: South side of Area 3

Drilling Equipment: CME 550

County: Jasper

Boring No. B208 Monitoring Well No. G208

Surface Elevation: 533.06 Completion Depth: 95'

Auger Depth: 95' Rotary Depth: NA

Date: Start: 10/11/11 Finish: 10/13/11

Personnel

G - Ken Miller
D - Todd Skinner
H - Justin Lance
H - Scott Walsh

Elev.	Description of Material	Graphic Log	Depth In Feet	Sample No.	Sample Type	Sample Recovery (X)	Penetrometer	N Values (Blow Counts)	OVA or HNU Readings	REMARKS
	Med. gray silty clay (ML-CL) w/ gravel; Trace sand; Moist; Very firm to hard			12	5' CS	100 %				
478.06			55	13	5' CS	100 %				
473.06			60	14	5' CS	60 %				
468.06			65	15	5' CS	100 %				
463.06	*Softer		70	16	2' SS	100 %				Drove split spoon to remove obstruction
				17	5' CS	100 %				
458.06			75	18	5' CS	100 %				
453.06			80	19	5' CS	100 %				
448.06	Large wood pieces & plant debris		85	20	5' CS	100 %				
443.06			90	21	5' CS	100 %				
438.06	EOB @ 95' BGS		95							

RAPPS

ENGINEERING&APPLIED SCIENCE

BORING LOG

821 S. DURKIN DRIVE-SPRINGFIELD IL 62704 - (217) 787-2118

Client: CIPS **Project:** Newton LF Monitoring Wells **Boring No:** G217

Drilling Firm: PSI **Drilling Method:** 4¼ HSA **Surface Elev:** 535.67

Logged By: MSS **Checked By:** - - - **Date Started:** 8/26/97 **Completed:** 8/26/97

DEPTH	Material Description Classification System (Unified)	Sampling: Tube No.	Sampling: Type	Sampling: % Rec.	Tests: Pocket Pen Qu tsf	Tests: % Moist	Comments	DEPTH
	Brown silty CLAY (CL): Fill Material 3.0	1	5 Foot	100	4.0, 2.0, 3.0, 2.5	dry		
-5-	Gray-Brown silty CLAY (CL) w/coarse sand 8.2	2	Continuous	100	2.0, 2.0, 1.75	mst	Gray, medium SAND (SM) w/silt from 8.2 to 8.6	-5-
	see comments 8.6							
-10-	Gray, mottled brown CLAY (CH-CL) w/silt 14.0	3		100	2.5, 3.0, 4.5+, 4.5+, 4.0	mst		-10-
-15-	Brown silty CLAY (CL) w/pebbles 15.0							-15-
	Gray, mottled Brown silty CLAY (CL) w/ pebbles	4	Sampler	100	4.5+, 4.5+, 4.5+, 4.5+, 4.5+	dry	very weathered	
-20-		5		100	4.5+, 4.5+, 4.5+, 4.5+, 4.5+	dry	End Boring at 25.0	-20-
-25-								-25-

Water Level NA at NA Hrs.
Water Level NA at NA Hrs.

Sheet 1 of 1

Illinois Environmental Protection Agency

Field Boring Log

Site ID No. 0798085001 Federal ID No. ______

Site Name: Newton Power Station Landfill Phase II

Quadrangle: Latona Sec. 27 T. 6N R. 8E

~~UTM (or State~~ Plant ~~Plane)~~ Coord. N. (X) 5322.24 E. (Y) 3989.08

Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Boring Location: South side of Area 3

Drilling Equipment: CME 550

County: Jasper

Boring No. B222 Monitoring Well No. G222

Surface Elevation: 532.12 Completion Depth: 80'

Auger Depth: 80' Rotary Depth: NA

Date: Start: 10/24/11 Finish: 10/25/11

Personnel

G - Ken Miller
D - Todd Skinner
H - Justin Lance
H - Tim Skinner

Elev.	Description of Material	Graphic Log	Depth In Feet	Sample No.	Sample Type	Sample Recovery (X)	Penetrometer	N Values (Blow Counts)	OVA or HNU Readings	REMARKS
527.12			5							
522.12			10							
517.12			15							
512.12			20							
507.12	Blind drill to 50'		25							
502.12			30							
497.12			35							
492.12			40							
487.12			45							

Illinois Environmental Protection Agency

Field Boring Log

Site ID No. 0798085001 Federal ID No. ______

Site Name: Newton Power Station Landfill Phase II

Quadrangle: Latona Sec. 27 T. 6N R. 8E

~~UTM (or State~~ Plant ~~Plane)~~ Coord. N. (X) 5322.24 E. (Y) 3989.08

Latitude: ___ ° ___ ' ___ " Longitude: ___ ° ___ ' ___ "

Boring Location: South side of Area 3

Drilling Equipment: CME 550

County: Jasper

Boring No. B222 Monitoring Well No. G222

Surface Elevation: 532.12 Completion Depth: 80'

Auger Depth: 80' Rotary Depth: NA

Date: Start: 10/24/11 Finish: 10/25/11

Personnel

G - Ken Miller
D - Todd Skinner
H - Justin Lance
H - Tim Skinner

Elev.	Description of Material	Graphic Log	Depth In Feet	Sample No.	Sample Type	Sample Recovery (X)	Penetrometer	N Values (Blow Counts)	OVA or HNU Readings	REMARKS
	Dk. gray to black silt (ML); Thinly laminated; Fissile; Hard									
	Med. gray silty clay (ML-CL) w/ gravel; Trace sand; Moist; Firm to hard			1	5' CS	100 %				
477.12			55	2	5' CS	100 %				
472.12			60	3	5' CS	100 %				
467.12	Coarse sand (SP) w/ gravel; Wet		65	4	5' CS	30 %				Poor recovery
462.12	Med. gray silty clay (ML-CL) w/ gravel; Trace sand; Moist; Firm to hard		70	5	2' SS	100 %				Drove split spoon to remove obstruction
				6	5' CS	100 %				
457.12			75	7	5' CS	100 %				
452.12	EOB @ 80' BGS		80							

Illinois Environmental Protection Agency

Field Boring Log

County: Jasper

Site ID No. 0798085001 Federal ID No. ____

Boring No. B224 Monitoring Well No. G224

Site Name: Newton Power Station Landfill Phase II

Surface Elevation: 532.26 Completion Depth: 74'

Quadrangle: Latona Sec. 26 T. 6N R. 8E

Auger Depth: 74' Rotary Depth: NA

~~UTM (or State~~ Plant ~~Plane)~~ Coord. N. (X) 6976.66 E. (Y) 6067.30

Date: Start: 10/04/11 Finish: 10/04/11

Latitude: ° ' " Longitude: ° ' "

Boring Location: South side of Area 3

Drilling Equipment: Diedrich D-50

Personnel:
G - Ken Miller
D - Tim Fuhl
H - Eric Sievers
H - Clifford Ohman

Elev.	Description of Material	Graphic Log	Depth In Feet	Sample No.	Sample Type	Sample Recovery (X)	Penetrometer	N Values (Blow Counts)	OVA or HNU Readings	REMARKS
	Brown silty clay (ML-CL); Moist; Firm			1	5' CS	10 %				
527.26	Reddish brown mottled gray silty clay (ML-CL); Trace sand & gravel; Moist; Firm		5	2	5' CS	90 %				
522.26	*Softer, less mottling		10	3	5' CS	10 %				
517.26	Dark gray silty clay (ML-CL) w/ sand; Moist to wet; Soft		15	4	5' CS	60 %				Plant debris
	Medium to coarse sand (SP); Wet									
512.26	Brown mottled gray silty clay (ML-CL) w/ sand & gravel; Dry; Hard		20	5	5' CS	100 %				
507.26	Med. gray silty clay (ML-CL) w/ gravel; Trace sand; Dry to moist; Hard		25	6	5' CS	60 %				
502.26	No recovery		30	7	5' CS	0 %				
497.26			35	8	5' CS	0 %				Hard drilling
492.26			40	9	5' CS	0 %				
487.26			45	10	2' SS	0 %				Drove split spoons to remove possible obstruction
				11	2' SS	0 %				
				12	2' SS	100 %				

Illinois Environmental Protection Agency

Field Boring Log

Site ID No. 0798085001 Federal ID No. ________

Site Name: Newton Power Station Landfill Phase II

Quadrangle: Latona Sec. 26 T. 6N R. 8E

~~UTM (or State~~ Plant ~~Plane)~~ Coord. N. (X) 6976.66 E. (Y) 6067.30

Latitude: ___ ° ___ ' ___ " Longitude: ___ ° ___ ' ___ "

Boring Location: South side of Area 3

Drilling Equipment: CME 550

County: Jasper

Boring No. B224 Monitoring Well No. G224

Surface Elevation: 532.26 Completion Depth: 74'

Auger Depth: 74' Rotary Depth: NA

Date: Start: 10/04/11 Finish: 10/04/11

Personnel:
G - Ken Miller
D - Tim Fuhl
H - Eric Sievers
H - Clifford Ohman

Elev.	Description of Material	Graphic Log	Depth In Feet	Sample No.	Sample Type	Sample Recovery (X)	Penetrometer	N Values (Blow Counts)	OVA or HNU Readings	REMARKS
	Med. gray silty clay (ML-CL) w/ gravel; Trace sand; Moist; Very firm to hard			13	5' CS	100 %				
477.26			55	14	5' CS	100 %				
472.26			60	15	5' CS	100 %				
467.26	Gray silt (ML), silty sand (SM) and sand (SP); Wet *w/ gravel		65	16	5' CS	60 %				Large wood pieces
462.26	No recovery		70	17	5' CS	0 %				Trace sand & gravel in tube; Harder drilling @ 72.5'
457.26	EOB @ 74' BGS		75							

HALEY ALDRICH

TEST BORING REPORT

Boring No. HAB-N-1

Project	Ash Pond, Newton, Illinois
Client	Dynegy
Contractor	CEC & Strata

File No.	129673-005
Sheet No.	1 of 1
Start	25 April 2017
Finish	26 April 2017
Driller	J. Cooley
H&A Rep.	J. Gerger
Elevation	535.0
Datum	
Location	See Plan

	Casing	Sampler	Barrel
Type		SS	--
Inside Diameter (in.)		1.375	--
Hammer Weight (lb)		140	-
Hammer Fall (in.)		30	-

Drilling Equipment and Procedures

Rig Make & Model: Diedrich D-25
Bit Type: Cutting Head
Drill Mud:
Casing:
Hoist/Hammer: /
PID Make & Model: N/A

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
40						Water from 0 to 41.5 ft (El. 535)
	WOR WOR WOR WOR	SS1 6	41.5 43.5	493.5 41.5		Very loose gray SILT/FLYASH -FILL-
	WOR WOR WOR WOR	SS2 10	43.5 45.5			
45	WOR WOR 2 2	SS3 24	45.5 47.5	490.0 45.0	CL	Very soft black CLAY (CL)
				488.5 46.5	CL	Very soft gray CLAY (CL), with trace roots (very fine small roots)
	2 1 2 3	SS4 24	47.5 49.5	486.7 48.3	CL	Very soft gray and brown mottled silty CLAY (CL), trace sand, moist
50	WOH WOH 1 3	SS5 22	49.5 51.5			
	1 3 3 2	SS6 20	51.5 53.5			Similar to above, except not as soft, trace fine gravel
	2 5 5 8	SS7 21	53.5 55.5			
55	2 1 1 1	SS8 21	55.5 57.5	480.0 55.0	SP-SC	Medium dense brown coarse SAND (SP-SC), moist
						Similar to above, except gray
				477.5 57.5		BOTTOM OF EXPLORATION 57.5 FT
60						

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft) 16.0
Rock Cored (ft) 0.0
Samples 8SS

Boring No. HAB-N-1

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 WATER 129673-005_HA-LIB07-1-CLE2.GLB HA-TB+CORE+WELL-07-1.GDT \\HALEYALDRICH.COM\SHARE\POR_COMMON\GINT\OHIO OFFICES\129673-005\129673-005_TB.GPJ 10 May 17

HALEY ALDRICH

TEST BORING REPORT

Boring No. HAB-N-2

Project Ash Pond, Newton, Illinois
Client Dynegy
Contractor CEC & Strata

File No. 129673-005
Sheet No. 1 of 1
Start 27 April 2017
Finish 27 April 2017
Driller J. Cooley
H&A Rep. J. Gerger
Elevation 535.2
Datum
Location See Plan

	Casing	Sampler	Barrel
Type		SS	--
Inside Diameter (in.)		1.375	--
Hammer Weight (lb)		140	-
Hammer Fall (in.)		30	-

Drilling Equipment and Procedures
Rig Make & Model: Diedrich D-25
Bit Type: Roller Bit
Drill Mud:
Casing:
Hoist/Hammer: /
PID Make & Model: N/A

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
40						Water from 0 to 41.0 ft (El. 535.2) [2.2 ft on Dynegy water level gauge]
	WOR WOR WOR WOR	SS1 4	41.0 43.0	494.2 41.0		Dark gray SILT/ASH, wet -FILL-
	WOR WOR WOR WOR	SS2 4	43.0 45.0			
45	WOR WOR WOR WOR	SS3 12	45.0 47.0			
				488.9 46.3	CL	Very soft black CLAY (CL)
				488.5 46.7	CL	Similar to above, except gray/light gray
	WOR WOR WOR WOR	SS4 15	47.0 49.0	488.2 47.0	CL	Very soft dark gray CLAY (CL), trace sand, moist, organics present
	WOR WOR 1 1	SS5 12	49.0 51.0			
50				485.2 50.0	CL	Dark brown sandy CLAY (CL), trace organics
	WOH 2 3 2	SS6 16	51.0 53.0	484.2 51.0	SP-SC	Brown medium clayey SAND (SP-SC)
				483.2 52.0	SC	Brown clayey SAND (SC)
				482.2 53.0		BOTTOM OF EXPLORATION 53.0 FT
55						
60						

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 12.0
Rock Cored (ft) 0.0
Samples 6SS

Boring No. HAB-N-2

Field Tests:
Dilatancy: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. HAB-N-4

Project	Ash Pond, Newton, Illinois	File No.	129673-005
Client	Dynegy	Sheet No.	1 of 1
Contractor	CEC & Strata	Start	27 April 2017
		Finish	27 April 2017
		Driller	J. Cooley
		H&A Rep.	J. Gerger
		Elevation	535.2
		Datum	
		Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		SS	--	Rig Make & Model: Diedrich D-25
Inside Diameter (in.)		1.375	--	Bit Type: / Drill Mud:
Hammer Weight (lb)		140	-	Casing:
Hammer Fall (in.)		30	-	Hoist/Hammer: / / PID Make & Model: N/A

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
						Water from 0 to 40.5 ft (El. 535.2) [2.2 ft on Dynegy water level gauge]
40	WOR WOR WOR WOR	SS1 4	40.5 42.5	494.7 40.5		Dark gray ASH -FILL-
	WOR WOR WOR WOR	SS2 8	42.5 44.5			Similar to above
45	WOR WOR WOR WOR	SS3 19	44.5 46.5			Similar to above, except darker black in color
	WOR WOR WOR WOR	SS4 4	46.5 48.5	488.7 46.5	CL	Soft black CLAY (CL)
				488.2 47.0	ML	Gray clayey SILT (ML)
	WOR WOR WOR WOR	SS5 24	48.5 50.5	486.7 48.5	SM	Gray silty SAND (SM), trace organics and very fine gravel
50				485.7 49.5	CL	Medium dense grayish-brown mottled sandy CLAY (CL), moist
	2 2 3 3	SS6 10	50.5 52.5			
	2 3 2 3	SS7 24	52.5 54.5	482.0 53.3	SP	Gray-brown SAND (SP)
				481.7 53.5	CL	Dense grayish-brown silty CLAY (CL), trace organics
55				480.7 54.5		BOTTOM OF EXPLORATION 54.5 FT

Water Level Data						Sample ID	Well Diagram	Summary
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water	O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample	Riser Pipe Screen Filter Sand Cuttings Grout Concrete Bentonite Seal	Overburden (ft) 14.0 Rock Cored (ft) 0.0 Samples 7SS **Boring No.** HAB-N-4

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. HAB-N-5

Project	Ash Pond, Newton, Illinois
Client	Dynegy
Contractor	CEC & Strata

File No.	129673-005
Sheet No.	1 of 1
Start	27 April 2017
Finish	27 April 2017
Driller	J. Cooley
H&A Rep.	J. Gerger
Elevation	535.2
Datum	
Location	See Plan

	Casing	Sampler	Barrel
Type		SS	--
Inside Diameter (in.)		1.375	--
Hammer Weight (lb)		140	-
Hammer Fall (in.)		30	-

Drilling Equipment and Procedures

Rig Make & Model: Diedrich D-25
Bit Type: Roller Bit
Drill Mud:
Casing:
Hoist/Hammer: /
PID Make & Model: N/A

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
						Water from 0 to 34.5 ft (El. 535.2) [2.2 ft on Dynegy water level gauge]
35	WOR WOR WOR WOR	SS1 11	34.5 36.5	500.7 34.5		Gray SILT/ASH -FILL-
	WOR WOR WOR 1	SS2 22	36.5 38.5	497.7 37.5	CL	Black CLAY (CL)
				497.2 38.0	CL	Medium stiff grayish-brown sandy CLAY (CL), trace gravel, moist
	2 4 3 2	SS3 13	38.5 40.5	496.2 39.0	CL	Stiff gray sandy CLAY (CL), trace gravel, moist
40				495.2 40.0	CL	Hard brown sandy CLAY (CL), trace gravel, moist
	1 3 3 4	SS4 16	40.5 42.5			
	2 2 4 6	SS5 21	42.5 44.5	492.2 43.0	SP	Well graded coarse brown SAND (SP)
				491.7 43.5	CL	Stiff brown sandy CLAY (CL), trace gravel, moist
				490.7 44.5		BOTTOM OF EXPLORATION 44.5 FT
45						
50						

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 10.0
Rock Cored (ft) 0.0
Samples 5SS

Boring No. HAB-N-5

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 WATER 129673-005_HA-LIB07-1-CLE2.GLB HA-TB+CORE+WELL-07-1.GDT \\HALEYALDRICH.COM\SHARE\POR_COMMON\GINT\OHIO OFFICES\129673-005\129673-005_TB.GPJ 10 May 17

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Generating Co.
Site: Newton Power Station
Location: 6725 N 500th St, Newton, IL 62448
Project: 16E0044A
DATES: Start: 9/25/2017
Finish: 9/26/2017
WEATHER: Sunny, warm (lo-80's)

CONTRACTOR: Bulldog Drilling
Rig mfg/model: CME-750 ATV Drill
Drilling Method: Mud Rotary w/split spoon

FIELD STAFF: Driller: J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

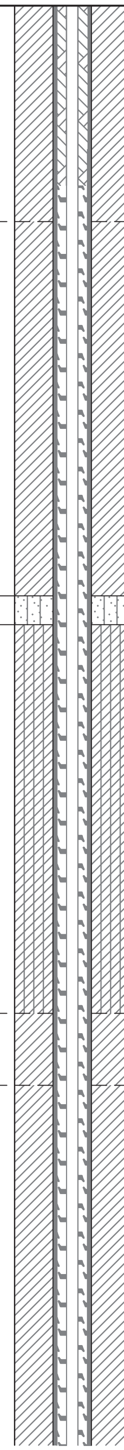
BOREHOLE ID: R217D
Well ID: R217D
Surface Elev: 535.91 ft. MSL
Completion: 65.24 ft. BGS
Station: 7,126.90N
6,712.16E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

SAMPLE			TESTING			
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type
1	0/60 *0%*	BD				
2	0/60 *0%*	BD				
3	0/60 *0%*	BD				
4	0/60 *0%*	BD				

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	FILL - Brown, silty CLAY.	
2		534
4		532
	Gray-brown, silty CLAY with coarse sand.	
6		530
8		528
	Gray, medium SAND with silt.	
10		526
	Gray, mottled brown, CLAY with silt.	
12		524
14		522
	Brown, silty CLAY with pebbles.	
16		520
	Gray, mottles brown, silty CLAY with pebbles.	
18		518
20		516

Borehole Detail



Remarks: 6"Ø permanent, PVC casing set to 20'

NOTE(S): R217D drilled 15.5 feet west of G217D.
Borehole reamed to 6" diameter to set well.
Lithology description to 25 ft. taken from G217 boring log as prepared by Rapps Engineering & Applied Science (1997).

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Generating Co.
Site: Newton Power Station
Location: 6725 N 500th St, Newton, IL 62448
Project: 16E0044A
DATES: Start: 9/25/2017
Finish: 9/26/2017
WEATHER: Sunny, warm (lo-80's)

CONTRACTOR: Bulldog Drilling
Rig mfg/model: CME-750 ATV Drill
Drilling Method: Mud Rotary w/split spoon

FIELD STAFF: Driller: J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

BOREHOLE ID: R217D
Well ID: R217D
Surface Elev: 535.91 ft. MSL
Completion: 65.24 ft. BGS
Station: 7,126.90N
6,712.16E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
5	0/60 *0%*	BD					22, 24	Gray, mottles brown, silty CLAY with pebbles. *[Continued from previous page]*		514, 512	
6A	24/24 *100%*	SS	*12-19 27-34* N=46	11.2			26	Gray (10YR5/1), moist, hard, SILT with some clay, few very fine- to very coarse-grained sand, and trace small gravel.		510	
7A	22/24 *92%*	SS	*10-24 31-35* N=55	9.8			28			508	
8A	24/24 *100%*	SS	*9-16 24-25* N=40	11.2			30			506	
9A	24/24 *100%*	SS	*11-16 28-28* N=44	11.0			32			504	
10A	24/24 *100%*	SS	*11-16 24-32* N=40	11.5			34	Gray (10YR5/1), moist, hard, SILT with some clay, few very fine- to very coarse-grained sand, and trace small to medium gravel.		502	
11A	24/24 *100%*	SS	*11-17 26-34* N=43	15.0			36			500	
12A	24/24 *100%*	SS	*10-17 27-34* N=44	11.8			38			498	
	24/24		*9-23*				40	Gray (10YR5/1), moist, hard, CLAY, with some silt, few very fine- to very coarse-grained sand, and trace small to medium gravel.		496	

NOTE(S): R217D drilled 15.5 feet west of G217D.
Borehole reamed to 6" diameter to set well.
Lithology description to 25 ft. taken from G217 boring log as prepared by Rapps Engineering & Applied Science (1997).

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Generating Co.
Site: Newton Power Station
Location: 6725 N 500th St, Newton, IL 62448
Project: 16E0044A
DATES: Start: 9/25/2017
Finish: 9/26/2017
WEATHER: Sunny, warm (lo-80's)

CONTRACTOR: Bulldog Drilling
Rig mfg/model: CME-750 ATV Drill
Drilling Method: Mud Rotary w/split spoon
FIELD STAFF: Driller: J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

BOREHOLE ID: R217D
Well ID: R217D
Surface Elev: 535.91 ft. MSL
Completion: 65.24 ft. BGS
Station: 7,126.90N
6,712.16E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
13A	*100%*	SS	*33-35* N=56	10.9				Gray (10YR5/1), moist, hard, CLAY, with some silt, few very fine- to very coarse-grained sand, and trace small to medium gravel. *[Continued from previous page]*			
14A	24/24 *100%*	SS	*8-18 22-29* N=40	13.1			42			494	
15A	24/24 *100%*	SS	*9-15 17-22* N=32	14.1			44			492	
16A	24/24 *100%*	SS	*6-15 20-30* N=35	13.2			46			490	
17A	24/24 *100%*	SS	*8-14 20-25* N=34	14.8			48			488	
18A	24/24 *100%*	SS	*5-12 17-20* N=29	14.9			50	Gray (10YR5/1), moist, hard, CLAY, with some silt, few very fine- to very coarse-grained sand, and trace small to medium gravel, trace wood fragments.		486	
19A	6/24 *25%*	SS	*9-14 19-24* N=33	23.3			52			484	
20A	24/24 *100%*	SS	*5-11 15-20* N=26	16.6			54	Olive gray (5Y4/2) with 10% gray (10YR5/1) mottles, moist, hard, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small to medium gravel.		482	
21A	24/24 *100%*	SS	*6-10 14-20* N=24	19.7			56			480	
22A	24/24 *100%*	SS	*7-10 12-14* N=22	19.3			58			478	
23A	24/24		*5-8*	22.1			60			476	

NOTE(S): R217D drilled 15.5 feet west of G217D.
Borehole reamed to 6" diameter to set well.
Lithology description to 25 ft. taken from G217 boring log as prepared by Rapps Engineering & Applied Science (1997).

FIELD BORING LOG

CLIENT: Illinois Power Generating Co.
Site: Newton Power Station
Location: 6725 N 500th St, Newton, IL 62448
Project: 16E0044A
DATES: Start: 9/25/2017
Finish: 9/26/2017
WEATHER: Sunny, warm (lo-80's)

CONTRACTOR: Bulldog Drilling
Rig mfg/model: CME-750 ATV Drill
Drilling Method: Mud Rotary w/split spoon
FIELD STAFF: Driller: J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

HANSON

BOREHOLE ID: R217D
Well ID: R217D
Surface Elev: 535.91 ft. MSL
Completion: 65.24 ft. BGS
Station: 7,126.90N
6,712.16E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
23B	*100%*	SS	*16-20* N=24	18.8				Gray (10YR5/1), wet, dense, very fine- to very coarse-grained SAND, with little silt and trace small gravel.			
24A				19.5							
24B	24/24 *100%*	SS	*8-9* *22-27* N=31	14.6			62	Yellowish brown (10YR5/6), moist, hard, SILT with some clay, little very fine- to very coarse-grained sand, and trace small gravel.		474	
25A	24/24 *100%*	SS	*13-19* *27-35* N=46	13.2			64	Gray (10YR5/1), moist, hard, SILT with some clay, little very fine- to very coarse-grained sand, and trace small gravel.		472	
	0/3 *0%*	BD									

End of Boring = 65.24 feet

NOTE(S): R217D drilled 15.5 feet west of G217D.
Borehole reamed to 6" diameter to set well.
Lithology description to 25 ft. taken from G217 boring log as prepared by Rapps Engineering & Applied Science (1997).

RAPPS

ENGINEERING&APPLIED SCIENCE

BORING LOG

821 S. DURKIN DRIVE-SPRINGFIELD IL 62704 - (217) 787-2118

Client: CIPS **Project:** Newton LF Monitoring Wells **Boring No:** G217

Drilling Firm: PSI **Drilling Method:** 4¼ HSA **Surface Elev:** 535.67

Logged By: MSS **Checked By:** - - - **Date Started:** 8/26/97 **Completed:** 8/26/97

DEPTH	Material Description Classification System (Unified)	Sampling			Tests		Comments	DEPTH
		Tube No.	Type	% Rec.	Pocket Pen Qu tsf	% Moist		
			5		4.0			
	Brown silty CLAY (CL): Fill Material				2.0			
	3.0	1	F	100		dry		
			o		3.0			
-5-			o		2.5			-5-
	Gray-Brown silty CLAY (CL) w/coarse sand		t		2.0			
	8.2	2	C	100	2.0	mst	Gray, medium SAND (SM) w/silt from 8.2 to 8.6	
	see comments 8.6		o					
-10-			n		1.75			-10-
			t		2.5			
	Gray, mottled brown CLAY (CH-CL) w/silt		i		3.0			
		3	n	100	4.5+	mst		
	14.0		o		4.5+			
-15-	Brown silty CLAY (CL) w/pebbles 15.0		u		4.0			-15-
			s		4.5+			
					4.5+			
		4	S	100	4.5+	dry	very weathered	
			a		4.5+			
-20-	Gray, mottled Brown silty CLAY (CL) w/ pebbles		m		4.5+			-20-
			p		4.5+			
			l		4.5+			
		5	e	100	4.5+	dry		
			r		4.5+			
-25-					4.5+		End Boring at 25.0	-25-

Water Level NA at NA Hrs.
Water Level NA at NA Hrs.

Sheet 1 of 1

WELL CONSTRUCTION LOGS

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Newton Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: APW11
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 55' 58.1" Long. -88° 16' 31.6" or St. Plane 825,195 ft. N, 1,000,718 ft. E. Ⓔ/W	
Facility ID		Date Well Installed: 01/23/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 25, T. 6 N, R. 8 ☒ E ☐ W	Well Installed By: (Person's Name and Firm): Dave Gordon, Cascade Drilling
Distance from Waste/Source ____ ft. | State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known | Gov. Lot Number	

A. Protective pipe, top elevation 539.11 ft. (NAVD88)

B. Well casing, top elevation 538.63 ft. (NAVD88)

C. Land surface elevation 536.0 ft. (NAVD88)

D. Surface seal, bottom 534.0 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Potable Plant Water

E. Bentonite seal, top 481.0 ft. (NAVD88) or 55.0 ft.

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

G. Filter pack, top 478.0 ft. (NAVD88) or 58.0 ft.

H. Screen joint, top 476.0 ft. (NAVD88) or 60.0 ft.

I. Well bottom 471.0 ft. (NAVD88) or 65.0 ft.

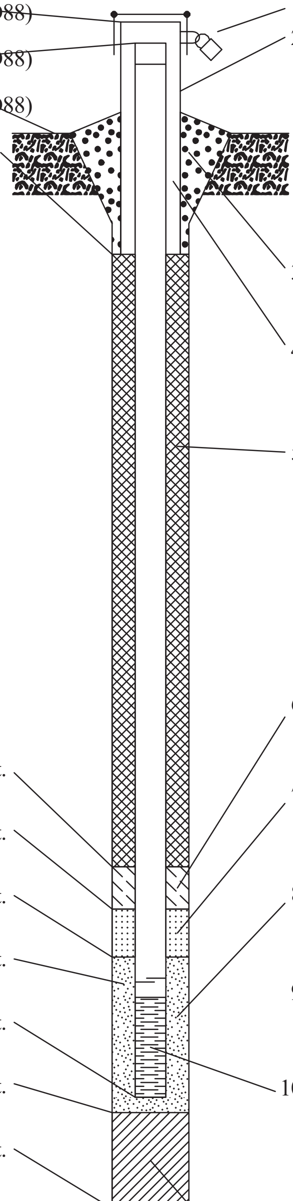
J. Filter pack, bottom 469.0 ft. (NAVD88) or 67.0 ft.

K. Borehole, bottom 436.0 ft. (NAVD88) or 100.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 9.250 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. Not Applicable
   b. Volume added 0 ft³
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 1.614 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 Johnson Screens
   c. Slot size: 0.010 in.
   d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐ Benoite Slurry Grout Other ☒

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

Date Modified: 5/3/2021

Signature [signature]

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Newton Power Station	______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 55' 47.1" Long. -88° 16' 19.4" or	APW12
Facility ID	St. Plane 824,081 ft. N, 1,001,683 ft. E. (E)/W	Date Well Installed 01/21/2021
Type of Well Well Code 72/dp	Section Location of Waste/Source ____ 1/4 of ____ 1/4 of Sec. 25, T. 6 N, R. 8 ☒ E ☐ W	Well Installed By: (Person's Name and Firm) Russ Gordon Cascade Drilling
Distance from Waste/ Source ft. — State IL	Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known Gov. Lot Number	

A. Protective pipe, top elevation 546.68 ft. (NAVD88)

B. Well casing, top elevation 546.29 ft. (NAVD88)

C. Land surface elevation 543.3 ft. (NAVD88)

D. Surface seal, bottom 541.3 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis, if required):
Potable Plant Water

E. Bentonite seal, top 541.3 ft. (NAVD88) or 2.0 ft.

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

G. Filter pack, top 525.3 ft. (NAVD88) or 18.0 ft.

H. Screen joint, top 523.3 ft. (NAVD88) or 20.0 ft.

I. Well bottom 513.3 ft. (NAVD88) or 30.0 ft.

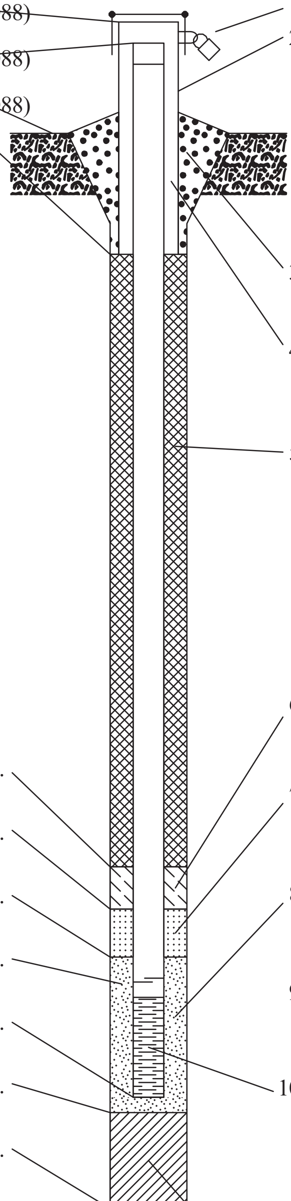
J. Filter pack, bottom 511.3 ft. (NAVD88) or 32.0 ft.

K. Borehole, bottom 456.3 ft. (NAVD88) or 87.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 0.000 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ______ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. Not Applicable
   b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 2.487 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒
   Flush threaded PVC schedule 80 ☐
   Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐
    Benoite Slurry Grout Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

Signature [signature]

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Newton Power Station	Local Grid Location of Well: ____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	Well Name: APW13
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 55' 32.4" Long. -88° 16' 27.9" or	
Facility ID	St. Plane 822,591 ft. N, 1,001,013 ft. E. (E)/W	Date Well Installed: 01/23/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____1/4 of ____1/4 of Sec. 25, T. 6 N, R. 8 ☒ E ☐ W	Well Installed By: (Person's Name and Firm) Russ Gordon, Cascade Drilling
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☐ Downgradient; n ☐ Not Known / Gov. Lot Number	

A. Protective pipe, top elevation 538.33 ft. (NAVD88)

B. Well casing, top elevation 537.99 ft. (NAVD88)

C. Land surface elevation 535.2 ft. (NAVD88)

D. Surface seal, bottom 533.2 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Potable Plant Water

E. Bentonite seal, top 481.2 ft. (NAVD88) or 54.0 ft.

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

G. Filter pack, top 479.2 ft. (NAVD88) or 56.0 ft.

H. Screen joint, top 476.7 ft. (NAVD88) or 58.5 ft.

I. Well bottom 471.7 ft. (NAVD88) or 63.5 ft.

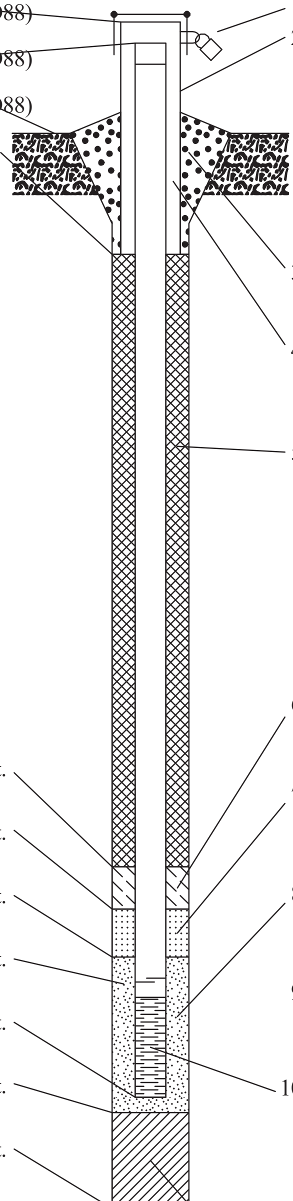
J. Filter pack, bottom 470.2 ft. (NAVD88) or 65.0 ft.

K. Borehole, bottom 445.2 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: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
   d. ____% Bentonite . . . Bentonite-cement grout ☐
   e. 9.076 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. Not Applicable
   b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 1.604 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
   b. Manufacturer Johnson Screens
   c. Slot size: 0.010 in.
   d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐ Formation Materials Other ☒

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

Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Newton Power Station	Local Grid Location of Well: ____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	Well Name: APW14
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 55' 26.6" Long. -88° 16' 40.8" or	
Facility ID	St. Plane 822,006 ft. N, 999,996 ft. E. (E)/W	Date Well Installed: 01/23/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____1/4 of ____ 1/4 of Sec. 25, T. 6 N, R. 8 ☒ E ☐ W	Well Installed By: (Person's Name and Firm) Adam Jochimsen, Cascade Drilling
Distance from Waste/Source ft. / State IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known / Gov. Lot Number	

A. Protective pipe, top elevation 526.63 ft. (NAVD88)

B. Well casing, top elevation 526.29 ft. (NAVD88)

C. Land surface elevation 523.9 ft. (NAVD88)

D. Surface seal, bottom 521.9 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Potable Plant Water

E. Bentonite seal, top 478.9 ft. (NAVD88) or 45.0 ft.

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

G. Filter pack, top 475.9 ft. (NAVD88) or 48.0 ft.

H. Screen joint, top 473.9 ft. (NAVD88) or 50.0 ft.

I. Well bottom 468.9 ft. (NAVD88) or 55.0 ft.

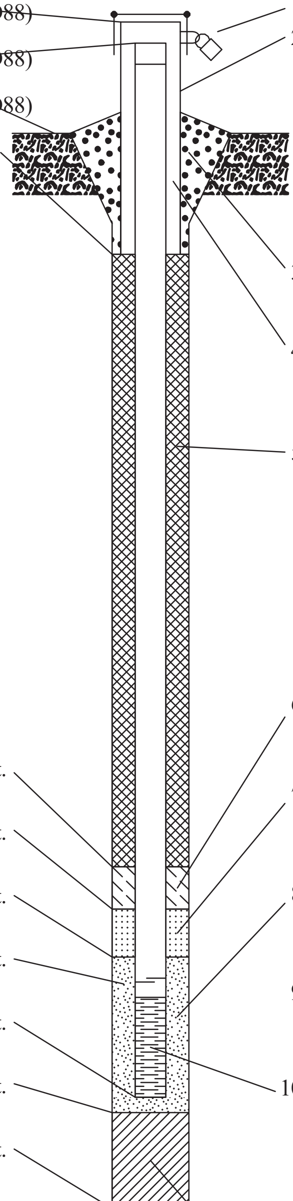
J. Filter pack, bottom 466.9 ft. (NAVD88) or 57.0 ft.

K. Borehole, bottom 428.9 ft. (NAVD88) or 95.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. 9.1 Lbs/gal mud weight . . . Bentonite slurry ☒
   d. ____% Bentonite . . . Bentonite-cement grout ☐
   e. 7.505 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. Not Applicable
   b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 1.614 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐ Benoite Slurry Grout Other ☒

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

Date Modified: 5/3/2021

Signature [signature]

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name Newton Power Station	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° 55' 17.7" Long. -88° 17' 6.8" or	APW15
Facility ID	St. Plane 821,108 ft. N, 997,939 ft. E. (E)/W	Date Well Installed 01/22/2021
Type of Well Well Code 72/dp	Section Location of Waste/Source ____1/4 of ____ 1/4 of Sec. 26, T. 6 N, R. 8 ☒ E ☐ W	Well Installed By: (Person's Name and Firm) Adam Jochimsen Cascade Drilling
Distance from Waste/ Source ft. / State IL	Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known / Gov. Lot Number	

A. Protective pipe, top elevation 525.07 ft. (NAVD88)

B. Well casing, top elevation 524.69 ft. (NAVD88)

C. Land surface elevation 522.1 ft. (NAVD88)

D. Surface seal, bottom 520.1 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis, if required):
Potable Plant Water

E. Bentonite seal, top 429.1 ft. (NAVD88) or 93.0 ft.

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

G. Filter pack, top 426.6 ft. (NAVD88) or 95.5 ft.

H. Screen joint, top 424.1 ft. (NAVD88) or 98.0 ft.

I. Well bottom 419.1 ft. (NAVD88) or 103.0 ft.

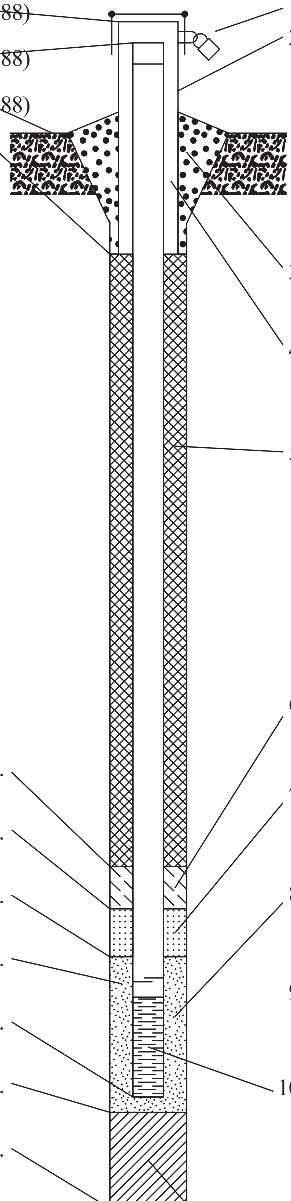
J. Filter pack, bottom 417.1 ft. (NAVD88) or 105.0 ft.

K. Borehole, bottom 412.1 ft. (NAVD88) or 110.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. 9.1 Lbs/gal mud weight . . . Bentonite slurry ☒
   d. ____% Bentonite . . . Bentonite-cement grout ☐
   e. 15.882 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ______ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. Not Applicable
   b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 1.702 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒
   Flush threaded PVC schedule 80 ☐
   Other ☐
10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
   b. Manufacturer Johnson Screens
   c. Slot size: 0.010 in.
   d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐
   Benoite Slurry Grout Other ☒

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

Date Modified: 5/3/2021

Signature

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Newton Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: APW16
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 55' 13.1" Long. -88° 17' 28.6" or	
Facility ID	St. Plane 820,642 ft. N, 996,214 ft. E. (E)/W	Date Well Installed: 01/20/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 35, T. 6 N, R. 8 ☒ E ☐ W	Well Installed By: (Person's Name and Firm) Adam Jochimsen, Cascade Drilling
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☐ Downgradient; n ☐ Not Known / Gov. Lot Number	

A. Protective pipe, top elevation 531.82 ft. (NAVD88)

B. Well casing, top elevation 531.18 ft. (NAVD88)

C. Land surface elevation 529.2 ft. (NAVD88)

D. Surface seal, bottom 527.2 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Plant Water

E. Bentonite seal, top 453.7 ft. (NAVD88) or 75.5 ft.

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

G. Filter pack, top 450.7 ft. (NAVD88) or 78.5 ft.

H. Screen joint, top 448.7 ft. (NAVD88) or 80.5 ft.

I. Well bottom 443.7 ft. (NAVD88) or 85.5 ft.

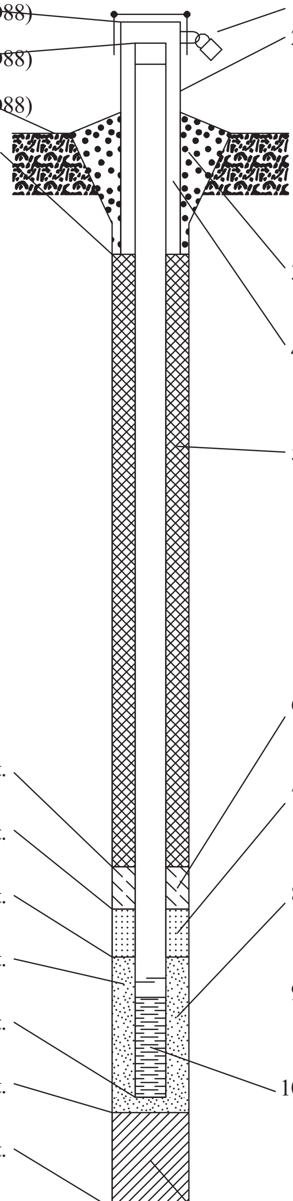
J. Filter pack, bottom 441.7 ft. (NAVD88) or 87.5 ft.

K. Borehole, bottom 419.2 ft. (NAVD88) or 110.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. 9.1 Lbs/gal mud weight . . . Bentonite slurry ☒
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 12.828 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. Not Applicable
   b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 1.614 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒
   Flush threaded PVC schedule 80 ☐
   Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐
    Benoite Slurry Grout Other ☒

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

Date Modified: 5/3/2021

Signature [signature]

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

RAMBOLL

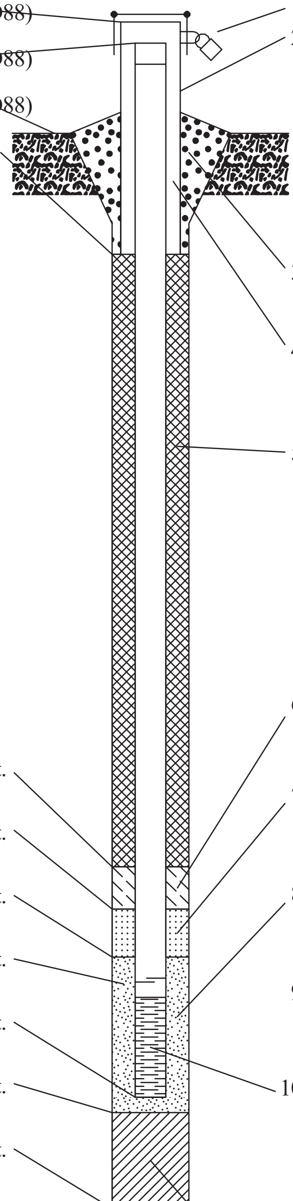
MONITORING WELL CONSTRUCTION

Facility/Project Name: Newton Power Station	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° 55' 33.3" Long. -88° 17' 38.1" or	APW17
Facility ID	St. Plane 822,681 ft. N, 995,462 ft. E. (E)/W	Date Well Installed: 01/22/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____1/4 of ____1/4 of Sec. 26, T. 6 N, R. 8 ☒ E ☐ W	Well Installed By: (Person's Name and Firm) Dave Gordon Cascade Drilling
Distance from Waste/Source ____ ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient, s ☐ Sidegradient, d ☐ Downgradient, n ☐ Not Known / Gov. Lot Number	

- A. Protective pipe, top elevation 533.02 ft. (NAVD88)
- B. Well casing, top elevation 532.52 ft. (NAVD88)
- C. Land surface elevation 529.8 ft. (NAVD88)
- D. Surface seal, bottom 527.8 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☒ SP ☒
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐
13. Sieve analysis attached? ☐ Yes ☐ No
14. Drilling method used: Rotary ☐; Hollow Stem Auger ☐; Mini-Sonic Other ☒
15. Drilling fluid used: Water ☒ 0 2; Air ☐; Drilling Mud ☐ 0 3; None ☐
16. Drilling additives used? ☐ Yes ☒ No
Describe ____
17. Source of water (attach analysis, if required): Potable Plant Water

- E. Bentonite seal, top 446.8 ft. (NAVD88) or 83.0 ft.
- F. Fine sand, top ____ ft. (NAVD88) or ____ ft.
- G. Filter pack, top 444.8 ft. (NAVD88) or 85.0 ft.
- H. Screen joint, top 442.8 ft. (NAVD88) or 87.0 ft.
- I. Well bottom 437.8 ft. (NAVD88) or 92.0 ft.
- J. Filter pack, bottom 435.8 ft. (NAVD88) or 94.0 ft.
- K. Borehole, bottom 429.8 ft. (NAVD88) or 100.0 ft.
- L. Borehole, diameter 6.0 in.
- M. O.D. well casing 2.38 in.
- N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒; Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐; Concrete ☒; Other ☐
4. Material between well casing and protective pipe: Bentonite ☐; Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
   d. ____% Bentonite . . . Bentonite-cement grout ☐
   e. 14.137 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐; Tremie pumped ☒; Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. Not Applicable
   b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 1.614 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒; Flush threaded PVC schedule 80 ☐; Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒; Continuous slot ☐; Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐; Bentonite Chips Other ☒

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

Date Modified: 5/3/2021

Signature: [signature]

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

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Newton Power Station

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

Well Name: APW18

Facility License, Permit or Monitoring No.:

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

Lat. 38° 55' 51.5" Long. -88° 17' 24.4" or

St. Plane 824,526 ft. N, 996,544 ft. E. (E)/W

Facility ID:

Date Well Installed: 01/21/2021

Section Location of Waste/Source: ____1/4 of ____ 1/4 of Sec. 26, T. 6 N, R. 8 ☒ E ☐ W

Type of Well: Well Code 72/dp

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

Distance from Waste/Source: ft.

State: IL

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

Gov. Lot Number:

A. Protective pipe, top elevation 543.81 ft. (NAVD88)

B. Well casing, top elevation 543.27 ft. (NAVD88)

C. Land surface elevation 540.6 ft. (NAVD88)

D. Surface seal, bottom 538.6 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis, if required):
Potable Plant Water

E. Bentonite seal, top 469.6 ft. (NAVD88) or 71.0 ft.

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

G. Filter pack, top 467.6 ft. (NAVD88) or 73.0 ft.

H. Screen joint, top 465.6 ft. (NAVD88) or 75.0 ft.

I. Well bottom 460.6 ft. (NAVD88) or 80.0 ft.

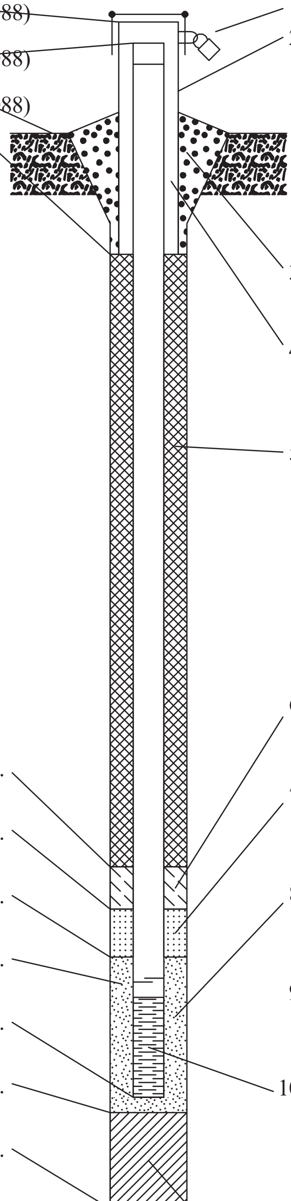
J. Filter pack, bottom 458.6 ft. (NAVD88) or 82.0 ft.

K. Borehole, bottom 433.6 ft. (NAVD88) or 107.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

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

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

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

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____% Bentonite . . . Bentonite-cement grout ☐
e. 12.043 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐

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

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

8. Filter pack material: Manufacturer, product name & mesh size
a. Filter Sil, Industrial Quartz
b. Volume added 1.614 ft^3

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

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

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

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

Date Modified: 5/3/2021

Signature: [signature]

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

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Newton Power Station	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° 55' 2.2" Long. -88° 16' 51.7" or	APW5S
Facility ID	St. Plane 825,612 ft. N, 999,129 ft. E. Ⓔ/W	Date Well Installed: 01/19/2021
Type of Well: Well Code 71/dw	Section Location of Waste/Source: ____1/4 of ____ 1/4 of Sec. 26, T. 6 N, R. 8 ☒ E ☐ W	Well Installed By: (Person's Name and Firm) Dave Gordon, Cascade Drilling
Distance from Waste/Source: ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient, s ☐ Sidegradient, d ☐ Downgradient, n ☐ Not Known / Gov. Lot Number	

A. Protective pipe, top elevation 544.41 ft. (NAVD88)

B. Well casing, top elevation 543.94 ft. (NAVD88)

C. Land surface elevation 541.0 ft. (NAVD88)

D. Surface seal, bottom 540.0 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 ☐
Mini-Sonic Other ☒

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Plant Water

E. Bentonite seal, top 540.0 ft. (NAVD88) or 1.0 ft.

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

G. Filter pack, top 533.0 ft. (NAVD88) or 8.0 ft.

H. Screen joint, top 531.0 ft. (NAVD88) or 10.0 ft.

I. Well bottom 521.0 ft. (NAVD88) or 20.0 ft.

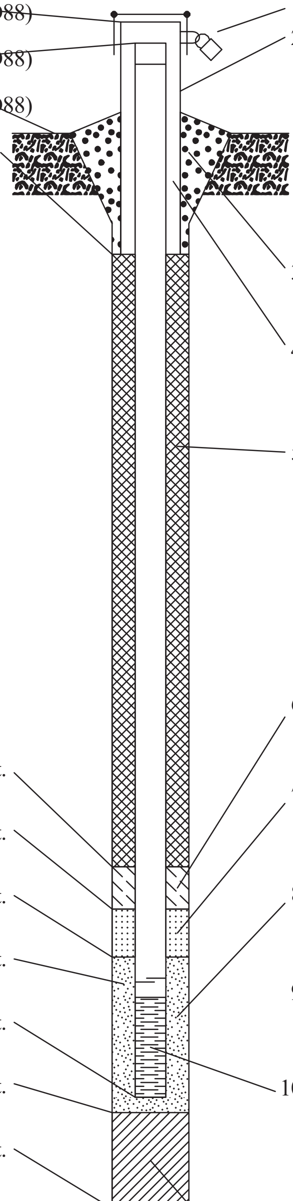
J. Filter pack, bottom 518.0 ft. (NAVD88) or 23.0 ft.

K. Borehole, bottom 518.0 ft. (NAVD88) or 23.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe:
   Bentonite ☐
   Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____% Bentonite . . . Bentonite-cement grout ☐
   e. 1.222 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. Not Applicable
   b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 2.683 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒
   Flush threaded PVC schedule 80 ☐
   Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

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

Date Modified: 5/3/2021

Signature [signature]

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Newton Power Station	______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.	
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 55' 55.9" Long. -88° 17' 7.9" or	XPW01
Facility ID	St. Plane 824,975 ft. N, 997,852 ft. E. (E)/W	Date Well Installed 01/20/2021
Type of Well: Well Code 99/ot	Section Location of Waste/Source ____1/4 of ____1/4 of Sec. 26, T. 6 N, R. 8 ☒ E ☐ W	Well Installed By: (Person's Name and Firm) Russ Gordon, Cascade Drilling
Distance from Waste/Source ft. / State IL	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☐ Downgradient; n ☐ Not Known / Gov. Lot Number	

A. Protective pipe, top elevation 552.11 ft. (NAVD88)

B. Well casing, top elevation 551.76 ft. (NAVD88)

C. Land surface elevation 548.6 ft. (NAVD88)

D. Surface seal, bottom 547.6 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 ☐ Mini-Sonic Other ☒

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis, if required): Potable Plant Water

E. Bentonite seal, top 547.6 ft. (NAVD88) or 1.0 ft.

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

G. Filter pack, top 543.6 ft. (NAVD88) or 5.0 ft.

H. Screen joint, top 541.6 ft. (NAVD88) or 7.0 ft.

I. Well bottom 531.6 ft. (NAVD88) or 17.0 ft.

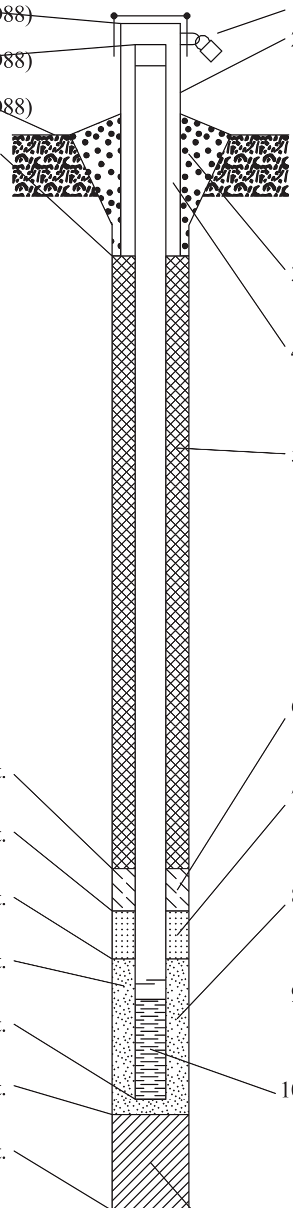
J. Filter pack, bottom 530.6 ft. (NAVD88) or 18.0 ft.

K. Borehole, bottom 528.6 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: 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. 0.698 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ______ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. Not Applicable
   b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 2.291 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
   b. Manufacturer Johnson Screens
   c. Slot size: 0.010 in.
   d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ Bentonite Chips Other ☒

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

Date Modified: 5/3/2021

Signature [signature]

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Newton Power Station

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

Well Name: XPW02

Facility License, Permit or Monitoring No.

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

Lat. 38° 55' 56.4" Long. -88° 16' 58.4" or

St. Plane 825,024 ft. N, 998,601 ft. E. (E)/W

Facility ID

Section Location of Waste/Source

Date Well Installed: 01/19/2021

Type of Well: Well Code 99/ot

____1/4 of ____ 1/4 of Sec. 26, T. 6 N, R. 8 ☒ E ☐ W

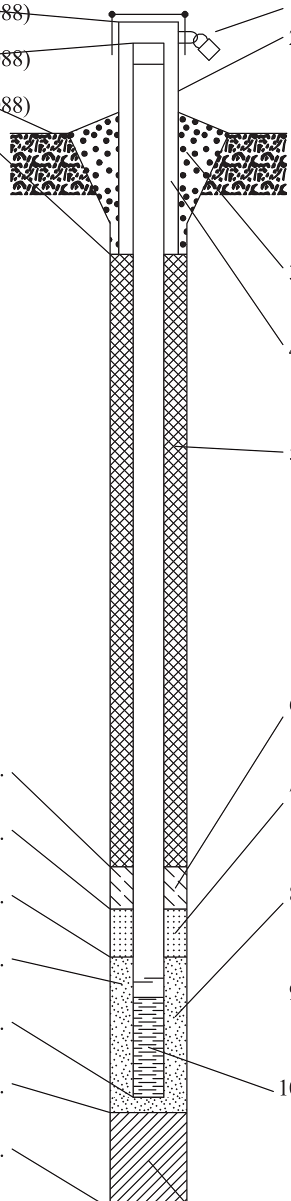
Well Installed By: (Person's Name and Firm): Russ Gordon, Cascade Drilling

Distance from Waste/Source ____ ft.

State: IL

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

Gov. Lot Number



A. Protective pipe, top elevation 554.83 ft. (NAVD88)

B. Well casing, top elevation 554.43 ft. (NAVD88)

C. Land surface elevation 552.0 ft. (NAVD88)

D. Surface seal, bottom 550.0 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Potable Plant Water

E. Bentonite seal, top 550.0 ft. (NAVD88) or 2.0 ft.

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

G. Filter pack, top 548.0 ft. (NAVD88) or 4.0 ft.

H. Screen joint, top 546.0 ft. (NAVD88) or 6.0 ft.

I. Well bottom 536.0 ft. (NAVD88) or 16.0 ft.

J. Filter pack, bottom 535.0 ft. (NAVD88) or 17.0 ft.

K. Borehole, bottom 532.0 ft. (NAVD88) or 20.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.

1. Cap and lock? ☒ Yes ☐ No

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

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

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

5. Annular space seal: a. Granular/Chipped Bentonite ☒
b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
d. ____% Bentonite . . . Bentonite-cement grout ☐
e. 0.349 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒

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

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

8. Filter pack material: Manufacturer, product name & mesh size
a. Filter Sil, Industrial Quartz
b. Volume added 2.291 ft^3

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

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

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

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

Signature: [signature]

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

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Newton Power Station	____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒	
	Lat. 38° 55' 51.8" Long. -88° 16' 35.1" or	XPW03
Facility ID	St. Plane 824,558 ft. N, 1,000,445 ft. E. (E)/W	Date Well Installed
	Section Location of Waste/Source	01/19/2021
Type of Well	____1/4 of ____ 1/4 of Sec. 25, T. 6 N, R. 8 ☒ E ☐ W	Well Installed By: (Person's Name and Firm)
Well Code 99/ot	Location of Well Relative to Waste/Source	Russ Gordon
Distance from Waste/ Source ____ ft. / State IL	u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known / Gov. Lot Number	Cascade Drilling

A. Protective pipe, top elevation 553.95 ft. (NAVD88)

B. Well casing, top elevation 553.65 ft. (NAVD88)

C. Land surface elevation 550.8 ft. (NAVD88)

D. Surface seal, bottom 548.8 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Plant Water

E. Bentonite seal, top 548.8 ft. (NAVD88) or 2.0 ft.

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

G. Filter pack, top 542.8 ft. (NAVD88) or 8.0 ft.

H. Screen joint, top 540.8 ft. (NAVD88) or 10.0 ft.

I. Well bottom 530.8 ft. (NAVD88) or 20.0 ft.

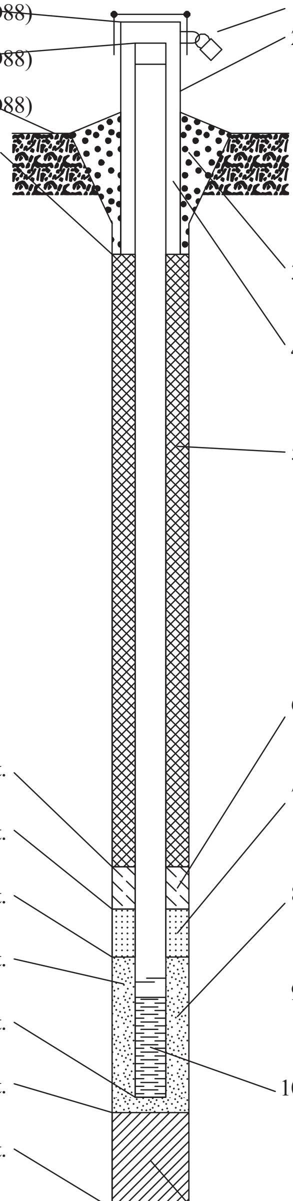
J. Filter pack, bottom 530.8 ft. (NAVD88) or 20.0 ft.

K. Borehole, bottom 530.8 ft. (NAVD88) or 20.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____% Bentonite . . . Bentonite-cement grout ☐
   e. 1.047 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. Not Applicable
   b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 2.094 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒
   Flush threaded PVC schedule 80 ☐
   Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

Signature	Firm	
[signature]	Ramboll 234 W. Florida Street, 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
Newton Power Station	____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	XPW04
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 55' 47.6" Long. -88° 16' 26.6" or St. Plane 824,131 ft. N, 1,001,110 ft. E. (E)/W	
Facility ID		Date Well Installed 01/19/2021
Type of Well: Well Code 99/ot	Section Location of Waste/Source ____1/4 of ____1/4 of Sec. 25, T. 6 N, R. 8 ☒ E ☐ W	Well Installed By: (Person's Name and Firm) Russ Gordon, Cascade Drilling
Distance from Waste/Source ft. / State IL	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☐ Downgradient; n ☐ Not Known / Gov. Lot Number	

A. Protective pipe, top elevation 554.74 ft. (NAVD88)

B. Well casing, top elevation 554.51 ft. (NAVD88)

C. Land surface elevation 551.9 ft. (NAVD88)

D. Surface seal, bottom 549.9 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Plant Water

E. Bentonite seal, top 549.9 ft. (NAVD88) or 2.0 ft.

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

G. Filter pack, top 543.9 ft. (NAVD88) or 8.0 ft.

H. Screen joint, top 541.9 ft. (NAVD88) or 10.0 ft.

I. Well bottom 531.9 ft. (NAVD88) or 20.0 ft.

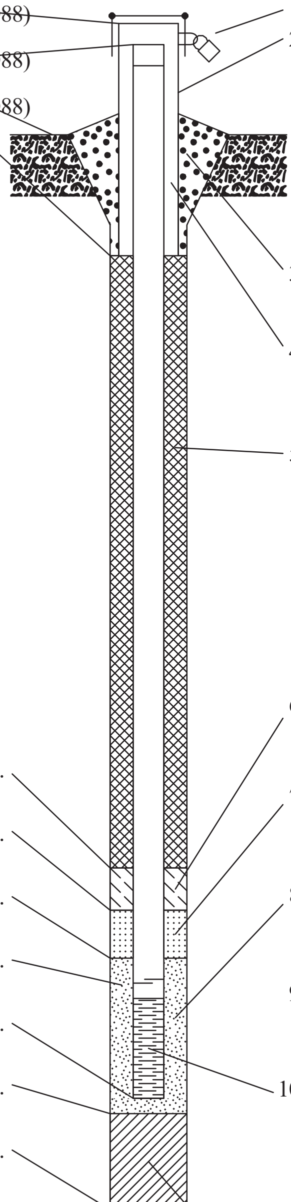
J. Filter pack, bottom 531.9 ft. (NAVD88) or 20.0 ft.

K. Borehole, bottom 531.9 ft. (NAVD88) or 20.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

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

3. Surface seal: Bentonite ☐
Concrete ☒
Other ☐

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

5. Annular space seal: a. Granular/Chipped Bentonite ☒
b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
d. ____% Bentonite . . . Bentonite-cement grout ☐
e. 1.047 Ft^3 volume added for any of the above
f. How installed: Tremie ☐
Tremie pumped ☐
Gravity ☒

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

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

8. Filter pack material: Manufacturer, product name & mesh size
a. Filter Sil, Industrial Quartz
b. Volume added 2.094 ft^3

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

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

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

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

Date Modified: 5/3/2021

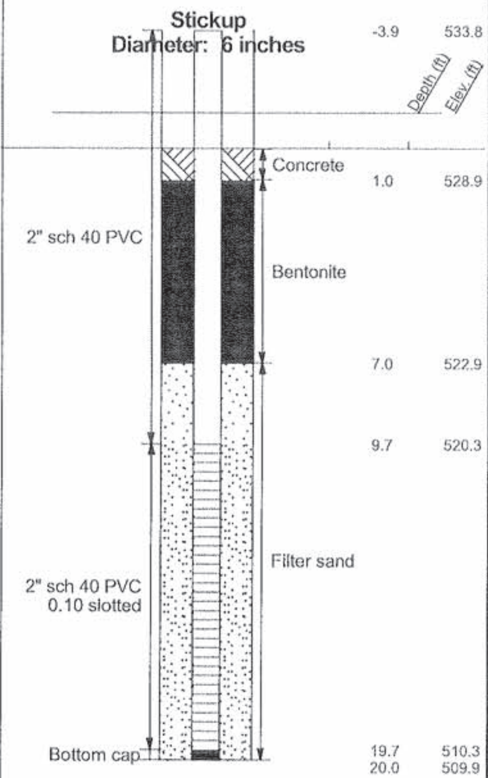
Signature	Firm	
[signature]	Ramboll 234 W. Florida Street, Milwaukee, WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

Surface Elevation: 529.93 | Datum: msl

Completion Date: 6/19/10 | Northing: 822688.04 | Easting: 995465.25

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Soft, brown, silty CLAY - CL			
4	Stiff, brown, sandy CLAY - CL			
7	Hard, brown, sandy CLAY with gravel - CL (▽ 8.5)			
13	Hard, dark gray CLAY and glacial till - CH			
20	Boring terminated at 20 feet.			

WELL DIAGRAM



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

GROUNDWATER DATA

ENCOUNTERED AT 8.5 FEET ▽

DRILLING DATA

4 1/4" AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

MVU DRILLER KCR LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: RBP	App'vd. by: DTK
Date: 6/29/10	Date: 2-7-11	Date: 2-7-11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Newton, Illinois

LOG OF BORING: APW-2

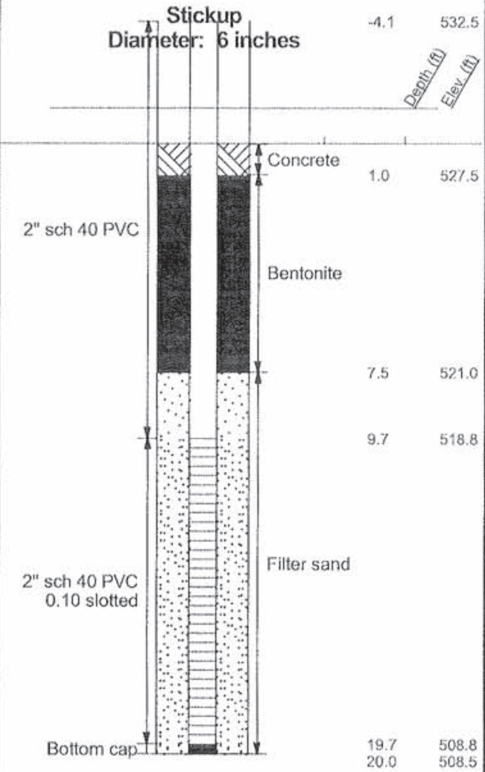
Project No. J017150.01

Surface Elevation: 528.47 | Datum: msl | Completion Date: 6/18/10 | Northing: 821379.76 | Easting: 998975.74

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Soft, brown, silty CLAY - CL			
6	Soft, brown, sandy CLAY with gravel - CL			
9	Hard, brown, sandy CLAY with gravel - CL			
13	Hard, brownish-gray, sandy CLAY with gravel - CL			
20	Boring terminated at 20 feet.			

Depth scale: 5, 10, 15, 20, 25, 30, 35

WELL DIAGRAM



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

LOG OF BORING 2002 WL J017150.01ENV - AMEREN-NEWTON.GPJ GTINC 0638301.GPJ 2/22/11

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

4 1/4" AUGER __ HOLLOW STEM

WASHBORING FROM __ FEET

MVU DRILLER KCR LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: RSJ	App'vd. by: DTK
Date: 6/29/10	Date: 2/7/11	Date: 2-7-11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Newton, Illinois

LOG OF BORING: APW-3

Project No. J017150.01

Surface Elevation: 521.56

Datum: msl

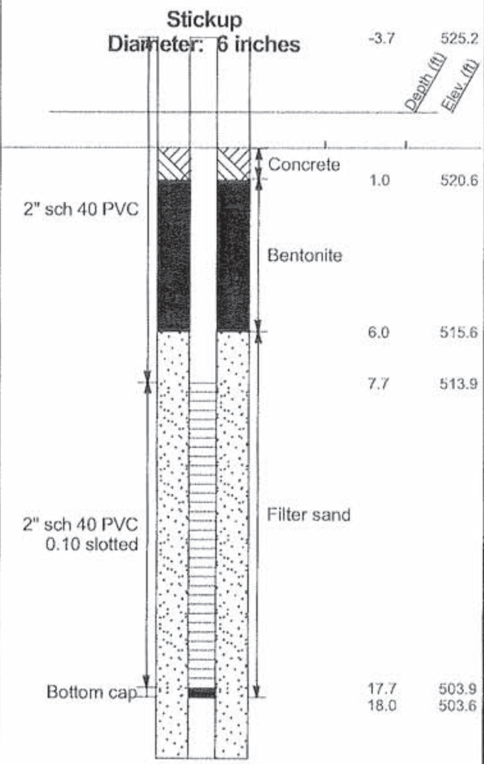
Completion Date: 6/19/10

Northing: 823246.45

Easting: 1001379.56

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Soft, brown, silty CLAY - CL			
7	Soft, brown, sandy CLAY - CL ▽			
12	Stiff, brown, sandy CLAY with gravel - CL			
18	Boring terminated at 18 feet.			

WELL DIAGRAM



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

GROUNDWATER DATA

ENCOUNTERED AT 8 FEET ▽

DRILLING DATA

4 1/4" AUGER __ HOLLOW STEM

WASHBORING FROM __ FEET

MVU DRILLER KCR LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: RJS	App'vd. by: DTK
Date: 6/29/10	Date: 2-7-11	Date: 2-7-11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Newton, Illinois

LOG OF BORING: APW-4

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01ENV - AMEREN-NEWTON.GPJ GTINC 0638301.GPJ 12/22/10

Illinois Environmental Protection Agency — Well Completion Report

Site #: ______ County: Jasper County Well #: APW5

Site Name: Newton Energy Center Borehole #: APW5

~~State~~ Plant ~~Plane~~ Coordinate: X 9,318.2 Y 7,758.0 (or) Latitude: 38° 56' 2.270" Longitude: -88° 16' 51.560"

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

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

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

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

Logged By: Suzanna L. Keim Date Started: 10/22/2015 Date Finished: 10/22/2015

Report Form Completed By: Suzanna L. Keim Date: 11/6/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

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

Installation Method: Gravity

Setting Time: 45 minutes

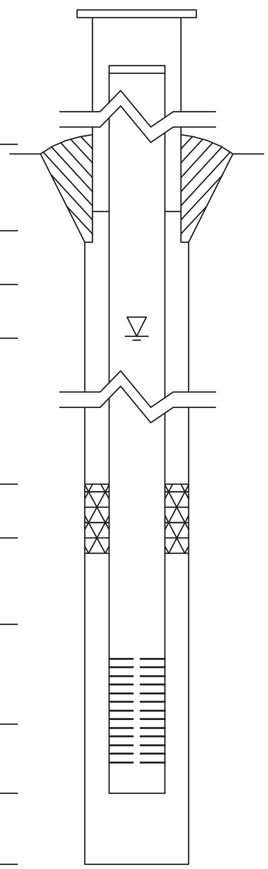
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

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

Installation Method: ______



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
545.00	-3.43	Top of Protective Casing
544.56	-2.99	Top of Riser Pipe
541.57	0.00	Ground Surface
539.57	2.00	Top of Annular Sealant
527.06	14.51	Static Water Level (After Completion) 12/15/2015
484.39	57.18	Top of Seal
480.62	60.95	Top of Sand Pack
478.93	62.64	Top of Screen
474.13	67.44	Bottom of Screen
473.73	67.84	Bottom of Well
473.57	68.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	65.63
Bottom of Screen to End Cap	(feet)	0.40
Screen Length (1st slot to last slot)	(feet)	4.80
Total Length of Casing	(feet)	70.83
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

Illinois Environmental Protection Agency — Well Completion Report

Site #: ____ County: Jasper County Well #: APW6

Site Name: Newton Energy Center Borehole #: APW6

~~State~~ Plant ~~Plane~~ Coordinate: X 7,811.9 Y 7,688.5 (or) Latitude: 38° 56' 1.510" Longitude: -88° 17' 10.610"

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

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

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

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

Logged By: Suzanna L. Keim Date Started: 10/20/2015 Date Finished: 10/21/2015

Report Form Completed By: Suzanna L. Keim Date: 11/6/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

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

Installation Method: Gravity

Setting Time: 30 minutes

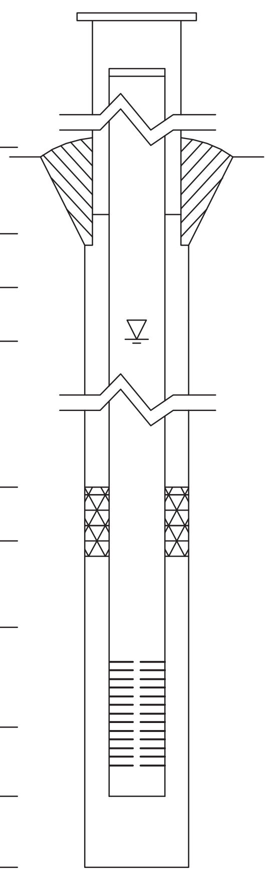
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Quartz Sand (if applicable)

Installation Method: gravity



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
546.88	-3.50	Top of Protective Casing
546.56	-3.18	Top of Riser Pipe
543.38	0.00	Ground Surface
541.38	2.00	Top of Annular Sealant
523.45	19.93	Static Water Level (After Completion) 12/15/2015
478.48	64.90	Top of Seal
477.28	66.10	Top of Sand Pack
475.71	67.67	Top of Screen
470.90	72.48	Bottom of Screen
470.50	72.88	Bottom of Well
469.38	74.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	70.85
Bottom of Screen to End Cap	(feet)	0.40
Screen Length (1st slot to last slot)	(feet)	4.81
Total Length of Casing	(feet)	76.06
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

Illinois Environmental Protection Agency — Well Completion Report

Site #: ______ County: Jasper County Well #: APW7

Site Name: Newton Energy Center Borehole #: APW7a

~~State~~ Plant ~~Plane~~ Coordinate: X 6,151.6 Y 5,688.8 (or) Latitude: 38° 55' 41.660" Longitude: -88° 17' 31.490"

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Bulldog Drilling, Inc. Driller: J. Gates

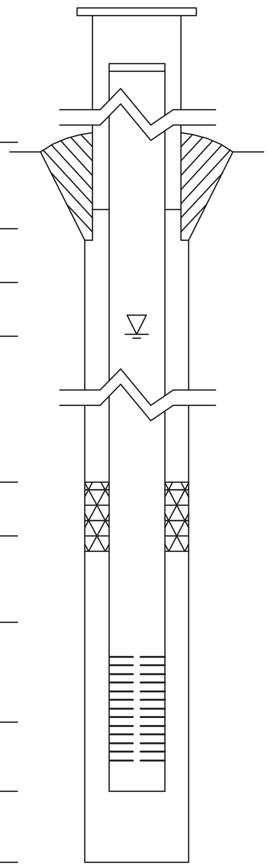
Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

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

Logged By: Rhonald W. Hasenyager Date Started: 11/3/2015 Date Finished: 11/5/2015

Report Form Completed By: Suzanna L. Keim Date: 11/9/2015

ANNULAR SPACE DETAILS



	Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
	539.24	-3.03	Top of Protective Casing
	538.86	-2.65	Top of Riser Pipe
Type of Surface Seal: Concrete	536.21	0.00	Ground Surface
Type of Annular Sealant: High-solids bentonite	534.21	2.00	Top of Annular Sealant
Installation Method: Tremie			
Setting Time: >48 hours	490.68	45.53	Static Water Level (After Completion) 12/15/2015
Type of Bentonite Seal -- Granular (Pellet) Slurry (choose one)			
Installation Method: Gravity	462.06	74.15	Top of Seal
Setting Time: 120 minutes	460.21	76.00	Top of Sand Pack
Type of Sand Pack: Quartz Sand			
Grain Size: 10-20 (sieve size)	458.32	77.89	Top of Screen
Installation Method: Gravity			
	453.51	82.70	Bottom of Screen
Type of Backfill Material: Quartz Sand (if applicable)	453.11	83.10	Bottom of Well
Installation Method: gravity	453.11	83.10	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	80.54
Bottom of Screen to End Cap	(feet)	0.40
Screen Length (1st slot to last slot)	(feet)	4.81
Total Length of Casing	(feet)	85.75
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

Illinois Environmental Protection Agency — Well Completion Report

Site #: ______ County: Jasper County Well #: APW8

Site Name: Newton Energy Center Borehole #: APW8

~~State~~ Plant ~~Plane~~ Coordinate: X 6,082.4 Y 3,839.6 (or) Latitude: 38° 55' 23.380" Longitude: -88° 17' 32.250"

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

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

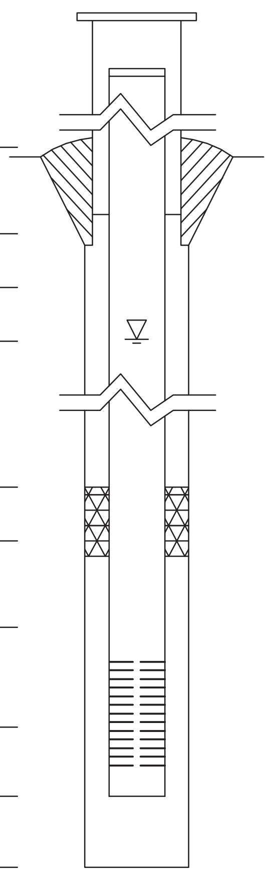
Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

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

Logged By: Suzanna L. Keim Date Started: 10/27/2015 Date Finished: 10/28/2015

Report Form Completed By: Suzanna L. Keim Date: 11/6/2015

ANNULAR SPACE DETAILS



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
529.86	-3.11	Top of Protective Casing
529.46	-2.71	Top of Riser Pipe
526.75	0.00	Ground Surface
524.75	2.00	Top of Annular Sealant
490.50	36.25	Static Water Level (After Completion) 12/15/2015
462.45	64.30	Top of Seal
458.70	68.05	Top of Sand Pack
455.35	71.40	Top of Screen
445.69	81.06	Bottom of Screen
445.22	81.53	Bottom of Well
444.75	82.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

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

Installation Method: Gravity

Setting Time: 55 minutes

Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

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

Installation Method: ______

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	74.11
Bottom of Screen to End Cap	(feet)	0.47
Screen Length (1st slot to last slot)	(feet)	9.66
Total Length of Casing	(feet)	84.24
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

Illinois Environmental Protection Agency — Well Completion Report

Site #: ______ County: Jasper County Well #: APW9

Site Name: Newton Energy Center Borehole #: APW9

~~State~~ Plant ~~Plane~~ Coordinate: X 9,125.3 Y 3,519.6 (or) Latitude: 38° 55' 20.370" Longitude: -88° 16' 53.730"

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Bulldog Drilling, Inc. Driller: J. Gates

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

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

Logged By: Rhonald W. Hasenyager Date Started: 11/2/2015 Date Finished: 11/3/2015

Report Form Completed By: Suzanna L. Keim Date: 11/9/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

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

Installation Method: Gravity

Setting Time: 65 minutes

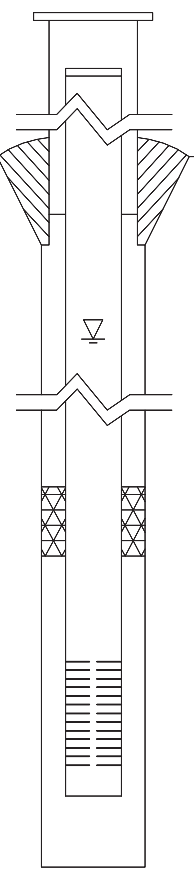
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

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

Installation Method: ______



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
532.43	-3.61	Top of Protective Casing
532.01	-3.19	Top of Riser Pipe
528.82	0.00	Ground Surface
526.82	2.00	Top of Annular Sealant
502.18	26.64	Static Water Level (After Completion) 12/15/2015
475.91	52.91	Top of Seal
474.20	54.62	Top of Sand Pack
472.16	56.66	Top of Screen
467.36	61.46	Bottom of Screen
466.97	61.85	Bottom of Well
466.82	62.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	59.85
Bottom of Screen to End Cap	(feet)	0.39
Screen Length (1st slot to last slot)	(feet)	4.80
Total Length of Casing	(feet)	65.04
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

WELL CONSTRUCTION MATERIALS
(Choose one type of material for each area)

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

Illinois Environmental Protection Agency — Well Completion Report

Site #: ______ County: Jasper County Well #: APW10

Site Name: Newton Energy Center Borehole #: APW10a

~~State~~ Plant ~~Plane~~ Coordinate: X 11,541.2 Y 5,371.3 (or) Latitude: 38° 55' 38.790" Longitude: -88° 16' 23.280"

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

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

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

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

Logged By: Suzanna L. Keim Date Started: 10/27/2015 Date Finished: 10/27/2015

Report Form Completed By: Suzanna L. Keim Date: 11/6/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

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

Installation Method: Gravity

Setting Time: 50 minutes

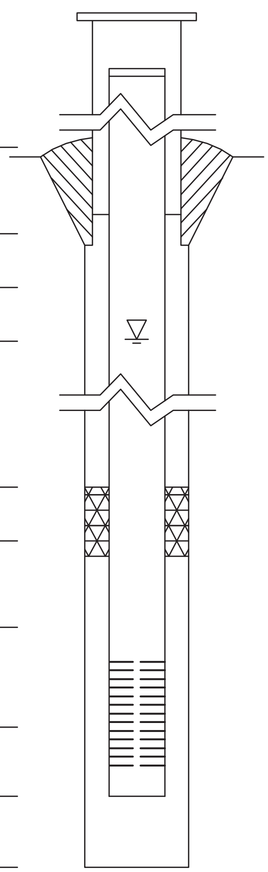
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

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

Installation Method: ______



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
525.12	-3.14	Top of Protective Casing
524.74	-2.76	Top of Riser Pipe
521.98	0.00	Ground Surface
519.98	2.00	Top of Annular Sealant
504.12	17.86	Static Water Level (After Completion) 12/15/2015
484.66	37.32	Top of Seal
483.22	38.76	Top of Sand Pack
481.24	40.74	Top of Screen
476.44	45.54	Bottom of Screen
476.04	45.94	Bottom of Well
476.04	45.94	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	43.50
Bottom of Screen to End Cap	(feet)	0.40
Screen Length (1st slot to last slot)	(feet)	4.80
Total Length of Casing	(feet)	48.70
Screen Slot Size **	(inches)	0.010

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

Well Completion Form (revised 02/06/02)

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: ______ County: Jasper County Well #: G06D

Site Name: Newton Energy Center Borehole #: G06D

~~State~~ Plant ~~Plane~~ Coordinate: X 4,926.0 Y 5,328.8 (or) Latitude: 38° 55' 38.040" Longitude: -88° 17' 46.980"

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Bulldog Drilling, Inc. Driller: J. Gates

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

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

Logged By: Rhonald W. Hasenyager Date Started: 11/9/2015 Date Finished: 11/10/2015

Report Form Completed By: Suzanna L. Keim Date: 11/16/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

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

Installation Method: Gravity

Setting Time: 45 minutes

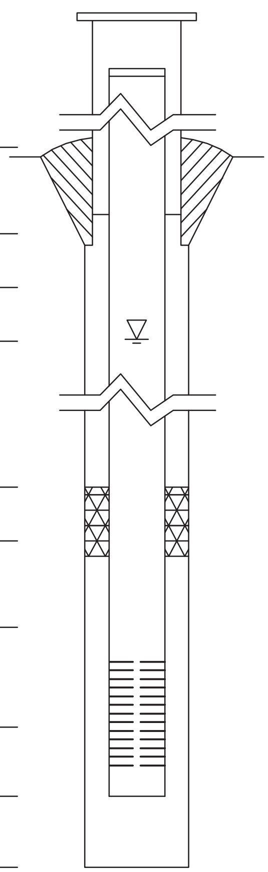
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Quartz Sand (if applicable)

Installation Method: gravity



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
532.59	-2.90	Top of Protective Casing
532.18	-2.49	Top of Riser Pipe
529.69	0.00	Ground Surface
527.69	2.00	Top of Annular Sealant
439.57	90.12	Static Water Level (After Completion) 12/16/2016
459.39	70.30	Top of Seal
457.58	72.11	Top of Sand Pack
455.46	74.23	Top of Screen
435.80	93.89	Bottom of Screen
435.36	94.33	Bottom of Well
433.69	96.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	76.72
Bottom of Screen to End Cap	(feet)	0.44
Screen Length (1st slot to last slot)	(feet)	19.66
Total Length of Casing	(feet)	96.82
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

Well Completion Form (revised 02/06/02)

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/19/2015
Finish: 10/20/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

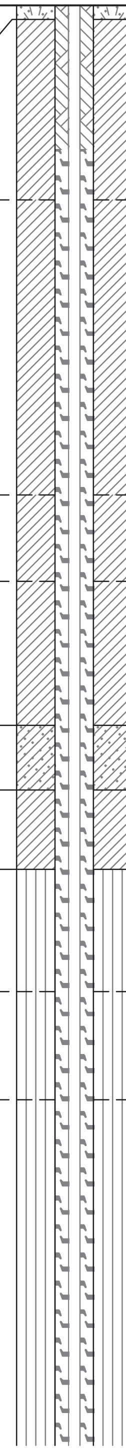
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: G48MG
Well ID: G48MG
Surface Elev: 543.17 ft. MSL
Completion: 77.06 ft. BGS
Station: 9,706.71N
5,052.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							0–0.6	Grayish brown (10YR5/2), moist, very soft, silty CLAY, trace roots.			
							0.6–2.7	Grayish brown (10YR5/2) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY, slight trace roots.		542	
							2.7–6.8	Brown (10YR5/3) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.		540, 538	
							6.8–8	Gray (10YR5/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.		536	
							8–10	Gray (10YR5/1) with 40% dark yellowish brown (10YR4/6) mottles, very moist, soft, silty CLAY with trace sand and slight trace gravel.		534	
							10–10.9	Yellowish brown (10YR5/4) with 10% gray (10YR6/1) mottles, soft, wet, sandy CLAY with slight trace gravel.			
							10.9–12	Yellowish brown (10YR5/4) with 10% gray (10YR5/1) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.		532	
							12–13.7	Dark gray (10YR4/1) with 30% brown (10YR4/3) mottles, slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		530	
							13.7–15.2	Dark gray (10YR4/1) with 20% dark grayish brown (10YR4/2) mottles, slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		528	
							15.2–20	Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		526, 524	



NOTE(S): G48MG installed in borehole.
Sample and testing data can be found on B-48 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/19/2015
Finish: 10/20/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: G48MG
Well ID: G48MG
Surface Elev: 543.17 ft. MSL
Completion: 77.06 ft. BGS
Station: 9,706.71N
5,052.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
										522	
							22	Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel. *[Continued from previous page]*		520	
							24			518	
							26	Dark gray (10YR4/1), moist, firm, silty CLAY with slight trace sand and gravel.			
								Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		516	
							28	Dark gray (10YR4/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.		514	
							30			512	
							32			510	
							34	Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		508	
							36			506	
							38	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.		504	
							40				

NOTE(S): G48MG installed in borehole.
Sample and testing data can be found on B-48 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/19/2015
Finish: 10/20/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: G48MG
Well ID: G48MG
Surface Elev: 543.17 ft. MSL
Completion: 77.06 ft. BGS
Station: 9,706.71N
5,052.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							42	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel. *[Continued from previous page]*		502, 500	
							44	Dark gray (10YR4/1), slightly moist, firm, SILT with slight trace sand.			
							46, 48, 50	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.		498, 496, 494, 492	
							52	Olive gray (5Y4/2), slightly moist, firm, silty CLAY with slight trace sand and gravel.			
							54	Dark greenish gray (10Y4/1) with 20% greenish gray (10Y6/1) mottles, slightly moist, hard, silty CLAY with trace sand and slight trace gravel.		490	
							56	Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, hard, silty CLAY with slight trace sand and gravel.		488, 486	
							58, 60	Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel.		484	

NOTE(S): G48MG installed in borehole.
Sample and testing data can be found on B-48 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/19/2015
Finish: 10/20/2015
WEATHER: Sunny, breezy, warm, lo-80s

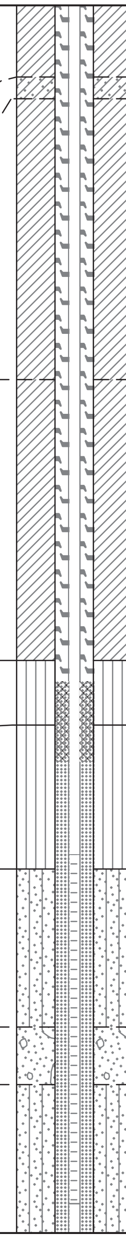
CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: G48MG
Well ID: G48MG
Surface Elev: 543.17 ft. MSL
Completion: 77.06 ft. BGS
Station: 9,706.71N
5,052.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
								Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel. *[Continued from previous page]*		482	
							62	Light olive gray (5Y5/2), very moist, very soft, sandy CLAY with slight trace gravel.			
							64	Light olive gray (5Y5/2) with 10% greenish gray (5GY5/1) mottles, slightly moist, firm, silty CLAY with trace sand and slight trace gravel.		480	
							66, 68	Greenish gray (10Y5/1) with 10% olive gray (5Y4/2) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel.		478, 476	
							70	Greenish gray (10G5/1) with 5% dark yellowish brown (10YR4/6) mottles, moist, dense, SILT with slight trace sand.		474	
							72	Dark greenish gray (10GY4/1), slightly moist, very hard, clayey SILT with trace sand and slight trace gravel.		472	
							74	Dark greenish gray (10GY4/1), wet, very dense, silty, medium- to coarse-grained SAND with slight trace gravel.		470	
								Dark greenish gray (10GY4/1), wet, very dense, silty, coarse-grained SAND and gravel.		468	
							76	Dark gray (10YR4/1), wet, very dense, silty, medium- to coarse-grained SAND with slight trace gravel.			



End of boring = 77.06 feet

NOTE(S): G48MG installed in borehole.
Sample and testing data can be found on B-48 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: AEG Newton Power Station	**CONTRACTOR:** Skinner Limited		
Site: Gypsum Management Facility	**Rig mfg/model:** CME-550 ATV Drill	**BOREHOLE ID:** B48	
Location: Newton, Jasper Co., IL	**Drilling Method:** 4¼" hollow stem auger w/split spoon sampler	**Well ID:** n/a	
Project: 07E0150A 3000		**Surface Elev:**	542.9 ft. MSL
DATES: Start: 5/12/2009	**FIELD STAFF: Driller:** T. Skinner	**Completion:**	103.5 ft. BGS
Finish: 5/14/2009	**Helper:** T. Skinner/J. Austin	**Station:**	9,703.88N
WEATHER: Sunny, warm, windy, (mid-60's)	**Eng/Geo:** S. Suzanna Simpson		5,042.40E

TOPOGRAPHIC MAP INFORMATION:

Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:

▼ = 10.00 - during drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type
1A	13/18 *72%*	SS	*woh-2* *3* N=5	25.8		
2A	17/18 *94%*	SS	*2-3* *4* N=7	22.0		3.88 Sh
3A	17/18 *94%*	SS	*2-4* *4* N=8	15.7		1.90 Sh
4A	24/24 *100%*	SS	*woh-1* *2-3* N=3	20.5		1.78 BSh
5A	18/18 *100%*	SS	*1-1* *2* N=3	22.7		1.40 Sh
6A	24/24 *100%*	SS	*1-2* *3-3* N=5	18.3		1.27 Sh
7-1						
7-2	23/24 *96%*	SH		19.9		
7-3				15.0		
7-4				19.5		
8A	18/18 *100%*	SS	*8-13* *17* N=30	10.2		8.92 Sh
9A	18/18 *100%*	SS	*6-12* *17* N=29	9.7		5.62 Sh
10A	24/24 *100%*	SS	*7-14* *20-20* N=34	9.0		7.18 Sh
11A	18/18 *100%*	SS	*6-14* *15* N=29	8.5		9.89 Sh
12A	18/18 *100%*	SS	*5-12* *14* N=26	10.2		11.25 Sh

Depth ft. BGS: 2, 4, 6, 8, 10 (▼), 12, 14, 16, 18, 20

Elevation ft. MSL: 542, 540, 538, 536, 534, 532, 530, 528, 526, 524

Lithologic Description:

Grayish brown (10YR5/2), moist, very soft, silty CLAY, trace roots.

Grayish brown (10YR5/2) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY, slight trace roots.

Brown (10YR5/3) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.

Gray (10YR5/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.

Gray (10YR5/1) with 40% dark yellowish brown (10YR4/6) mottles, very moist, soft, silty CLAY with trace sand and slight trace gravel.

Yellowish brown (10YR5/4) with 10% gray (10YR6/1) mottles, soft, wet, sandy CLAY with slight trace gravel.

Yellowish brown (10YR5/4) with 10% gray (10YR5/1) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.

Dark gray (10YR4/1) with 30% brown (10YR4/3) mottles, slightly moist, hard, clayey SILT with trace sand and slight trace gravel.

Dark gray (10YR4/1) with 20% dark grayish brown (10YR4/2) mottles, slightly moist, hard, clayey SILT with trace sand and slight trace gravel.

Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.

Borehole Detail | Remarks

NOTE(S): Borehole abandoned using bentonite grout.

FIELD BORING LOG

HANSON

CLIENT: AEG Newton Power Station
Site: Gypsum Management Facility
Location: Newton, Jasper Co., IL
Project: 07E0150A 3000
DATES: Start: 5/12/2009
Finish: 5/14/2009
WEATHER: Sunny, warm, windy, (mid-60's)

CONTRACTOR: Skinner Limited
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: T. Skinner
Helper: T. Skinner/J. Austin
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: B48
Well ID: n/a
Surface Elev: 542.9 ft. MSL
Completion: 103.5 ft. BGS
Station: 9,703.88N
5,042.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type
13A	24/24 *100%*	SS	*8-13 17-17* N=30	10.1		12.36 Sh
14A	18/18 *100%*	SS	*7-11 14* N=25	10.1		10.47 Sh
15A	18/18 *100%*	SS	*7-11 13* N=24	9.9		9.31 Sh
16A	24/24 *100%*	SS	*5-7 12-14* N=19	11.4		11.06 Sh
16B				16.3		2.13 BSh
17A	18/18 *100%*	SS	*4-6 11* N=17	11.2		6.79 Sh
18A	18/18 *100%*	SS	*5-9 16* N=25	11.4		9.70 Sh
19A	24/24 *100%*	SS	*4-8 14-19* N=22	10.4		10.47 Sh
20A	18/18 *100%*	SS	*6-13 17* N=30	11.4		
21A	18/18 *100%*	SS	*7-13 19* N=32	11.3		10.28 Sh
22A	24/24 *100%*	SS	*7-12 19-22* N=31	10.3		11.44 Sh
23A	18/18 *100%*	SS	*6-12 19* N=31	11.5		10.86 Sh
24A	18/18 *100%*	SS	*7-11 19* N=30	12.7		5.24 Sh

Depth ft. BGS: 22, 24, 26, 28, 30, 32, 34, 36, 38, 40

Elevation ft. MSL: 522, 520, 518, 516, 514, 512, 510, 508, 506, 504

Lithologic Description:

Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.
[Continued from previous page]

Dark gray (10YR4/1), moist, firm, silty CLAY with slight trace sand and gravel.

Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.

Dark gray (10YR4/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.

Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.

Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.

Remarks:

NOTE(S): Borehole abandoned using bentonite grout.

FIELD BORING LOG

HANSON

CLIENT: AEG Newton Power Station
Site: Gypsum Management Facility
Location: Newton, Jasper Co., IL
Project: 07E0150A 3000
DATES: Start: 5/12/2009
Finish: 5/14/2009
WEATHER: Sunny, warm, windy, (mid-60's)

CONTRACTOR: Skinner Limited
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: T. Skinner
Helper: T. Skinner/J. Austin
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: B48
Well ID: n/a
Surface Elev: 542.9 ft. MSL
Completion: 103.5 ft. BGS
Station: 9,703.88N
5,042.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ =
▽ =

Number	Recov / Total (in) % Recovery	Type	Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
25A	24/24 100%	SS	8-12 22-26 N=34	11.5		10.47 Sh	42	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel. *[Continued from previous page]*	502	
26A	18/18 100%	SS	7-12 18 N=30	11.7		7.76 Sh			500	
27A	18/18 100%	SS	7-15 18 N=33	13.1			44	Dark gray (10YR4/1), slightly moist, firm, SILT with slight trace sand.		
27B				10.9		11.64 Sh			498	
28A	24/24 100%	SS	8-10 16-21 N=26	13.7			46		496	
29A	18/18 100%	SS	7-10 16 N=26	14.5		5.82 Sh	48	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.	494	
30A	18/18 100%	SS	4-9 13 N=22	14.1		2.52 B	50			
31-1										
31-2	19/24 79%	SH		14.0					492	
31-3										
31-4							52	Olive gray (5Y4/2), slightly moist, firm, silty CLAY with slight trace sand and gravel.		
32A	18/18 100%	SS	7-13 19 N=32	12.9		10.28 Sh				
32B				12.5		8.92 Sh		Dark greenish gray (10Y4/1) with 20% greenish gray (10Y6/1) mottles, slightly moist, hard, silty CLAY with trace sand and slight trace gravel.	490	
33A	18/18 100%	SS	5-10 16 N=26	14.9		2.13 BSh	54			
33B				14.6		6.59 Sh		Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, hard, silty CLAY with slight trace sand and gravel.	488	
34A	24/24 100%	SS	6-10 16-19 N=26	15.5		3.88 Sh	56		486	
35A	18/18 100%	SS	2-7 14 N=21	18.2		1.94 BSh	58	Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel.	484	
36A	18/18 100%	SS	3-7 14 N=21	13.8		5.04 BSh	60			

NOTE(S): Borehole abandoned using bentonite grout.

FIELD BORING LOG

HANSON

CLIENT: AEG Newton Power Station
Site: Gypsum Management Facility
Location: Newton, Jasper Co., IL
Project: 07E0150A 3000
DATES: Start: 5/12/2009
Finish: 5/14/2009
WEATHER: Sunny, warm, windy, (mid-60's)

CONTRACTOR: Skinner Limited
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: T. Skinner
Helper: T. Skinner/J. Austin
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: B48
Well ID: n/a
Surface Elev: 542.9 ft. MSL
Completion: 103.5 ft. BGS
Station: 9,703.88N
5,042.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ =
▽ =

Number	Recov / Total (in) % Recovery	Type	Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
37-1	19/24 79%	SH		16.5		1.75 BSh		Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel. *[Continued from previous page]*		482	
37-2				12.7		3.50 None		Light olive gray (5Y5/2), very moist, very soft, sandy CLAY with slight trace gravel.			
37-3				15.0							
37-4							62				
38A	18/18 100%	SS	8-13 15 N=28	14.5		3.10 B		Light olive gray (5Y5/2) with 10% greenish gray (5GY5/1) mottles, slightly moist, firm, silty CLAY with trace sand and slight trace gravel.		480	
39A	18/18 100%	SS	6-9 15 N=24	12.8		5.04 BSh	64			478	
40A	24/24 100%	SS	4-9 13-15 N=22	13.6		5.43 Sh	66	Greenish gray (10Y5/1) with 10% olive gray (5Y4/2) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel.		476	
41A	18/18 100%	SS	12-13 14 N=27	13.2		4.07 BSh	68			474	
42A	16/17 94%	SS	6-32 28/5"	15.2				Greenish gray (10G5/1) with 5% dark yellowish brown (10YR4/6) mottles, moist, dense, SILT with slight trace sand.			
43A	3/3 100%	SS	60/3"	15.4			70	Dark greenish gray (10GY4/1), slightly moist, very hard, clayey SILT with trace sand and slight trace gravel.		472	
44A	13/14 93%	SS	28-47 15/2"	16.7			72	Dark greenish gray (10GY4/1), wet, very dense, silty, medium- to coarse-grained SAND with slight trace gravel.		470	
45A	16/17 94%	SS	31-33 27/5"	13.6			74	Dark greenish gray (10GY4/1), wet, very dense, silty, coarse-grained SAND and gravel.		468	
46A	12/15 80%	SS	20-38 22/3"	15.3			76	Dark gray (10YR4/1), wet, very dense, silty, medium- to coarse-grained SAND with slight trace gravel.		466	
47A	18/18 100%	SS	3-11 17 N=28	13.9		5.62 B	78	Dark gray (N4/1), moist, firm, silty CLAY with slight trace sand and gravel.		464	
48A	17/18 94%	SS	5-10 14 N=24	14.9		5.24 BSh	80	Dark gray (N4/1), slightly moist, firm, silty CLAY with slight trace sand and gravel.			

NOTE(S): Borehole abandoned using bentonite grout.

FIELD BORING LOG

HANSON

CLIENT: AEG Newton Power Station	**CONTRACTOR:** Skinner Limited		
Site: Gypsum Management Facility	**Rig mfg/model:** CME-550 ATV Drill	**BOREHOLE ID:** B48	
Location: Newton, Jasper Co., IL	**Drilling Method:** 4¼" hollow stem auger w/split spoon sampler	**Well ID:** n/a	
Project: 07E0150A 3000		**Surface Elev:**	542.9 ft. MSL
DATES: Start: 5/12/2009	**FIELD STAFF: Driller:** T. Skinner	**Completion:**	103.5 ft. BGS
Finish: 5/14/2009	**Helper:** T. Skinner/J. Austin	**Station:**	9,703.88N
WEATHER: Sunny, warm, windy, (mid-60's)	**Eng/Geo:** S. Suzanna Simpson		5,042.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) % Recovery	Type	TESTING: Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
49A	24/24 100%	SS	5-7 12-14 N=19	15.5		5.04 BSh	82	Dark gray (N4/1), slightly moist, firm, silty CLAY with slight trace sand and gravel. *[Continued from previous page]*	462	
50A	18/18 100%	SS	4-8 10 N=18	15.4		5.24 BSh			460	
51A	18/18 100%	SS	4-9 10 N=19	15.7		5.04 B	84		458	
52-1 52-2 52-3	18/18 100%	SH		14.3			86		456	
53A	24/24 100%	SS	9-12 21-26 N=33	13.9		6.21 B	88	Dark gray (N4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.		
54A	18/18 100%	SS	6-11 17 N=28	13.8		6.79 Sh	90	Dark gray (N4/1), slightly moist, firm, silty CLAY with slight trace sand and gravel.	454	
55A	24/24 100%	SS	6-12 15-24 N=27	13.6		7.37 Sh	92		452	
56A	18/18 100%	SS	5-8 12 N=20	13.9		3.88 Sh			450	
57A	18/18 100%	SS	5-12 19 N=31	13.4		6.21 Sh	94		448	
58A	24/24 100%	SS	4-18 20-22 N=38	12.5			96	Dark gray (N4/1), very moist, dense, silty, fine- to coarse-grained SAND with slight trace gravel.		
58B				13.4		5.82 BSh		Dark gray (N4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.	446	
59A	16/16 100%	SS	16-33 27/4"	16.0				Dark gray (N4/1), wet, dense, silty, fine- to medium-grained SAND with slight trace gravel.		
59B				15.7		3.69 Sh	98	Dark gray (N4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.		
								Dark gray (N4/1), wet, dense, silty, very fine- to medium-grained SAND with slight trace gravel.	444	
60A	18/18 100%	SS	16-21 15 N=36	12.6				Dark gray (N4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.		
60B							100			

NOTE(S): Borehole abandoned using bentonite grout.

FIELD BORING LOG

HANSON

CLIENT: AEG Newton Power Station
Site: Gypsum Management Facility
Location: Newton, Jasper Co., IL
Project: 07E0150A 3000
DATES: Start: 5/12/2009
Finish: 5/14/2009
WEATHER: Sunny, warm, windy, (mid-60's)

CONTRACTOR: Skinner Limited
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: T. Skinner
Helper: T. Skinner/J. Austin
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: B48
Well ID: n/a
Surface Elev: 542.9 ft. MSL
Completion: 103.5 ft. BGS
Station: 9,703.88N
5,042.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ =
▽ =

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
61A	24/24 *100%*	SS	*7-12 18-25* N=30	13.4		6.59 Sh		Dark gray (N4/1), slightly moist, firm, silty CLAY with slight trace sand and gravel.		442	
62A	17/18 *94%*	SS	*12-18 22* N=40	15.3		3.88 BSh	102	Dark gray (N4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.		440	

EOB = 103.5 feet bgs

NOTE(S): Borehole abandoned using bentonite grout.

Illinois Environmental Protection Agency

Well Completion Report

Site #: ILD 0798080002 County: Jasper Well #: G106

Site Name: Scrubber Sludge Landfill PLANT Grid Coordinate Northing: 983.42 N Easting: 7065.61 W

Drilling Contractor: Broecke Engineering Date Drilled Start: 8/1/90

Driller: Mike Fappy Geologist: Rich Bouer CHEI Date Completed: 8/1/90

Drilling Method: 4¼" ID, 8" OD Hollow Stem Augers Drilling Fluids (type): None

Annular Space Details

Type of Surface Seal: Cement/Bentonite Grout

Type of Annular Sealant: Cement/Bentonite Grout

Amount of cement: # of bags 3 lbs. per bag 94

Amount of bentonite: # of bags 0.28 lbs. per bag 50

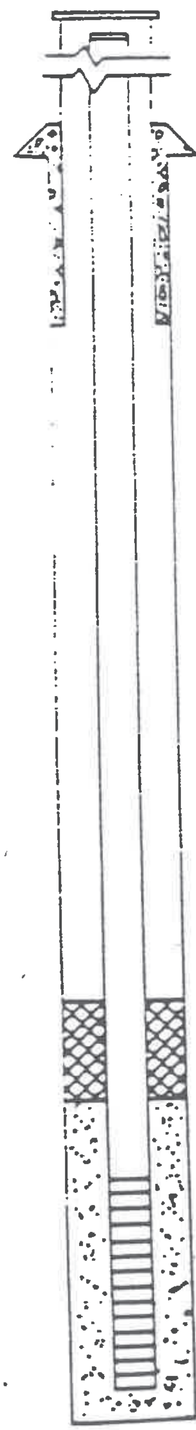
Type of Bentonite Seal (Granular, Pellet): ¼" pellets

Amount of bentonite # of Bags 2 lbs. per bag 50

Type of Sand Pack: Silica Sand

Source of Sand: Meramec WB-35

Amount of Sand # of bags 3 lbs. per bag 94



Elevations – .01 ft.

530.87 MSL Top of Protective Casing

530.86 MSL Top of Riser Pipe

1.86 ft. Casing Stickup

529.00 MSL Ground Surface

529.00 ft. Top of annular sealant

515.76 ft. Top of Seal

3.20 ft. Total Seal Interval

512.56 ft. Top of Sand

509.36 ft. Top of Screen

14.90 ft. Total Screen Interval

494.46 ft. Bottom of Screen

492.56 ft. Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type Schedule 40	Other Specify Type
Riser coupling joint			X	
Riser pipe above w.t.			2" ID	
Riser pipe below w.t.			2" ID	
Screen			0.01"	
Coupling joint screen to riser			X	
Protective casing				Steel

Measurements

to .01 ft. (where applicable)

Riser pipe length	21.5
Protective casing length	5.0
Screen length	14.9
Bottom of screen to end cap	0
Top of screen to first joint	10
Total length of casing	36.4
Screen slot size	0.01"
# of openings in screen	0.125" spacing
Diameter of borehole (in)	8
ID of riser pipe (in)	2

Completed by: Robert Cowles (HEI) Surveyed by: Herb Williams (HEI) Ill. registration #: 035-00238

Illinois Environmental Protection Agency

Well Completion Report

Site #: ________ County: Jasper Well #: G202

Site Name: Newton Power Station Landfill Grid Coordinate: Northing 6649.68 Easting 6587.20

Drilling Contractor: Professional Service Industries, Inc. Date Drilled Start: 10/16/96

Driller: ________ Geologist: Mike Summers Date Completed: 10/16/96

Drilling Method: 4¼" I.D. HSA Drilling Fluids (type): N/A

Annular Space Details

Type of Surface Seal: Portland Cement

Type of Annular Sealant: Cement/Bentonite Grout (20:1)

Amount of cement: # of bags 14 lbs. per bag 94

Amount of bentonite: # of bags 1.5 lbs. per bag 50

Type of Bentonite Seal (Granular, Pellet): Pellet

Amount of bentonite: # of Bags 1 lbs. per bag 50

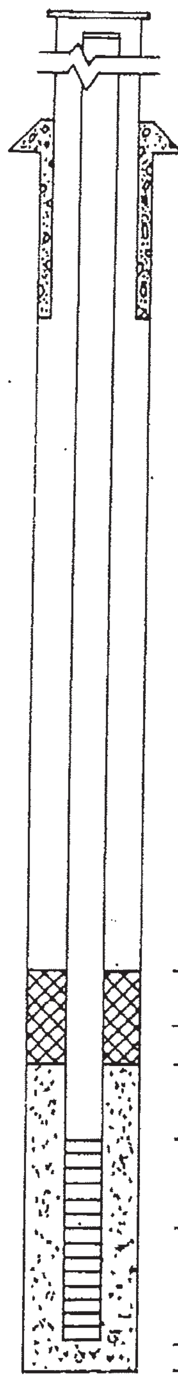
Type of Sand Pack: Silica

Source of Sand: ________

Amount of Sand: # of bags 12.5 lbs. per bag 100

Elevations — .01 ft.

		MSL Top of Protective Casing
540	02	MSL Top of Riser Pipe
2	78	ft. Casing Stickup
537	24	MSL Ground Surface
		ft. Top of annular sealant
479	24	ft. Top of Seal
2	50	ft. Total Seal Interval
476	74	ft. Top of Sand
473	24	ft. Top of Screen
10	00	ft. Total Screen Interval
463	24	ft. Bottom of Screen
463	24	ft. Bottom of Borehole



Well Construction Materials

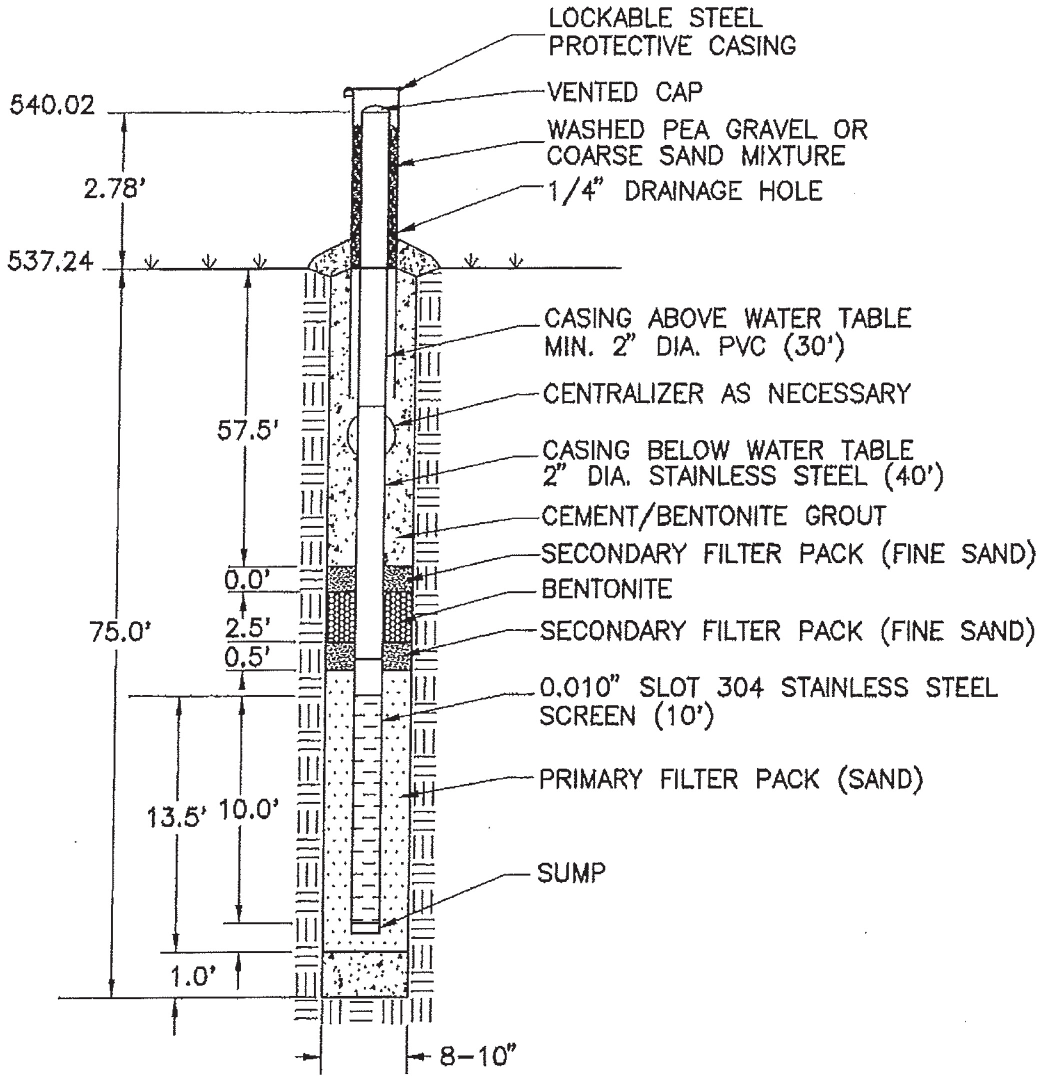
	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint				
Riser pipe above w.t.				
Riser pipe below w.t.				
Screen				
Coupling joint screen to riser				
Protective casing				

Measurements

to .01 ft. (where applicable)

Riser pipe length	66.78 ft.
Protective casing length	
Screen length	10.0 ft.
Bottom of screen to end cap	
Top of screen to first joint	
Total length of casing	
Screen slot size	.010 in.
% of openings in screen	
Diameter of borehole (in)	8
ID of riser pipe (in)	2

Completed by: ________ Surveyed by: ________ Ill. registration #: ________



N: 6649.68 / E: 6587.20

RAPPS

ENGINEERING & APPLIED SCIENCE

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1601 BROADWAY • MT. VERNON, IL 62864 • (618) 244-2611

G202
MONITORING WELL AS-BUILT DIAGRAM

CIPS-NEWTON LANDFILL
JASPER COUNTY, ILLINOIS

Illinois Environmental Protection Agency

Well Completion Report

Site #: ______ County: Jasper Well #: G203

Site Name: Newton Power Station Landfill Grid Coordinate: Northing 5821.29 Easting 6113.10

Drilling Contractor: Professional Service Industries, Inc. Date Drilled Start: 10/15/96

Driller: ______ Geologist: Mike Summers Date Completed: 10/15/96

Drilling Method: 4¼" I.D. HSA Drilling Fluids (type): N/A

Annular Space Details

Type of Surface Seal: Portland Cement

Type of Annular Sealant: Cement/Bentonite Grout (20:1)

Amount of cement: # of bags 10 lbs. per bag 94

Amount of bentonite: # of bags 1 lbs. per bag 50

Type of Bentonite Seal (Granular, Pellet): Pellet

Amount of bentonite: # of Bags 8 lbs. per bag 50

Type of Sand Pack: Silica

Source of Sand: ______

Amount of Sand: # of bags 13.5 lbs. per bag 100

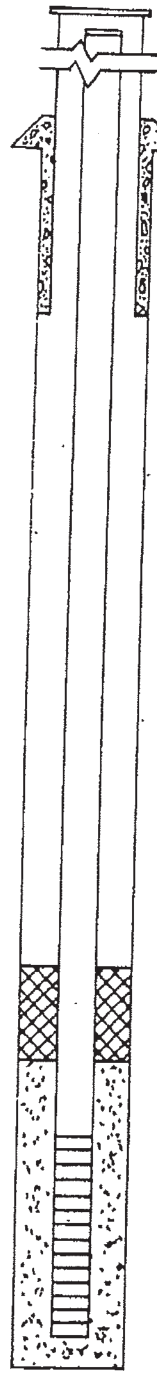
Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint				
Riser pipe above w.t.			Sch 40	
Riser pipe below w.t.	Type304			
Screen	Type304			
Coupling joint screen to riser				
Protective casing				Steel

Measurements

to .01 ft. (where applicable)

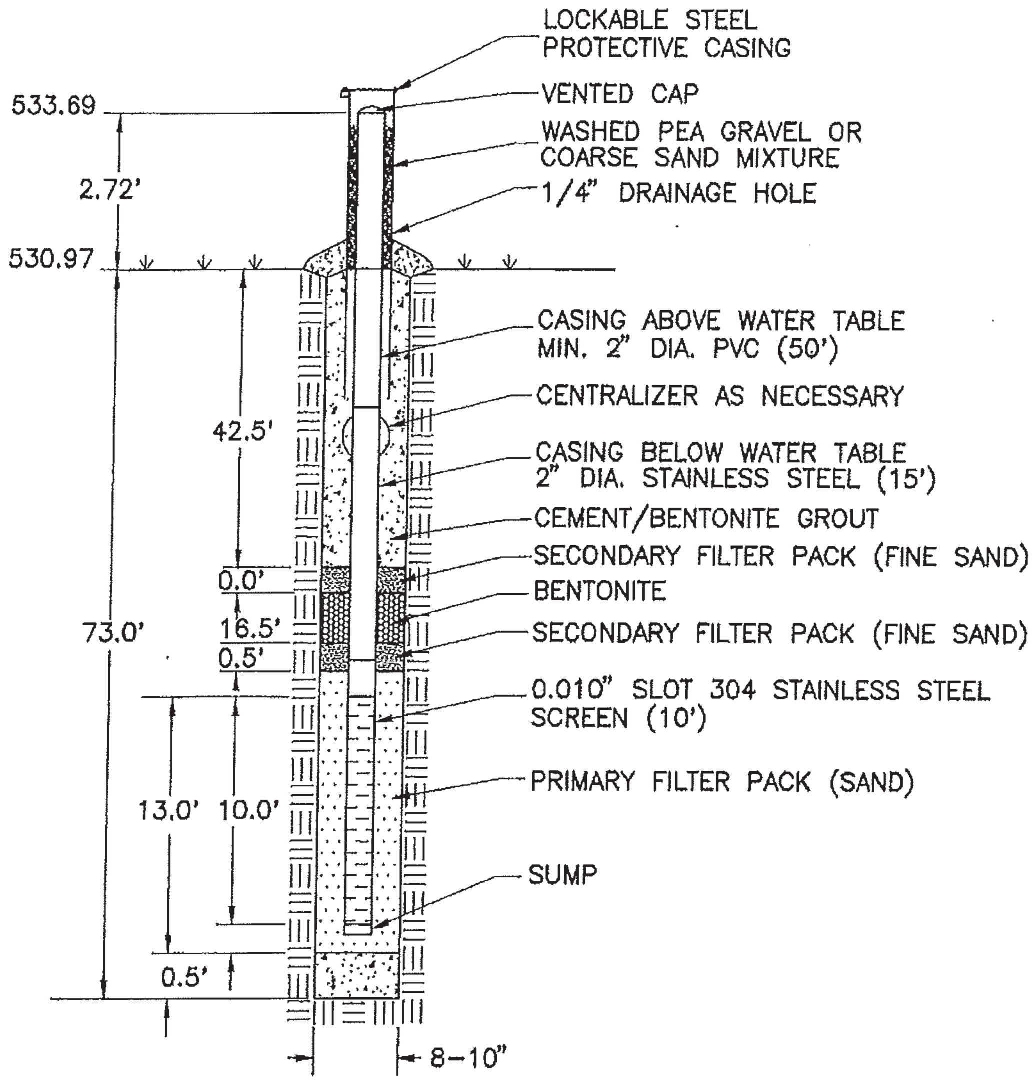
Riser pipe length	65.22 ft.
Protective casing length	
Screen length	10.0 ft.
Bottom of screen to end cap	
Top of screen to first joint	
Total length of casing	
Screen slot size	.010 in.
% of openings in screen	
Diameter of borehole (in)	8
ID of riser pipe (in)	2



Elevations – .01 ft.

533	69	MSL Top of Protective Casing
		MSL Top of Riser Pipe
2	72	ft. Casing Stickup
530	97	MSL Ground Surface
		ft. Top of annular sealant
487	97	ft. Top of Seal
16	50	ft. Total Seal Interval
471	47	ft. Top of Sand
468	47	ft. Top of Screen
10	00	ft. Total Screen Interval
458	47	ft. Bottom of Screen
458	47	ft. Bottom of Borehole

Completed by: ______ Surveyed by: ______ Ill. registration # ______



N: 5821.29 / E: 6113.10

RAPPS

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1601 BROADWAY • MT. VERNON, IL 62864 • (618) 244-2611

G203
MONITORING WELL AS-BUILT DIAGRAM

CIPS-NEWTON LANDFILL
JASPER COUNTY, LANDFILL

Illinois Environmental Protection Agency **Well Completion Report**

Site Number: 0798085001 County: Jasper

Site Name: Newton Power Station Landfill Phase II Well #: G208

State Plane Coordinate: X ____ Y ____ (or) Latitude: ___ ° ___ ' ___ " Longitude: ___ ° ___ ' ___ " Borehole #: B208

Plant Coordinates: Northing 6208.18 Easting 4417.18

Surveyed by: Ken Miller IL Registration #: 196-001263

Drilling Contractor: Skinner Ltd. Driller: Todd Skinner

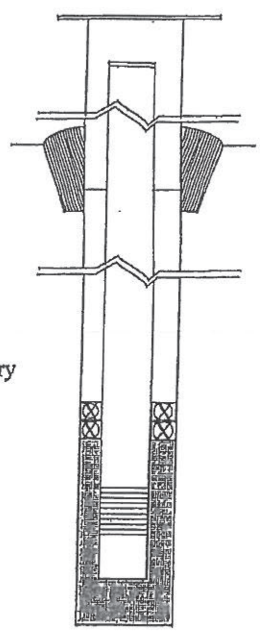
Consulting Firm: Rapps Engineering Geologist: Ken Miller

Drilling Method: HSA Drilling Fluid (Type): None

Logged By: Ken Miller Date Started: 10/11/11 Date Finished: 10/13/11

Report Form Completed By: Ken Miller Date: 11/30/11

ANNULAR SPACE DETAILS



Elevations (MSL)*	Depths (BGS)	(.01ft.)
535.89	-2.83	Top of Protective Casing
535.52	-2.46	Top of Riser Pipe
533.06	0.00	Ground Surface
530.06	3.00	Top of Annular Sealant
____	____	Static Water Level (After Completion)
463.13	69.93	Top of Seal
460.13	72.93	Top of Sand Pack
458.13	74.93	Top of Screen
438.35	94.71	Bottom of Screen
438.29	94.77	Bottom of Well
438.06	95.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Slurry

Installation Method: Tremi

Setting Time: ____

Type of Bentonite Seal -- Granular, (Pellet), Slurry (Choose One)

Installation Method: Poured

Setting Time: ____

Type of Sand Pack: Silica Sand

Grain Size: 20/40 (Sieve Size)

Installation Method: Poured

Type of Backfill Material: NA (if applicable)

Installation Method: ____

CASING MEASURMENTS

Diameter of Borehole (inches)	9
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	77.39
Bottom of Screen to End Cap (feet)	0.06
Screen Length (1st slot to last slot) (feet)	19.78
Total Length of Casing (feet)	97.23
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or (Other)
Riser Pipe Above W.T.	SS304, SS316, PTFE, (PVC), or Other
Riser Pipe Below W.T.	(SS304), SS316, PTFE, PVC, or Other
Screen	(SS304), SS316, PTFE, PVC, or Other

Well Completion Form (revised 02/06/02)

Illinois Environmental Protection Agency

Well Completion Report

Site #: 0798085001 County Jasper Well # G217

Site Name: Newton Power Station Landfill Grid Coordinate: Northing 7121.09 Easting 6736.33

Drilling Contractor: PSI Environmental Services Date Drilled Start: 8/26/97

Driller: A. Shawgo Geologist: M. Summers Date Completed: 8/26/97

Drilling Method: 4¼ ID HSA Drilling Fluids (type): None

Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant: 5% Bentonite in Cement

Amount of cement: # of bags ____ lbs. per bag ____

Amount of bentonite: # of bags ____ lbs. per bag ____

Type of Bentonite Seal (Granular, Pellet): Slurry

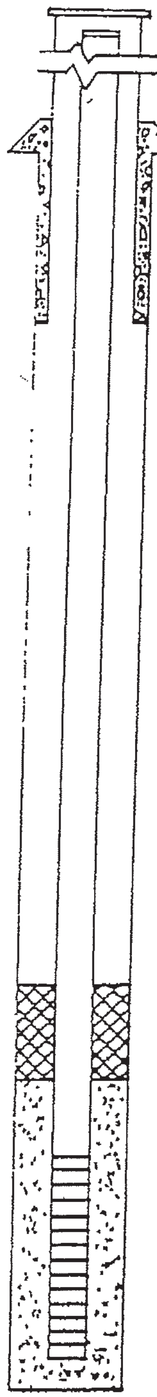
Amount of bentonite: # of Bags ____ lbs. per bag ____

Type of Sand Pack: Silica Sand #7

Source of Sand: Moble Drilling Supply

Amount of Sand: # of bags ____ lbs. per bag ____

Elevations — .01 ft.



____ . ____	MSL Top of Protective Casing
538. 16	MSL Top of Riser Pipe
____	ft. Casing Stickup
535. 67	MSL Ground Surface
____	ft. Top of annular sealant
530. 67	ft. Top of Seal
2. 0	ft. Total Seal Interval
528. 67	ft. Top of Sand
526. 67	ft. Top of Screen
10. 0	ft. Total Screen Interval
516. 67	ft. Bottom of Screen
510. 67	ft. Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			Sch 40	
Riser pipe above w.t.			Sch 40	
Riser pipe below w.t.	304			
Screen	304			
Coupling joint screen to riser	304			
Protective casing				Steel

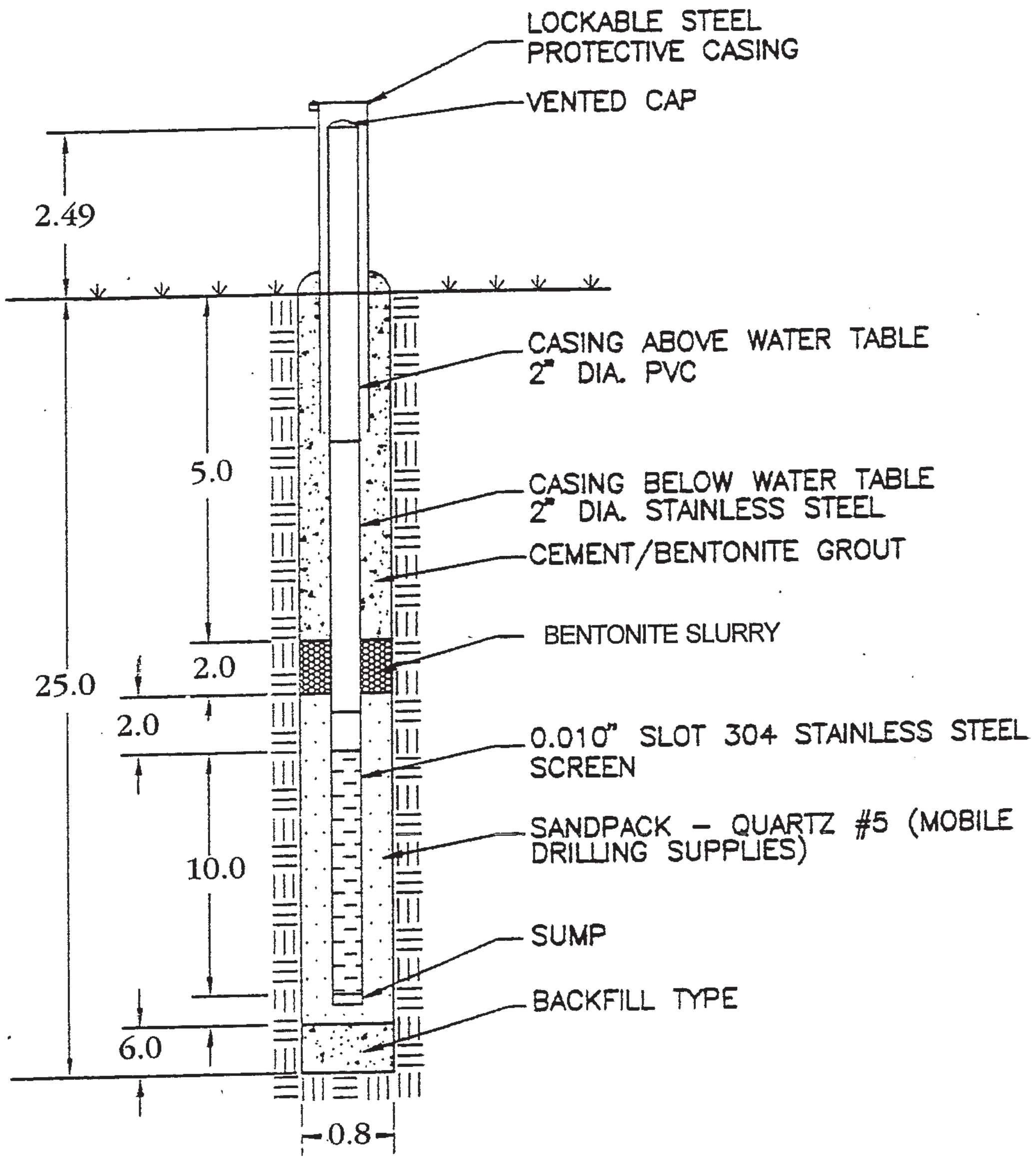
Measurements

to .01 ft. (where applicable)

Riser pipe length	10.0
Protective casing length	
Screen length	10.0
Bottom of screen to end cap	0.1
Top of screen to first joint	0.1
Total length of casing	5.0
Screen slot size	10 slot (0.01")
% of openings in screen	Continuous
Diameter of borehole (in)	8½"
ID of riser pipe (in)	2.0

Completed by: M. Summers Surveyed by: R. Whaley Ill. registration #: ____

MONITORING WELL CONSTRUCTION DIAGRAM



RAPPS

ENGINEERING & APPLIED SCIENCE
821 S. DURKIN DR. • SPRINGFIELD, IL 62704 • (217) 787-2118
1601 BROADWAY • MT. VERNON, IL 62864 • (618) 244-2611

G217

MONITORING WELL CONSTRUCTION DETAIL

Newton Power Station Landfill

Jasper County

Illinois Environmental Protection Agency

Well Completion Report

Site Number: 0798085001 County: Jasper

Site Name: Newton Power Station Landfill Phase II

Well #: G222

State Plane Coordinate: X ____ Y ____ (or) Latitude: ___ ° ___ ' ___ " Longitude: ___ ° ___ ' ___ "

Borehole #: B222

Plant Coordinates: Northing 5322.24 Easting 3989.08

Surveyed by: Ken Miller

IL Registration #: 196-001263

Drilling Contractor: Skinner Ltd.

Driller: Todd Skinner

Consulting Firm: Rapps Engineering

Geologist: Ken Miller

Drilling Method: HSA

Drilling Fluid (Type): None

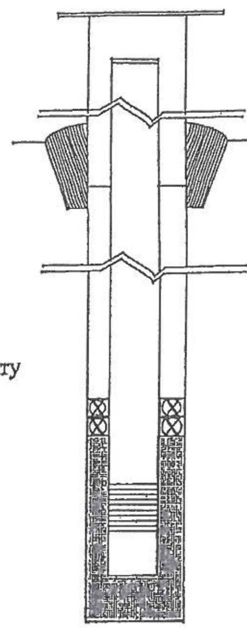
Logged By: Ken Miller

Date Started: 10/24/11 Date Finished: 10/25/11

Report Form Completed By: Ken Miller

Date: 11/30/11

ANNULAR SPACE DETAILS



Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Slurry

Installation Method: Tremi

Setting Time: ____

Type of Bentonite Seal - - Granular, (Pellet), Slurry (Choose One)

Installation Method: Poured

Setting Time: ____

Type of Sand Pack: Silica Sand

Grain Size: 20/40 (Sieve Size)

Installation Method: Poured

Type of Backfill Material: NA (if applicable)

Installation Method: ____

Elevations (MSL)*	Depths (BGS)	(.01ft.)
535.16	-3.04	Top of Protective Casing
534.78	-2.66	Top of Riser Pipe
532.12	0.00	Ground Surface
529.12	3.00	Top of Annular Sealant
		Static Water Level (After Completion)
472.55	59.57	Top of Seal
469.55	62.57	Top of Sand Pack
467.55	64.57	Top of Screen
452.88	79.24	Bottom of Screen
452.81	79.31	Bottom of Well
452.12	80.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or (Other)
Riser Pipe Above W.T.	SS304, SS316, PTFE, (PVC), or Other
Riser Pipe Below W.T.	(SS304), SS316, PTFE, PVC, or Other
Screen	(SS304), SS316, PTFE, PVC, or Other

CASING MEASURMENTS

Diameter of Borehole (inches)	9
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	67.27
Bottom of Screen to End Cap (feet)	0.07
Screen Length (1st slot to last slot) (feet)	14.63
Total Length of Casing (feet)	81.97
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

Illinois Environmental Protection Agency — **Well Completion Report**

Site Number: 0798085001 County: Jasper

Well #: G224

Site Name: Newton Power Station Landfill Phase II

State Plane Coordinate: X ____ Y ____ (or) Latitude: __° __' __" Longitude: __° __' __"

Borehole #: B224

Plant Coordinates: Northing 6976.66 Easting 6067.30

Surveyed by: Ken Miller

IL Registration #: 196-001263

Drilling Contractor: Whitney & Associates

Driller: Tim Fuhl

Consulting Firm: Rapps Engineering

Geologist: Ken Miller

Drilling Method: HSA

Drilling Fluid (Type): None

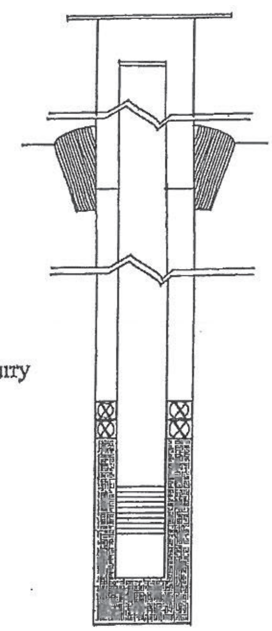
Logged By: Ken Miller

Date Started: 10/4/11 Date Finished: 10/5/11

Report Form Completed By: Ken Miller

Date: 11/30/11

ANNULAR SPACE DETAILS



Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Chips

Installation Method: Poured

Setting Time: ____

Type of Bentonite Seal -- Granular, (Pellet), Slurry (Choose One)

Installation Method: Poured

Setting Time: ____

Type of Sand Pack: Silica Sand

Grain Size: 50 (Sieve Size).

Installation Method: Poured

Type of Backfill Material: NA (if applicable)

Installation Method: ____

Elevations (MSL)*	Depths (BGS)	(.01ft.)
535.19	-2.93	Top of Protective Casing
534.78	-2.52	Top of Riser Pipe
532.26	0.00	Ground Surface
529.26	3.00	Top of Annular Sealant
		Static Water Level (After Completion)
473.75	58.51	Top of Seal
470.75	61.51	Top of Sand Pack
468.75	63.51	Top of Screen
459.09	73.17	Bottom of Screen
458.75	73.51	Bottom of Well
458.26	74.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASURMENTS

Diameter of Borehole (inches)	9
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	66.03
Bottom of Screen to End Cap (feet)	0.34
Screen Length (1st slot to last slot) (feet)	9.66
Total Length of Casing (feet)	76.03
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or (Other)
Riser Pipe Above W.T.	SS304, SS316, PTFE, (PVC) or Other
Riser Pipe Below W.T.	(SS304) SS316, PTFE, PVC, or Other
Screen	(SS304) SS316, PTFE, PVC, or Other

Illinois Environmental Protection Agency — Well Completion Report

Site #: 0798085001 County: Jasper Well #: R217D

Site Name: Newton Power Station Borehole #: R217D

~~State~~ Plant ~~Plane~~ Coordinate: X 6,712.2 Y 7,126.9 (or) Latitude: 38° 55' 55.889" Longitude: -88° 17' 24.426"

Surveyed By: Matthew H. Schrader IL Registration #: 035-003487

Drilling Contractor: Bulldog Drilling Driller: J. Dittmaier

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

Drilling Method: Mud Rotary Drilling Fluid (Type): Bentonite mud

Logged By: Rhonald W. Hasenyager Date Started: 9/25/2017 Date Finished: 9/26/2017

Report Form Completed By: Suzanna L. Keim Date: 10/16/2017

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: high-solids bentonite

Installation Method: Tremie

Setting Time: +24 hours

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

Installation Method: Gravity

Setting Time: 10 minutes

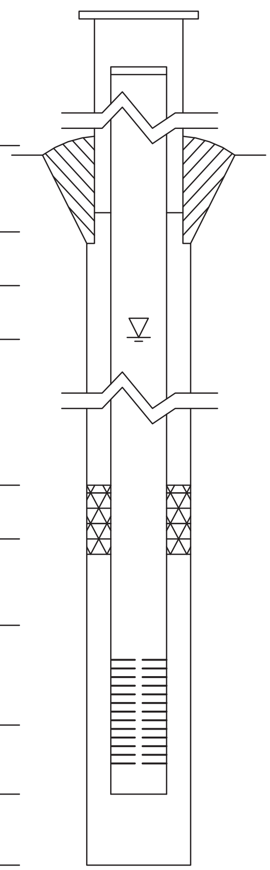
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: none (if applicable)

Installation Method:



Elevations (MSL)*	Depths (BGS) (0.01 ft.)	
538.85	-2.94	Top of Protective Casing
538.55	-2.64	Top of Riser Pipe
535.91	0.00	Ground Surface
533.41	2.50	Top of Annular Sealant
		Static Water Level (After Completion)
479.39	56.52	Top of Seal
478.01	57.90	Top of Sand Pack
475.81	60.10	Top of Screen
470.88	65.03	Bottom of Screen
470.67	65.24	Bottom of Well
470.67	65.24	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	62.64
Bottom of Screen to End Cap	(feet)	0.31
Screen Length (1st slot to last slot)	(feet)	4.93
Total Length of Casing	(feet)	67.88
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

Well Completion Form (revised 02/06/02)

APPENDIX D
GEOTECHNICAL LABORATORY REPORT

April 13, 2021
Revised: May 10, 2021

Mr. Scott Woods
Ramboll Environ U.S. Corporation
333 West Wacker Drive, Ste 2700
Chicago, IL 60606-2872

RE: Laboratory Testing Program for the Newton Power Station Project – Terracon Project No. 11215019

Dear Mr. Woods,

We are pleased to submit our report pertaining to geotechnical laboratory testing of thirty-one (31) soil samples in reference to the Newton Power Station Project. Per your instructions, Terracon performed the following tests on each of the samples:

- Specific Gravity of Soils – ASTM D854
- Water Content of Soil and Rock – ASTM D2216
- Liquid Limit, Plastic Limit and Plasticity Index of Soils – ASTM D4318
- Permeability of Granular Soils (Constant Head) – ASTM D 2434 *
- Hydraulic Conductivity of Saturated Porous Materials Using a Flexible-Wall Permeameter – ASTM D5084
- Laboratory Determination of Density (Unit Weight) of Soil Specimens – ASTM D7263
- Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis – ASTM D6913
- Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis – ASTM D7928

Three samples originally scheduled for hydraulic conductivity tests following ASTM D5084 did not meet the flow criteria for the standard because of the granular matrix of the samples. Instead the tests were run following ASTM D 2434 which allows for greater permeant flow through the specimen.

The test data included in this report, only represent the samples tested and may not reflect actual site materials and/or conditions. The scope of services provided by Terracon did not include interpretation of the laboratory test data, and therefore, we are not liable for any interpretation performed by others. If you wish us to provide you with this service, we would be happy to discuss this matter with you at your convenience. Any reproduction of this report must be done in its entirety.

We are pleased to have the opportunity to provide you with our testing services. Should you have any questions, or require additional assistance, please feel free to contact us at any time.

Sincerely,
Terracon Consultants, Inc.

William P. Quinn
Department Manager – Laboratory Services

Attachments:

LABORATORY TESTING SUMMARY

PROJECT NAME: Newton Power Station | PROJECT NUMBER: 11215019 | CLIENT: Ramboll

Boring Number	Sample Number	Depth	Description	USCS	WC %	Dry Density (pcf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Permeability k (cm/sec)	Specific Gravity
APW-11	0805	10.0'-12.0'	BROWN SANDY LEAN CLAY	CL	17.8	111.7	1.1	45.1	25.2	28.6	28	12	16	8.57E-08	2.645
APW-11	1050	61.0'-61.5'	GRAYISH BROWN LEAN CLAY WITH SAND	CL	17.8	110.5	0.0	21.4	48.4	30.2	27	18	9	1.87E-07	2.686
APW-11	1115	80.0'-82.0'	DARK GRAY LEAN CLAY WITH SAND	CL	16.5	116.1	0.0	21.0	44.4	34.6	32	14	18	2.94E-08	2.705
APW-12	0825	20.0'-22.0'	BROWN AND RUST BROWN CLAYEY SAND - ROOTS NOTED	SC	15.1	118.3	7.4	46.8	24.3	21.5	27	12	15	1.07E-07	2.694
APW-12	0845	25.5'-26.0'	BROWN POORLY GRADED SAND WITH SILT AND GRAVEL	SP-SM	8.4	113.0	24.3	69.5	2.9	3.3	10	13	NP	8.43E-06	2.654
APW-12	1245	85.0'-87.0'	DARK GRAY LEAN CLAY WITH SAND - SILT POCKETS NOTED	CL	14.4	116.4	0.3	19.5	44.4	35.8	29	14	15	2.36E-08	2.711
APW-13	0845	25.0'-27.0'	DARK BROWN AND GRAY POORLY GRADED SAND WITH SILT	SP-SM	21.2	87.1	0.0	88.9	6.8	4.3	9	10	NP	9.63E-05	2.649
APW-13	1345	60.5'-61.0'	BROWN SILTY SAND	SM	14.5	114.3	0.3	75.2	19.4	5.1	8	13	NP	2.18E-04	2.661
APW-14	0955	45.0'-47.0'	BROWN SANDY LEAN CLAY	CL	12.4	119.6	4.4	32.3	36.5	26.8	26	14	12	9.65E-08	2.706
APW-14	1045	55.5'-56.0'	GRAY AND BROWNISH GRAY LEAN CLAY WITH SAND	CL	18.0	104.6	0.0	27.8	44.4	27.8	25	15	10	2.74E-07	2.709
APW-15	1005	20.0'-22.0'	BROWN SANDY LEAN CLAY	CL	18.5	109.8	0.0	40.8	27.4	31.8	33	10	23	3.21E-08	2.686
APW-15	0755	100.5'-101.0'	GRAY SILTY SAND	SM	12.1	116.4	4.4	49.8	39.0	6.8	15	12	3	3.50E-06	2.665
APW-15	0905	105.0'-107.0'	DARK GRAY LEAN CLAY WITH SAND	CL	19.1	107.8	0.0	23.8	47.1	29.1	29	13	16	8.20E-08	2.695
APW-17	0945	40.0'-42.0'	GRAY LEAN CLAY WITH SAND	CL	16.6	108.8	1.3	27.6	44.1	27.0	26	13	13	3.34E-08	2.709
APW-17	1045	71.0'-71.5'	GRAY WELL GRADED SAND WITH SILT	SW-SM	7.8	110.2	14.3	76.8	5.1	3.8	5	9	NP	7.21E-04	2.660
APW-17	1200	90.5'-91.0'	GRAYISH BROWN POORLY GRADED SAND WITH SILT AND GRAVEL	SP-SM	6.1	116.8	28.2	65.1	4.2	2.5	6	8	NP	6.39E-04	2.672
SB-300	0825	50.0'-52.0'	DARK GRAY LEAN CLAY WITH SAND	CL	12.9	122.7	0.8	22.4	44.5	32.3	32	12	20	7.29E-08	2.700
SB-300	0905	61.0'-61.5'	GRAYISH BROWN SILTY SAND	SM	13.6	109.6	4.7	78.2	12.5	4.6	5	9	NP	1.85E-05	2.686
SB-300	0920	62.5'-63.0'	GRAY AND BROWN SANDY SILTY CLAY	CL-ML	11.1	124.6	0.0	42.4	40.8	16.8	20	14	6	4.32E-06	2.659
SB-300	1350	105.0'-107.0'	DARK GRAY SANDY LEAN CLAY	CL	14.1	116.4	0.0	30.7	37.7	31.6	28	13	15	4.28E-08	2.710
SB-301	1330	48.0'-50.0'	BROWN AND GRAY SANDY LEAN CLAY	CL	14.1	117.3	0.4	34.2	35.5	29.9	27	14	13	6.63E-08	2.697
SB-301	1600	68.5'-69.0'	GRAY SANDY LEAN CLAY	CL	13.1	121.3	0.0	31.3	43.2	25.5	23	14	9	4.05E-08	2.723
SB-301	0946	98.0'-100.0'	DARK BROWN TO DARK GRAY LEAN CLAY WITH SAND	CL	15.7	118.2	0.0	17.8	47.0	35.2	37	15	22	6.13E-08	2.720
XPW-01	0820	8.5'-9.0'	DARK GRAY AND BROWN POORLY GRADED SAND WITH SILT AND GRAVEL	SP-SM	18.6	87.7	37.1	51.1	8.2	3.6	47	57	NP	1.71E-04	2.675
XPW-01	0840	15.5'-16.0'	GRAY AND BROWN SANDY LEAN CLAY	CL	12.6	84.4	4.6	34.1	35.1	26.2	35	17	18	1.58E-05	2.741

LABORATORY TESTING SUMMARY

PROJECT NAME: Newton Power Station | PROJECT NUMBER: 11215019 | CLIENT: Ramboll

Boring Number	Sample Number	Depth	Description	USCS	WC %	Dry Density (pcf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Permeability k (cm/sec)	Specific Gravity
XPW-02	1530	8.0'-8.5'	VERY DARK GRAY, GRAY AND BROWN SANDY LEAN CLAY	CL	29.1	92.9	0.3	44.8	28.9	26.0	36	16	20	6.07E-08	2.691
XPW-02	1545	16.5'-17.0'	GRAY AND DARK BROWN LEAN CLAY WITH SAND	CL	21.8	103.7	0.0	19.8	42.5	37.7	36	14	22	7.38E-08	2.694
XPW-03	1255	6.0'-6.5'	DARK BROWNISH GRAY SILTY SAND	SM	17.4	75.3	6.8	71.7	16.0	5.5	33	27	6	1.34E-03	2.663
XPW-03	1315	15.5'-16.0'	BROWNISH GRAY SILTY SAND WITH GRAVEL	SM	16.7	103.6	16.4	67.3	12.3	4.0	12	19	NP	9.70E-05	2.689
XPW-04	1000	6.5'-7.0'	GRAY SILTY SAND	SM	31.1	73.9	1.6	84.5	10.9	3.0	41	38	3	1.61E-04	2.697
XPW-04	1020	15.5'-16.0'	DARK BROWNISH GRAY SILTY SAND WITH GRAVEL	SM	31.1	80.8	15.7	51.0	24.7	8.6	46	42	4	7.83E-05	2.650

Terracon

Specific Gravity of Soils
ASTM D854

Terracon
Consulting Engineers & Scientists

SPECIFIC GRAVITY OF SOIL SOLIDS
ASTM D-854

Laboratory Services Group 192 Exchange Blvd. Glendale Heights, Illinois 60139 Ph. (630) 717-4263

Project Number: 11215019
Project Name: Newton Power Station
Test Date: 3/1/2021

Results Summary

Boring / Sample	Sample Number	Depth (ft)		Specific Gravity (Gs)
APW-11	0805	10.0'-12.0'		2.645
APW-11	1050	61.0'-61.5'		2.686
APW-11	1115	80.0'-82.0'		2.705
APW-12	0825	20.0'-22.0'		2.694
APW-12	0845	25.5'-26.0'		2.654
APW-12	1245	85.0'-87.0'		2.711
APW-13	0845	25.0'-27.0'		2.649
APW-13	1345	60.5'-61.0'		2.661
APW-14	0955	45.0'-47.0'		2.706
APW-14	1045	55.5'-56.0'		2.709
APW-15	1005	20.0'-22.0'		2.686
APW-15	0755	100.5'-101.0'		2.665
APW-15	0905	105.0'-107.0'		2.692
APW-17	0945	40.0'-42.0'		2.709
APW-17	1045	71.0'-71.5'		2.660
APW-17	1200	90.5'-91.0'		2.672

Tested By: SJH Checked By: WPQ

Terracon
Consulting Engineers & Scientists

SPECIFIC GRAVITY OF SOIL SOLIDS
ASTM D-854

Laboratory Services Group 192 Exchange Blvd. Glendale Heights, Illinois 60139 Ph. (630) 717-4263

Project Number: 11215019
Project Name: Newton Power Station
Test Date: 3/1/2021

Results Summary

Boring / Sample	Sample Number	Depth (ft)		Specific Gravity (Gs)
SB-300	0825	50.0'-52.0'		2.700
SB-300	0905	61.0'-61.5'		2.686
SB-300	0920	62.5'-63.0'		2.659
SB-300	1350	105.0'-107.0'		2.710
SB-301	1330	48.0'-50.0'		2.697
SB-301	1600	68.5'-69.0'		2.723
SB-301	0946	98.0'-100.0'		2.720
XPW-01	0820	8.5'-9.5'		2.675
XPW-01	0840	15.5'-16.0'		2.741
XPW-02	1530	8.0'-8.5'		2.691
XPW-02	1545	16.5'-17.0'		2.694
XPW-03	1355	6.0'-6.5'		2.663
XPW-03	1315	15.5'-16.0'		2.689
XPW-04	1000	6.5'-7.0'		2.697
XPW-04	1020	15.5'-16.0'		2.650

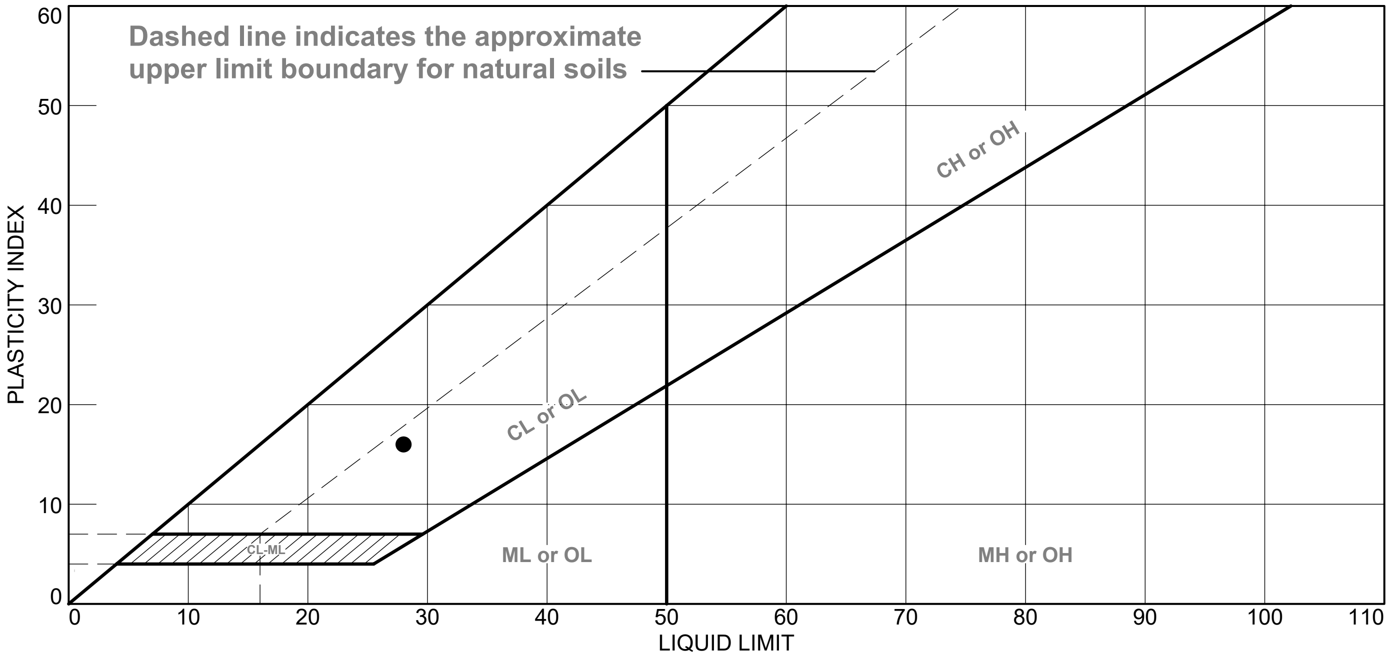
Tested By: SJH

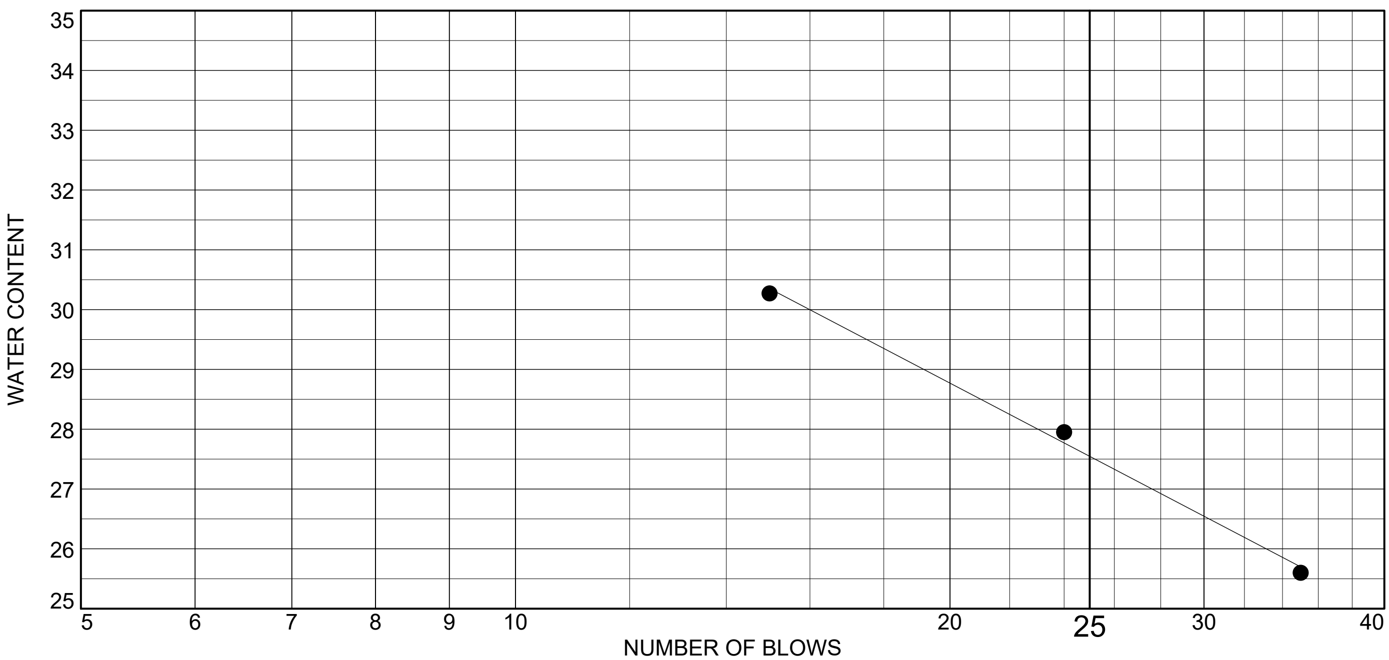
Checked By: WPQ

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 SANDY LEAN CLAY	28	12	16	88.7	53.8	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: APW-11 **Depth:** 10.0'-12.0'
Sample Number: 0805

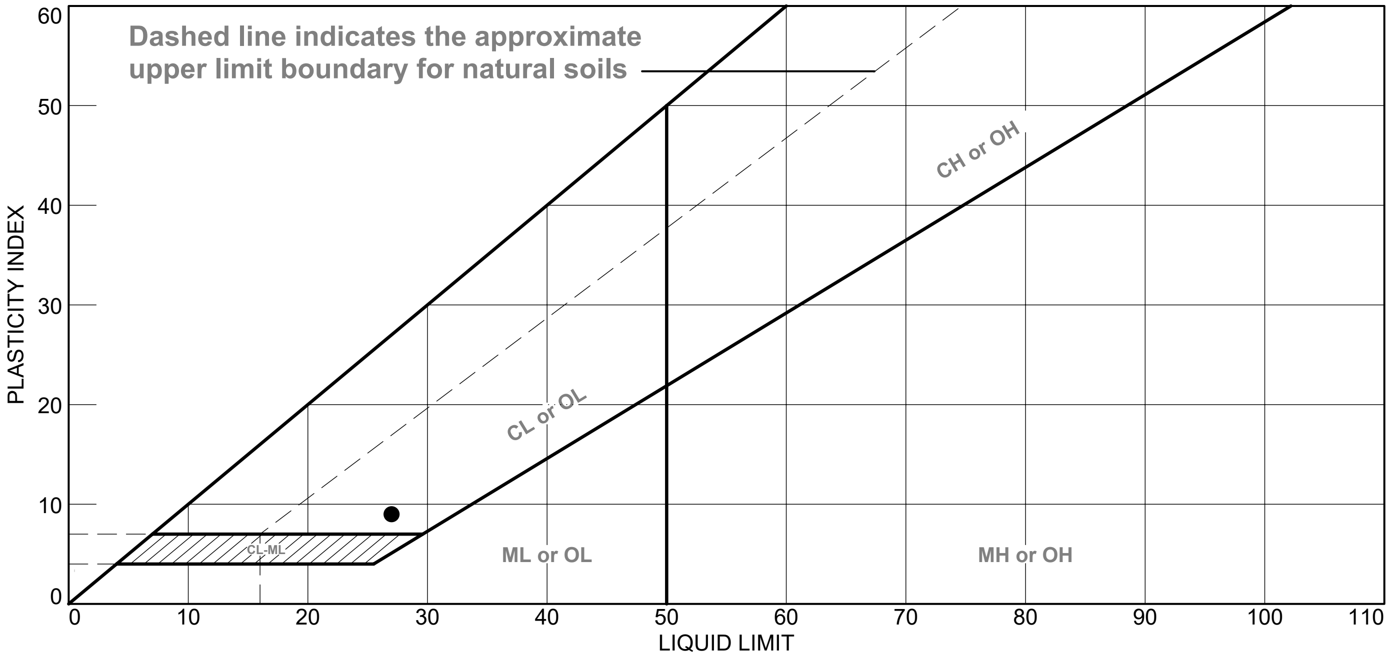
Terracon

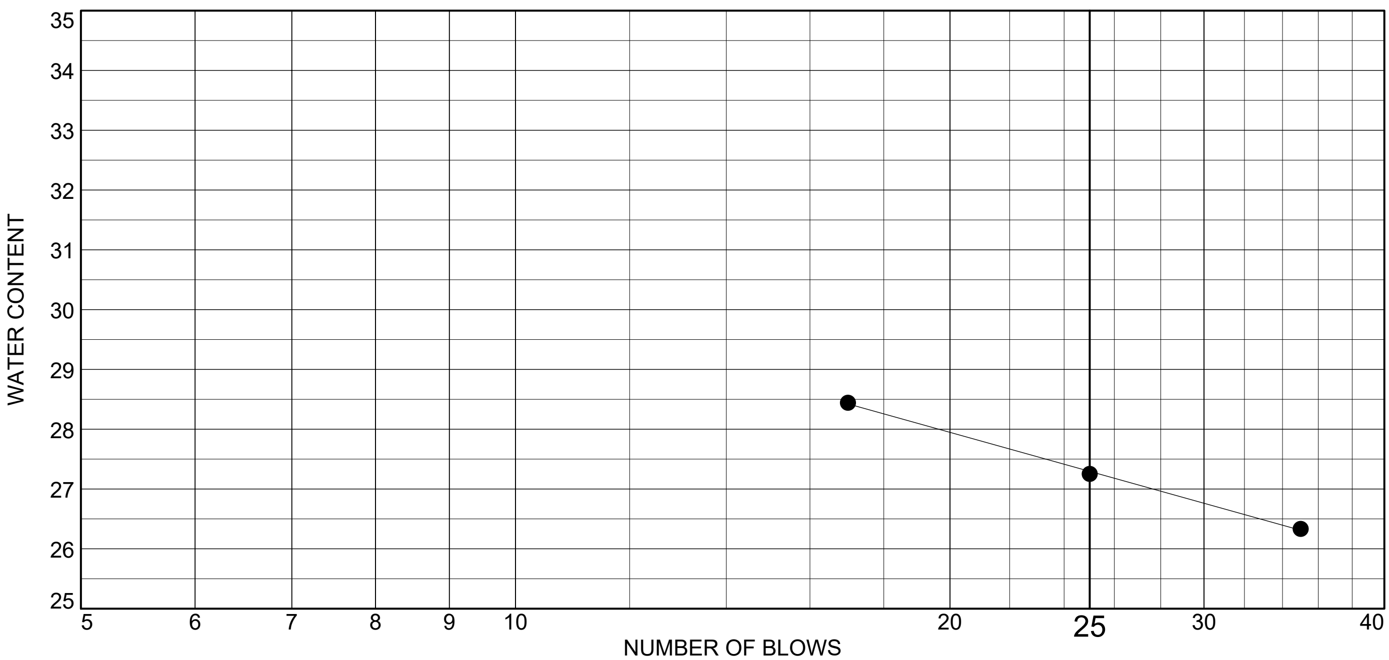
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAYISH BROWN LEAN CLAY WITH SAND	27	18	9	91.9	78.6	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

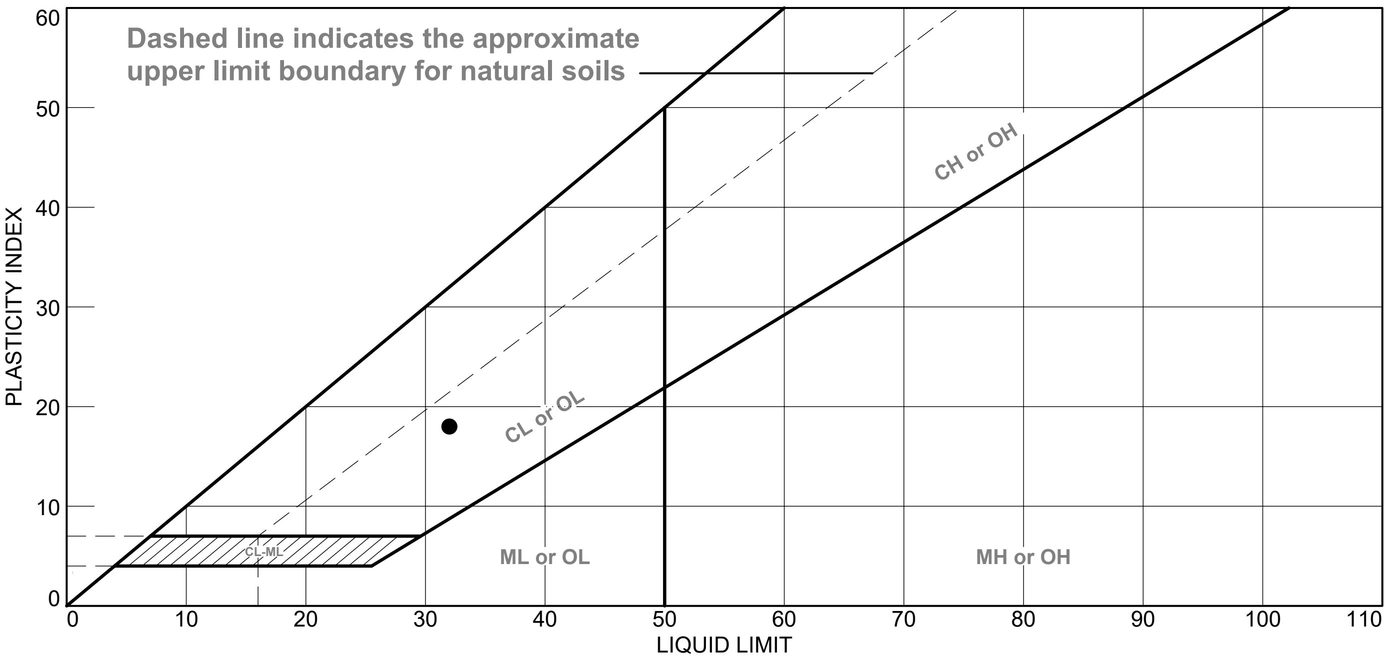
Source of Sample: APW-11 **Depth:** 61.0'-61.5'
Sample Number: 1050

Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY LEAN CLAY WITH SAND	32	14	18	95.4	79.0	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

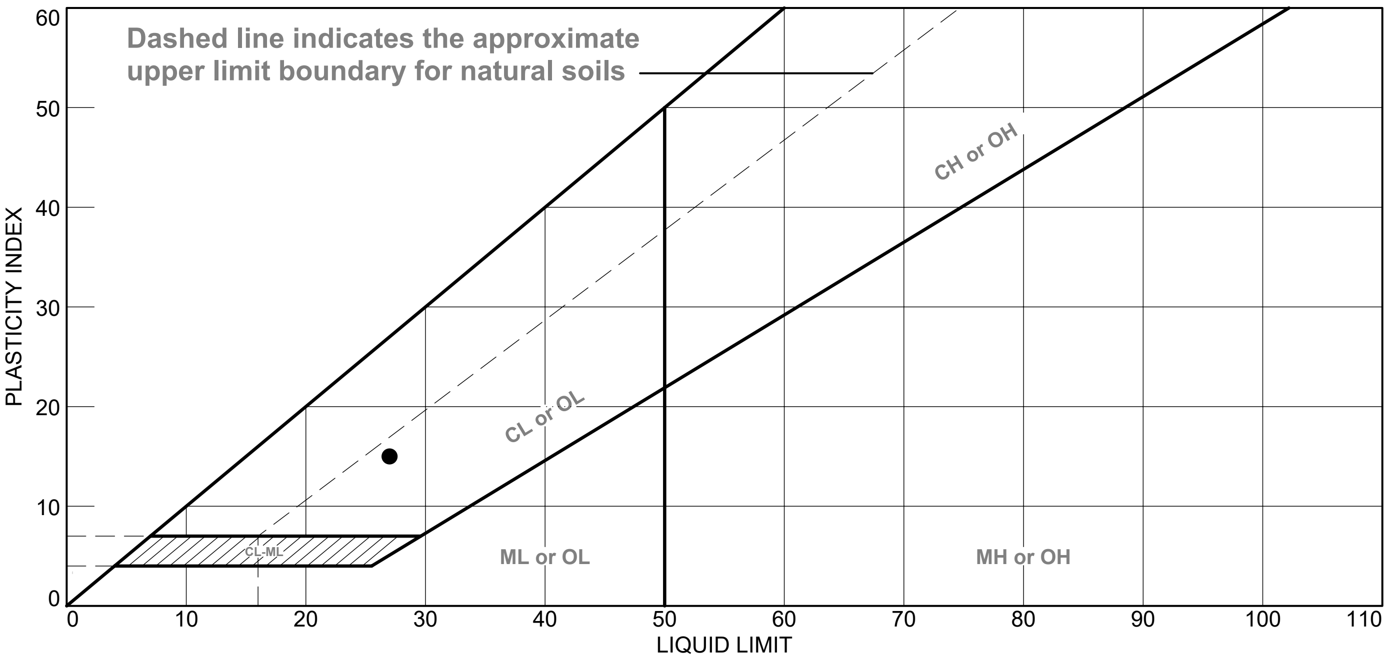
Source of Sample: APW-11 **Depth:** 80.0'-82.0'
Sample Number: 1115

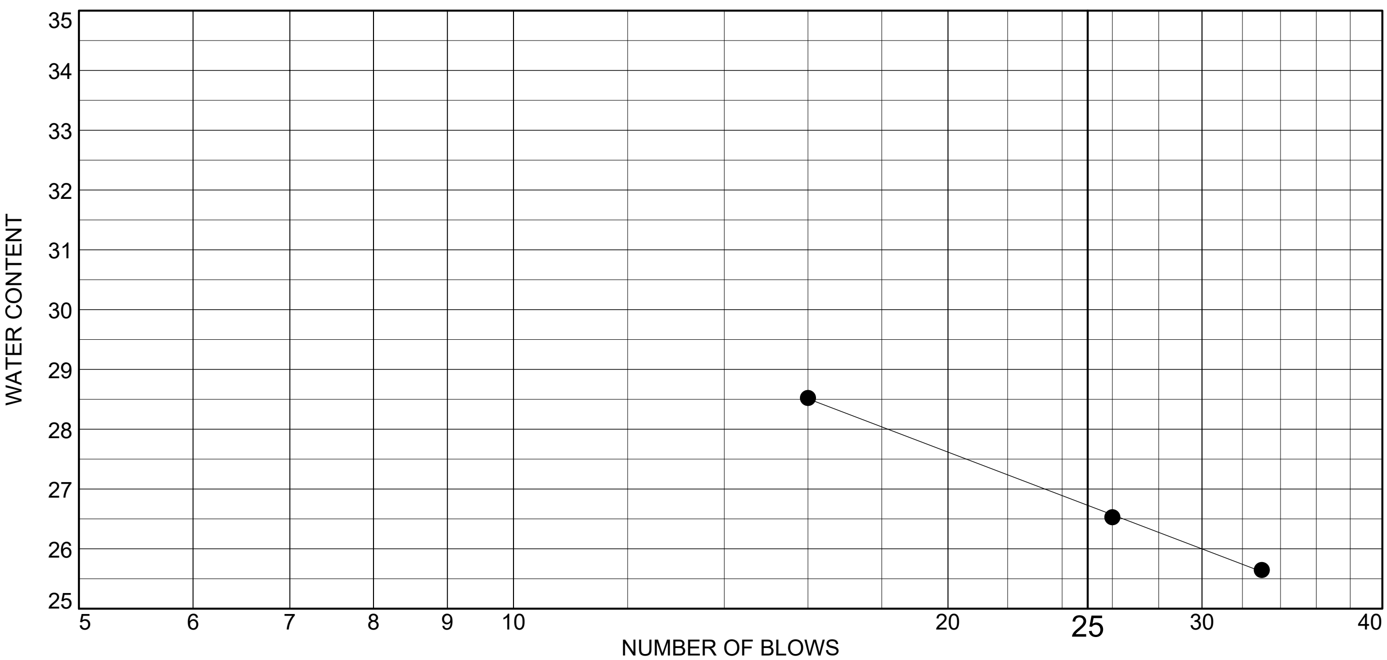
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND RUST BROWN CLAYEY SAND - ROOTS NOTED	27	12	15	82.3	45.8	SC

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

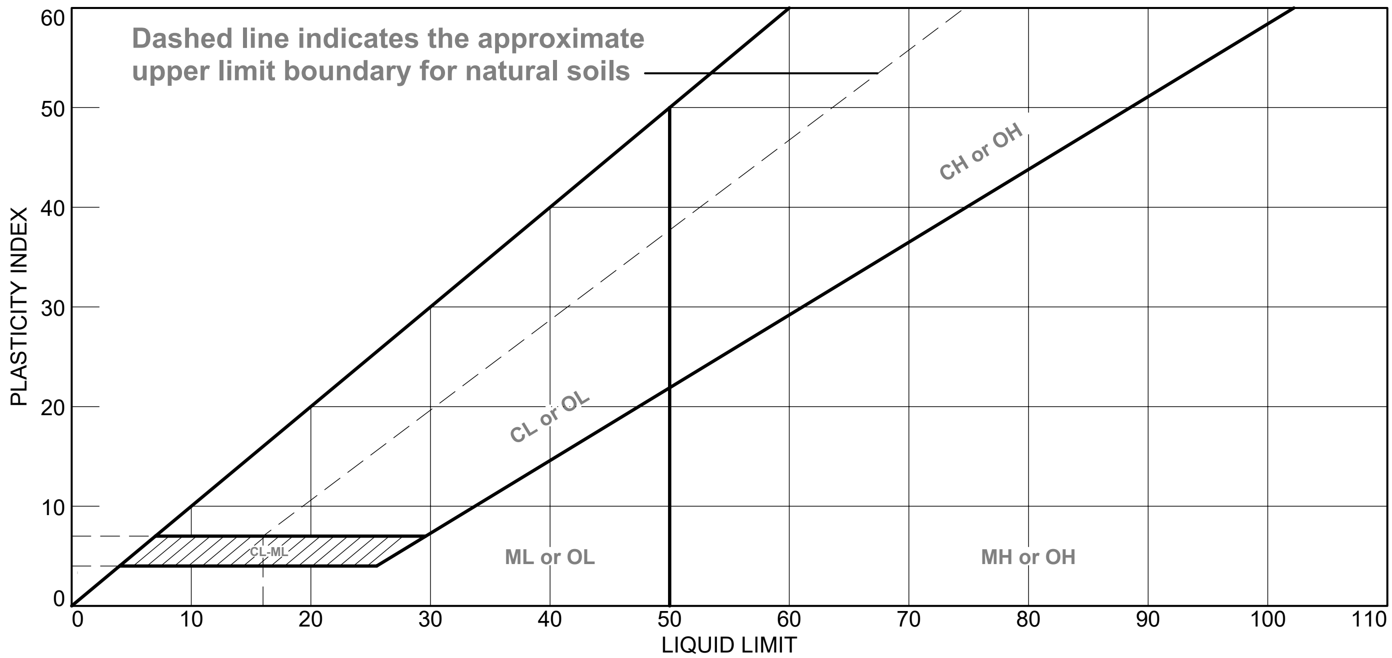
Source of Sample: APW-12 **Depth:** 20.0'-22.0'
Sample Number: 0825

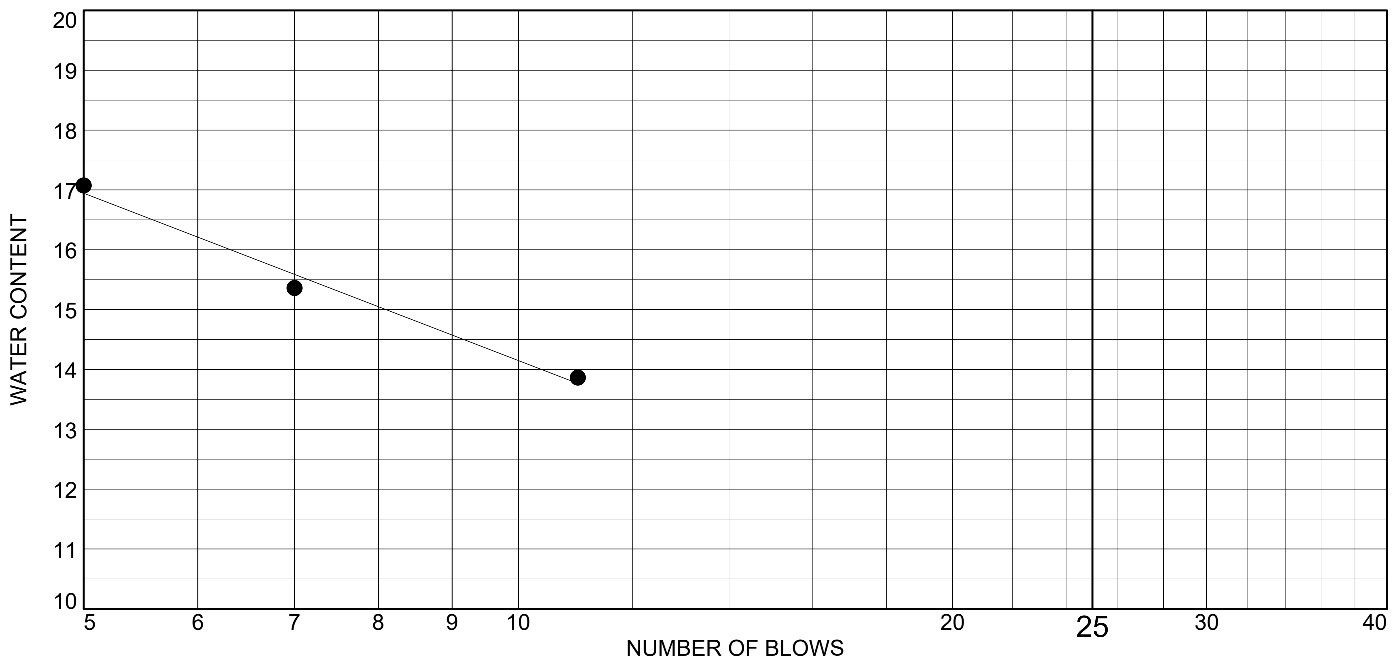
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN POORLY GRADED SAND WITH SILT AND GRAVEL	10	13	NP	21.4	6.2	SP-SM

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: APW-12 **Depth:** 25.5'-26.0'
Sample Number: 0845

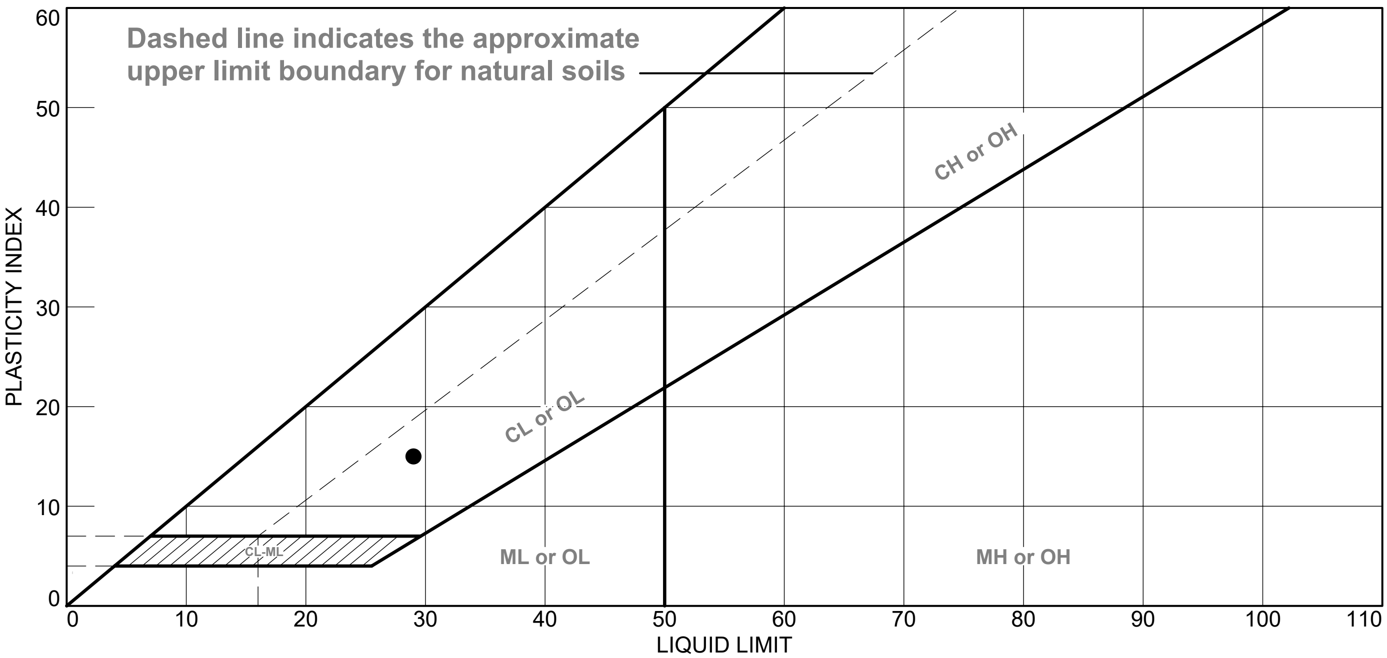
Terracon

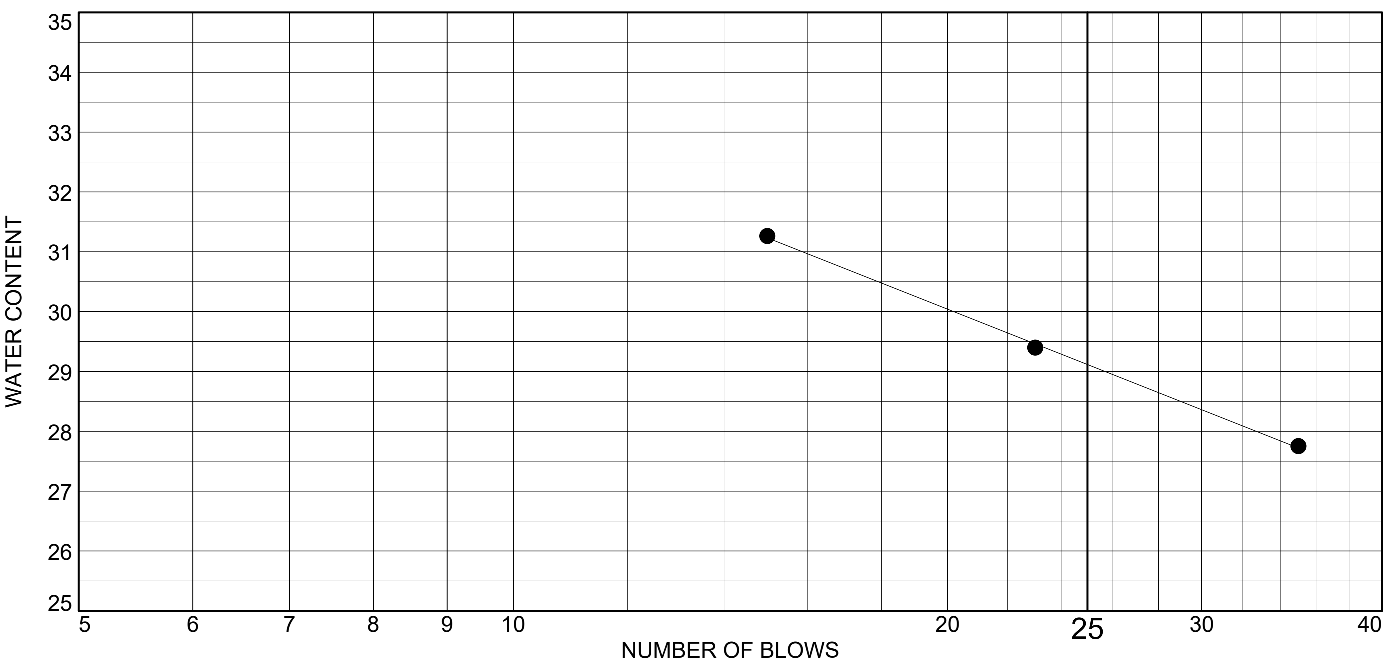
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY LEAN CLAY WITH SAND - SILT POCKETS NOTED	29	14	15	96.1	80.2	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: APW-12 **Depth:** 85.0'-87.0'
Sample Number: 1245

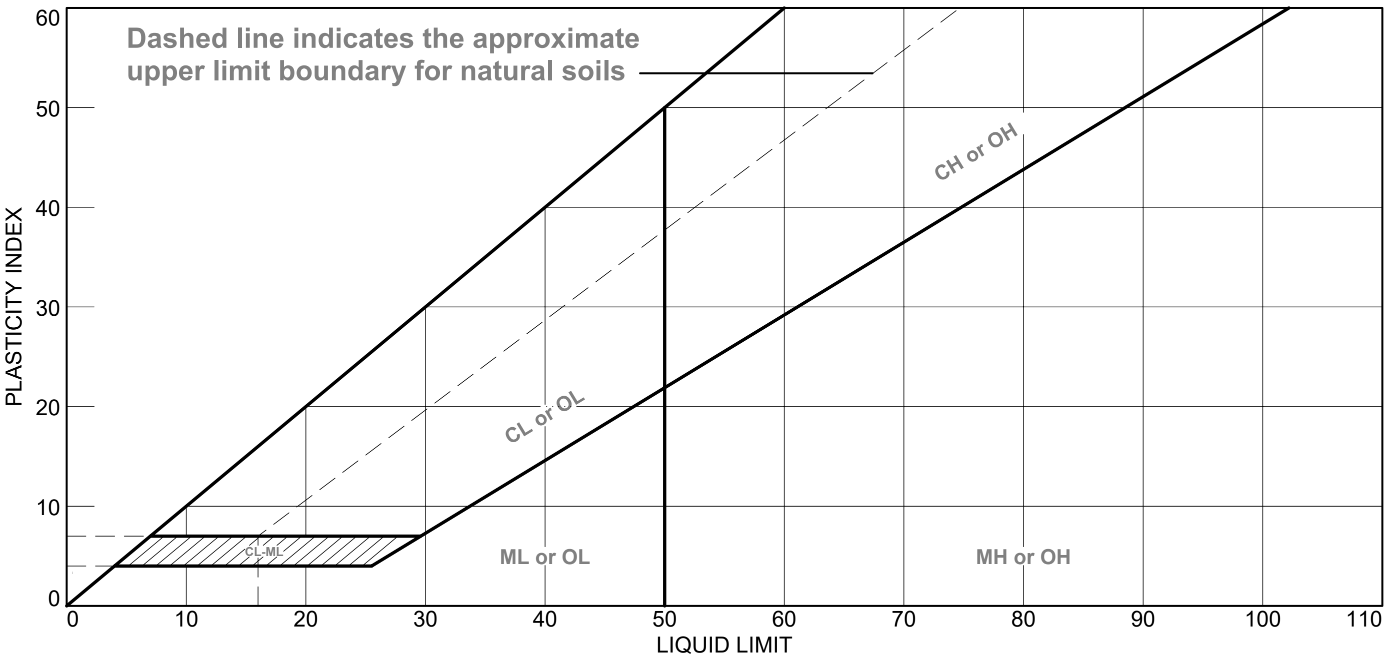
Terracon

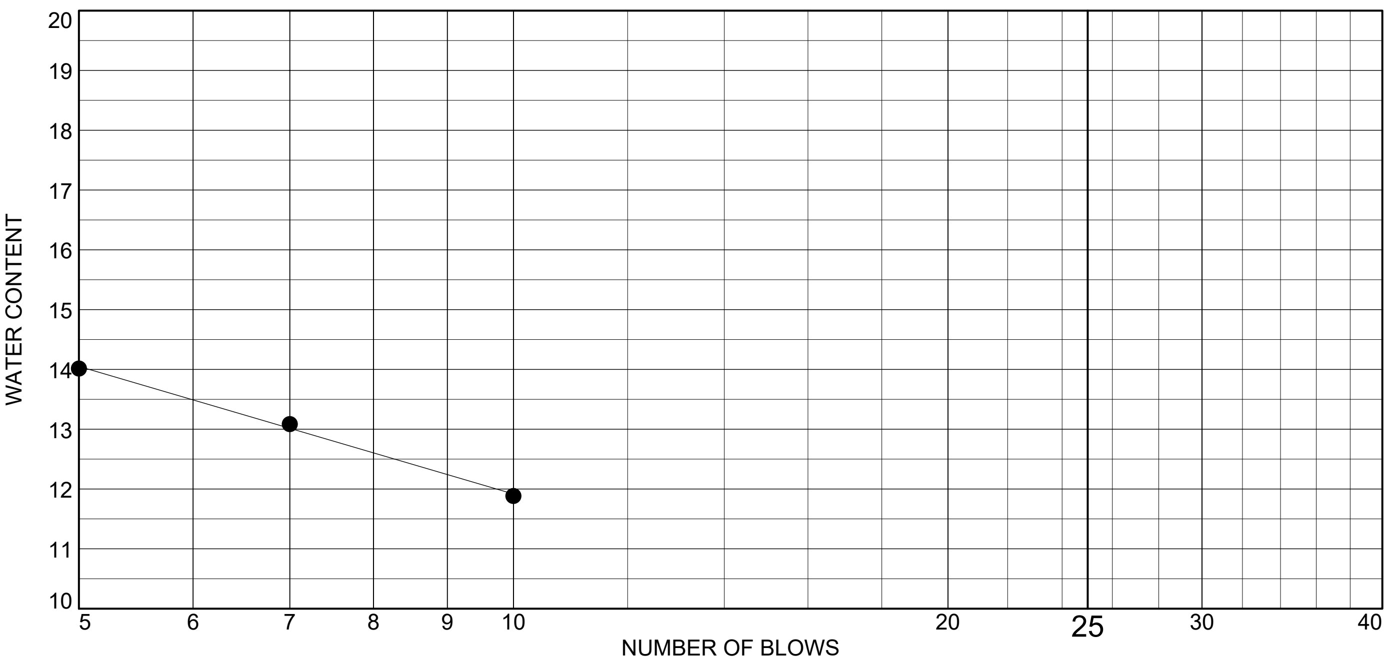
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK BROWN AND GRAY POORLY GRADED SAND WITH SILT	9	10	NP	30.5	11.1	SP-SM

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: APW-13 **Depth:** 25.0'-27.0'
Sample Number: 0845

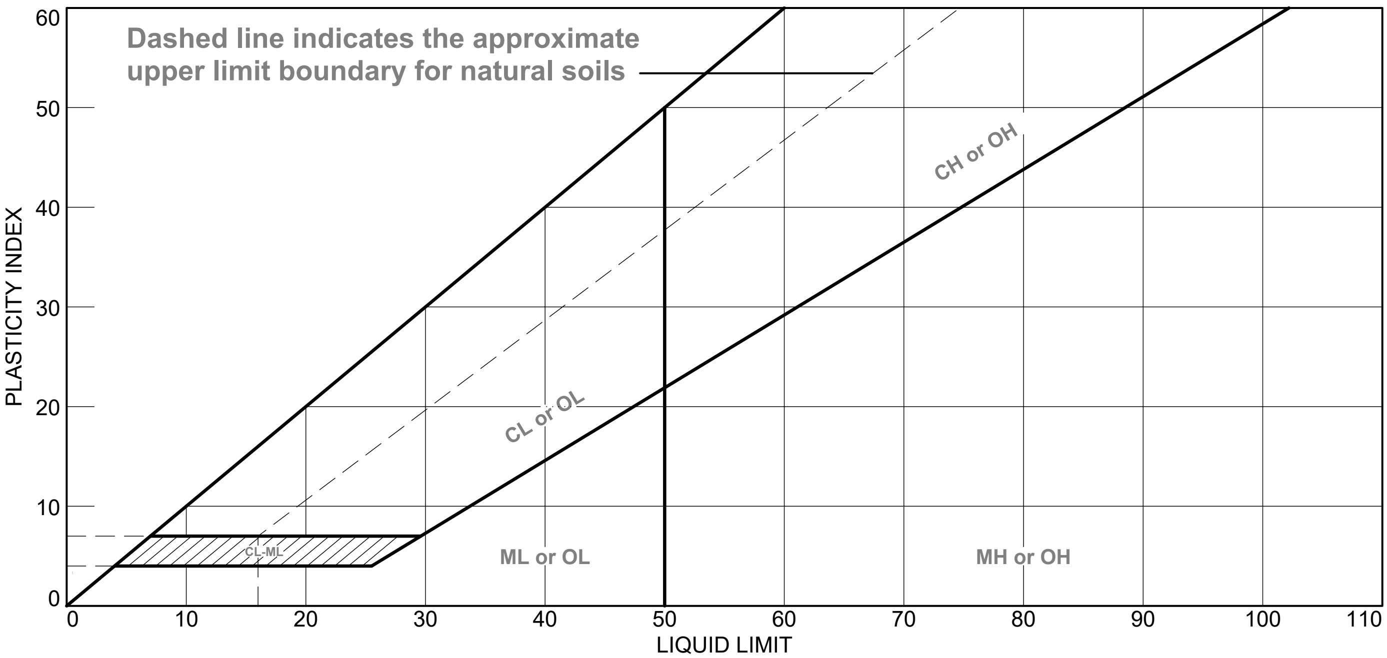
Terracon

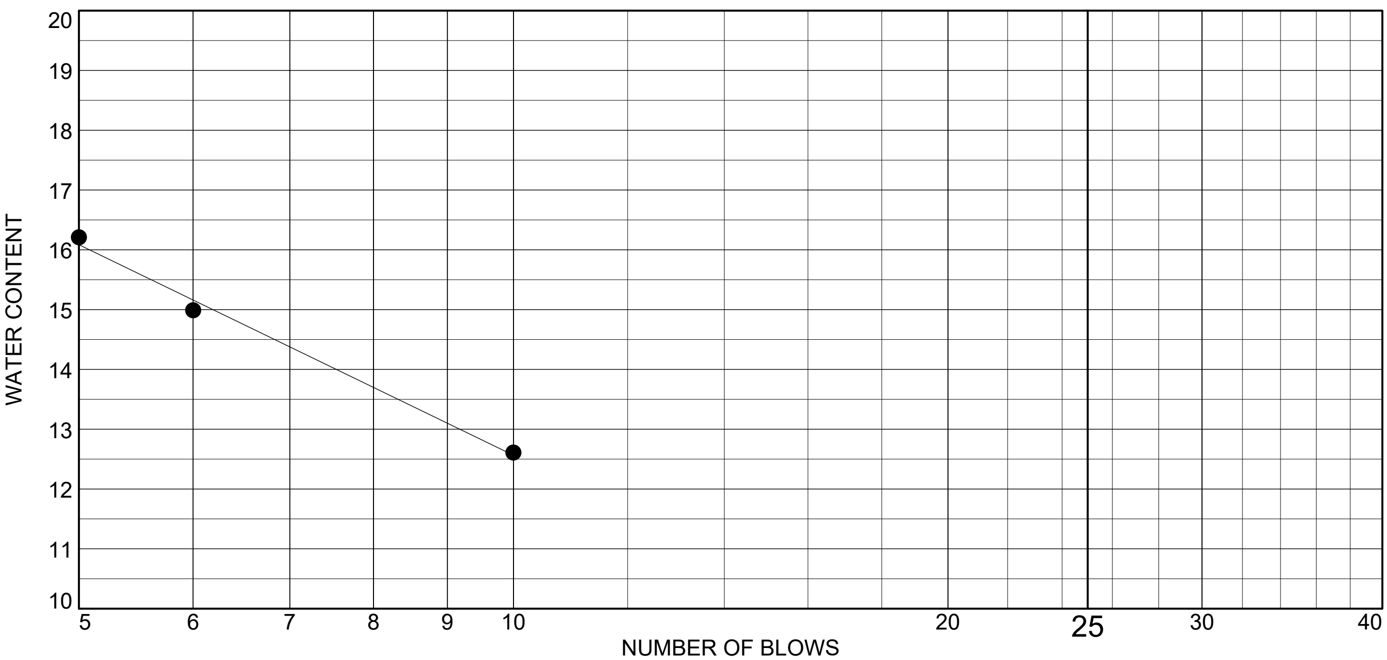
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN SILTY SAND	8	13	NP	86.6	24.5	SM

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: APW-13 **Depth:** 60.5'-61.0'
Sample Number: 1345

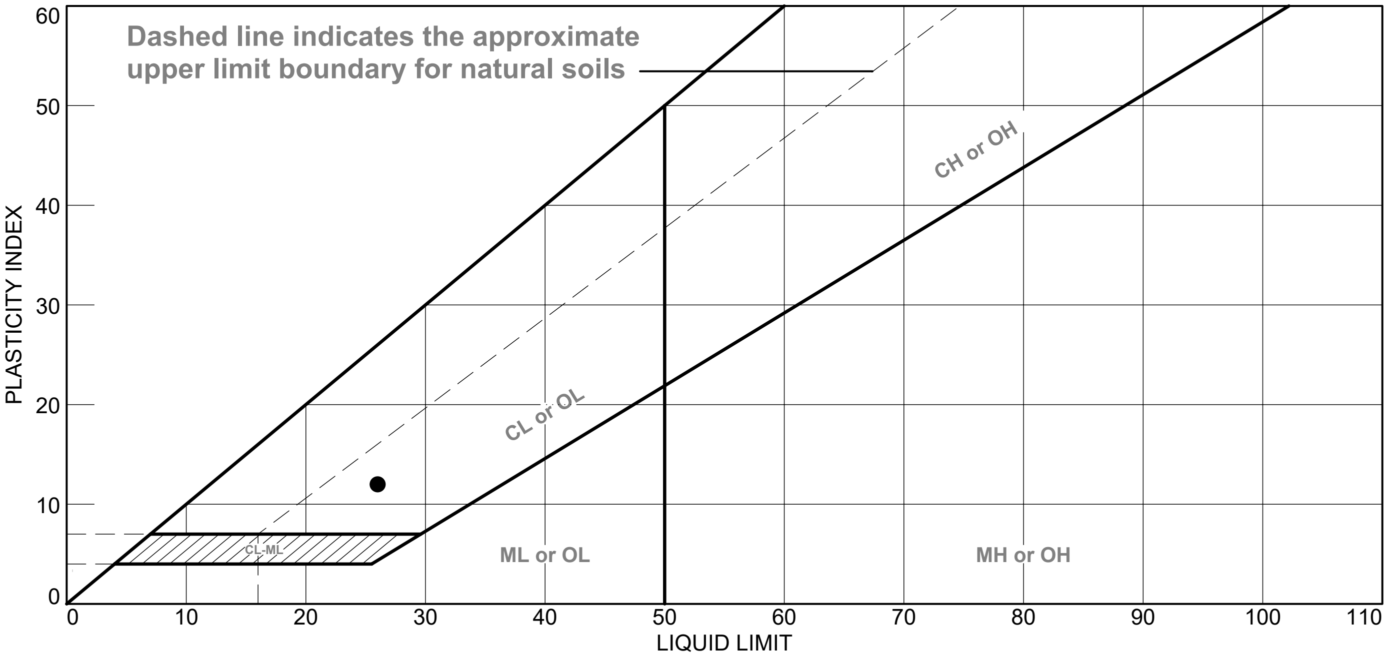
Terracon

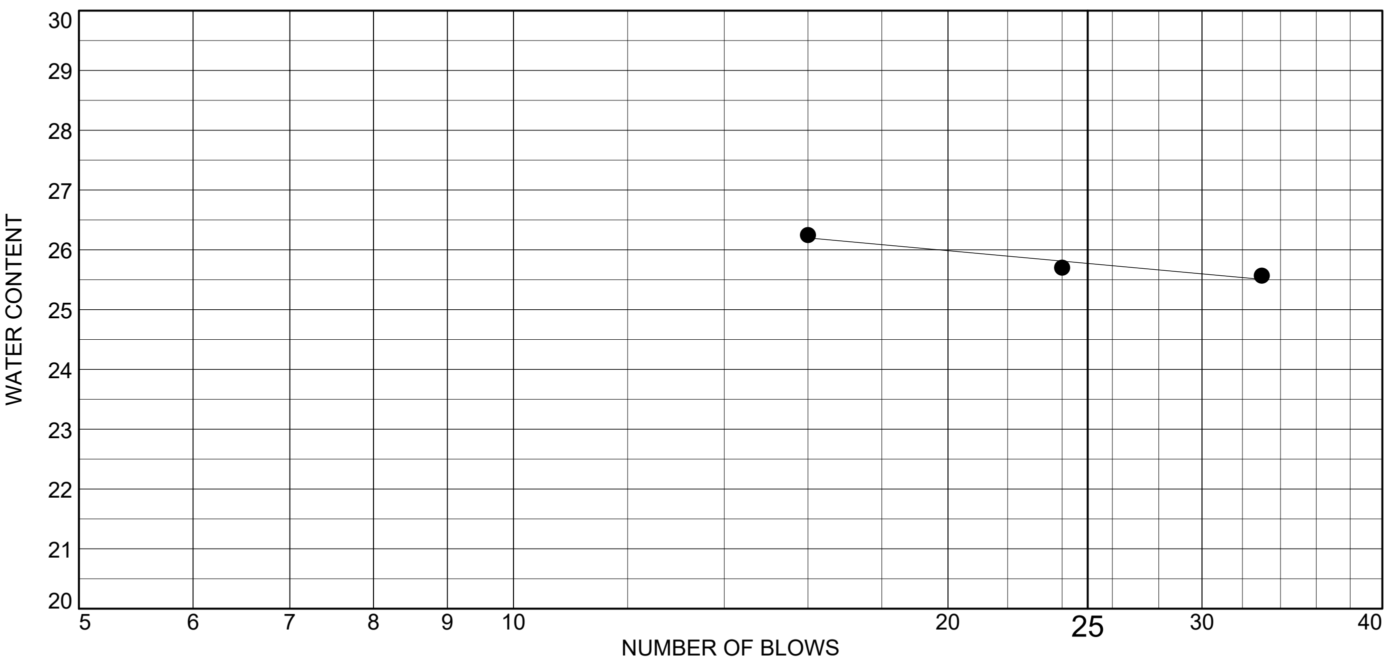
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN SANDY LEAN CLAY	26	14	12	84.5	63.3	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: APW-14 **Depth:** 45.0'-47.0'
Sample Number: 0955

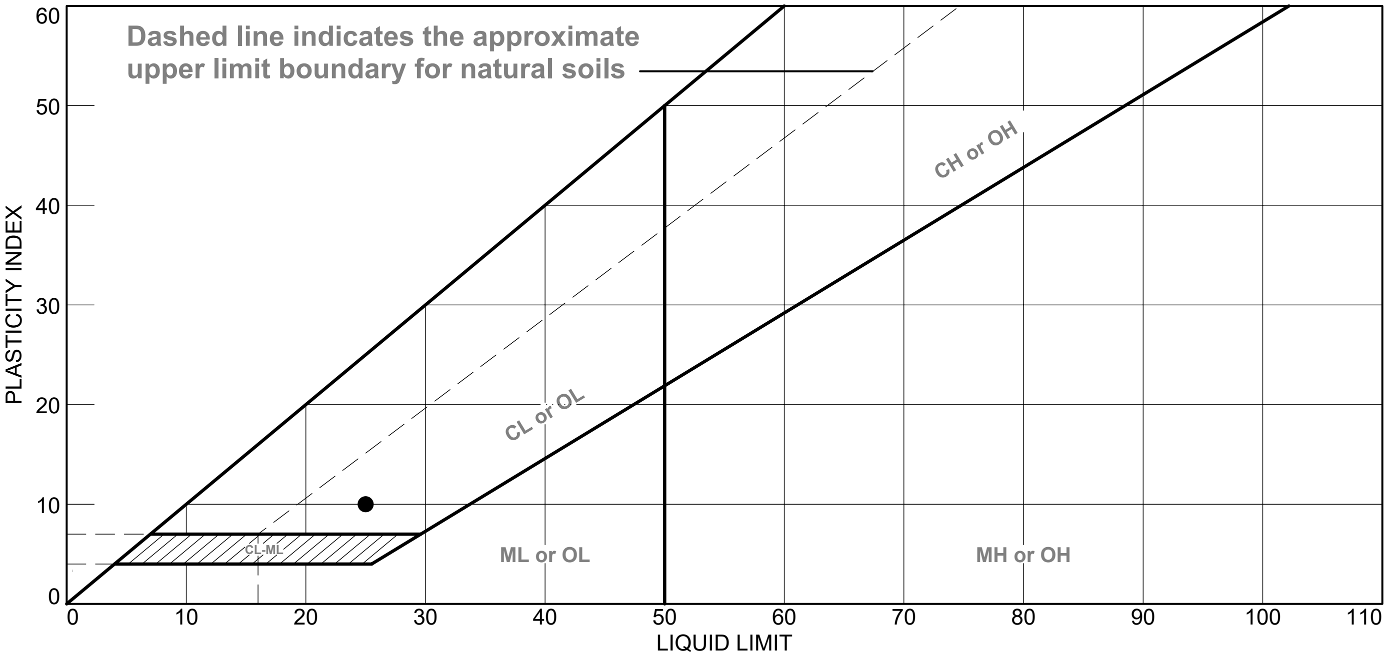
Terracon

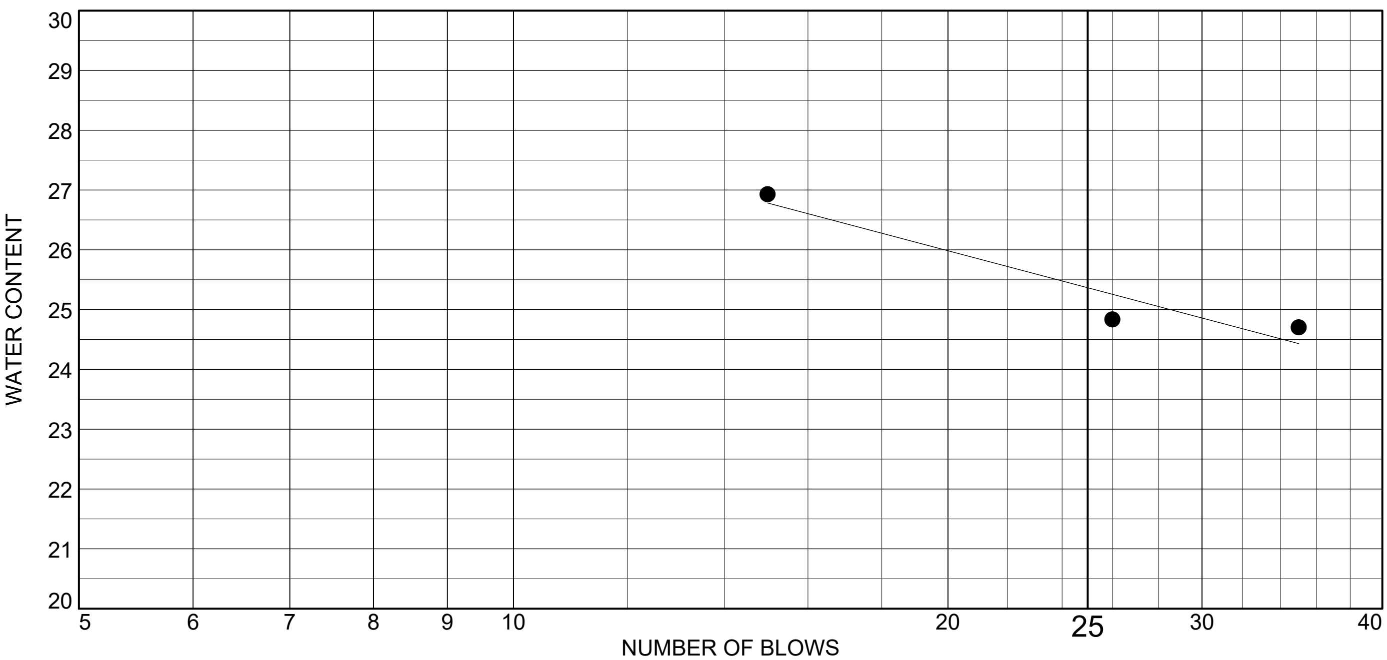
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND BROWNISH GRAY LEAN CLAY WITH SAND	25	15	10	91.1	72.2	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: APW-14 **Depth:** 55.5'-56.0'
Sample Number: 1045

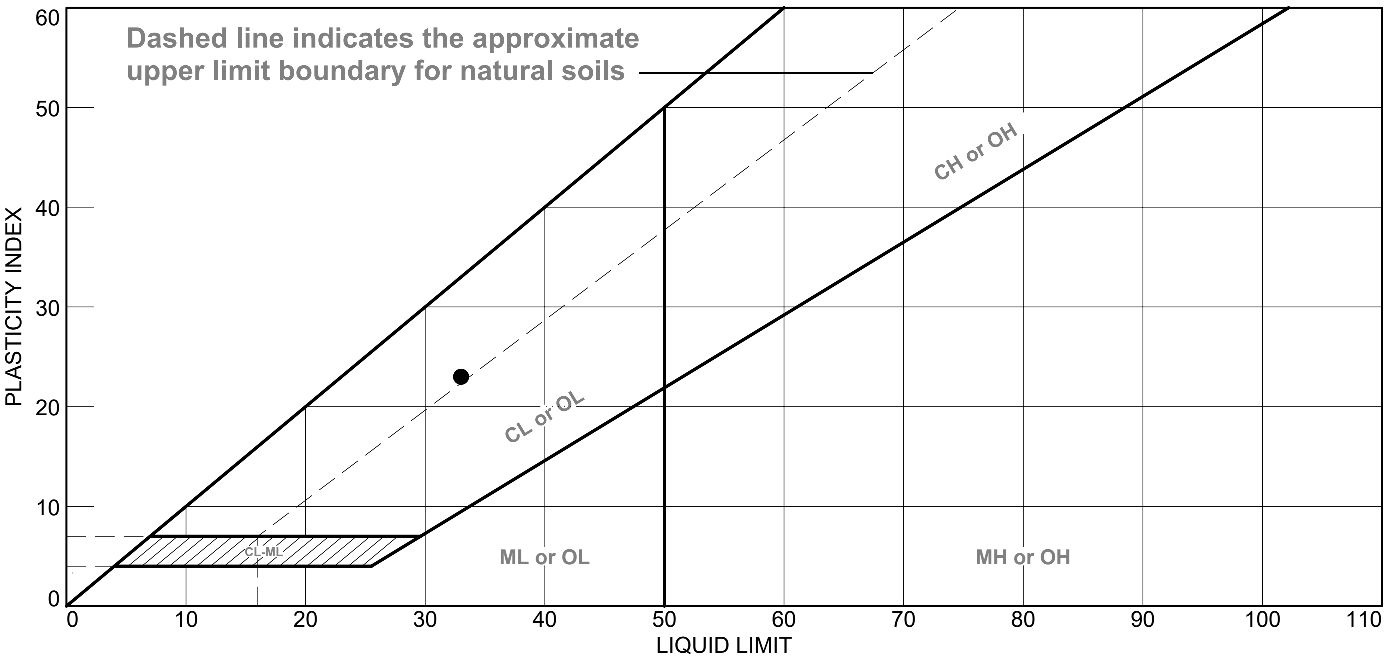
Terracon

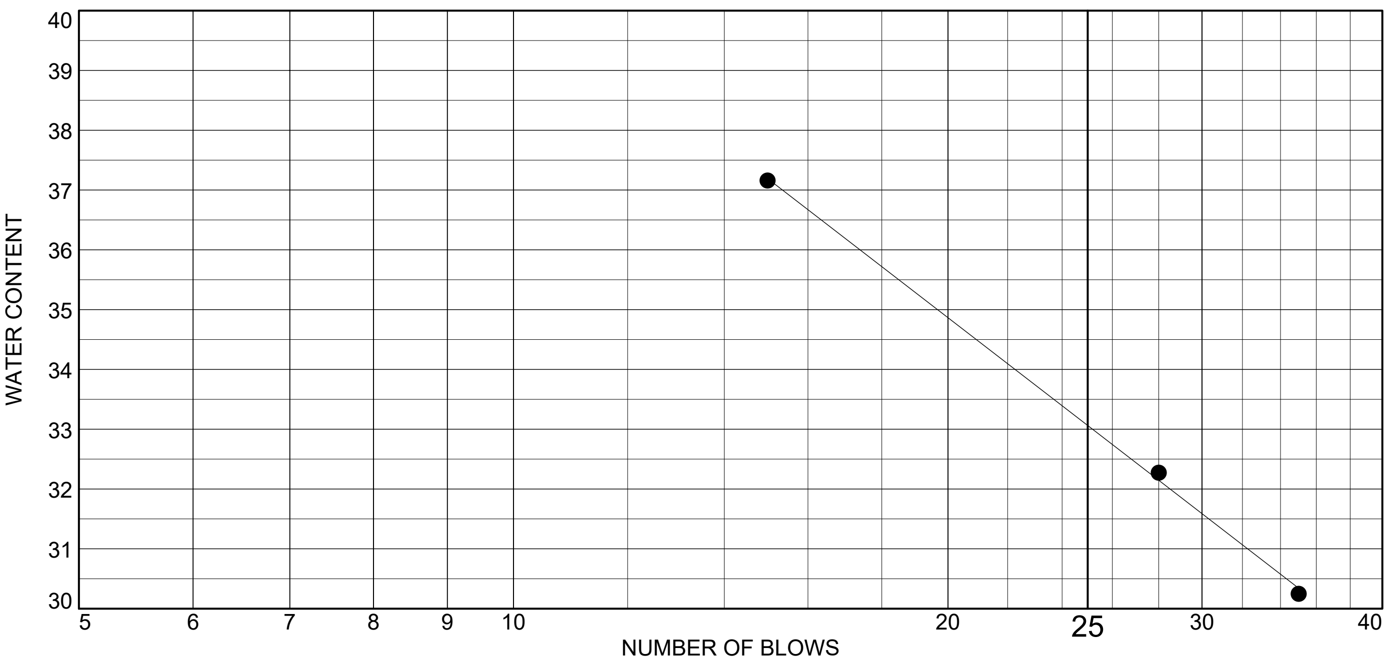
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN SANDY LEAN CLAY	33	10	23	95.1	59.2	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: APW-15 **Depth:** 20.0'-22.0'
Sample Number: 1005

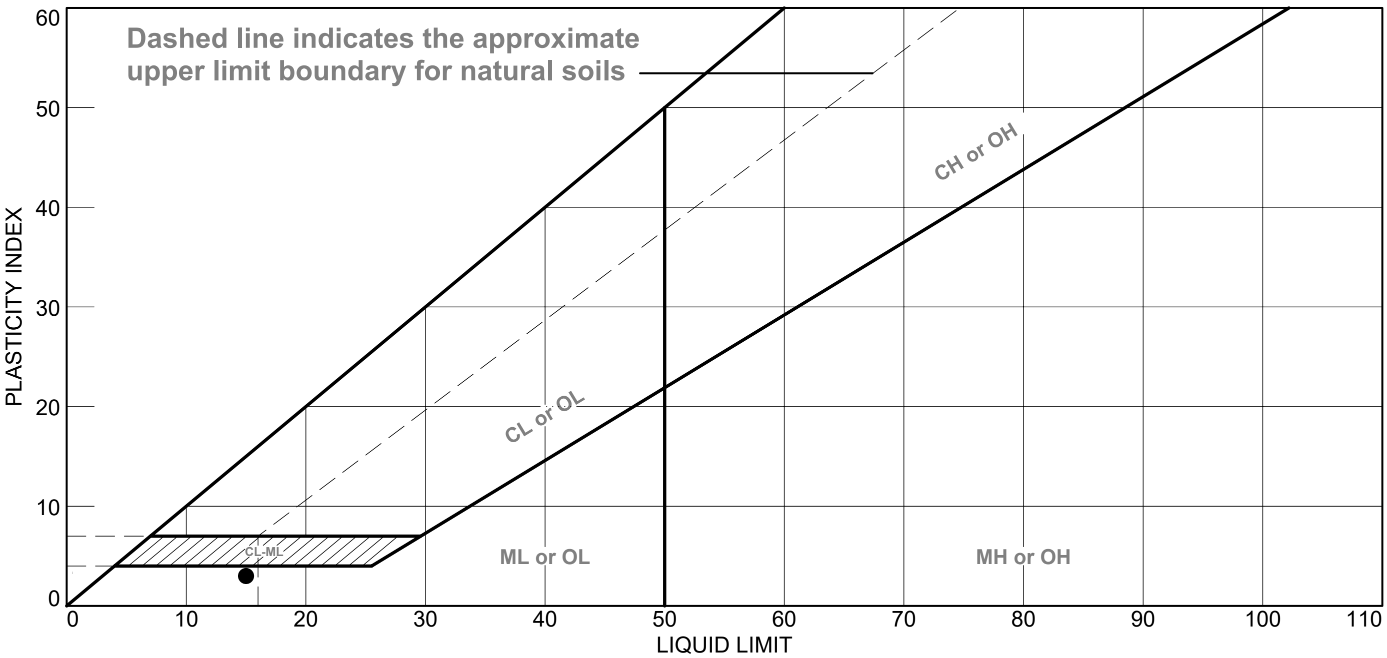
Terracon

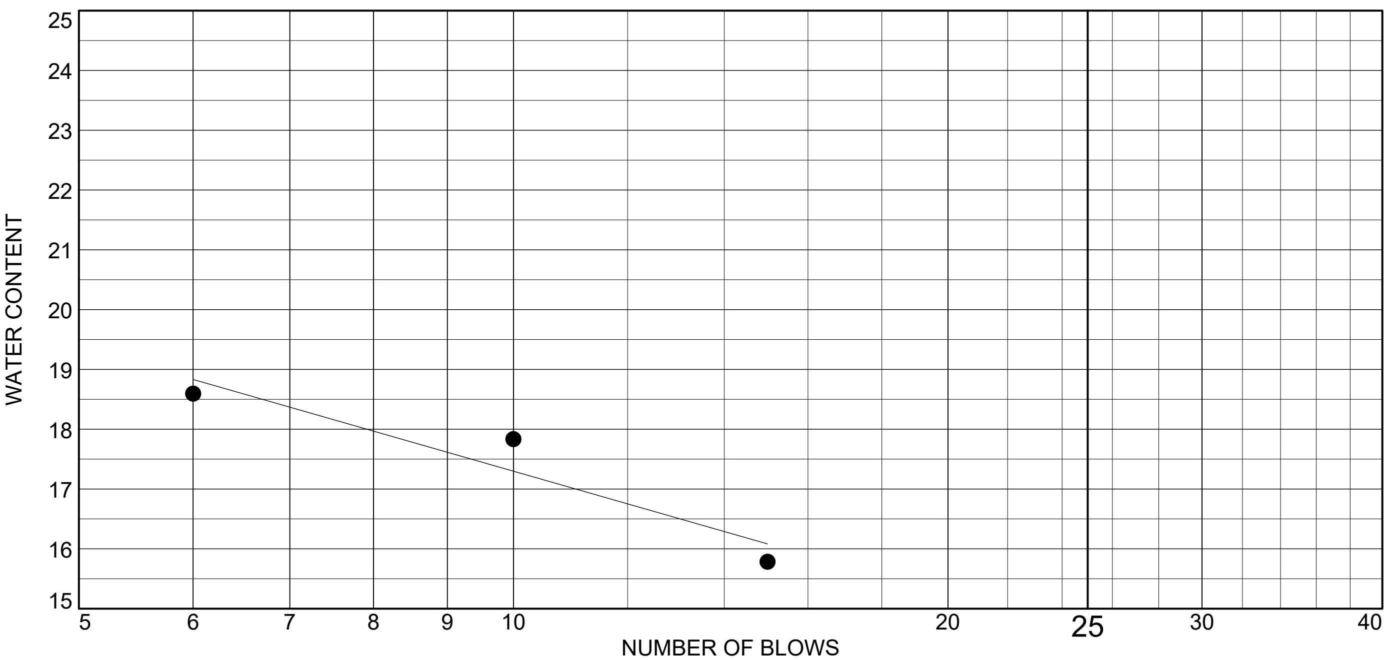
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY SILTY SAND	15	12	3	75.0	45.8	SM

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: APW-15 **Depth:** 100.5'-101.0'
Sample Number: 0755

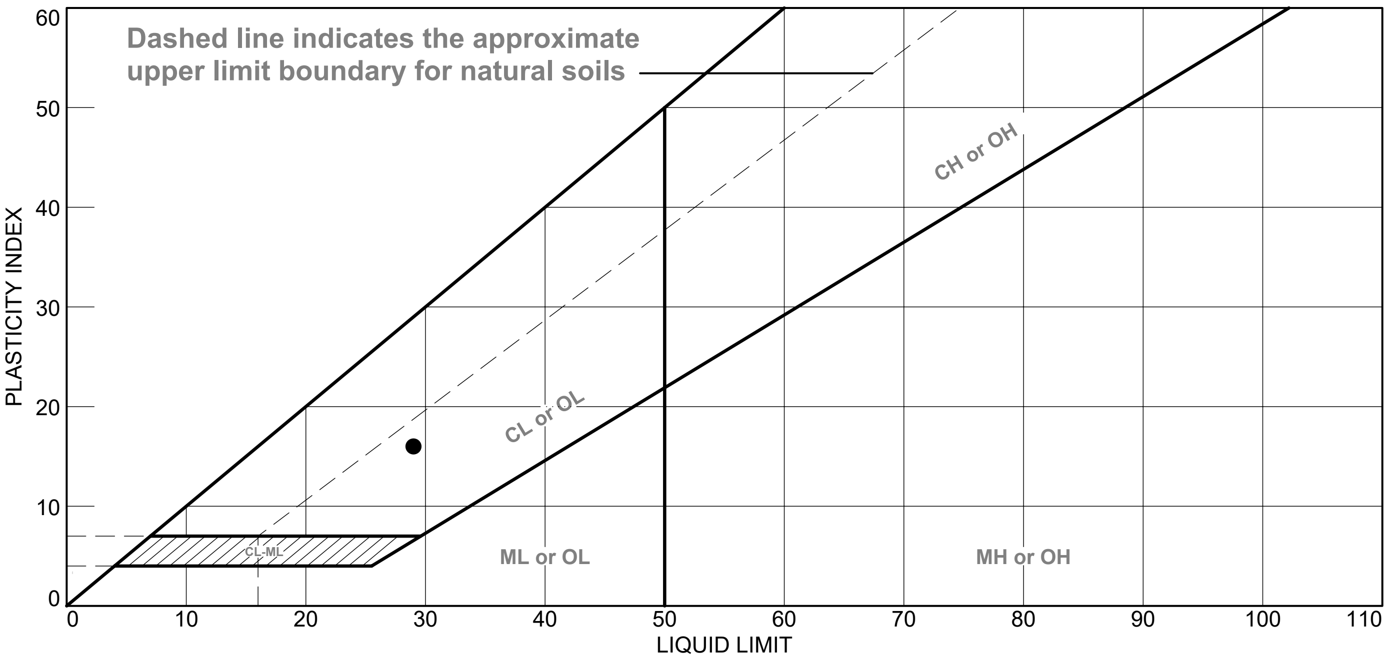
Terracon

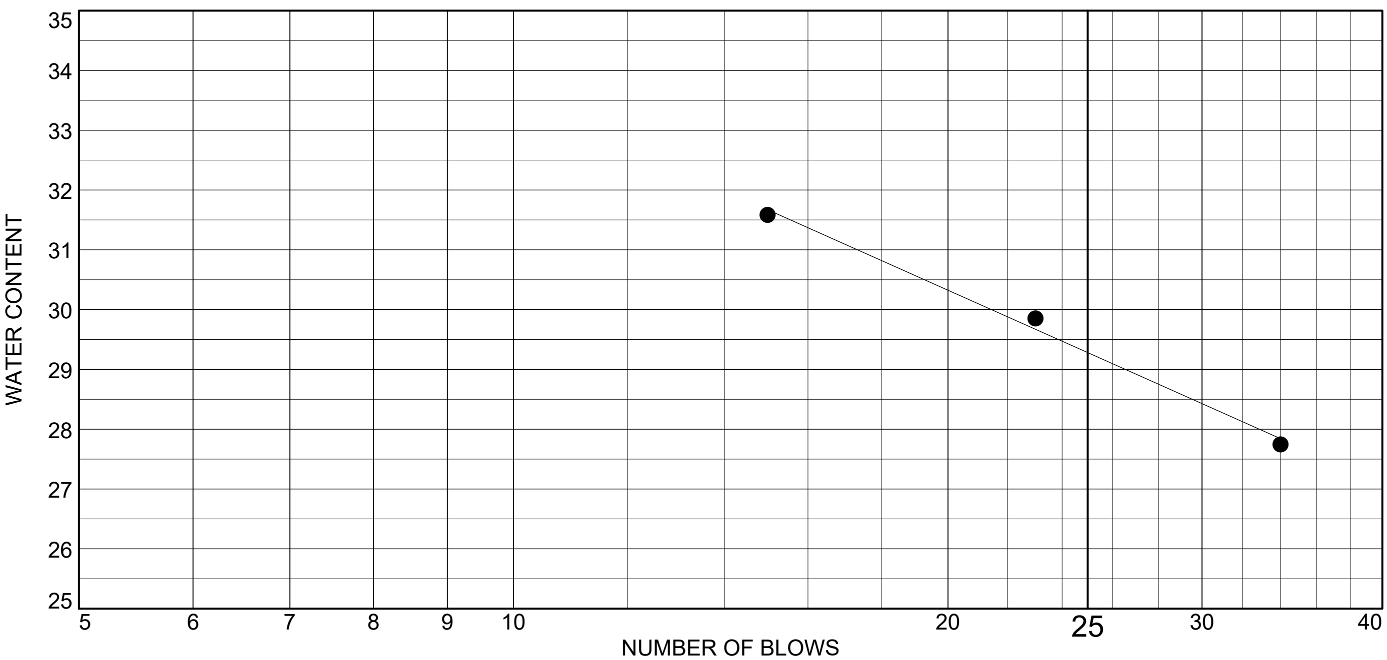
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY LEAN CLAY WITH SAND	29	13	16	94.1	76.2	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: APW-15 **Depth:** 105.0'-107.0'
Sample Number: 0905

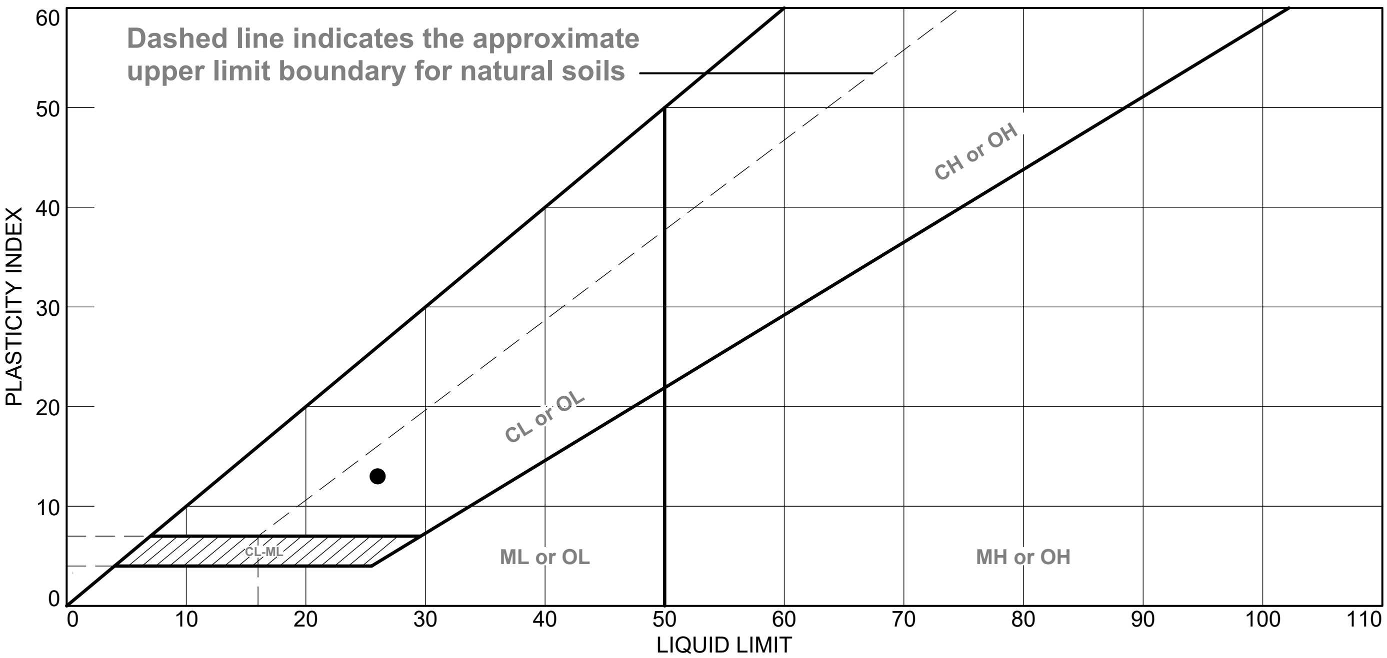
Terracon

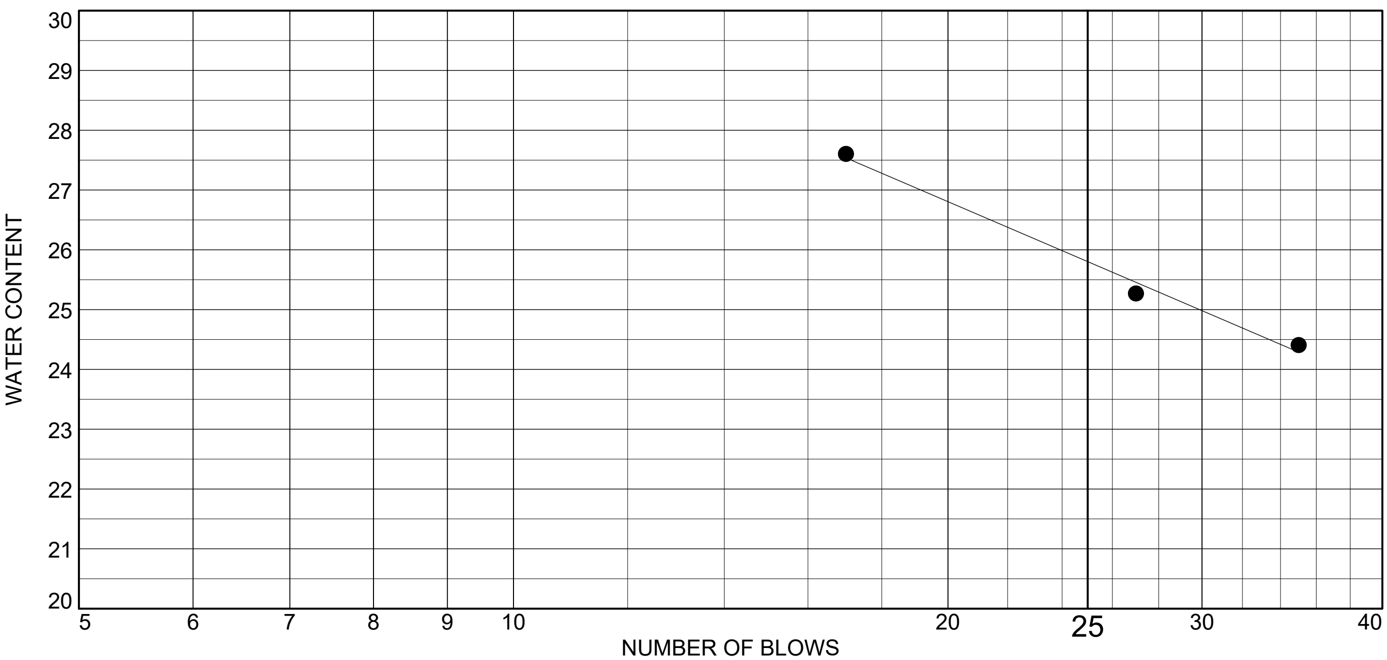
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY LEAN CLAY WITH SAND	26	13	13	90.4	71.1	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: APW-17 **Depth:** 40.0'-42.0'
Sample Number: 0945

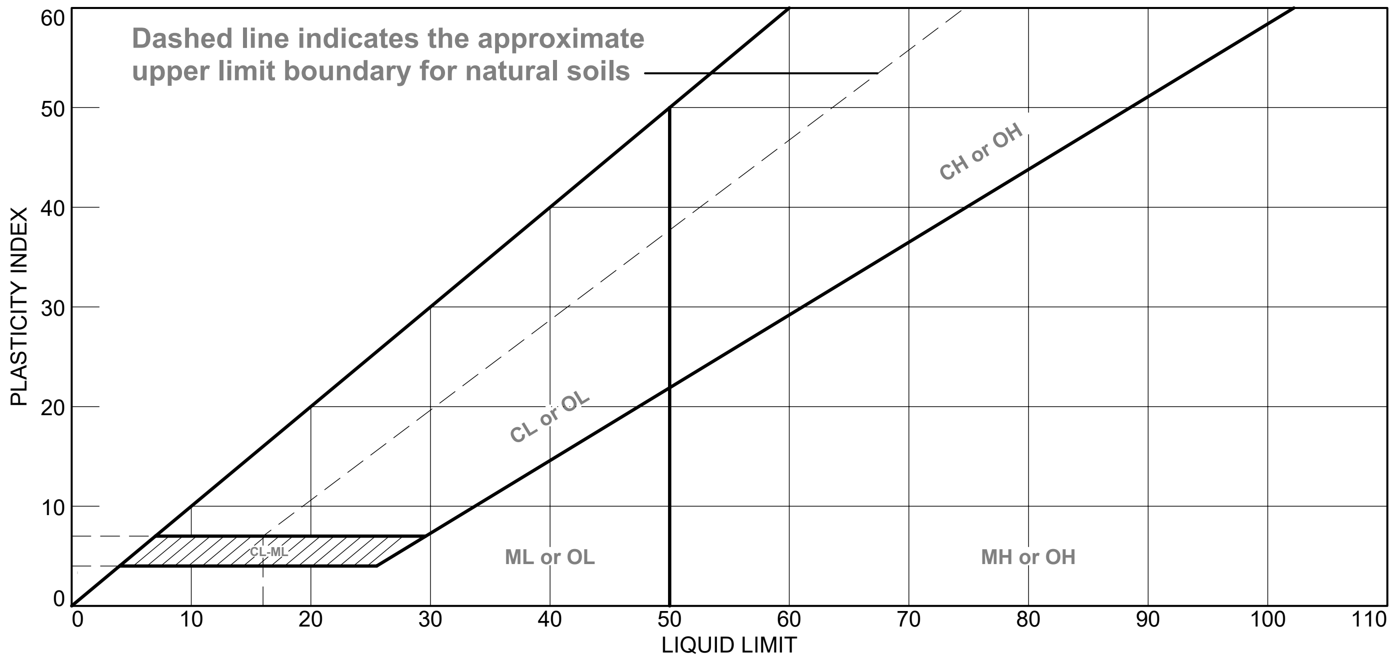
Terracon

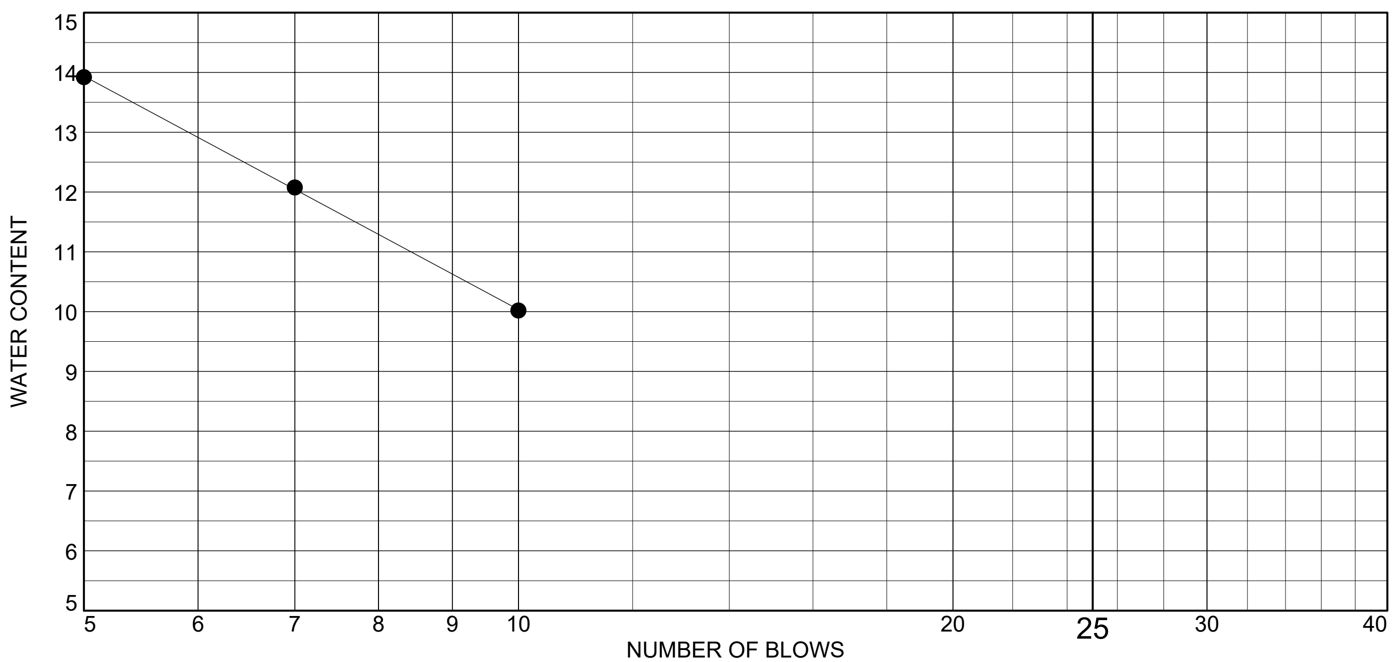
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY WELL GRADED SAND WITH SILT	5	9	NP	47.7	8.9	SW-SM

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: APW-17 **Depth:** 71.0'-71.5'
Sample Number: 1045

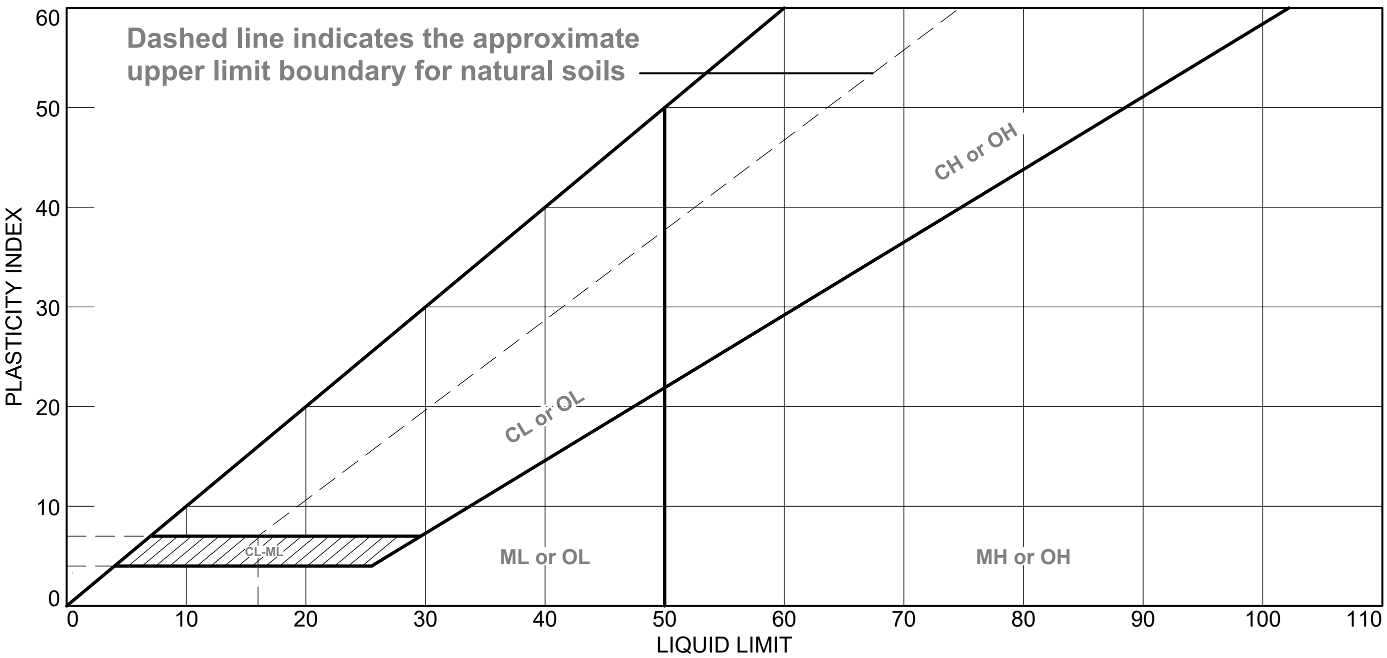
Terracon

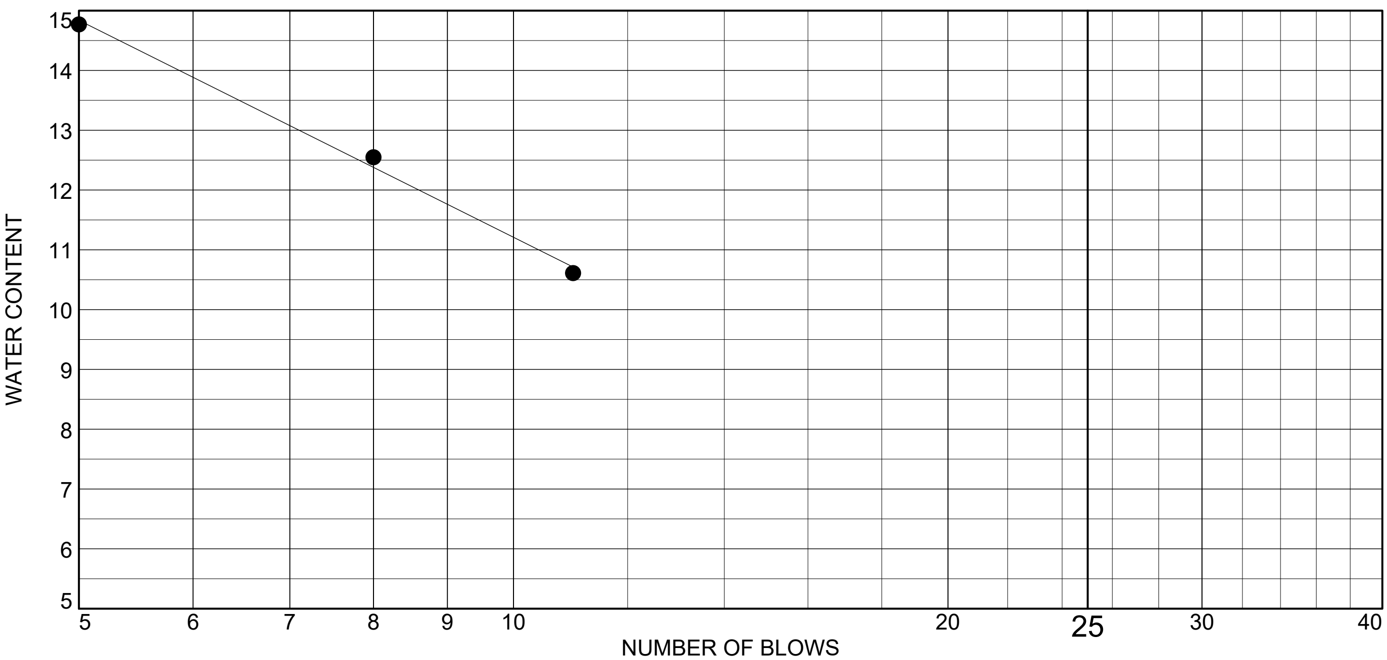
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAYISH BROWN POORLY GRADED SAND WITH SILT AND GRAVEL	6	8	NP	23.8	6.7	SP-SM

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: APW-17 **Depth:** 90.5'-91.0'
Sample Number: 1200

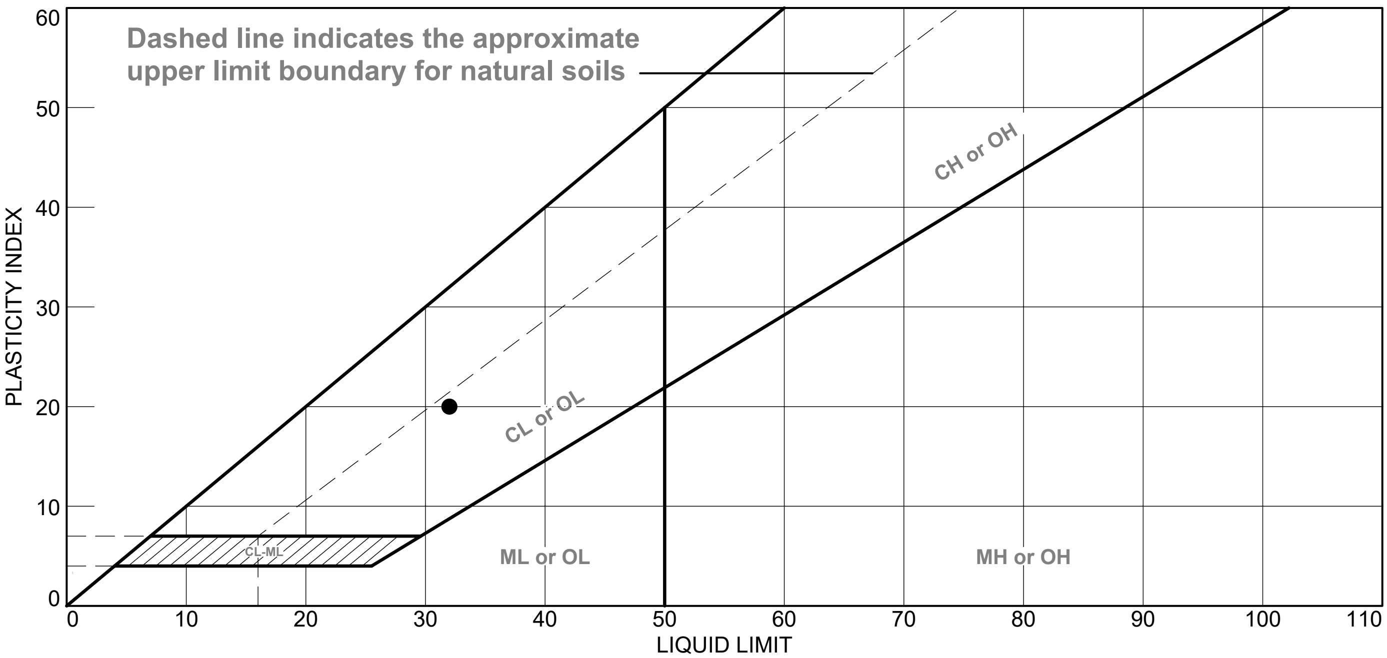
Terracon

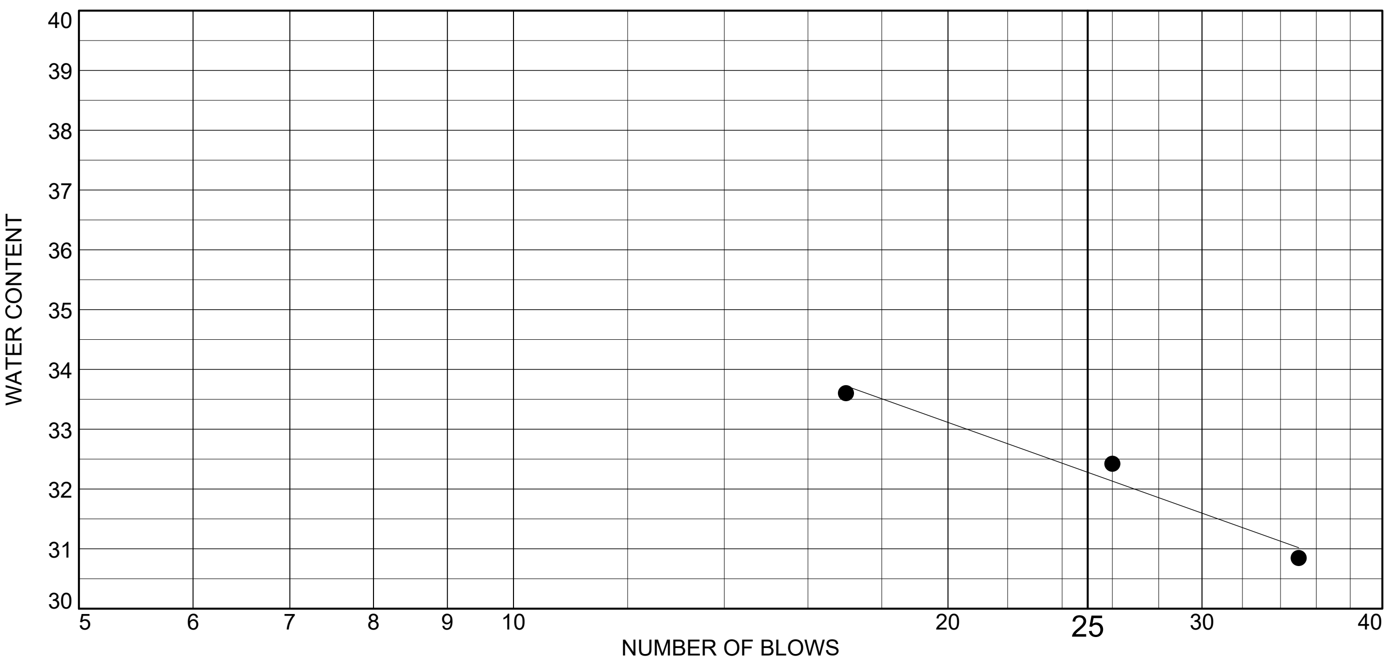
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY LEAN CLAY WITH SAND	32	12	20	93.5	76.8	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: SB-300 **Depth:** 50.0'-52.0'
Sample Number: 0825

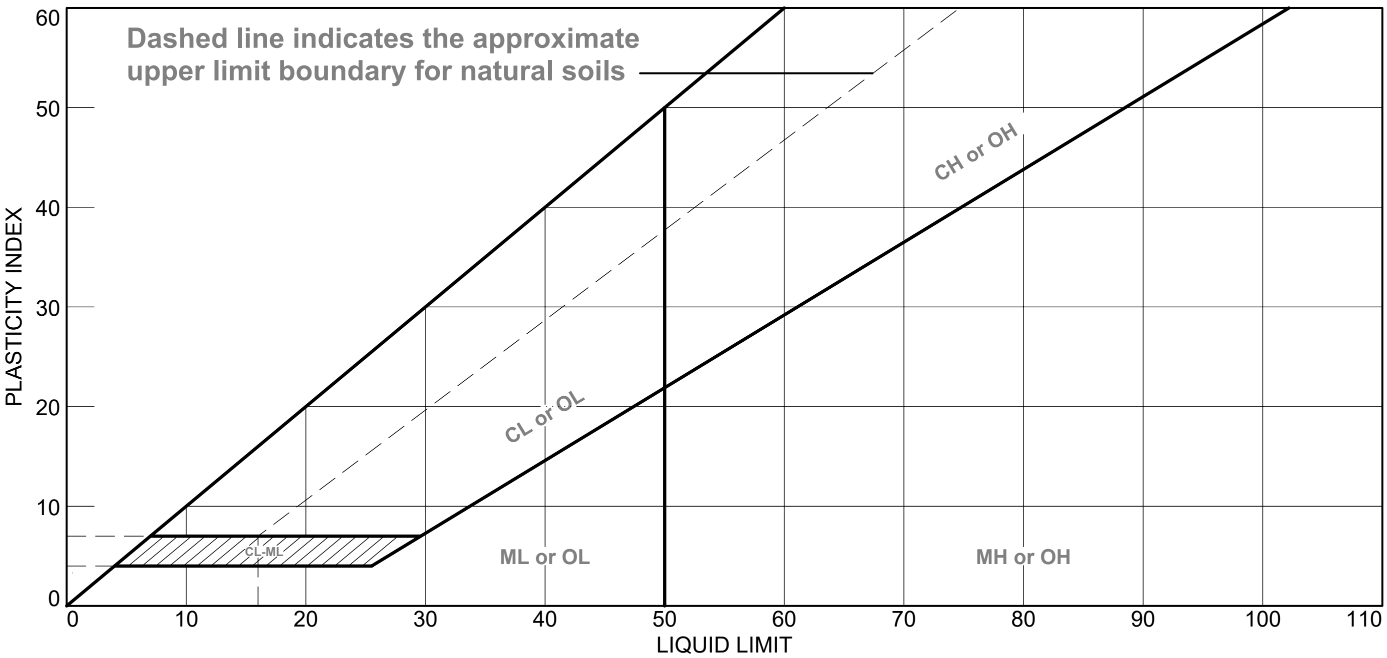
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAYISH BROWN SILTY SAND	5	9	NP	63.4	17.1	SM

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

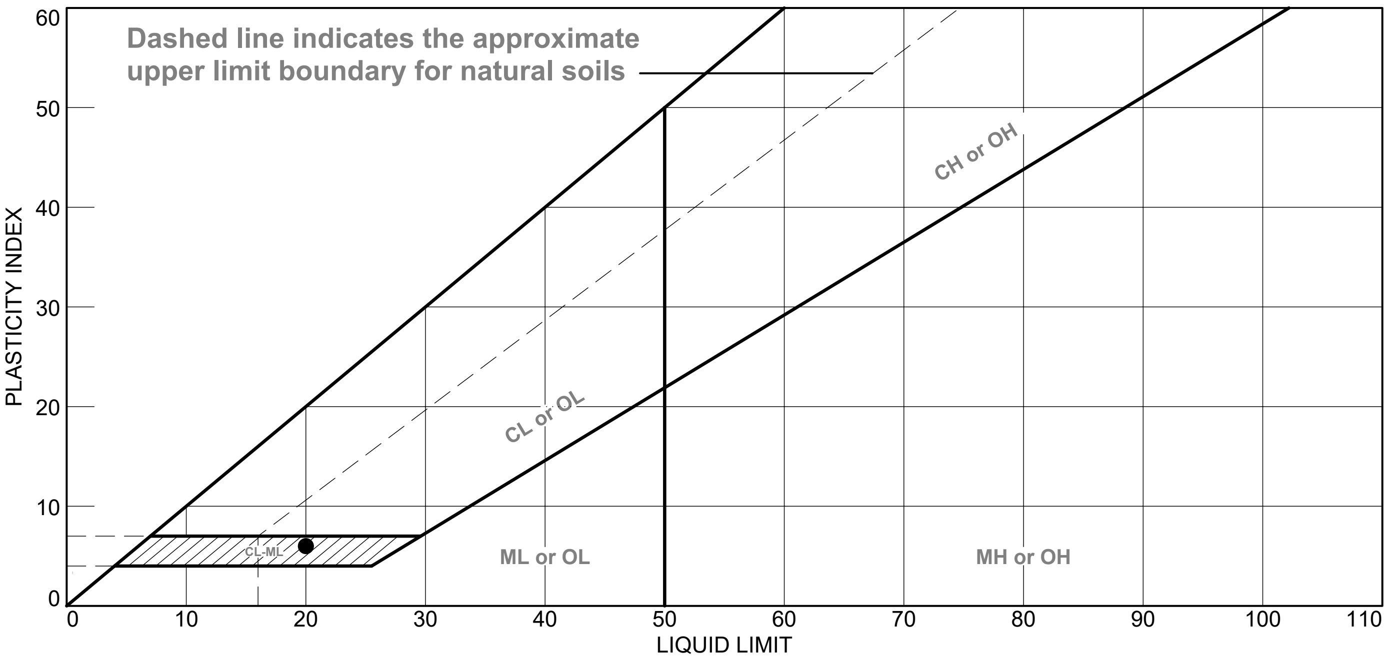
Source of Sample: SB-300 **Depth:** 61.0'-61.5'
Sample Number: 0905

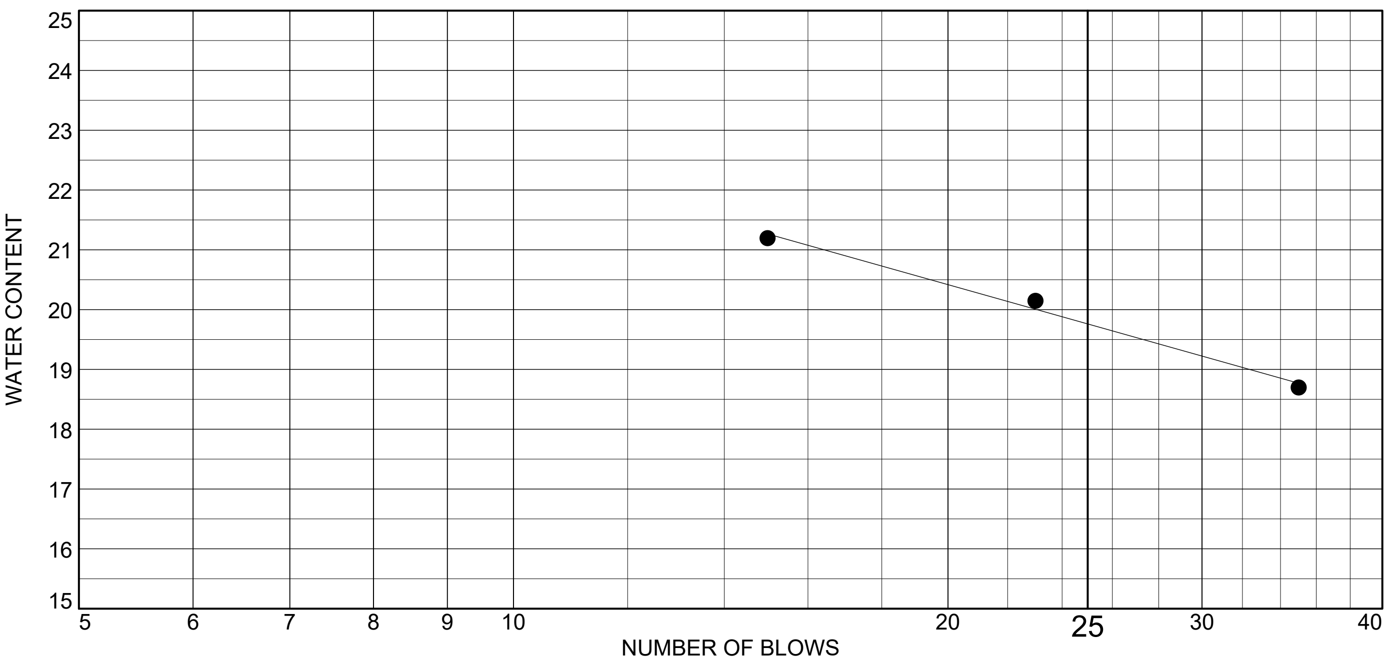
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND BROWN SANDY SILTY CLAY	20	14	6	96.1	57.6	CL-ML

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: SB-300 **Depth:** 62.5'-63.0'
Sample Number: 0920

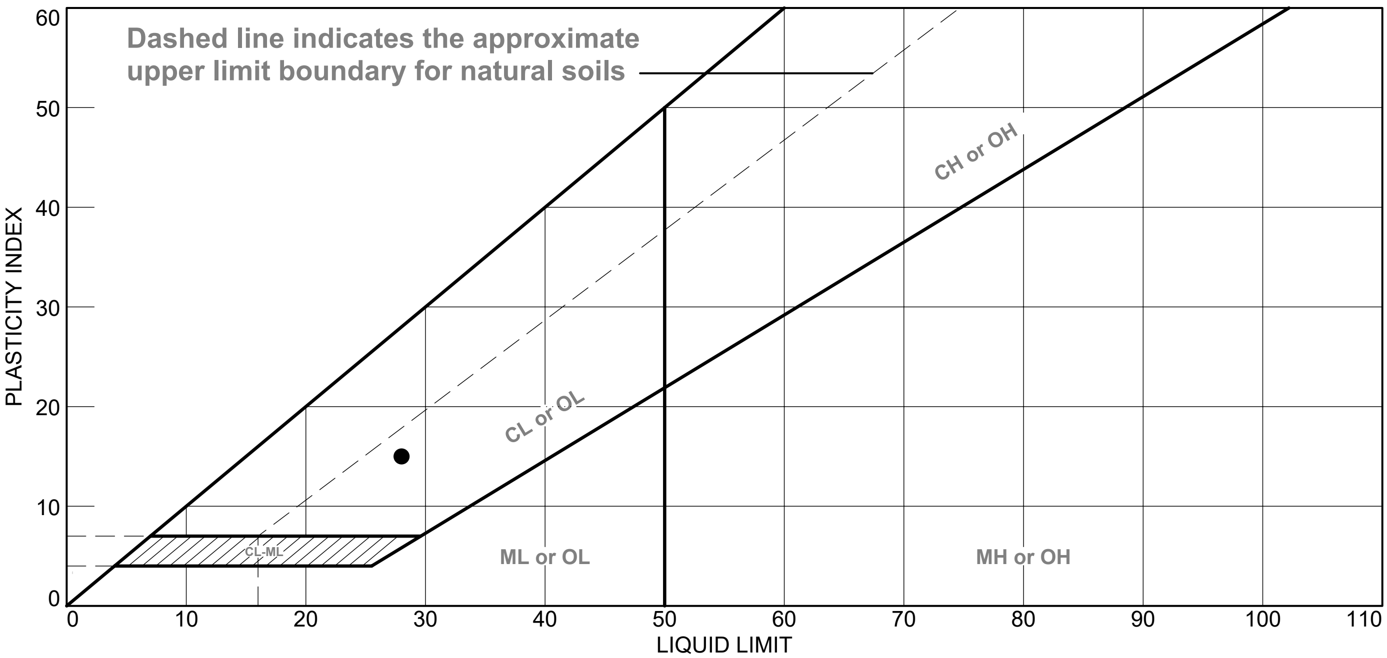
Terracon

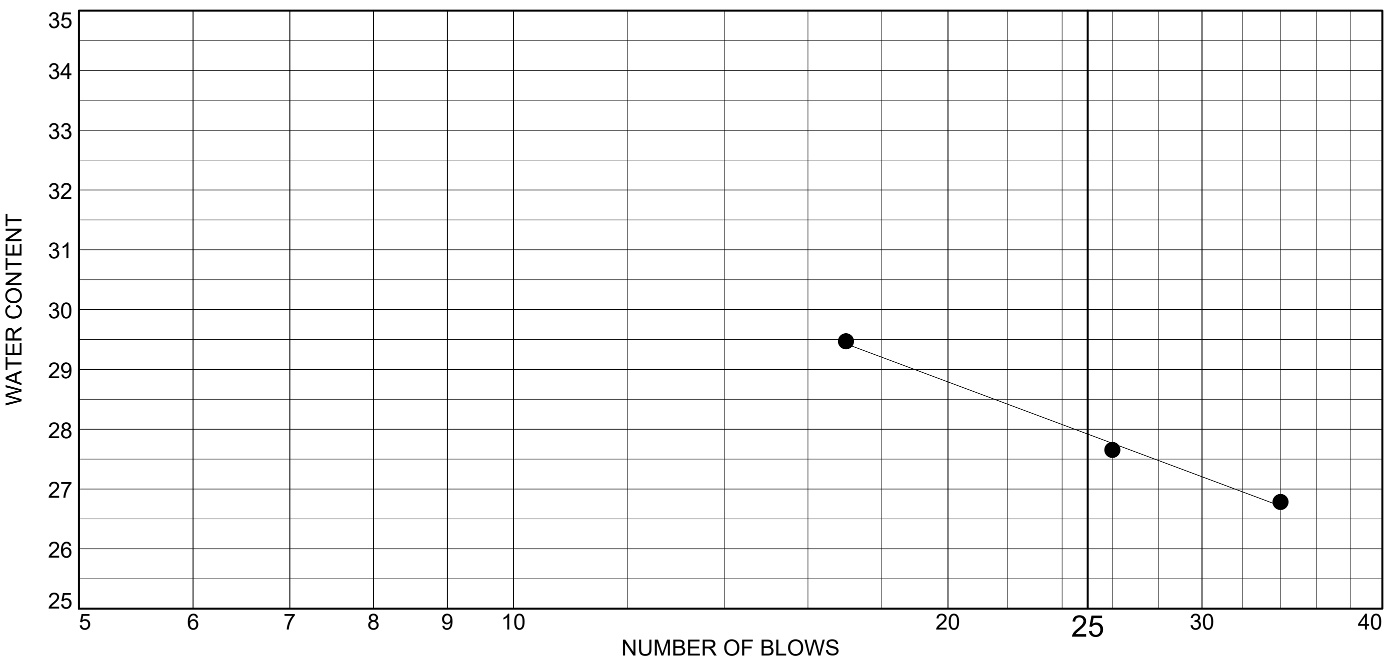
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY SANDY LEAN CLAY	28	13	15	91.6	69.3	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: SB-300 **Depth:** 105.0'-107.0'
Sample Number: 1350

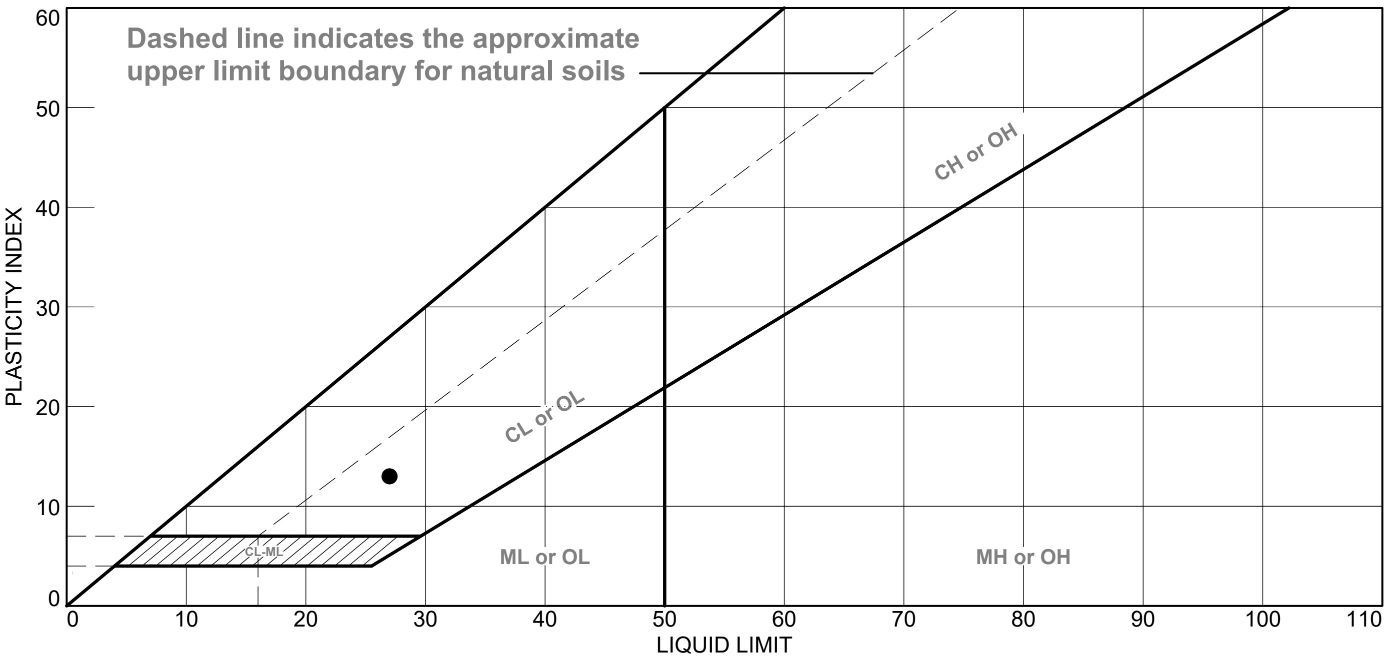
Terracon

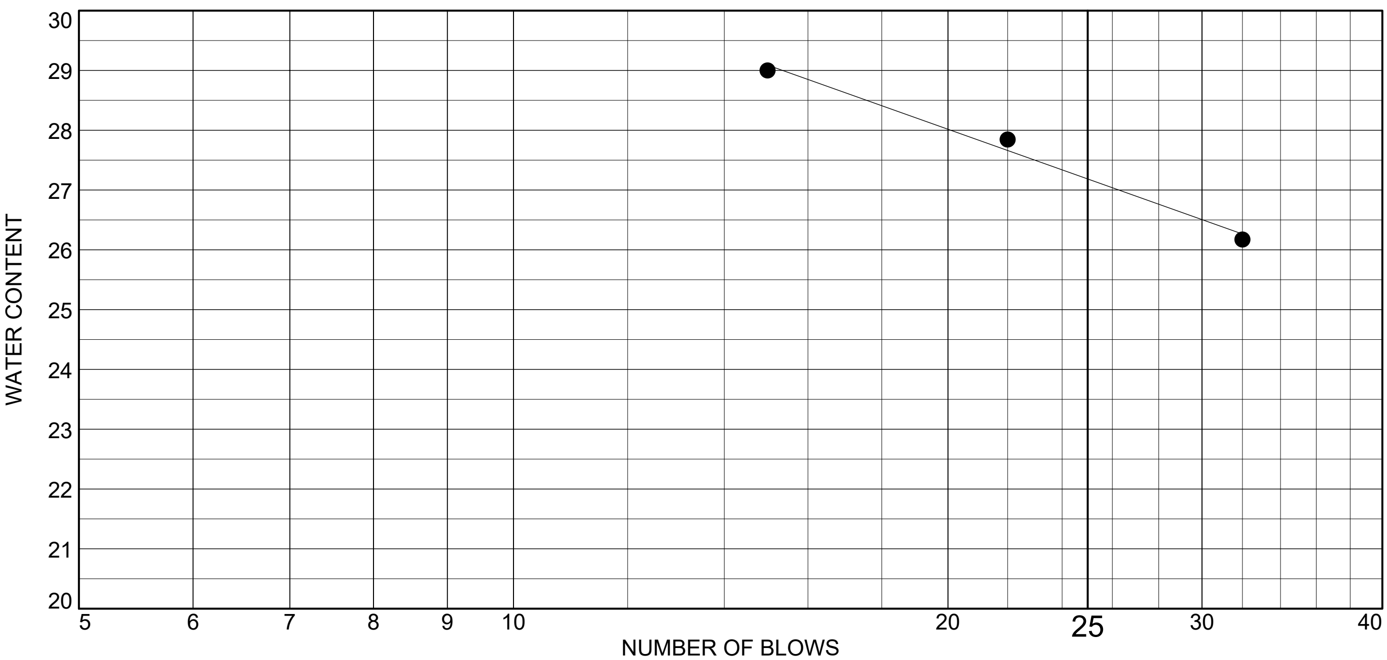
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAY SANDY LEAN CLAY	27	14	13	86.0	65.4	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: SB-301 **Depth:** 48.0'-50.0'
Sample Number: 1330

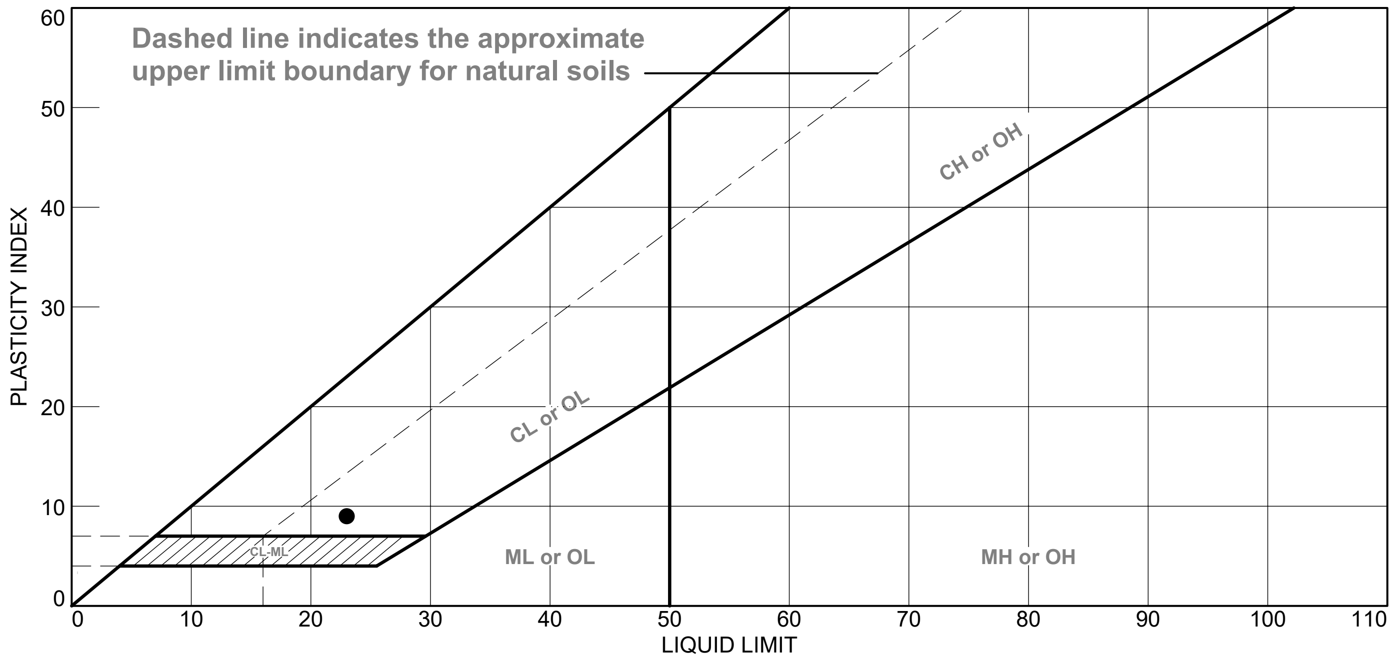
Terracon

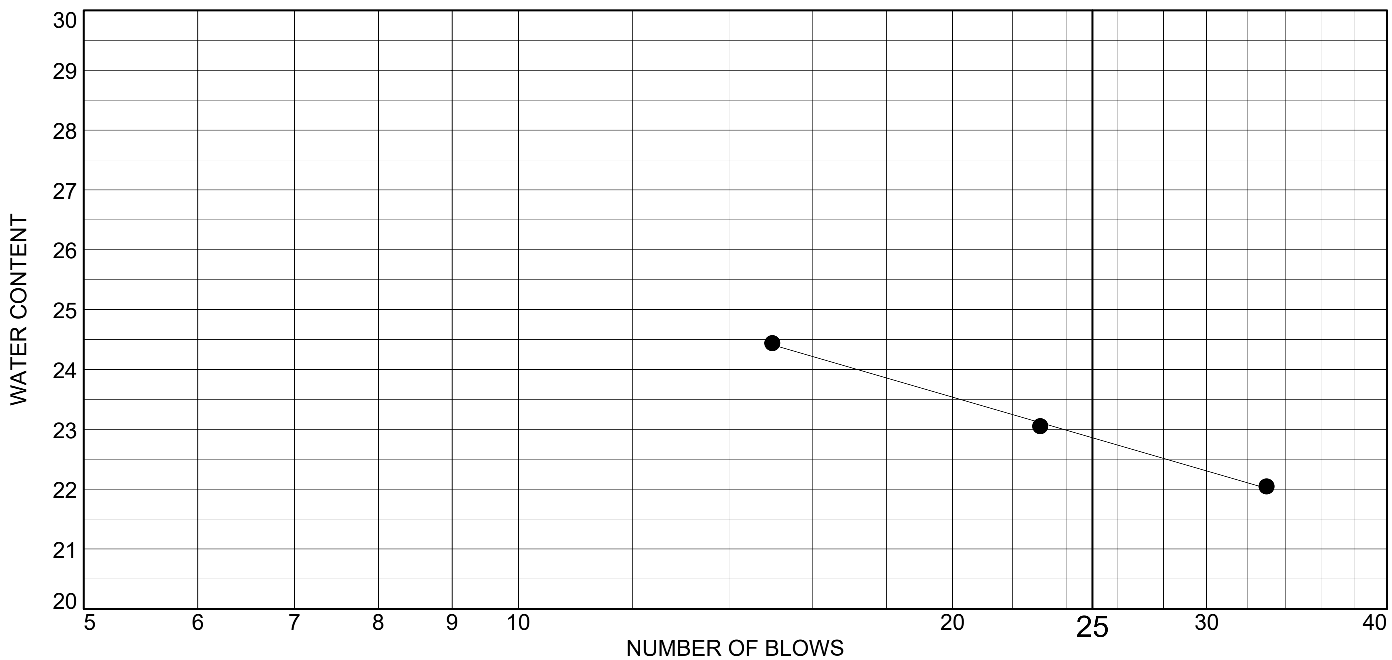
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY SANDY LEAN CLAY	23	14	9	92.5	68.7	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: SB-301 **Depth:** 68.5'-69.0'
Sample Number: 1600

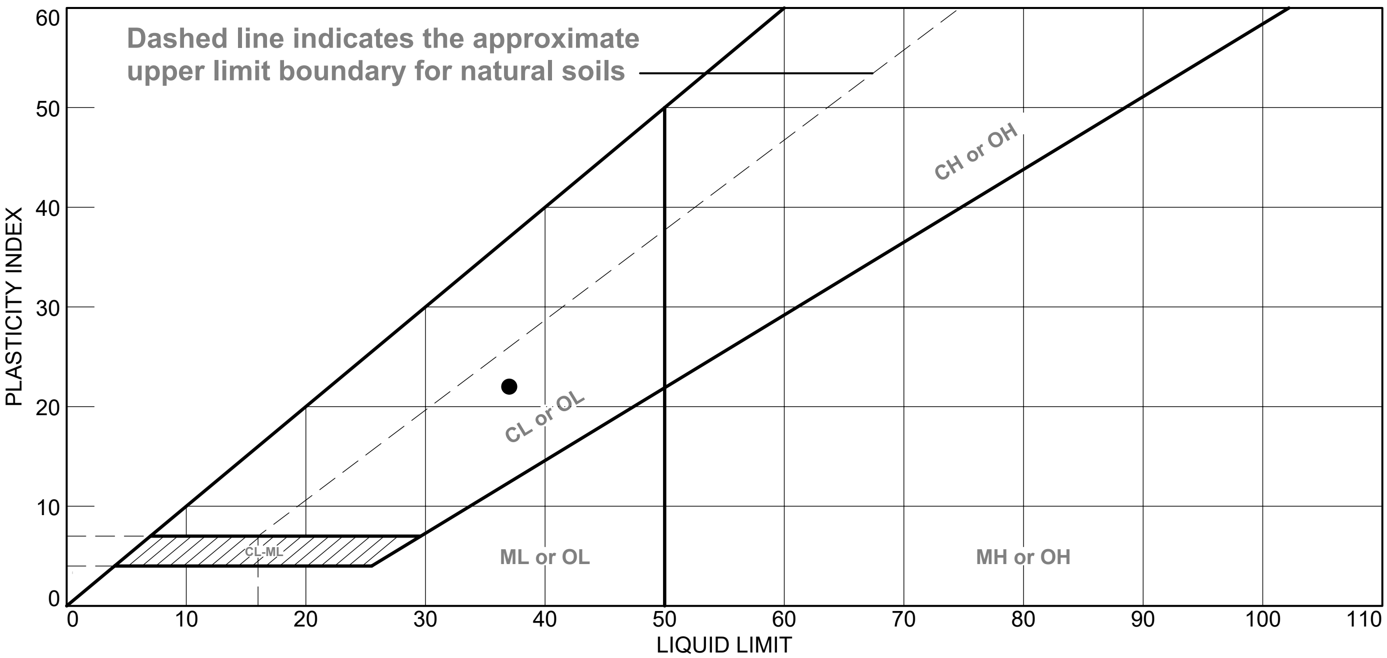
Terracon

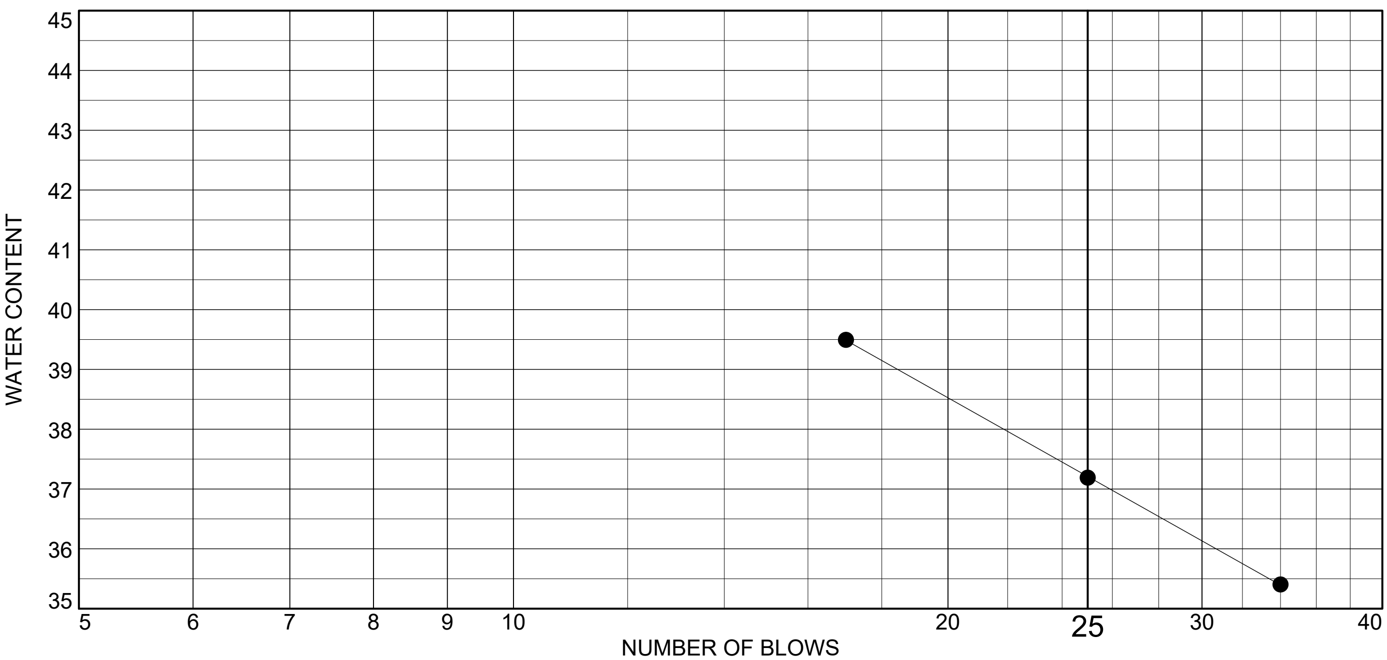
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK BROWN TO DARK GRAY LEAN CLAY WITH SAND	37	15	22	97.0	82.2	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: SB-301 **Depth:** 98.0'-100.0'
Sample Number: 0946

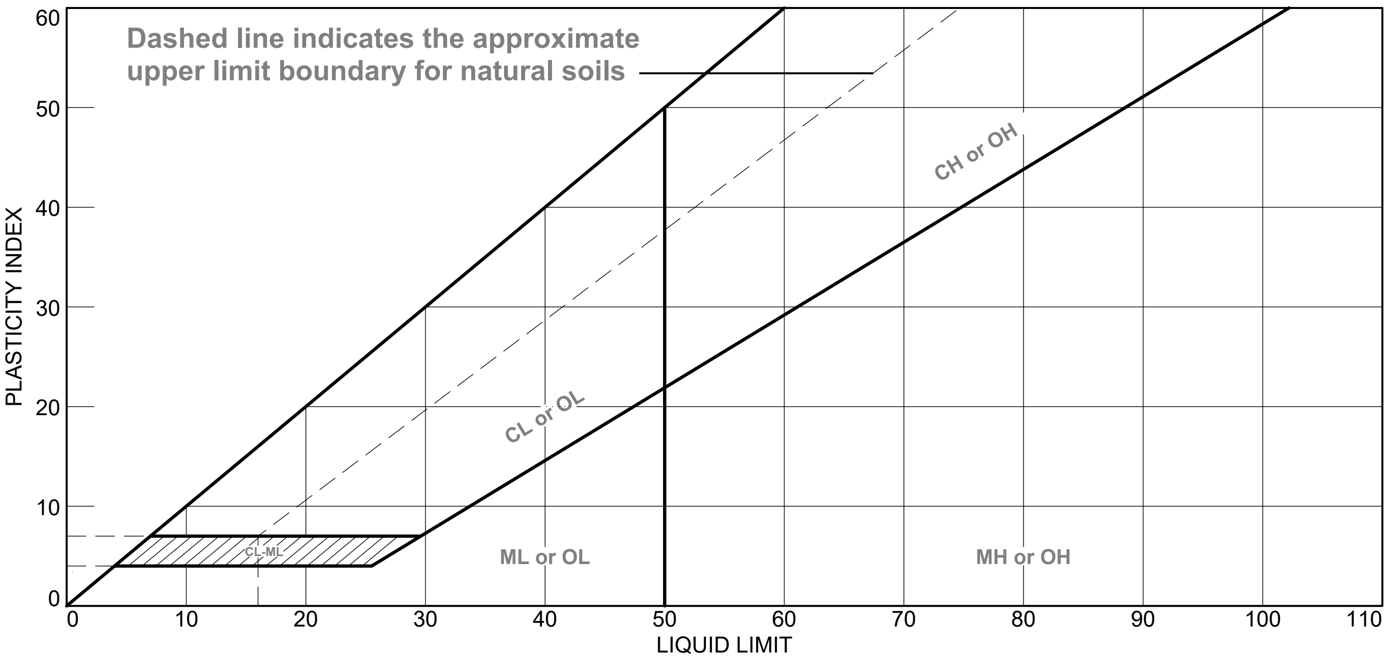
Terracon

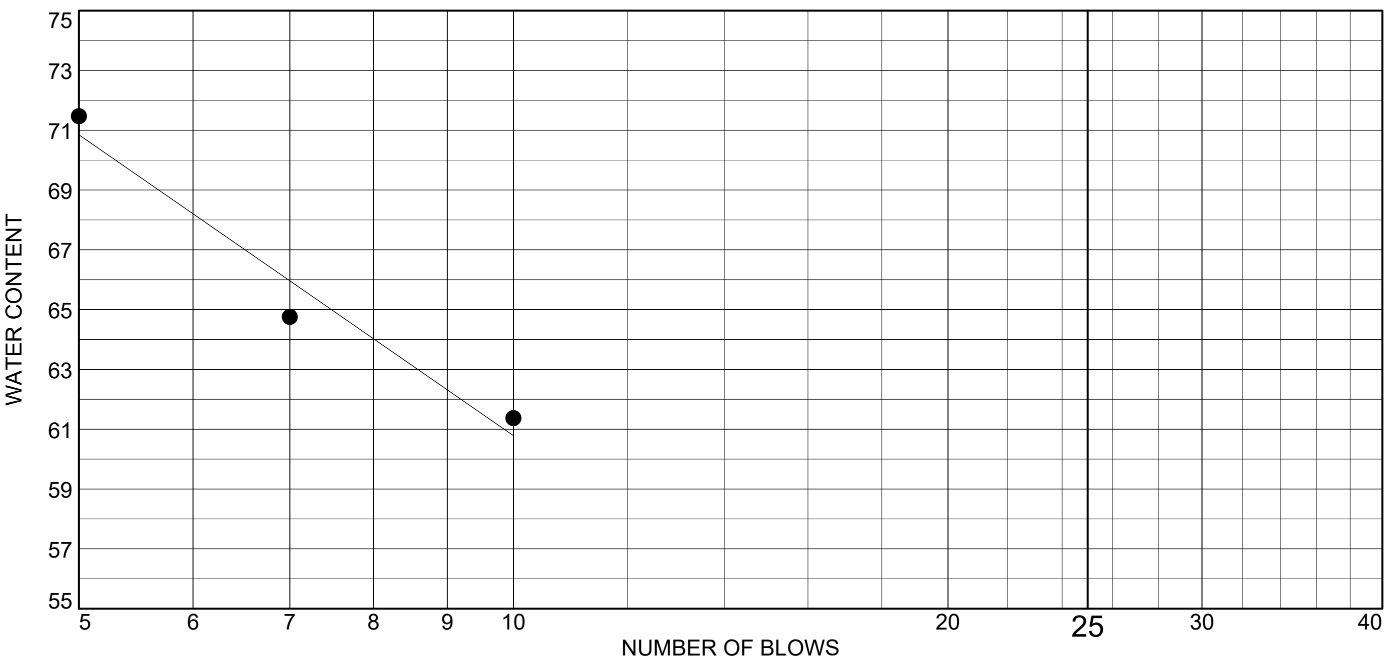
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY AND BROWN POORLY GRADED SAND WITH SILT AND GRAVEL	47	57	NP	22.3	11.8	SP-SM

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

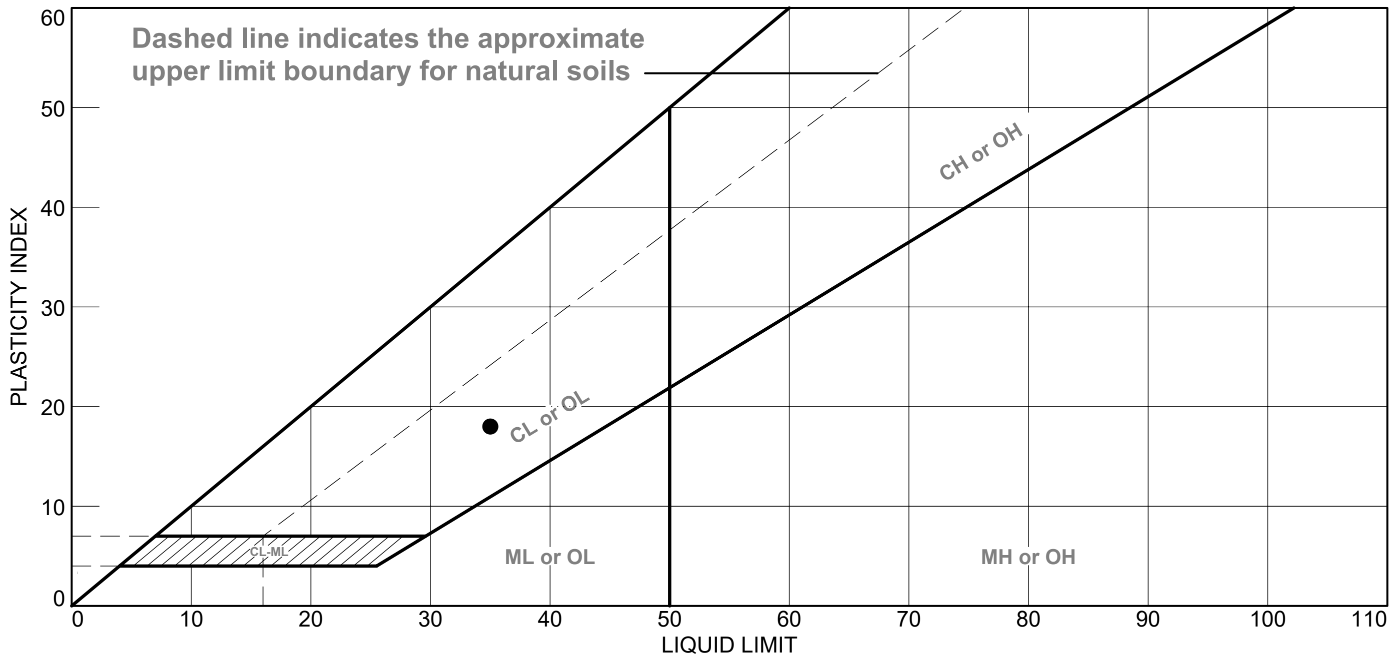
Source of Sample: XPW-01 **Depth:** 8.5'-9.0'
Sample Number: 0820

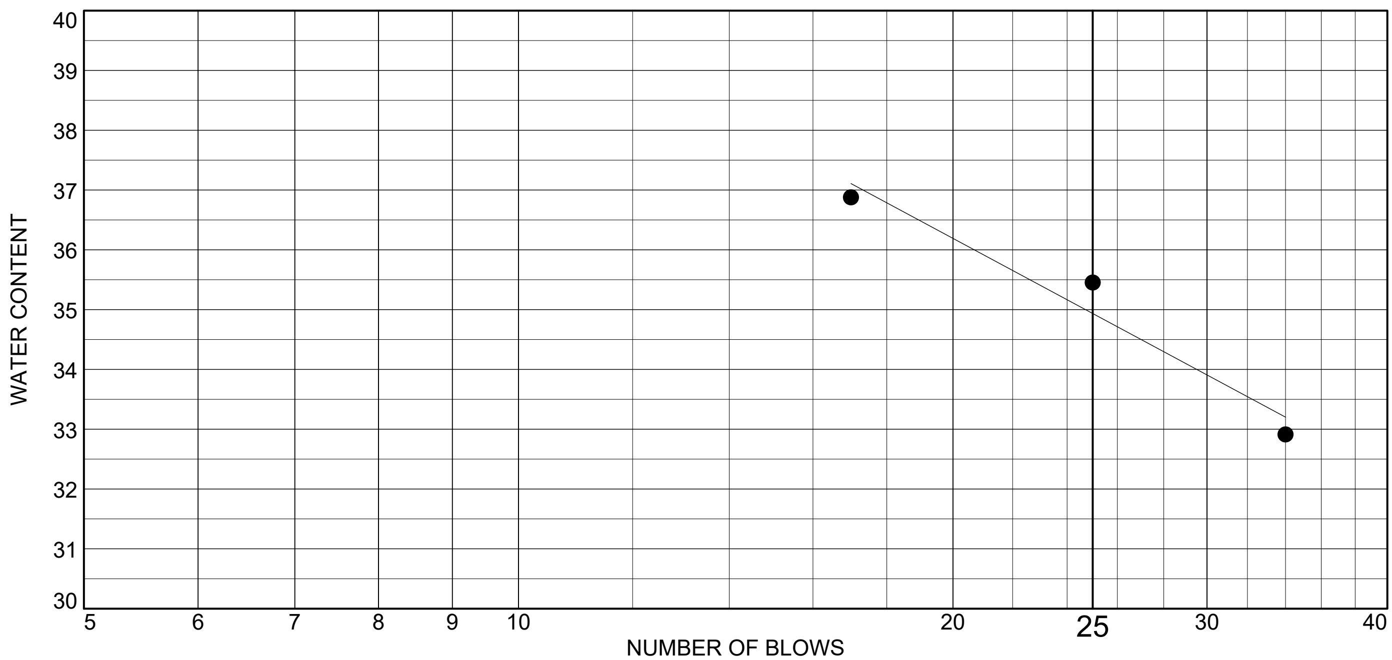
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND BROWN SANDY LEAN CLAY	35	17	18	81.1	61.3	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: XPW-01 **Depth:** 15.5'-16.0'
Sample Number: 0840

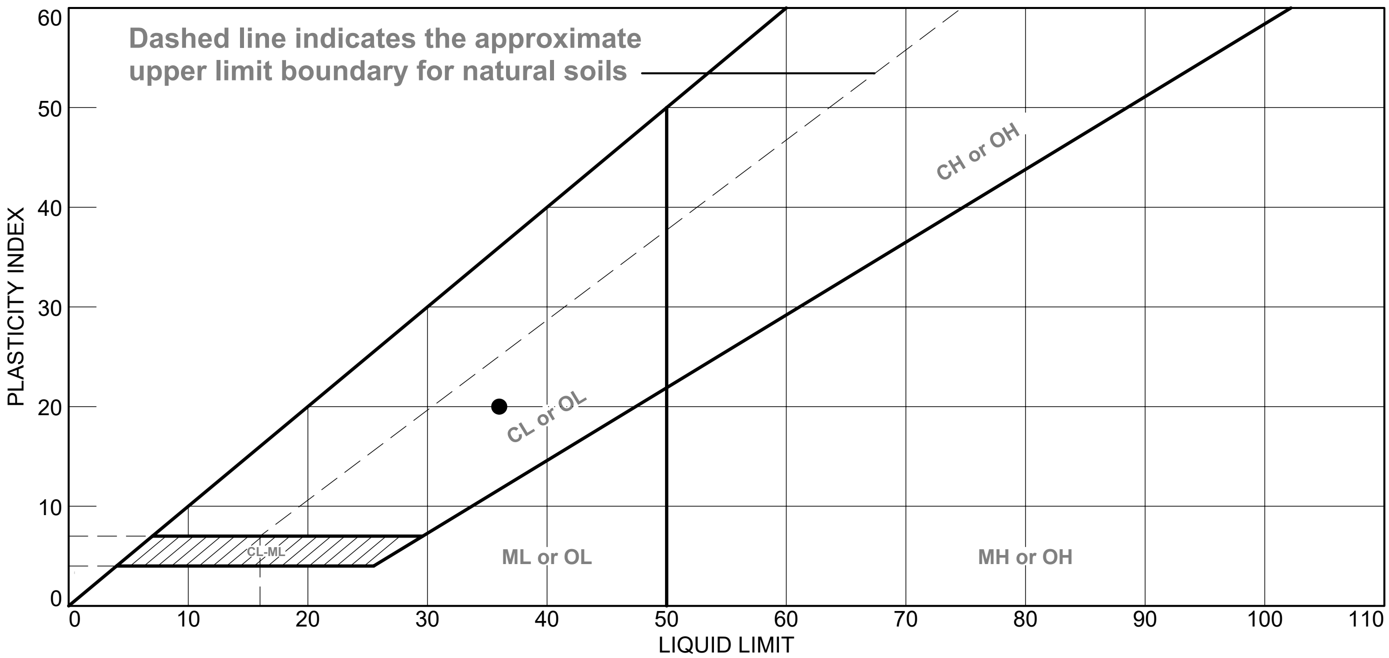
Remarks:

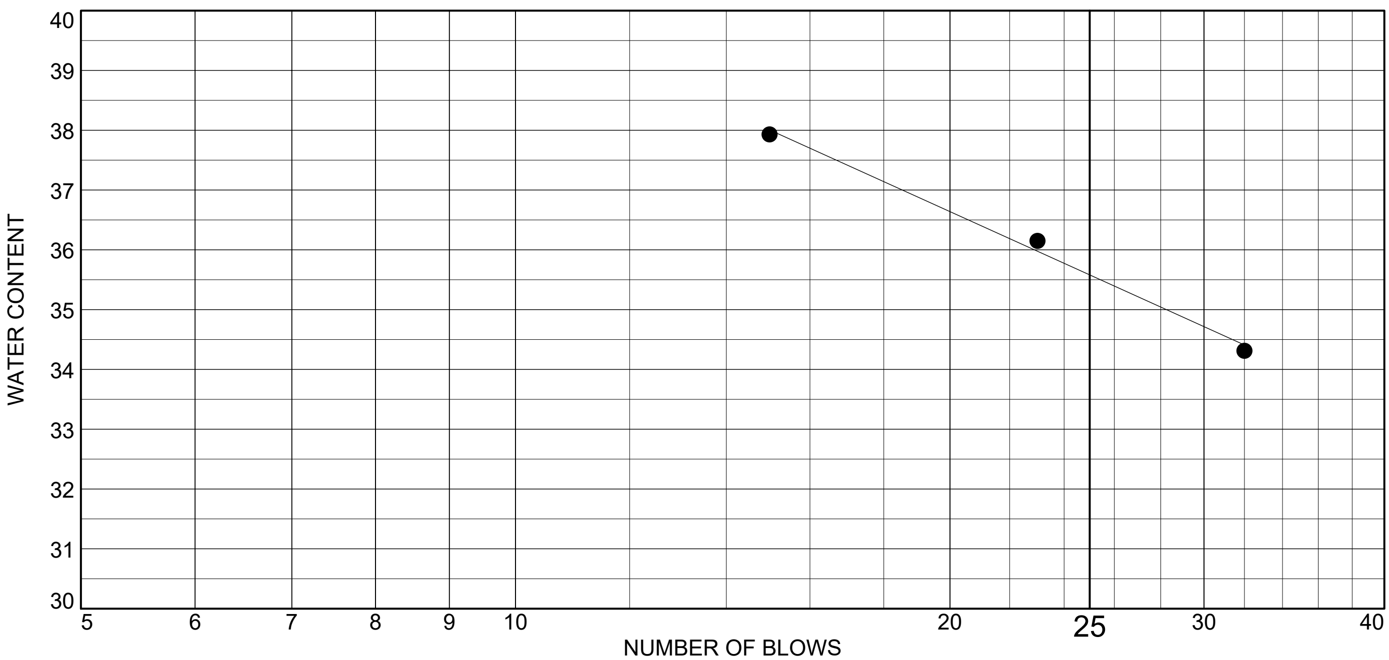
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	VERY DARK GRAY, GRAY AND BROWN SANDY LEAN CLAY	36	16	20	81.8	54.9	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: XPW-02 **Depth:** 8.0'-8.5'
Sample Number: 1530

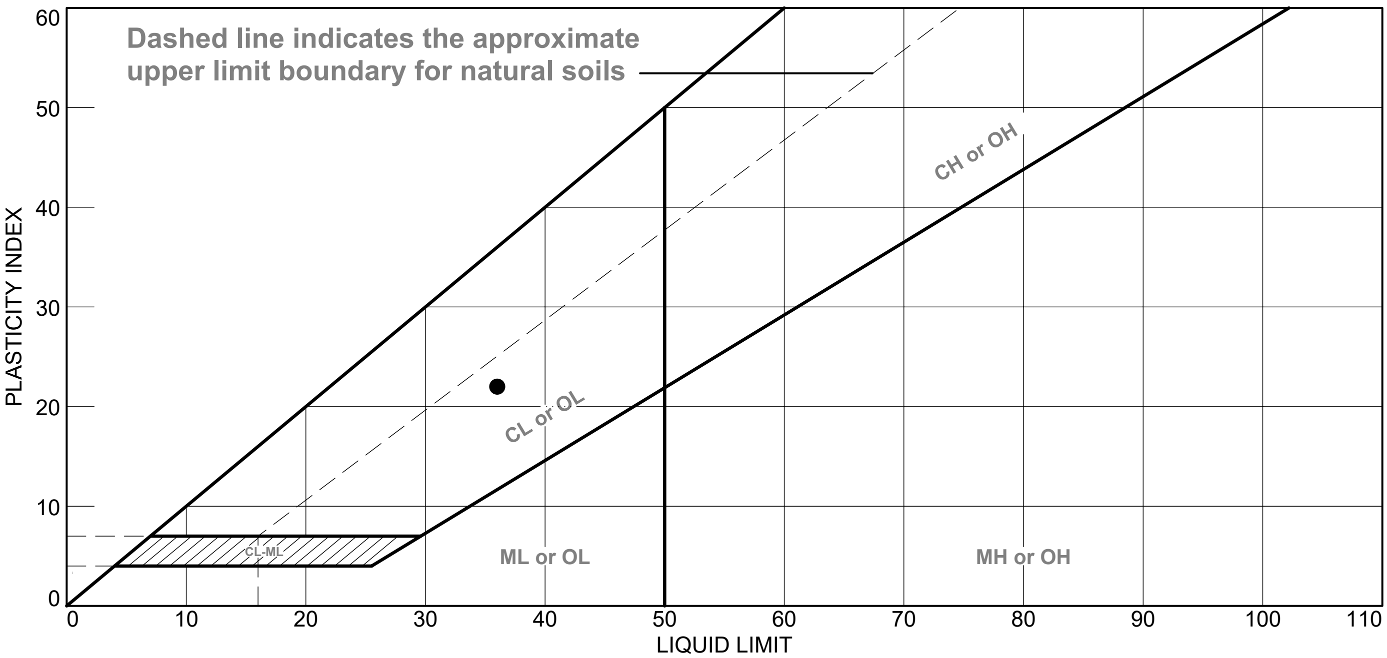
Terracon

Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND DARK BROWN LEAN CLAY WITH SAND	36	14	22	96.3	80.2	CL

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: XPW-02 **Depth:** 16.5'-17.0'
Sample Number: 1545

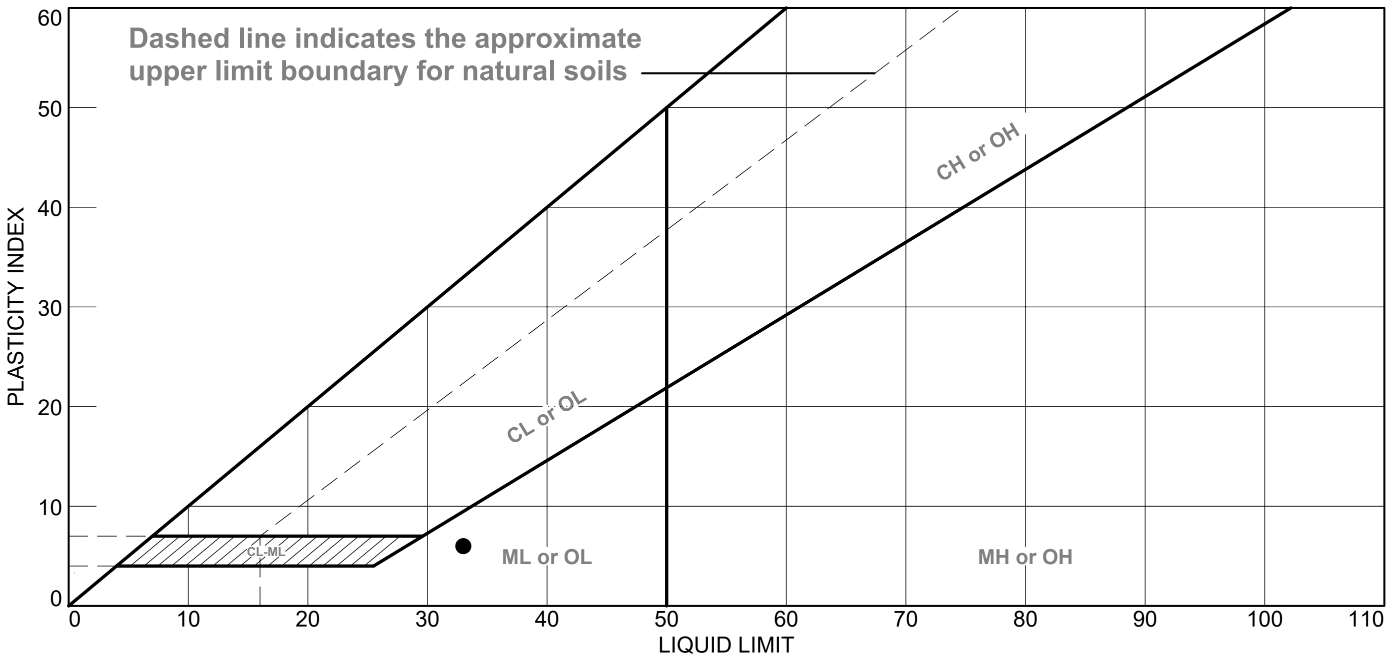
Terracon

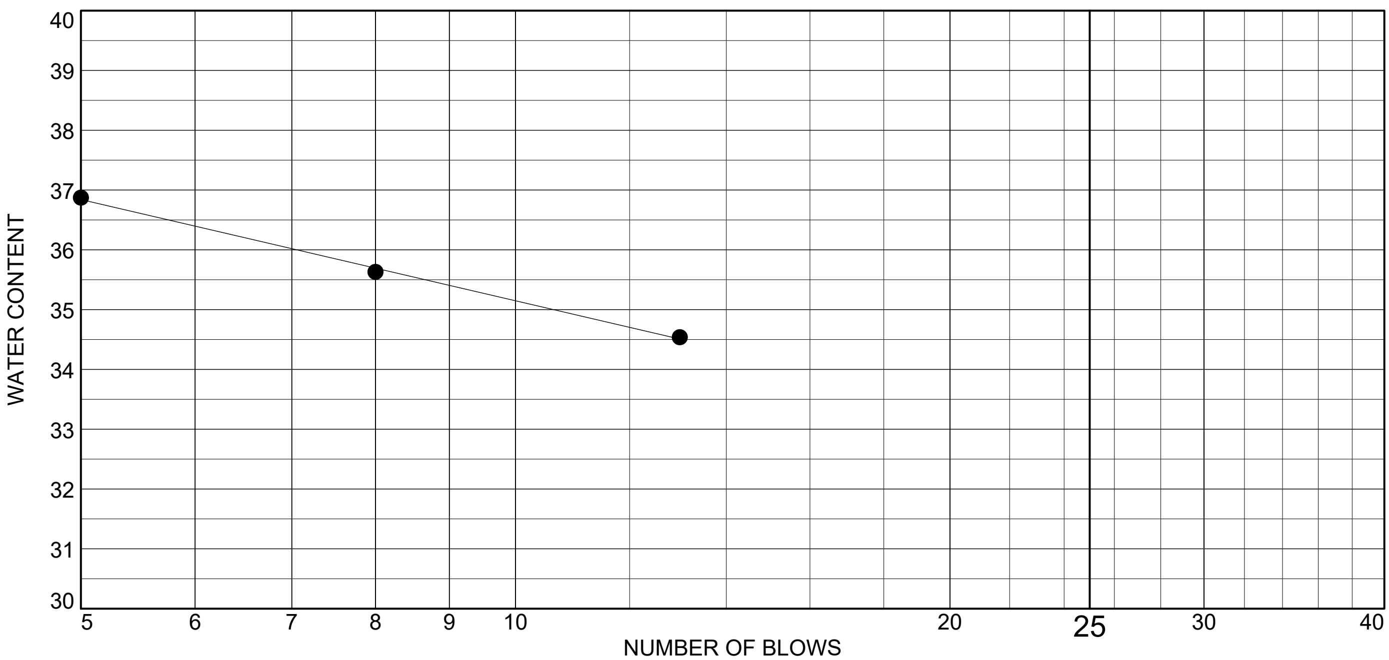
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK BROWNISH GRAY SILTY SAND	33	27	6	46.6	21.5	SM

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

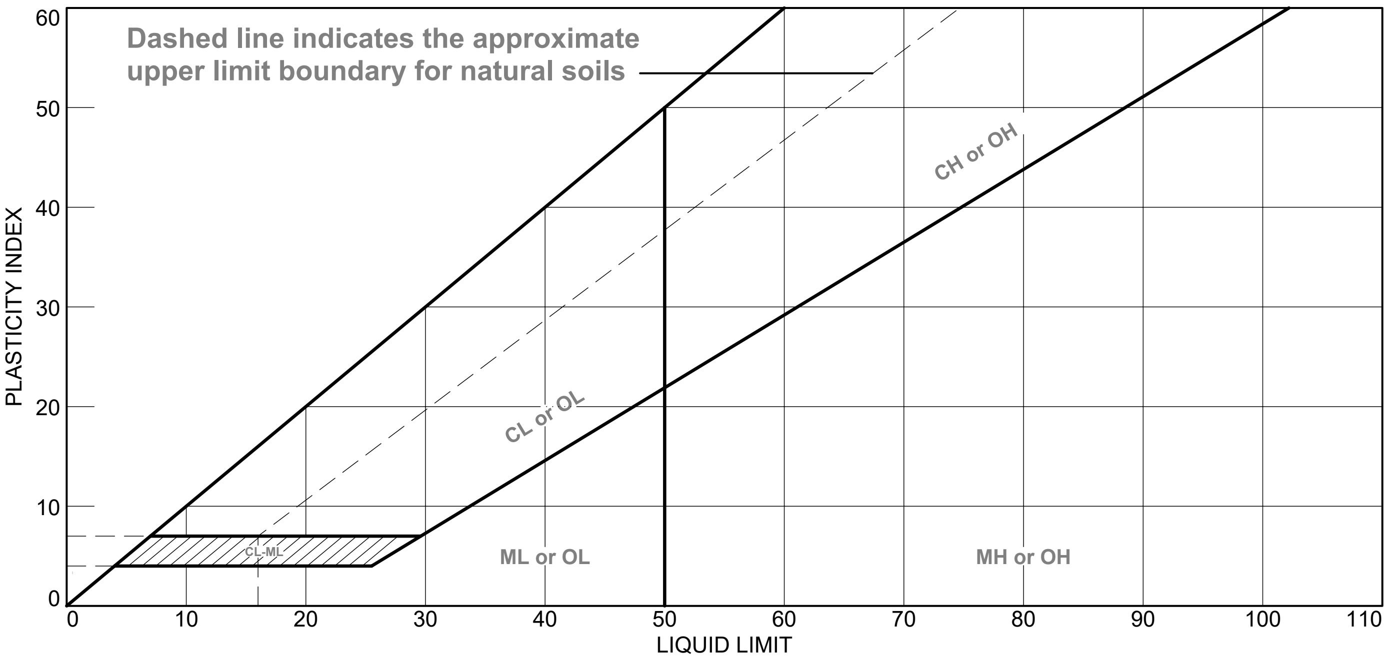
Source of Sample: XPW-03 **Depth:** 6.0'-6.5'
Sample Number: 1355

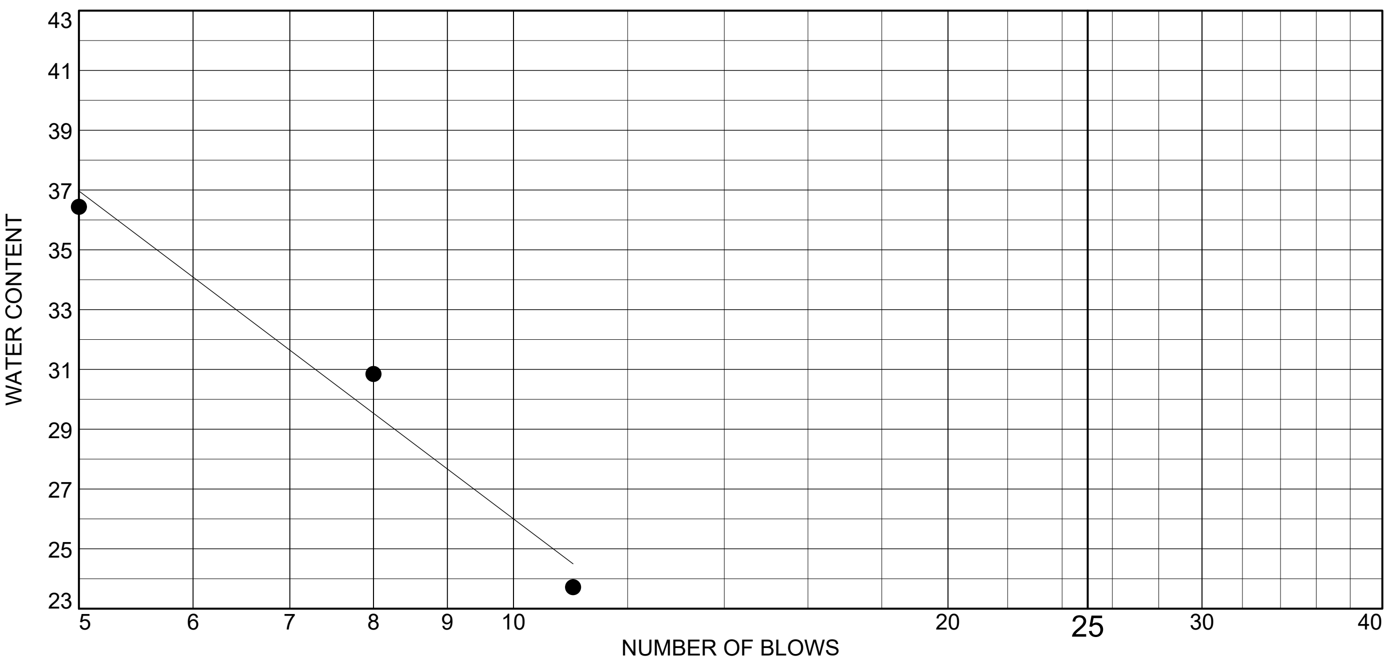
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWNISH GRAY SILTY SAND WITH GRAVEL	12	19	NP	46.1	16.3	SM

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: XPW-03 **Depth:** 15.5'-16.0'
Sample Number: 1315

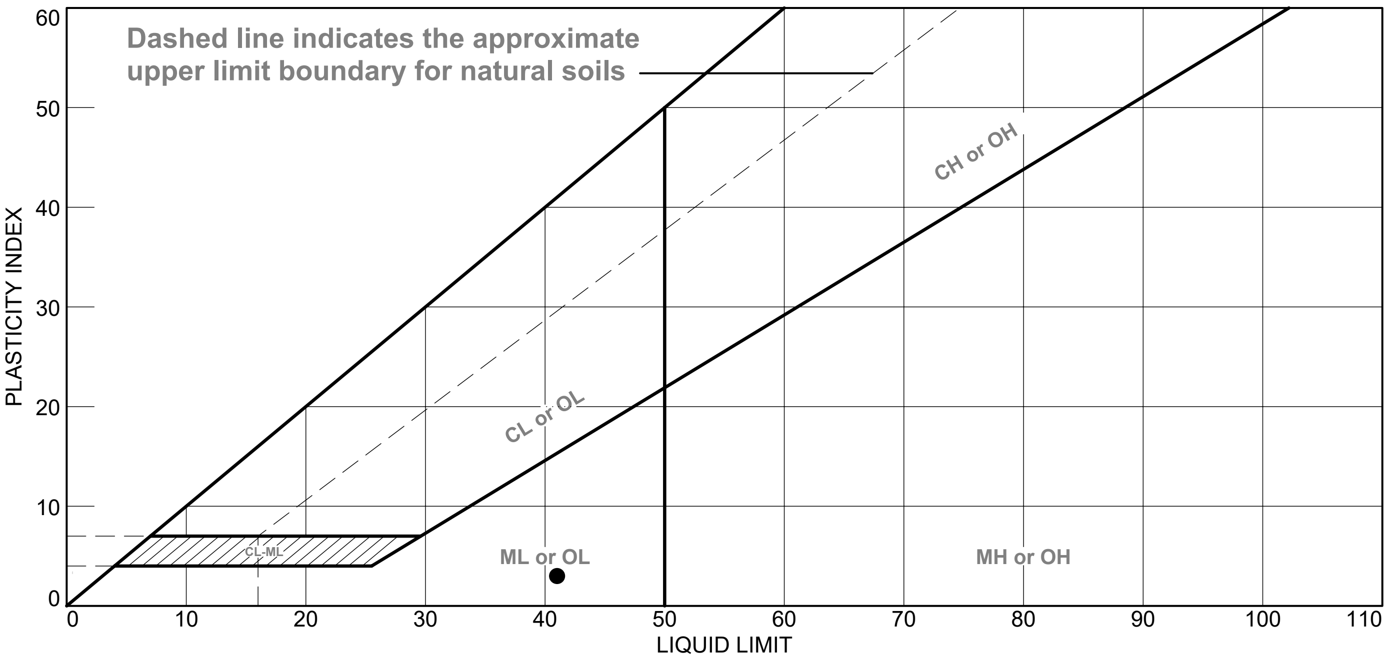
Terracon

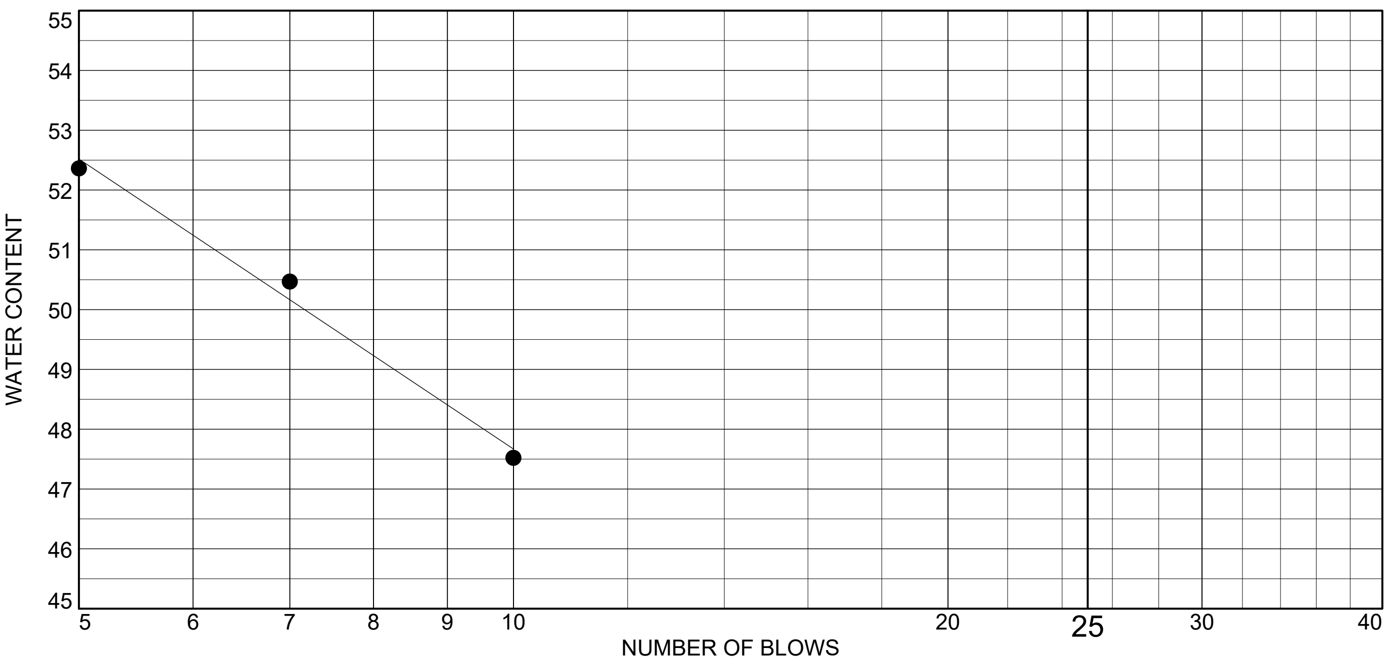
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY SILTY SAND	41	38	3	28.5	13.9	SM

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: XPW-04 **Depth:** 6.5'-7.0'
Sample Number: 1000

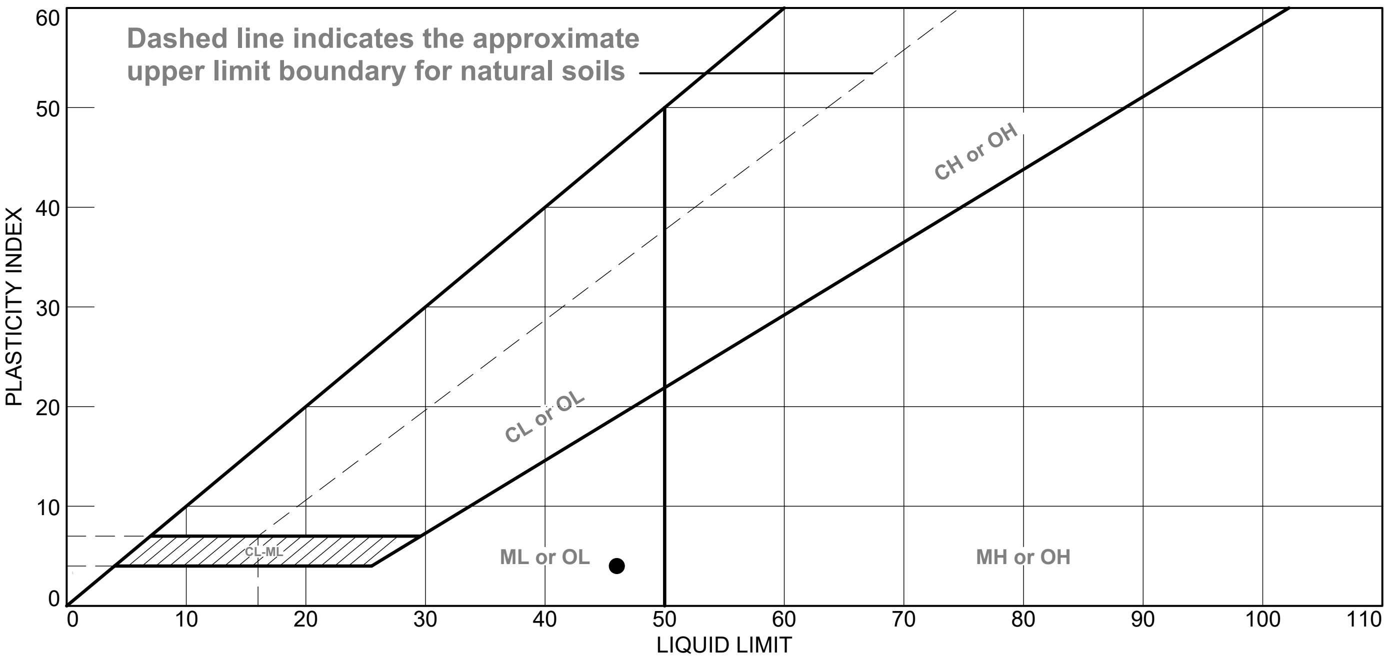
Terracon

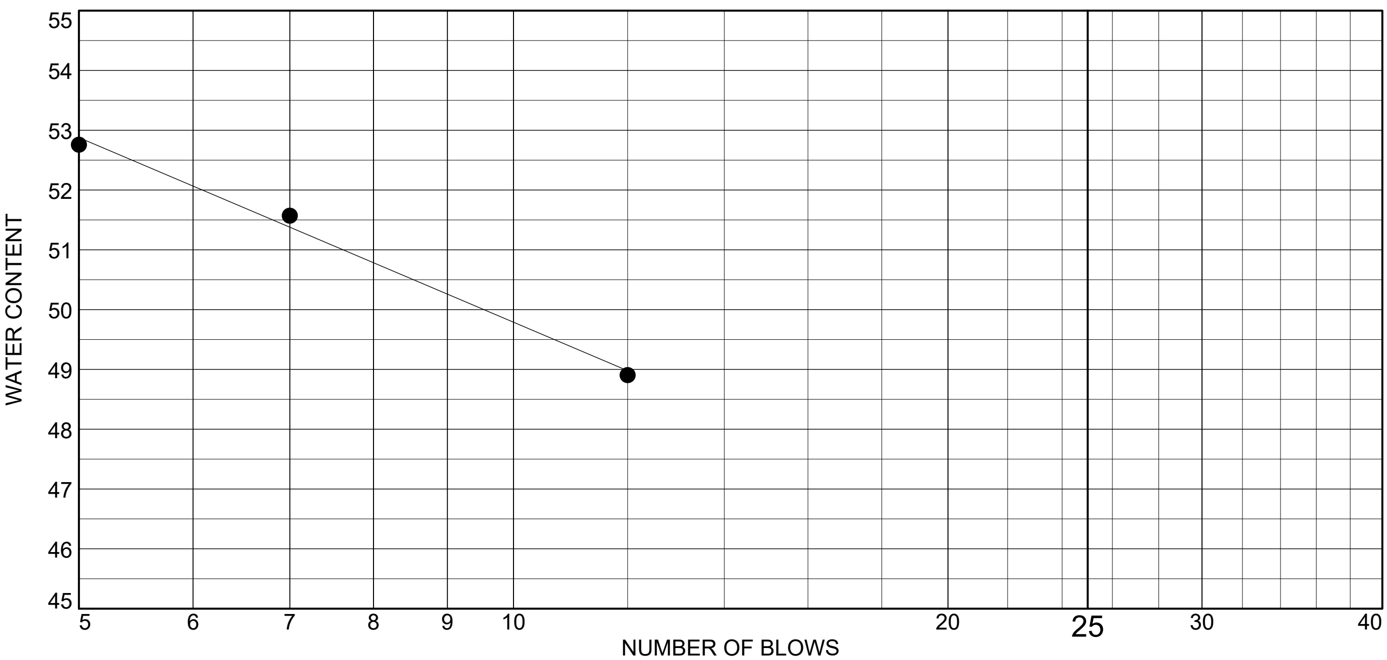
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK BROWNISH GRAY SILTY SAND WITH GRAVEL	46	42	4	45.5	33.3	SM

Project No. 11215019 **Client:** RAMBOLL ENVIRON US CORP.

Project: NEWTON POWER STATION

Source of Sample: XPW-04 **Depth:** 15.5'-16.0'
Sample Number: 1020

Remarks:

Terracon

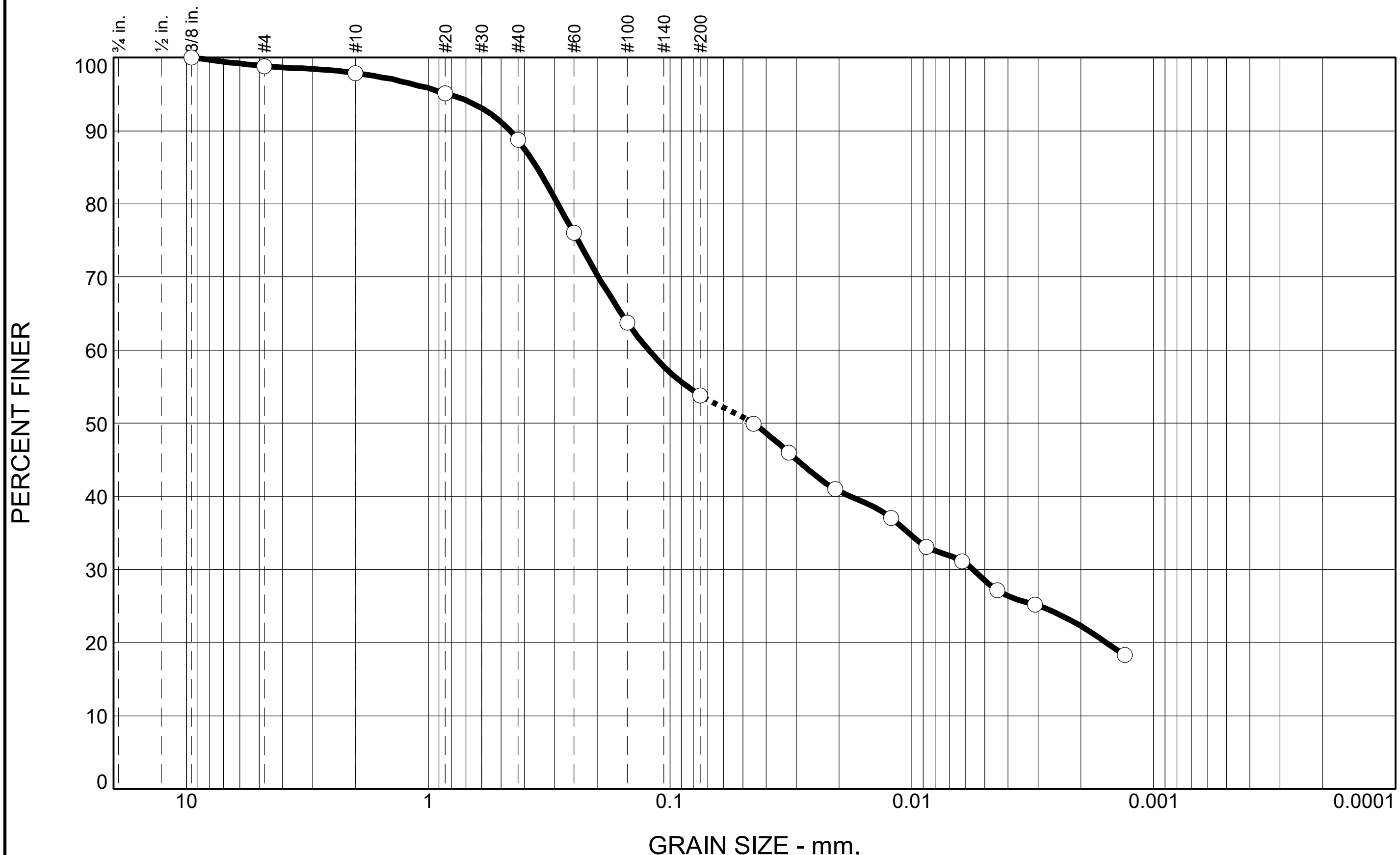
Figure

Tested By: DT **Checked By:** WPQ

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
ASTM D6913

Particle-Size Distribution (Gradation) of Fine-Grained Soils
Using the Sedimentation (Hydrometer) Analysis
ASTM D7928

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.1	1.0	9.2	34.9	25.2	28.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	98.9		
#10	97.9		
#20	95.1		
#40	88.7		
#60	76.0		
#100	63.8		
#200	53.8		
0.0450 mm.	49.9		
0.0323 mm.	46.0		
0.0208 mm.	41.0		
0.0122 mm.	37.1		
0.0087 mm.	33.1		
0.0062 mm.	31.1		
0.0044 mm.	27.2		
0.0031 mm.	25.2		
0.0013 mm.	18.3		

* (no specification provided)

Soil Description

BROWN SANDY LEAN CLAY

Atterberg Limits

PL= 12 LL= 28 PI= 16

Coefficients

D_{90}= 0.4588 D_{85}= 0.3552 D_{60}= 0.1224
D_{50}= 0.0454 D_{30}= 0.0056 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(5)

Remarks

F.M.=0.69

Source of Sample: APW-11 **Depth:** 10.0'-12.0'
Sample Number: 0805

Date: 3-30-21

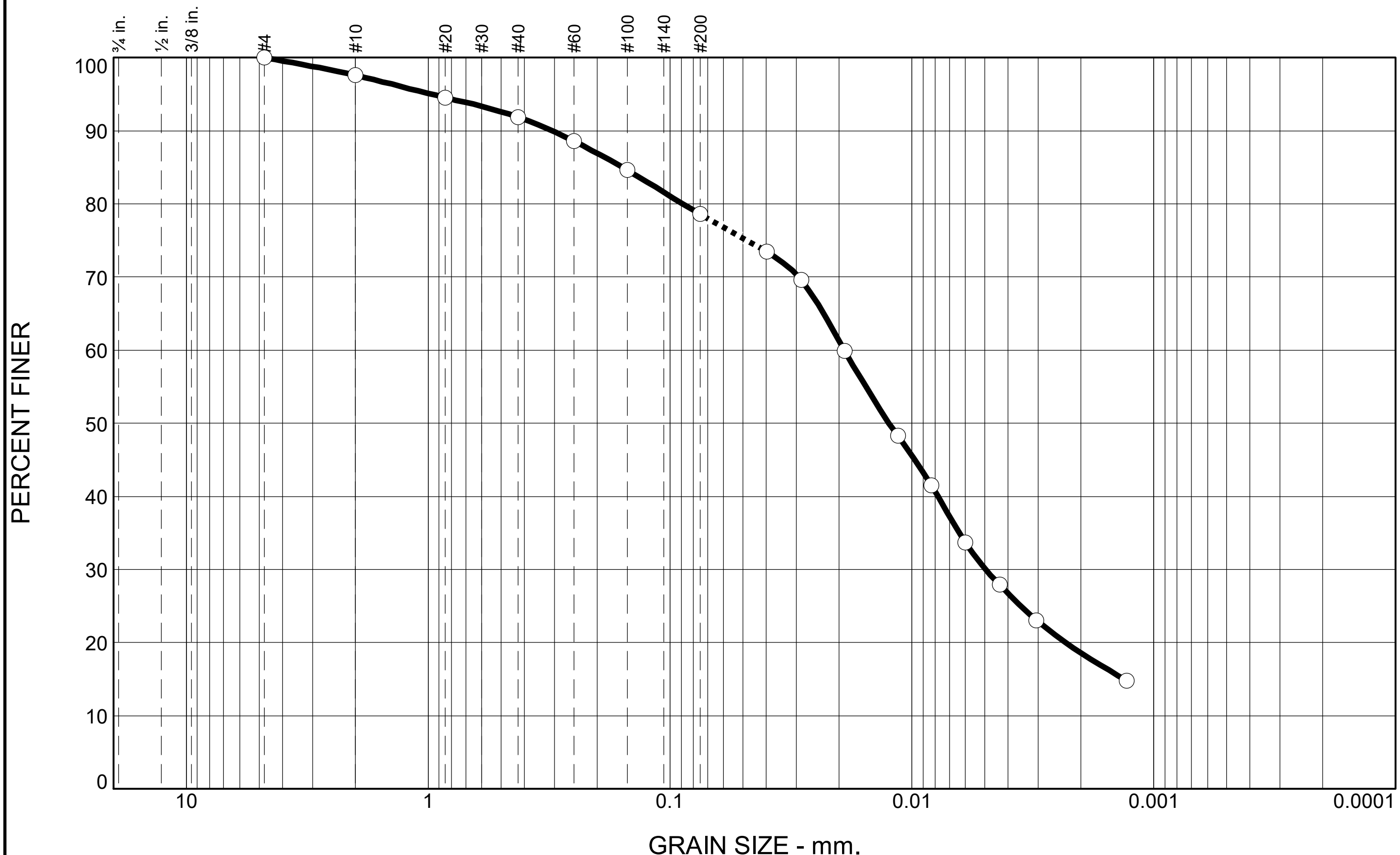
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.4	5.7	13.3	48.4	30.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	97.6		
#20	94.5		
#40	91.9		
#60	88.6		
#100	84.6		
#200	78.6		
0.0399 mm.	73.4		
0.0287 mm.	69.6		
0.0189 mm.	59.9		
0.0114 mm.	48.2		
0.0083 mm.	41.5		
0.0060 mm.	33.7		
0.0043 mm.	27.9		
0.0031 mm.	23.1		
0.0013 mm.	14.8		

* (no specification provided)

Soil Description

GRAYISH BROWN LEAN CLAY WITH SAND

Atterberg Limits

PL= 18 LL= 27 PI= 9

Coefficients

D_{90}= 0.3070 D_{85}= 0.1573 D_{60}= 0.0190
D_{50}= 0.0124 D_{30}= 0.0050 D_{15}= 0.0013
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-4(5)

Remarks

F.M.=0.38

Source of Sample: APW-11 **Depth:** 61.0'-61.5'
Sample Number: 1050

Date: 3-16-21

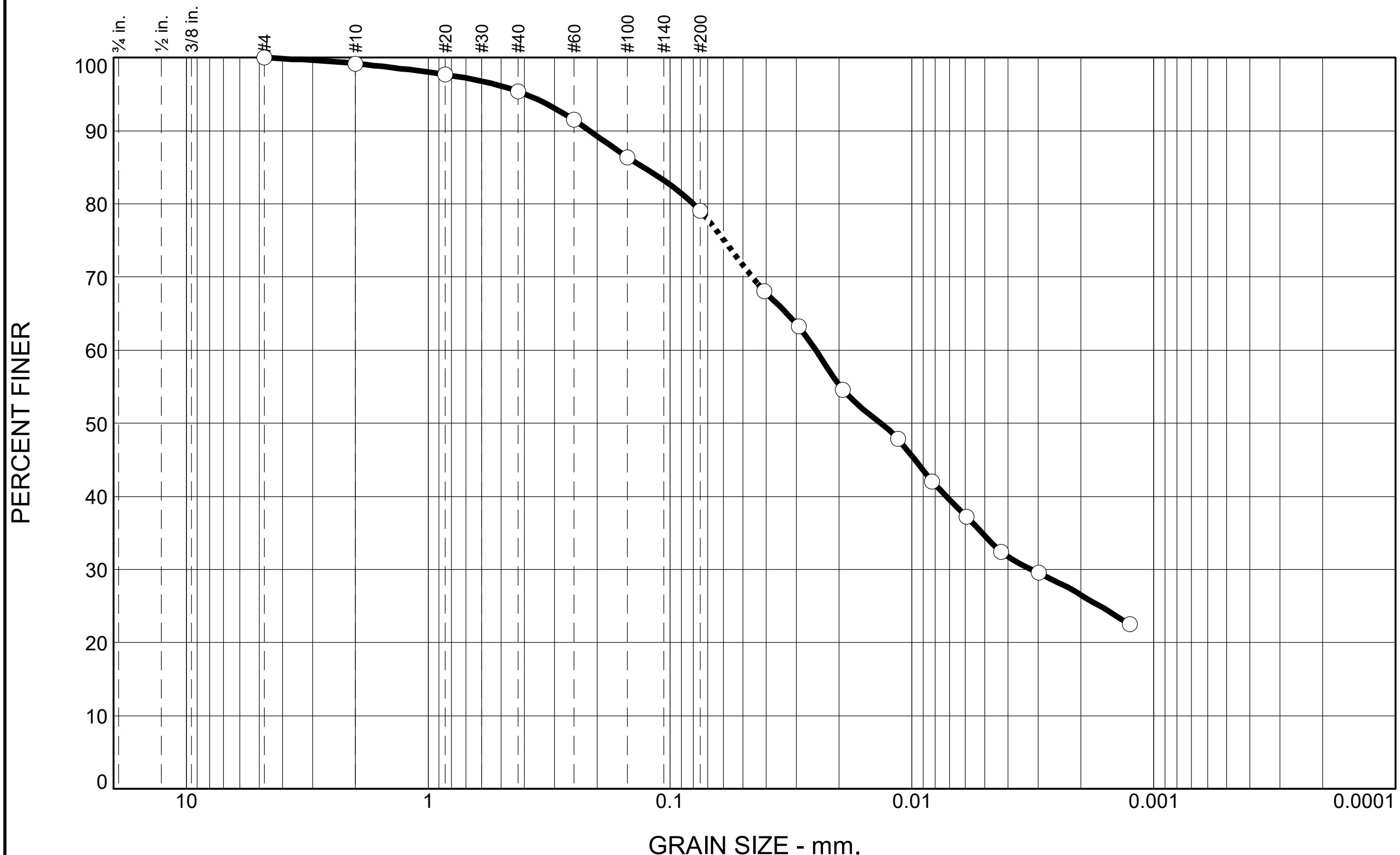
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.8	3.8	16.4	44.4	34.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.2		
#20	97.7		
#40	95.4		
#60	91.5		
#100	86.4		
#200	79.0		
0.0407 mm.	68.1		
0.0294 mm.	63.3		
0.0193 mm.	54.6		
0.0114 mm.	47.8		
0.0082 mm.	42.1		
0.0059 mm.	37.2		
0.0043 mm.	32.4		
0.0030 mm.	29.5		
0.0013 mm.	22.5		

* (no specification provided)

Soil Description

DARK GRAY LEAN CLAY WITH SAND

Atterberg Limits

PL= 14 LL= 32 PI= 18

Coefficients

D_{90}= 0.2146 D_{85}= 0.1293 D_{60}= 0.0250
D_{50}= 0.0135 D_{30}= 0.0032 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(12)

Remarks

F.M.=0.26

Source of Sample: APW-11 **Depth:** 80.0'-82.0'
Sample Number: 1115

Date: 3-2-21

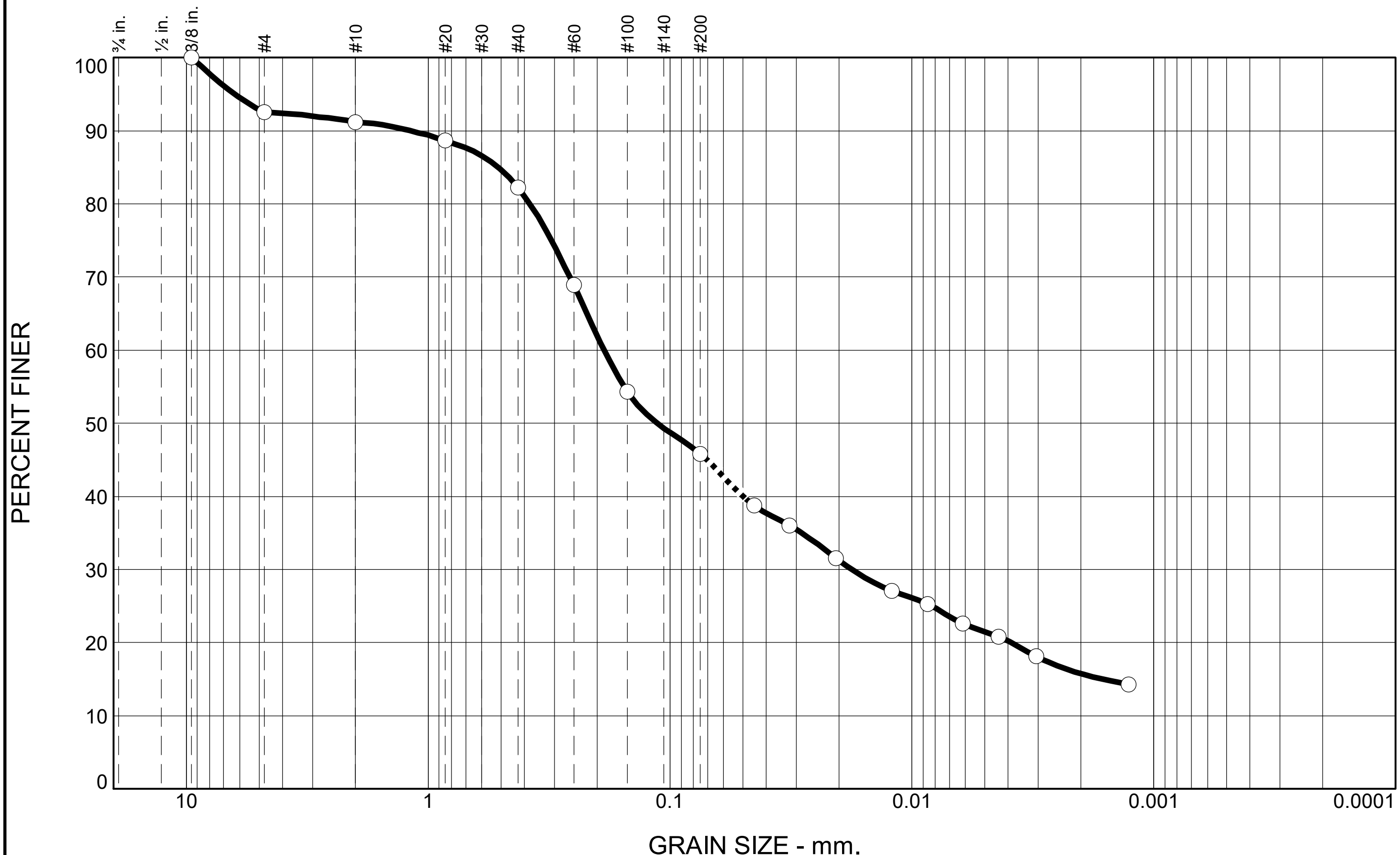
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	7.4	1.4	8.9	36.5	24.3	21.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	92.6		
#10	91.2		
#20	88.7		
#40	82.3		
#60	68.9		
#100	54.3		
#200	45.8		
0.0449 mm.	38.7		
0.0321 mm.	36.0		
0.0206 mm.	31.5		
0.0121 mm.	27.1		
0.0086 mm.	25.3		
0.0061 mm.	22.6		
0.0044 mm.	20.8		
0.0031 mm.	18.1		
0.0013 mm.	14.3		

* (no specification provided)

Soil Description

BROWN AND RUST BROWN CLAYEY SAND - ROOTS NOTED

Atterberg Limits

PL= 12 LL= 27 PI= 15

Coefficients

D_{90}= 1.1757 D_{85}= 0.5121 D_{60}= 0.1872
D_{50}= 0.1131 D_{30}= 0.0177 D_{15}= 0.0016
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-6(3)

Remarks

F.M.=1.11

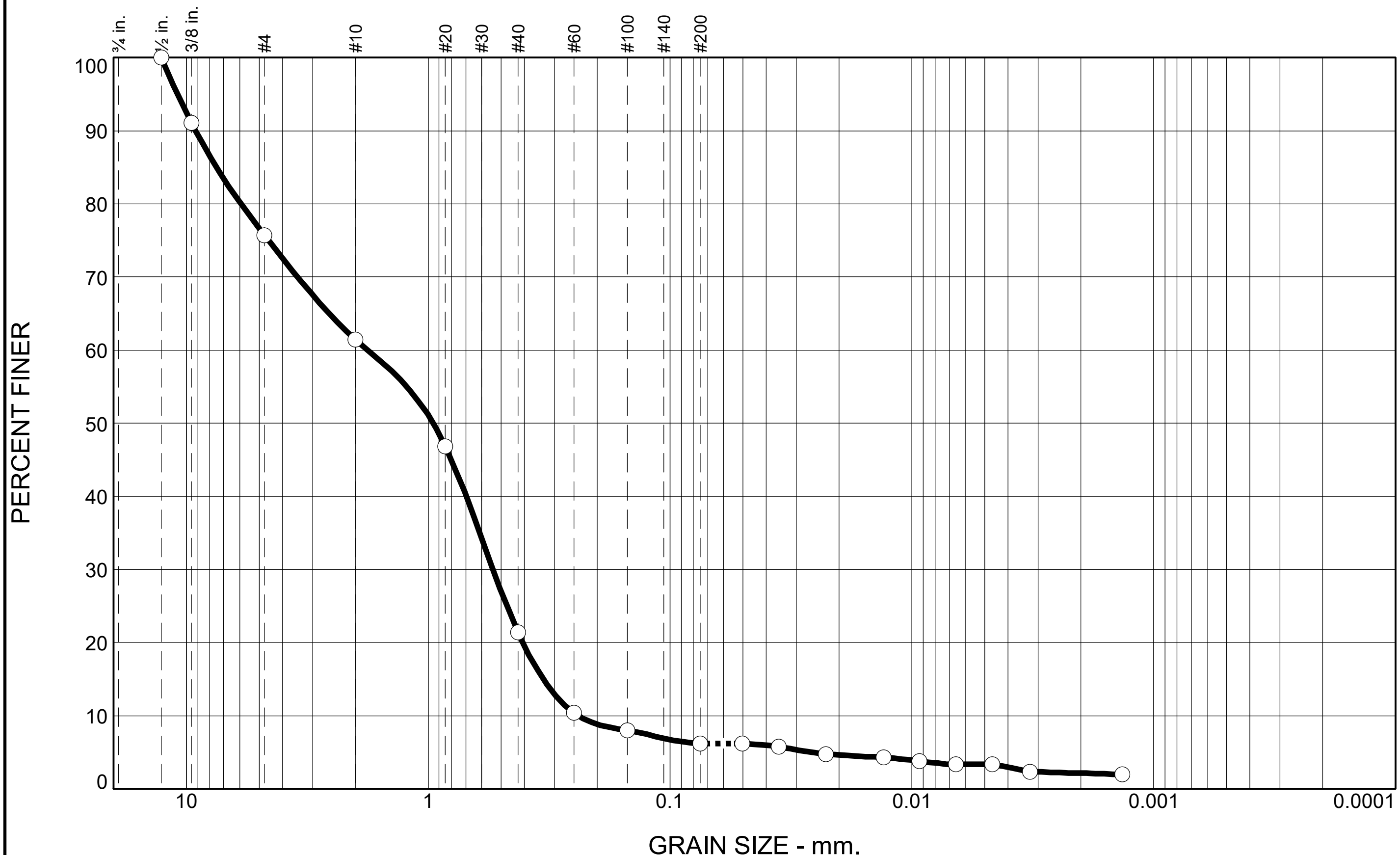
Source of Sample: APW-12 **Depth:** 20.0'-22.0'
Sample Number: 0825 **Date:** 2-26-21

Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION
Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	24.3	14.3	40.0	15.2	2.9	3.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	91.1		
#4	75.7		
#10	61.4		
#20	46.8		
#40	21.4		
#60	10.4		
#100	8.0		
#200	6.2		
0.0502 mm.	6.2		
0.0356 mm.	5.7		
0.0226 mm.	4.8		
0.0131 mm.	4.3		
0.0093 mm.	3.8		
0.0066 mm.	3.3		
0.0047 mm.	3.3		
0.0032 mm.	2.4		
0.0014 mm.	2.0		

* (no specification provided)

Soil Description

BROWN POORLY GRADED SAND WITH SILT AND GRAVEL

Atterberg Limits

PL= 13 LL= 10 PI= NP

Coefficients

D_{90}= 9.1597 D_{85}= 7.5109 D_{60}= 1.7814
D_{50}= 0.9547 D_{30}= 0.5391 D_{15}= 0.3343
D_{10}= 0.2395 C_u= 7.44 C_c= 0.68

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

F.M.=3.60

Source of Sample: APW-12 **Depth:** 25.5'-26.0'
Sample Number: 0845

Date: 3-11-21

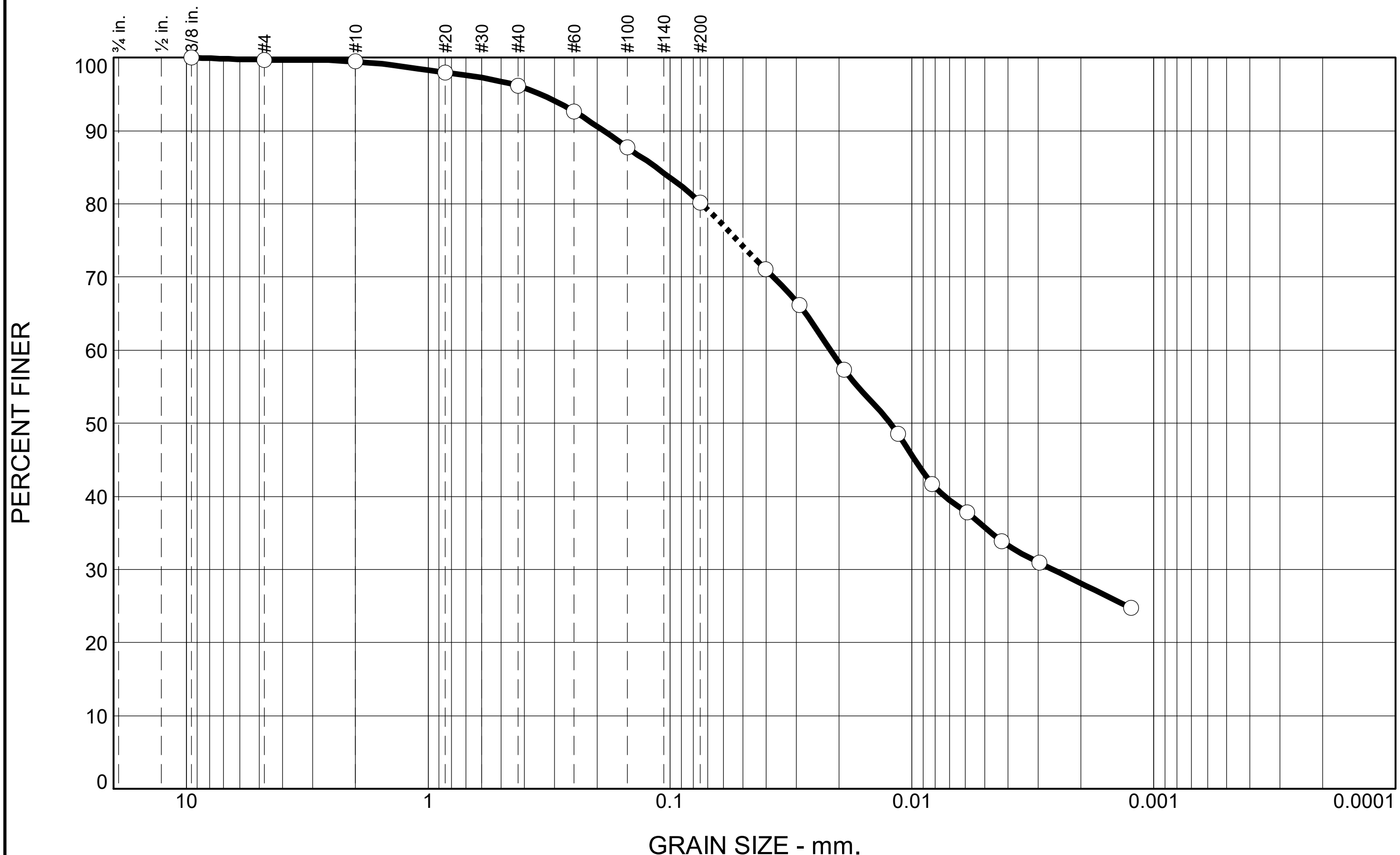
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.3	0.2	3.4	15.9	44.4	35.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.7		
#10	99.5		
#20	98.0		
#40	96.1		
#60	92.7		
#100	87.7		
#200	80.2		
0.0403 mm.	71.0		
0.0291 mm.	66.1		
0.0191 mm.	57.3		
0.0114 mm.	48.5		
0.0083 mm.	41.7		
0.0059 mm.	37.8		
0.0042 mm.	33.9		
0.0030 mm.	30.9		
0.0012 mm.	24.8		

* (no specification provided)

Soil Description

DARK GRAY LEAN CLAY WITH SAND - SILT POCKETS NOTED

Atterberg Limits

PL= 14 LL= 29 PI= 15

Coefficients

D_{90}= 0.1885 D_{85}= 0.1144 D_{60}= 0.0217
D_{50}= 0.0123 D_{30}= 0.0026 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(10)

Remarks

F.M.=0.23

Source of Sample: APW-12 **Depth:** 85.0'-87.0'
Sample Number: 1245

Date: 3-2-21

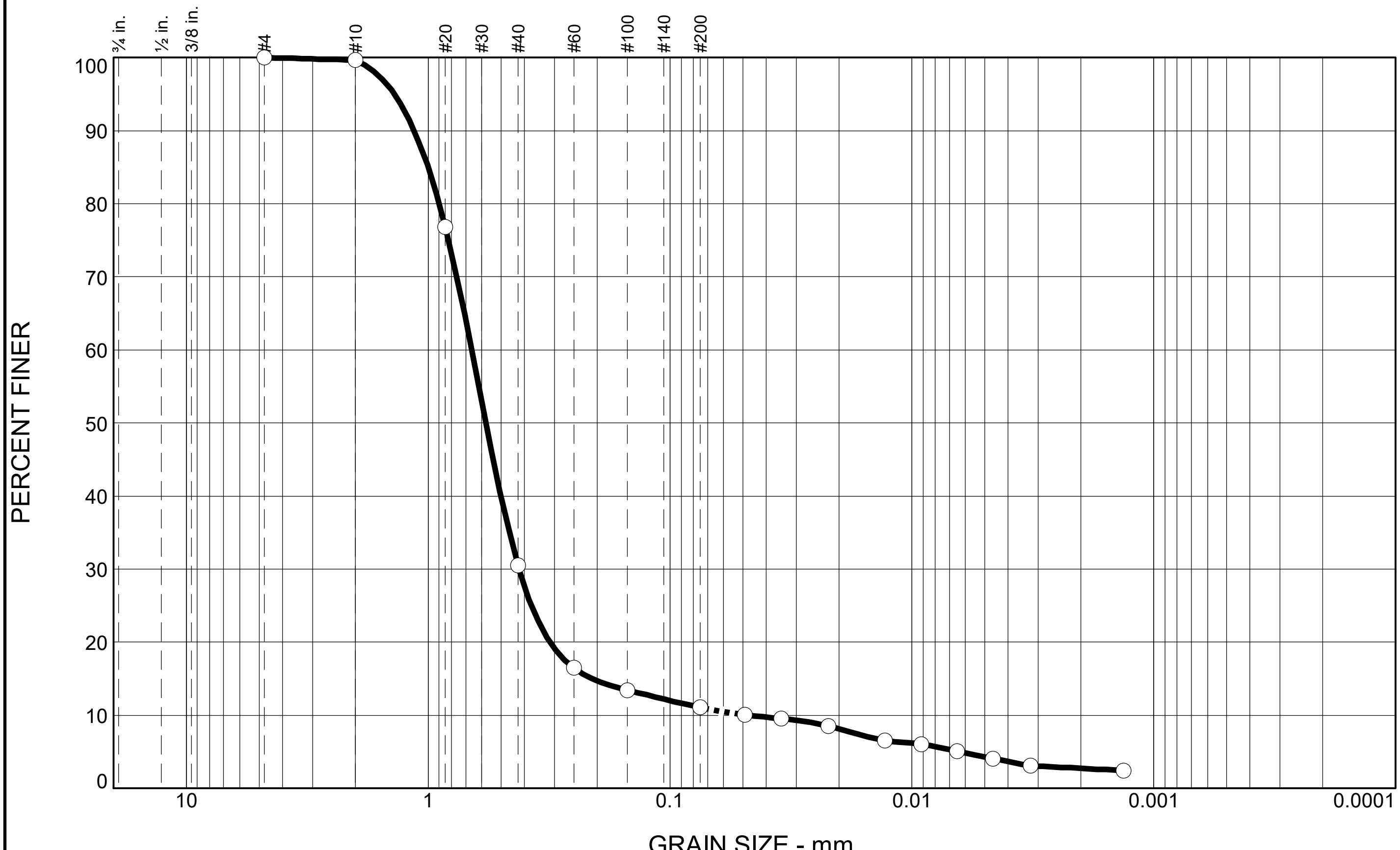
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	69.2	19.4	6.8	4.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#20	76.8		
#40	30.5		
#60	16.5		
#100	13.4		
#200	11.1		
0.0490 mm.	10.0		
0.0347 mm.	9.5		
0.0221 mm.	8.5		
0.0129 mm.	6.6		
0.0092 mm.	6.1		
0.0065 mm.	5.1		
0.0046 mm.	4.1		
0.0032 mm.	3.1		
0.0013 mm.	2.4		

* (no specification provided)

Soil Description

DARK BROWN AND GRAY POORLY GRADED SAND WITH SILT

Atterberg Limits

PL= 10 LL= 9 PI= NP

Coefficients

D_{90}= 1.1425 D_{85}= 1.0006 D_{60}= 0.6613
D_{50}= 0.5767 D_{30}= 0.4204 D_{15}= 0.2099
D_{10}= 0.0479 C_u= 13.80 C_c= 5.58

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

F.M.=2.24

Source of Sample: APW-13 **Depth:** 25.0'-27.0'
Sample Number: 0845

Date: 2-26-21

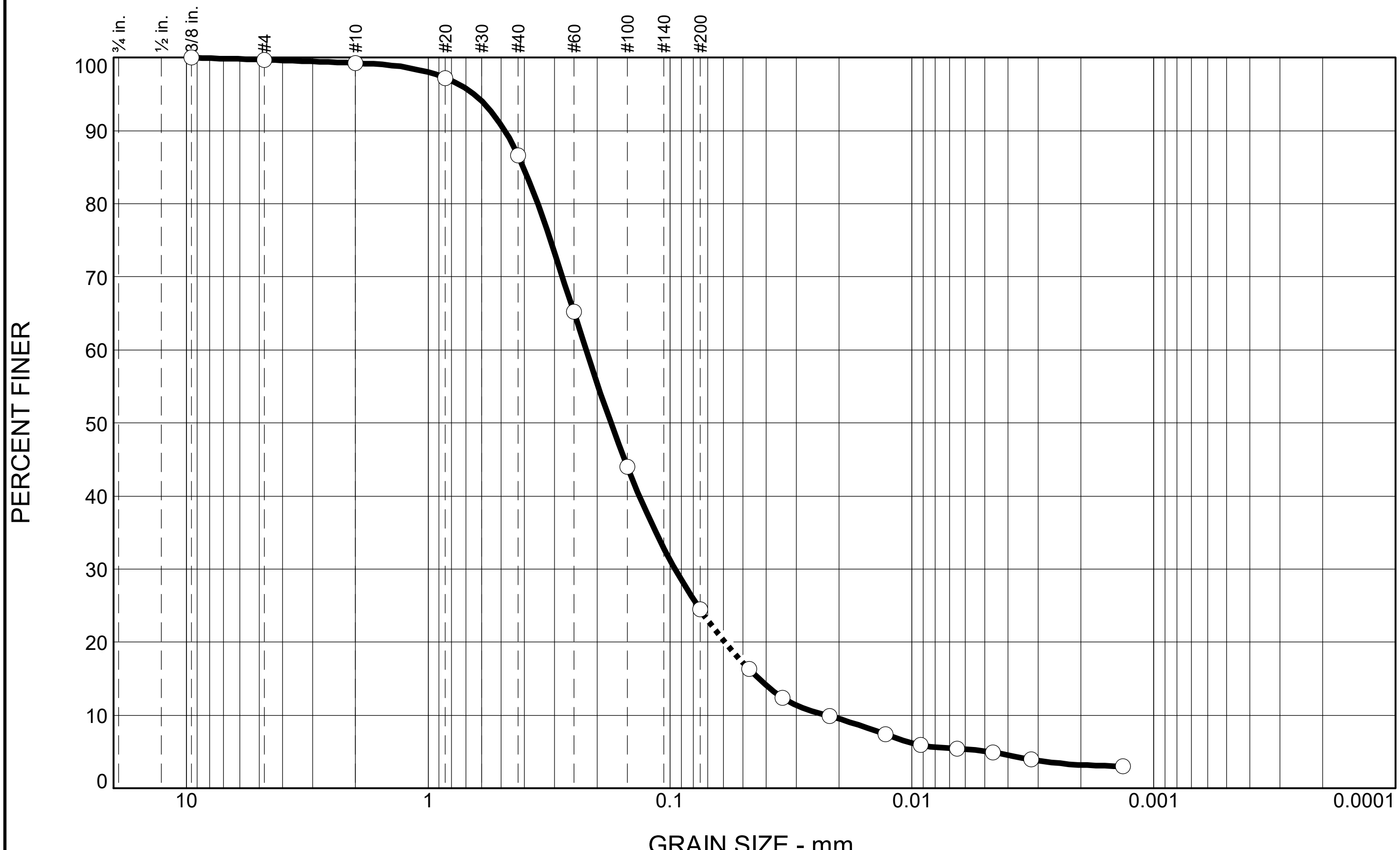
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.3	0.4	12.7	62.1	19.4	5.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.7		
#10	99.3		
#20	97.2		
#40	86.6		
#60	65.2		
#100	44.0		
#200	24.5		
0.0471 mm.	16.3		
0.0342 mm.	12.4		
0.0220 mm.	9.9		
0.0129 mm.	7.4		
0.0092 mm.	5.9		
0.0065 mm.	5.4		
0.0046 mm.	4.9		
0.0032 mm.	3.9		
0.0013 mm.	3.0		

* (no specification provided)

Soil Description

BROWN SILTY SAND

Atterberg Limits

PL= 13 LL= 8 PI= NP

Coefficients

D_{90}= 0.4819 D_{85}= 0.4036 D_{60}= 0.2222
D_{50}= 0.1755 D_{30}= 0.0953 D_{15}= 0.0429
D_{10}= 0.0226 C_u= 9.84 C_c= 1.81

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

F.M.=0.91

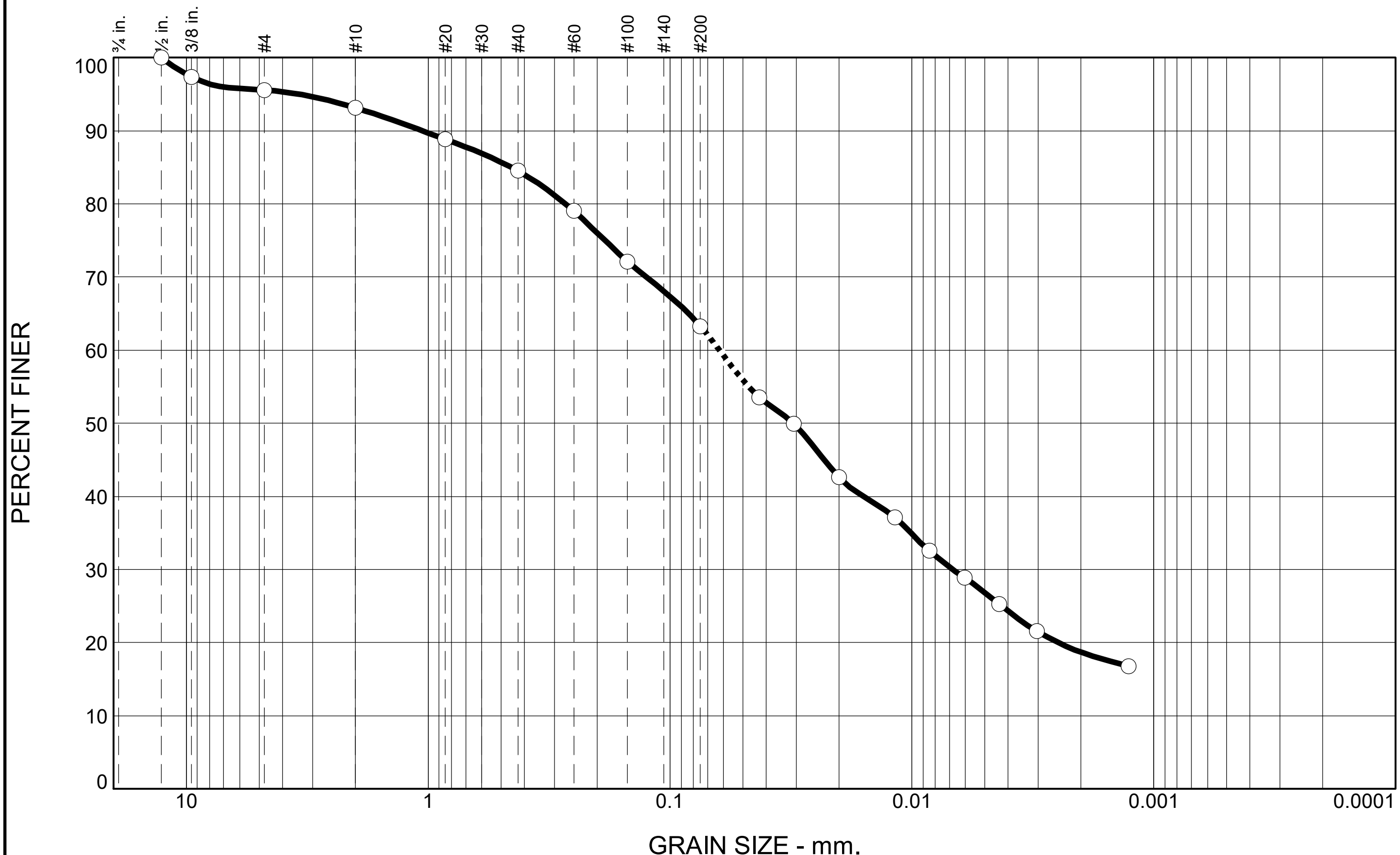
Source of Sample: APW-13 **Depth:** 60.5'-61.0'
Sample Number: 1345 **Date:** 3-11-21

Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION
Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.4	2.5	8.6	21.2	36.5	26.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	97.3		
#4	95.6		
#10	93.1		
#20	88.8		
#40	84.5		
#60	79.0		
#100	72.1		
#200	63.3		
0.0427 mm.	53.6		
0.0307 mm.	49.9		
0.0200 mm.	42.6		
0.0118 mm.	37.1		
0.0085 mm.	32.6		
0.0061 mm.	28.9		
0.0043 mm.	25.2		
0.0030 mm.	21.6		
0.0013 mm.	16.7		

* (no specification provided)

Soil Description

BROWN SANDY LEAN CLAY

Atterberg Limits

PL= 14 LL= 26 PI= 12

Coefficients

D_{90}= 1.0607 D_{85}= 0.4525 D_{60}= 0.0625
D_{50}= 0.0309 D_{30}= 0.0068 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(5)

Remarks

F.M.=0.83

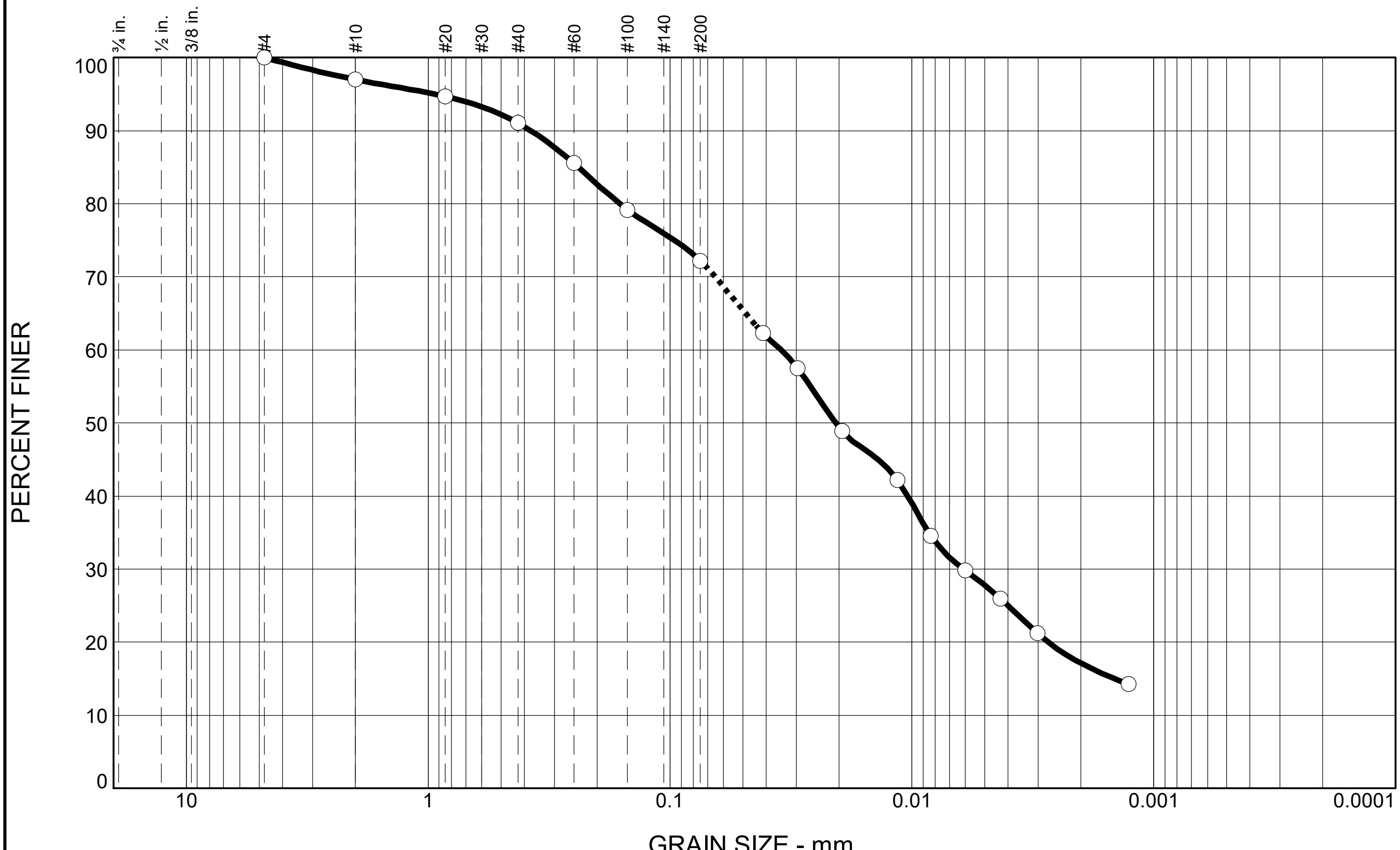
Source of Sample: APW-14 **Depth:** 45.0'-47.0'
Sample Number: 0955 **Date:** 3-2-21

Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION
Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.0	5.9	18.9	44.4	27.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	97.0		
#20	94.7		
#40	91.1		
#60	85.6		
#100	79.2		
#200	72.2		
0.0411 mm.	62.3		
0.0297 mm.	57.5		
0.0194 mm.	48.9		
0.0115 mm.	42.2		
0.0084 mm.	34.6		
0.0060 mm.	29.8		
0.0043 mm.	26.0		
0.0030 mm.	21.2		
0.0013 mm.	14.2		

* (no specification provided)

Soil Description

GRAY AND BROWNISH GRAY LEAN CLAY WITH SAND

Atterberg Limits

PL= 15 LL= 25 PI= 10

Coefficients

D_{90}= 0.3753 D_{85}= 0.2390 D_{60}= 0.0348
D_{50}= 0.0207 D_{30}= 0.0061 D_{15}= 0.0014
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-4(5)

Remarks

F.M.=0.47

Source of Sample: APW-14 **Depth:** 55.5'-56.0'
Sample Number: 1045 **Date:** 2-26-21

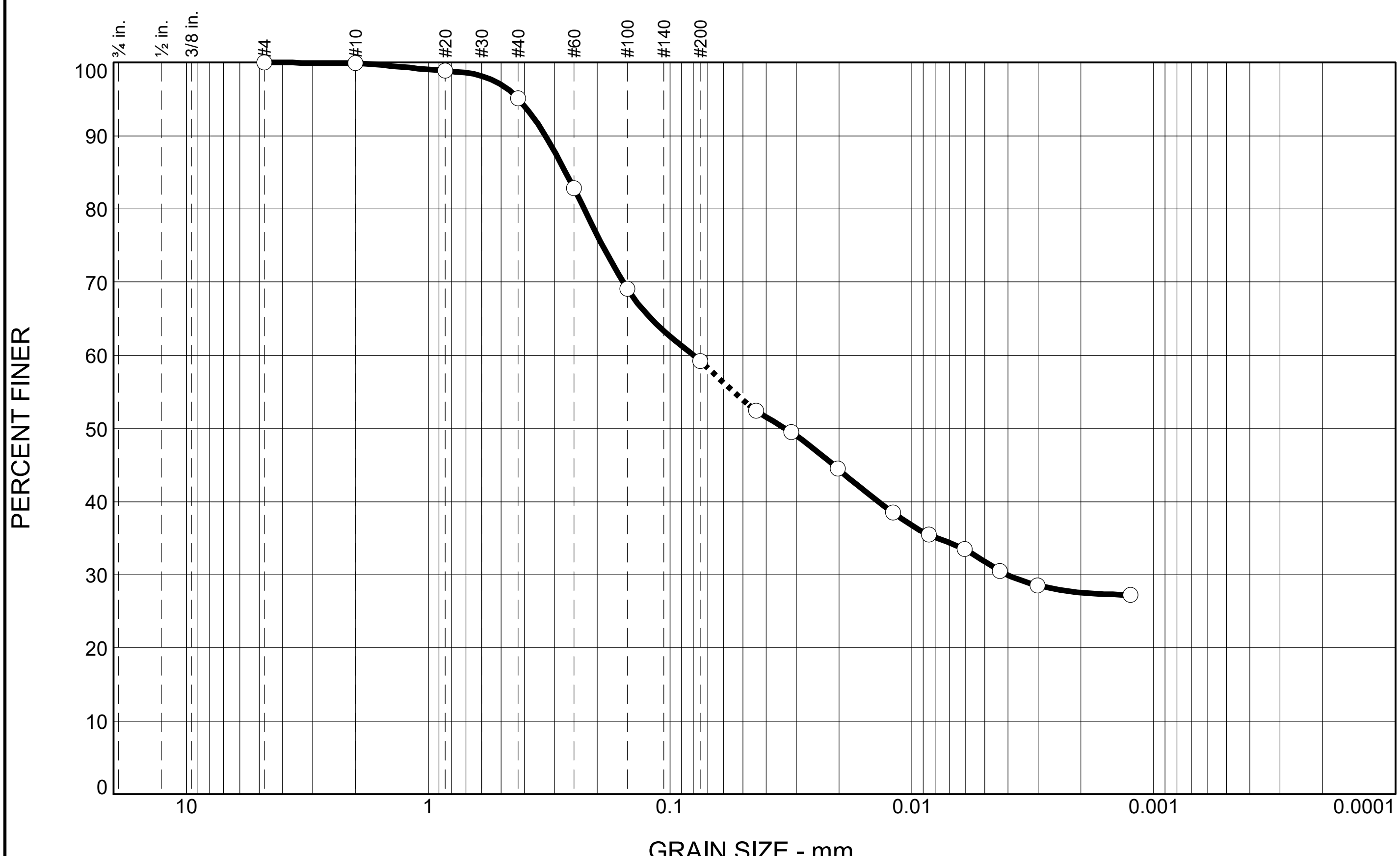
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	4.8	35.9	27.4	31.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	98.9		
#40	95.1		
#60	82.9		
#100	69.1		
#200	59.2		
0.0440 mm.	52.4		
0.0314 mm.	49.5		
0.0202 mm.	44.5		
0.0119 mm.	38.5		
0.0085 mm.	35.5		
0.0061 mm.	33.5		
0.0043 mm.	30.5		
0.0030 mm.	28.5		
0.0012 mm.	27.2		

* (no specification provided)

Soil Description

BROWN SANDY LEAN CLAY

Atterberg Limits

PL= 10 LL= 33 PI= 23

Coefficients

D_{90}= 0.3277 D_{85}= 0.2698 D_{60}= 0.0802
D_{50}= 0.0334 D_{30}= 0.0040 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(10)

Remarks

F.M.=0.46

Source of Sample: APW-15 **Depth:** 20.0'-22.0'
Sample Number: 1005 **Date:** 3-2-21

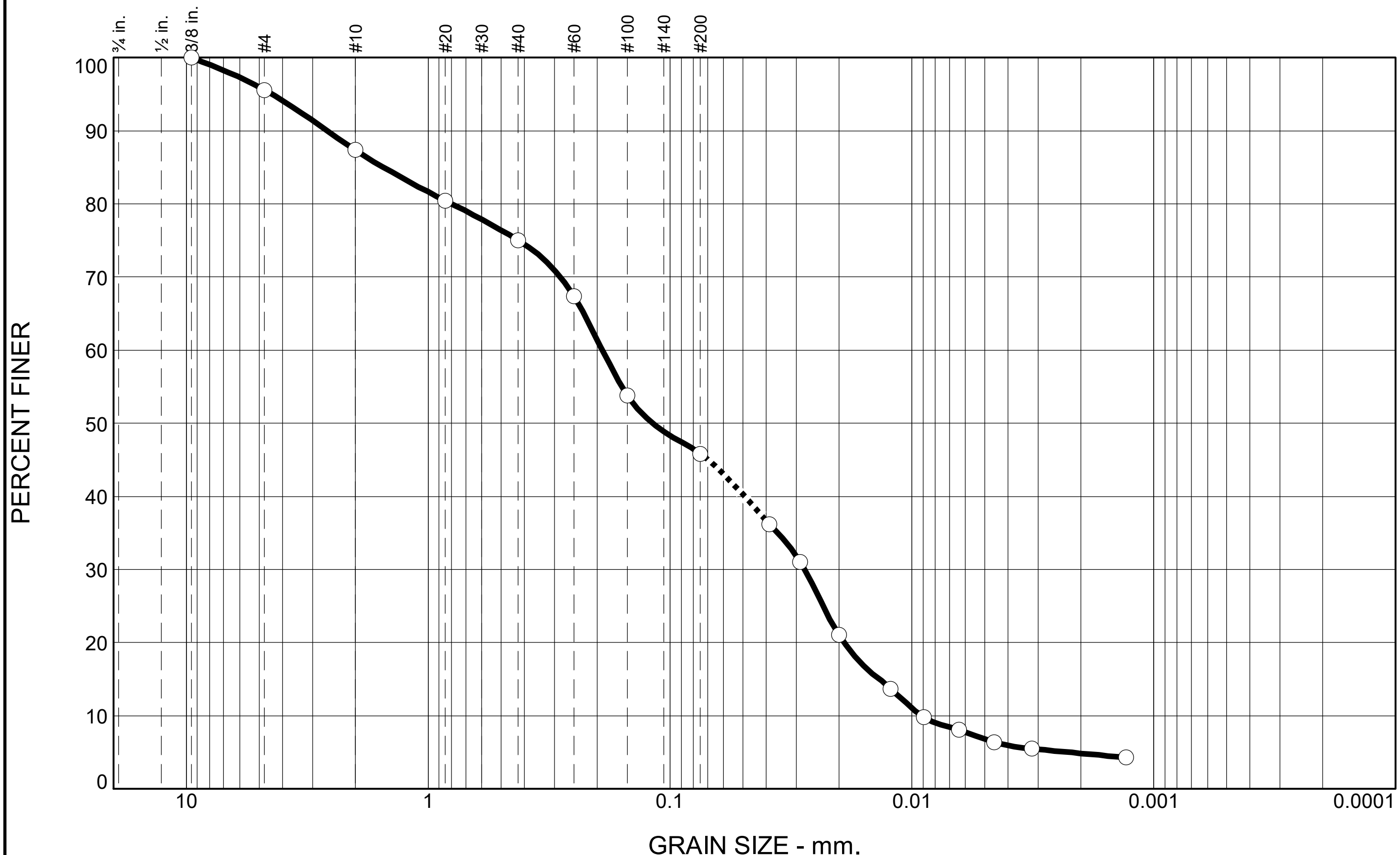
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.4	8.2	12.4	29.2	39.0	6.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	95.6		
#10	87.4		
#20	80.4		
#40	75.0		
#60	67.4		
#100	53.8		
#200	45.8		
0.0388 mm.	36.2		
0.0290 mm.	31.0		
0.0201 mm.	21.1		
0.0123 mm.	13.7		
0.0089 mm.	9.8		
0.0064 mm.	8.1		
0.0046 mm.	6.3		
0.0032 mm.	5.5		
0.0013 mm.	4.3		

* (no specification provided)

Soil Description

GRAY SILTY SAND

Atterberg Limits

PL= 12 LL= 15 PI= 3

Coefficients

D_{90}= 2.6175 D_{85}= 1.5318 D_{60}= 0.1904
D_{50}= 0.1183 D_{30}= 0.0278 D_{15}= 0.0137
D_{10}= 0.0091 C_u= 20.90 C_c= 0.45

Classification

USCS= SM AASHTO= A-4(0)

Remarks

F.M.=1.30

Source of Sample: APW-15 **Depth:** 100.5'-101.0'
Sample Number: 0755 **Date:** 2-26-21

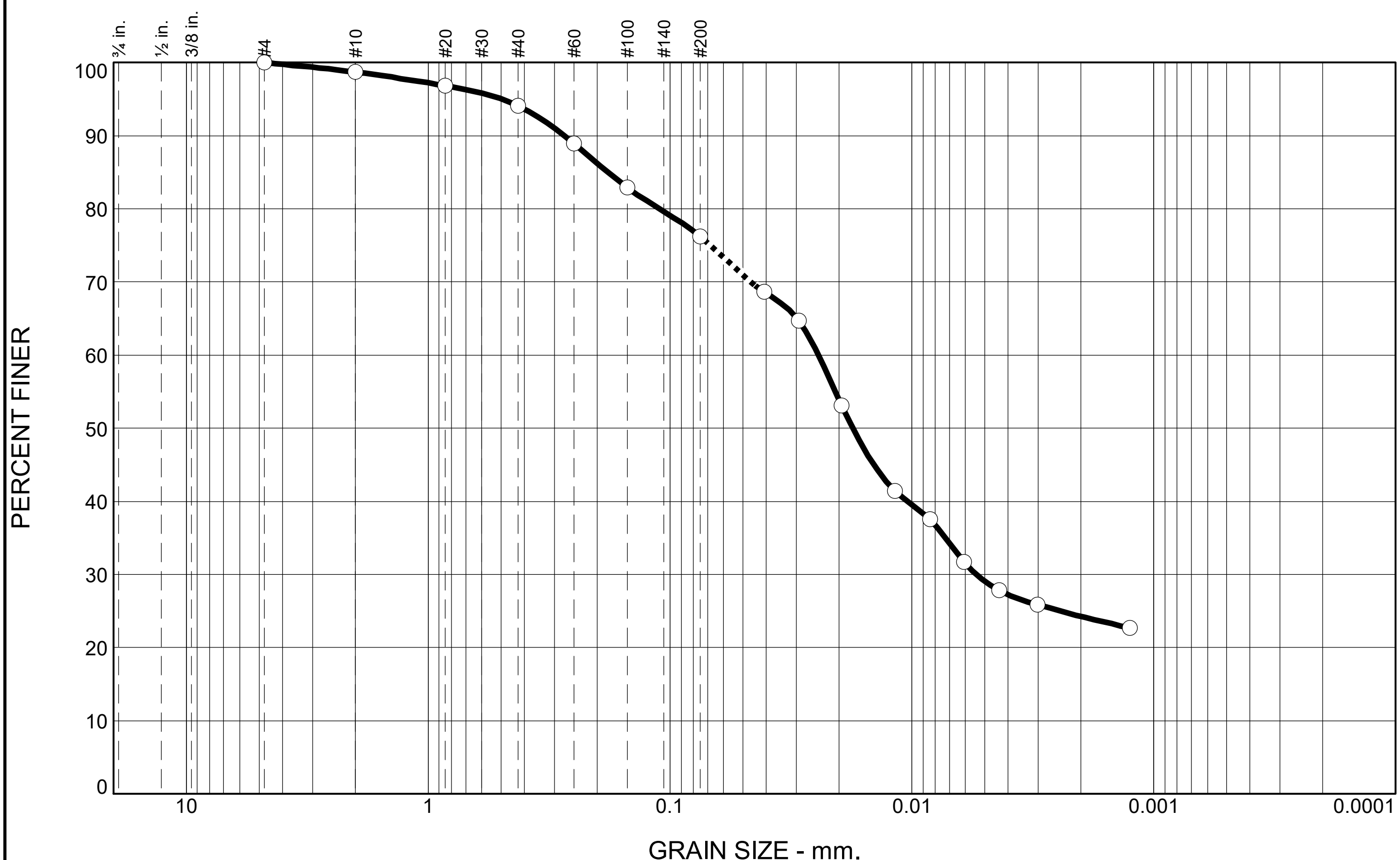
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.3	4.6	17.9	47.1	29.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.7		
#20	96.8		
#40	94.1		
#60	89.0		
#100	82.9		
#200	76.2		
0.0409 mm.	68.6		
0.0294 mm.	64.7		
0.0195 mm.	53.1		
0.0118 mm.	41.4		
0.0084 mm.	37.5		
0.0061 mm.	31.7		
0.0044 mm.	27.8		
0.0030 mm.	25.9		
0.0013 mm.	22.7		

* (no specification provided)

Soil Description

DARK GRAY LEAN CLAY WITH SAND

Atterberg Limits

PL= 13 LL= 29 PI= 16

Coefficients

D_{90}= 0.2737 D_{85}= 0.1806 D_{60}= 0.0244
D_{50}= 0.0175 D_{30}= 0.0054 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(10)

Remarks

F.M.=0.34

Source of Sample: APW-15 **Depth:** 105.0'-107.0'
Sample Number: 0905

Date: 3-2-21

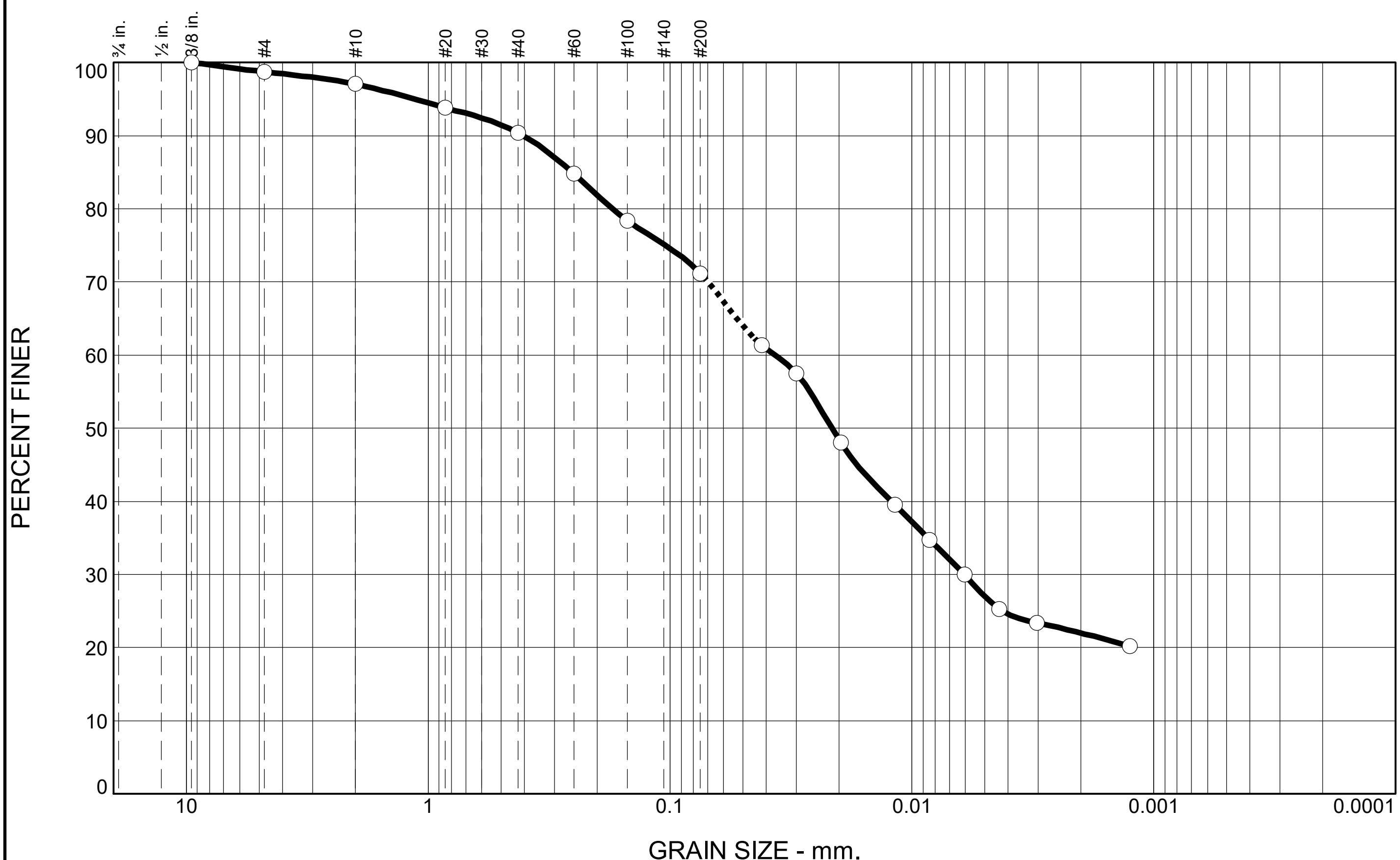
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.3	1.6	6.7	19.3	44.1	27.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	98.7		
#10	97.1		
#20	93.8		
#40	90.4		
#60	84.8		
#100	78.4		
#200	71.1		
0.0417 mm.	61.3		
0.0300 mm.	57.5		
0.0197 mm.	48.0		
0.0117 mm.	39.5		
0.0084 mm.	34.8		
0.0061 mm.	30.0		
0.0044 mm.	25.3		
0.0030 mm.	23.4		
0.0013 mm.	20.2		

* (no specification provided)

Soil Description

GRAY LEAN CLAY WITH SAND

Atterberg Limits

PL= 13 LL= 26 PI= 13

Coefficients

D_{90}= 0.4047 D_{85}= 0.2534 D_{60}= 0.0368
D_{50}= 0.0214 D_{30}= 0.0061 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(6)

Remarks

F.M.=0.51

Source of Sample: APW-17 **Depth:** 40.0'-42.0'
Sample Number: 0945 **Date:** 3-2-21

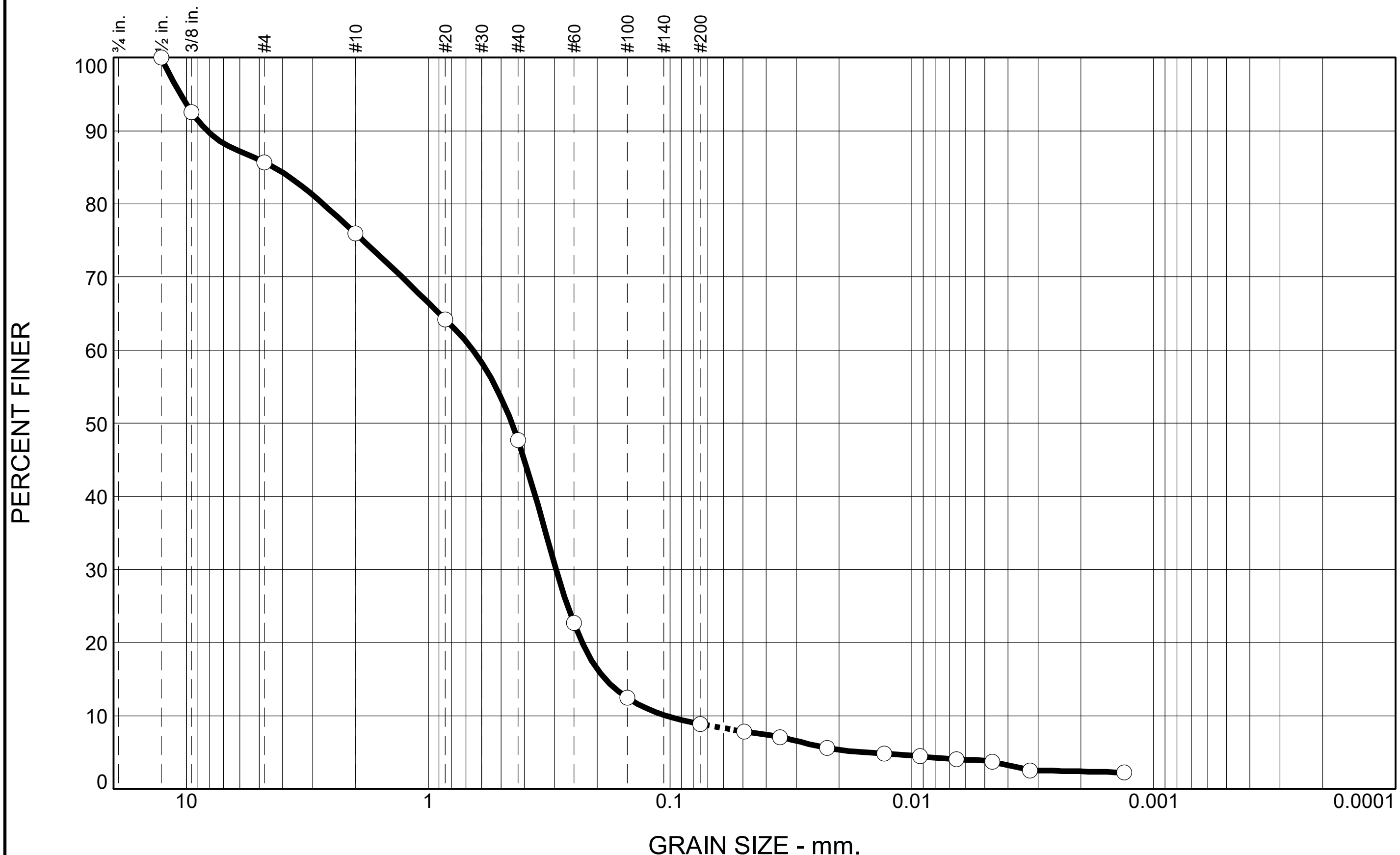
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	14.3	9.7	28.3	38.8	5.1	3.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	92.6		
#4	85.7		
#10	76.0		
#20	64.2		
#40	47.7		
#60	22.7		
#100	12.5		
#200	8.9		
0.0493 mm.	7.9		
0.0350 mm.	7.1		
0.0224 mm.	5.6		
0.0130 mm.	4.8		
0.0092 mm.	4.4		
0.0065 mm.	4.1		
0.0046 mm.	3.7		
0.0032 mm.	2.5		
0.0013 mm.	2.2		

* (no specification provided)

Soil Description

GRAY WELL GRADED SAND WITH SILT

Atterberg Limits

PL= 9 LL= 5 PI= NP

Coefficients

D_{90}= 8.1927 D_{85}= 4.3406 D_{60}= 0.6532
D_{50}= 0.4503 D_{30}= 0.2954 D_{15}= 0.1851
D_{10}= 0.1038 C_u= 6.29 C_c= 1.29

Classification

USCS= SW-SM AASHTO= A-1-b

Remarks

F.M.=2.73

Source of Sample: APW-17 **Depth:** 71.0'-71.5'
Sample Number: 1045

Date: 2-26-21

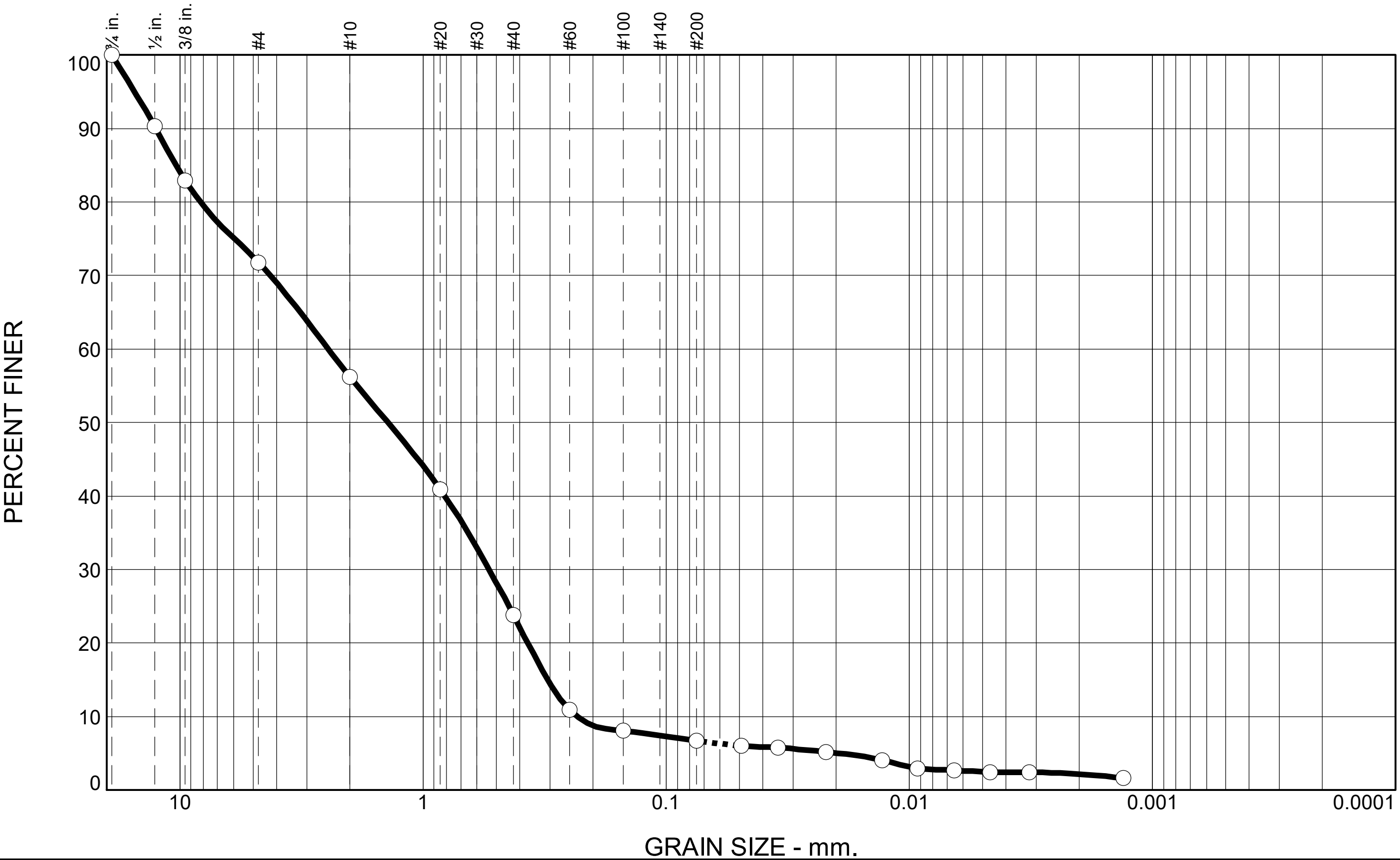
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	28.2	15.6	32.4	17.1	4.2	2.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	90.3		
.375	83.0		
#4	71.8		
#10	56.2		
#20	40.9		
#40	23.8		
#60	10.9		
#100	8.0		
#200	6.7		
0.0489 mm.	6.0		
0.0347 mm.	5.7		
0.0221 mm.	5.2		
0.0129 mm.	4.1		
0.0092 mm.	3.0		
0.0065 mm.	2.7		
0.0046 mm.	2.4		
0.0032 mm.	2.4		
0.0013 mm.	1.6		

* (no specification provided)

Soil Description

GRAYISH BROWN POORLY GRADED SAND WITH SILT AND GRAVEL

Atterberg Limits

PL= 8 LL= 6 PI= NP

Coefficients

D_{90}= 12.5520 D_{85}= 10.3682 D_{60}= 2.4528
D_{50}= 1.3942 D_{30}= 0.5340 D_{15}= 0.3065
D_{10}= 0.2326 C_u= 10.54 C_c= 0.50

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

F.M.=3.83

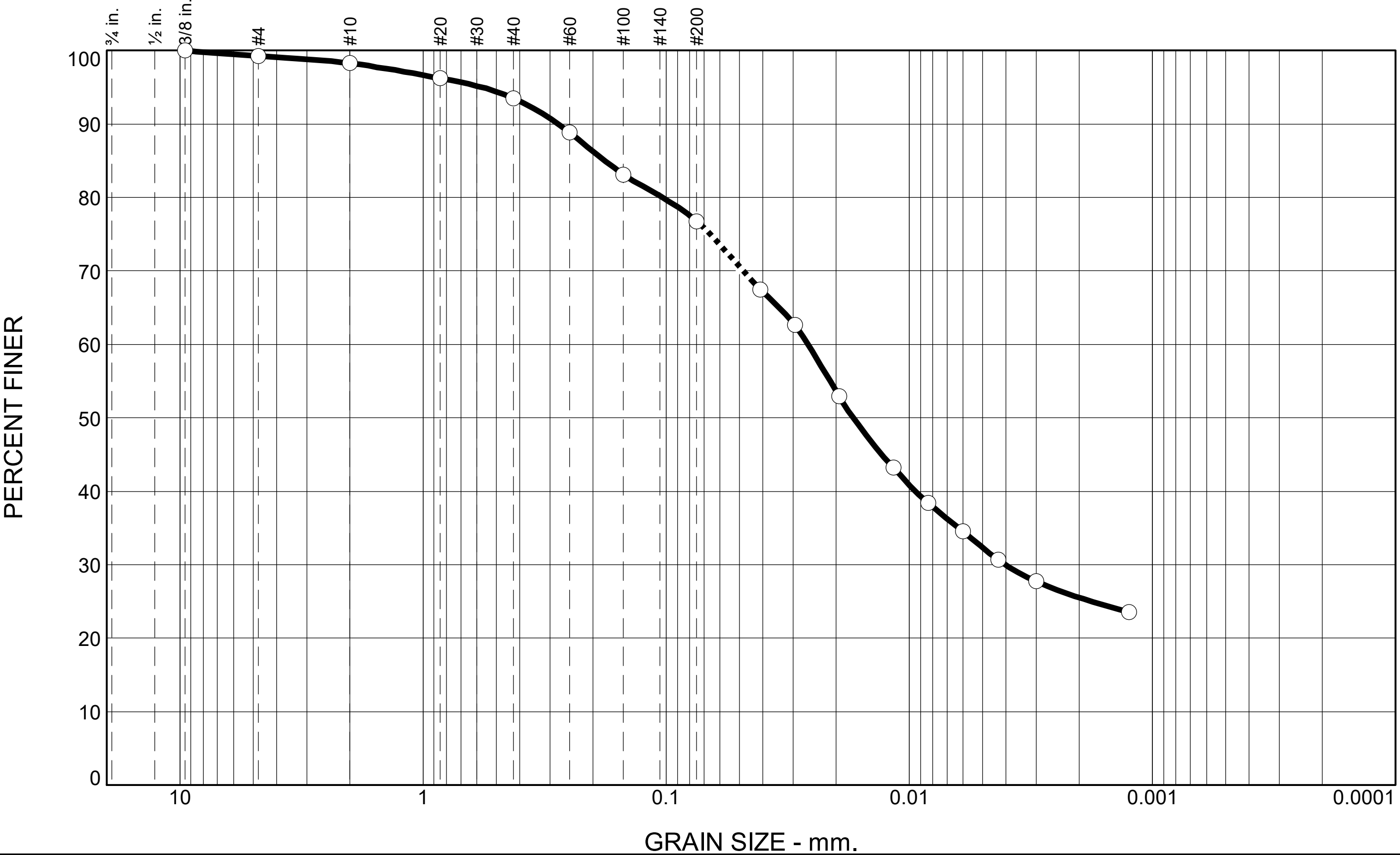
Source of Sample: APW-17 **Depth:** 90.5'-91.0'
Sample Number: 1200
Date: 2-26-21

Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION
Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.8	0.9	4.8	16.7	44.5	32.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.2		
#10	98.3		
#20	96.2		
#40	93.5		
#60	88.9		
#100	83.1		
#200	76.8		
0.0410 mm.	67.5		
0.0296 mm.	62.6		
0.0194 mm.	52.9		
0.0116 mm.	43.2		
0.0084 mm.	38.4		
0.0060 mm.	34.5		
0.0043 mm.	30.6		
0.0030 mm.	27.7		
0.0013 mm.	23.6		

* (no specification provided)

Soil Description

DARK GRAY LEAN CLAY WITH SAND

Atterberg Limits

PL= 12 LL= 32 PI= 20

Coefficients

D_{90}= 0.2782 D_{85}= 0.1790 D_{60}= 0.0261
D_{50}= 0.0170 D_{30}= 0.0040 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(13)

Remarks

F.M.=0.36

Source of Sample: SB-300 **Depth:** 50.0'-52.0'
Sample Number: 0825

Date: 3-2-21

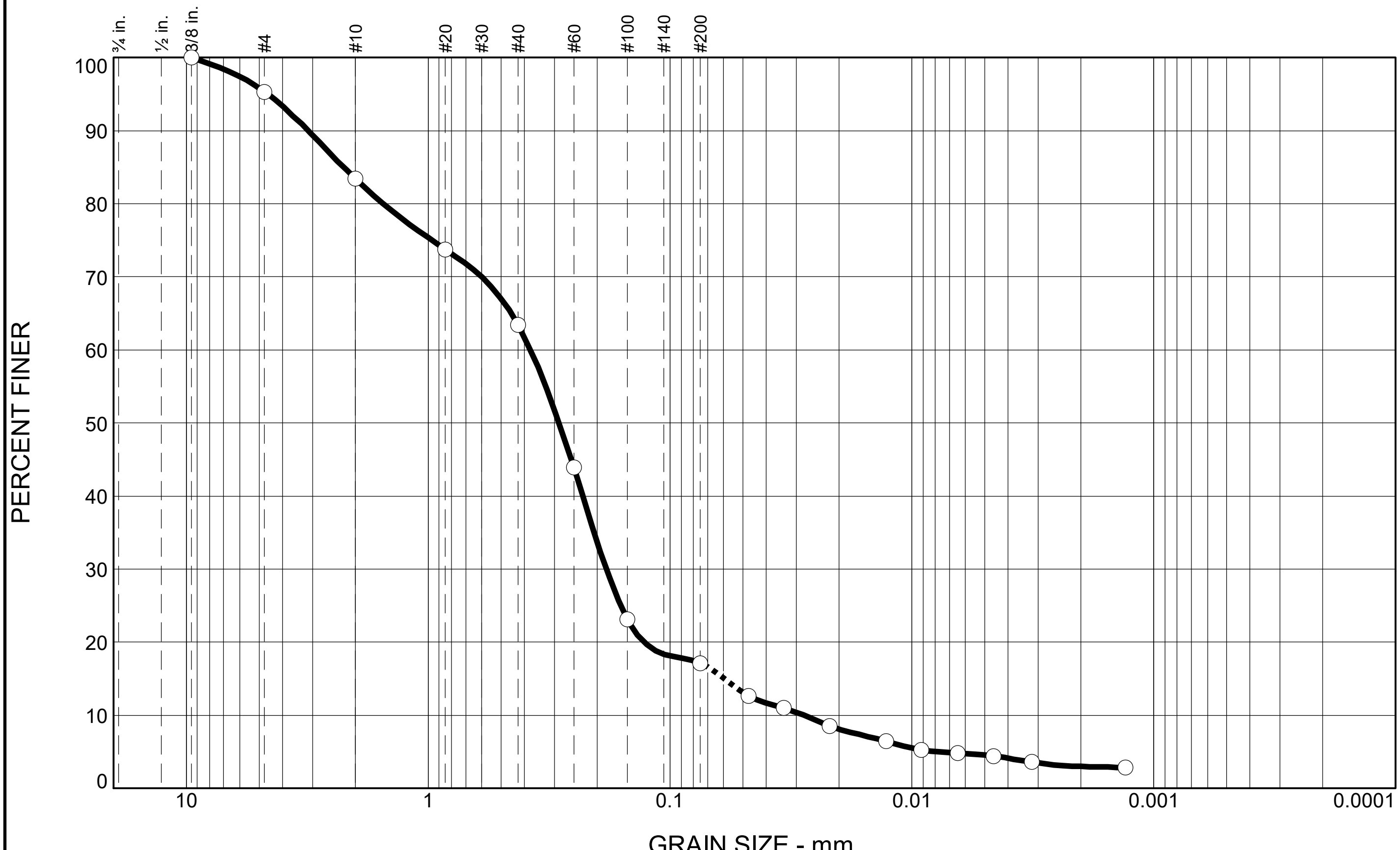
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.7	11.9	20.0	46.3	12.5	4.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	95.3		
#10	83.4		
#20	73.7		
#40	63.4		
#60	43.9		
#100	23.1		
#200	17.1		
0.0474 mm.	12.7		
0.0339 mm.	11.0		
0.0219 mm.	8.5		
0.0128 mm.	6.5		
0.0091 mm.	5.2		
0.0065 mm.	4.8		
0.0046 mm.	4.4		
0.0032 mm.	3.6		
0.0013 mm.	2.9		

* (no specification provided)

Soil Description

GRAYISH BROWN SILTY SAND

Atterberg Limits

PL= 9 LL= 5 PI= NP

Coefficients

D_{90}= 3.1361 D_{85}= 2.2352 D_{60}= 0.3777
D_{50}= 0.2877 D_{30}= 0.1834 D_{15}= 0.0597
D_{10}= 0.0281 C_u= 13.44 C_c= 3.17

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

F.M.=1.97

Source of Sample: SB-300 **Depth:** 61.0'-61.5'
Sample Number: 0905 **Date:** 2-26-21

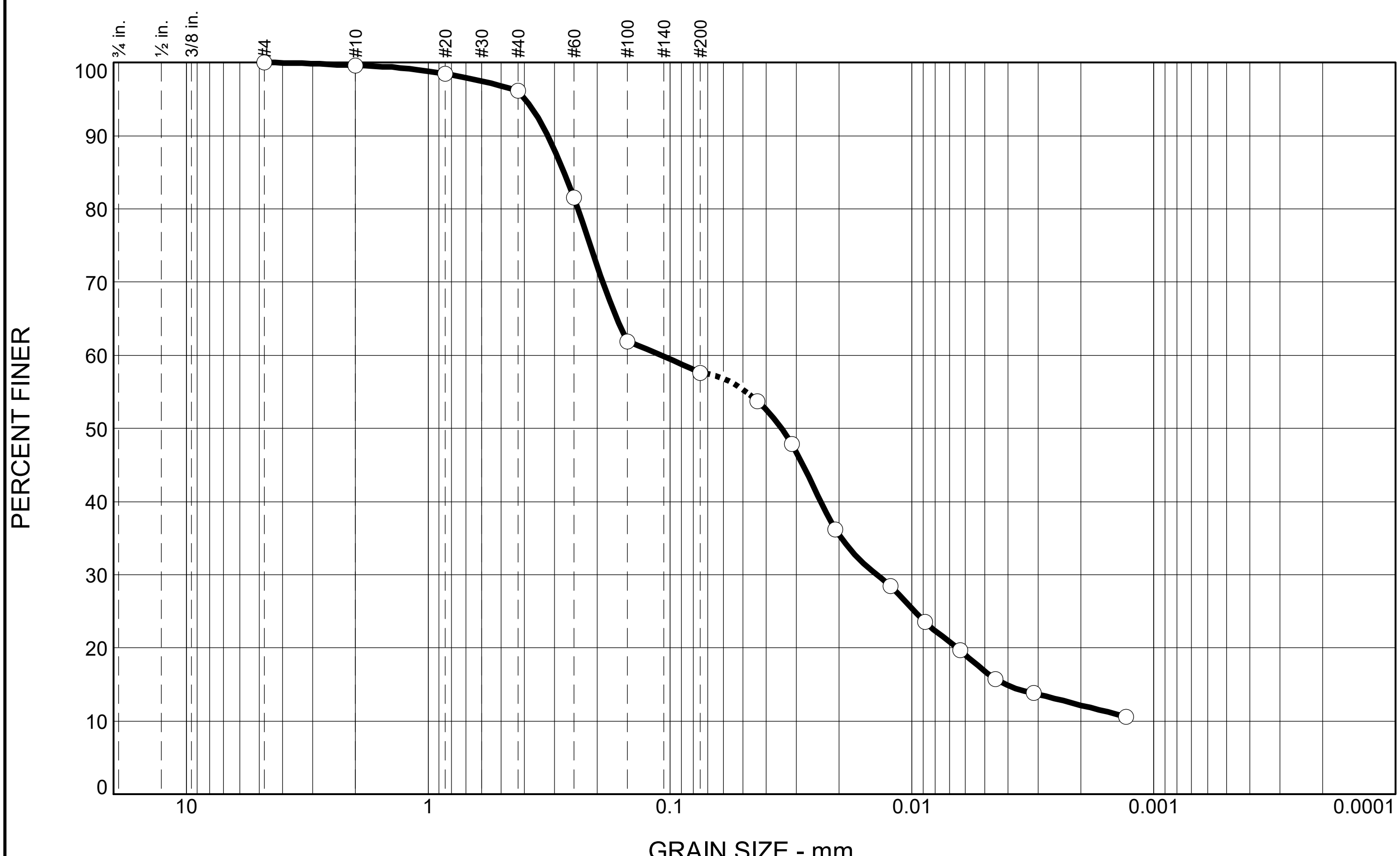
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.4	3.5	38.5	40.8	16.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.6		
#20	98.5		
#40	96.1		
#60	81.6		
#100	61.9		
#200	57.6		
0.0434 mm.	53.7		
0.0314 mm.	47.9		
0.0207 mm.	36.2		
0.0123 mm.	28.4		
0.0088 mm.	23.5		
0.0063 mm.	19.6		
0.0045 mm.	15.7		
0.0031 mm.	13.8		
0.0013 mm.	10.6		

* (no specification provided)

Soil Description

GRAY AND BROWN SANDY SILTY CLAY

Atterberg Limits

PL= 14 LL= 20 PI= 6

Coefficients

D_{90}= 0.3201 D_{85}= 0.2739 D_{60}= 0.1090
D_{50}= 0.0345 D_{30}= 0.0139 D_{15}= 0.0041
D_{10}= C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(1)

Remarks

F.M.=0.54

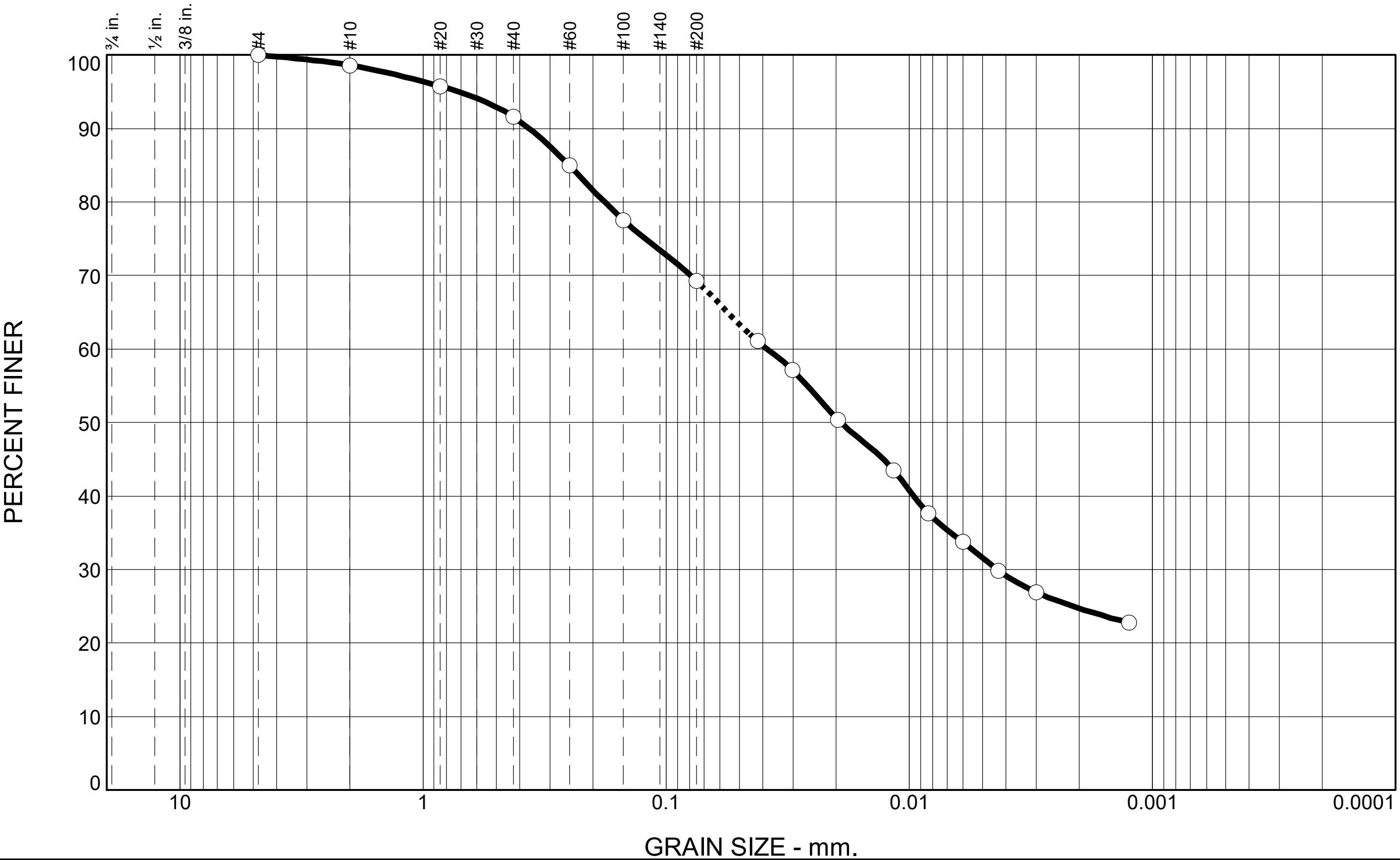
Source of Sample: SB-300 **Depth:** 62.5'-63.0'
Sample Number: 0920 **Date:** 2-26-21

Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION
Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.4	7.0	22.3	37.7	31.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.6		
#20	95.7		
#40	91.6		
#60	84.9		
#100	77.5		
#200	69.3		
0.0420 mm.	61.1		
0.0302 mm.	57.2		
0.0196 mm.	50.3		
0.0116 mm.	43.5		
0.0084 mm.	37.7		
0.0060 mm.	33.8		
0.0043 mm.	29.9		
0.0030 mm.	26.9		
0.0013 mm.	22.7		

* (no specification provided)

Soil Description

DARK GRAY SANDY LEAN CLAY

Atterberg Limits

PL= 13 LL= 28 PI= 15

Coefficients

D_{90}= 0.3661 D_{85}= 0.2511 D_{60}= 0.0384
D_{50}= 0.0191 D_{30}= 0.0044 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(7)

Remarks

F.M.=0.45

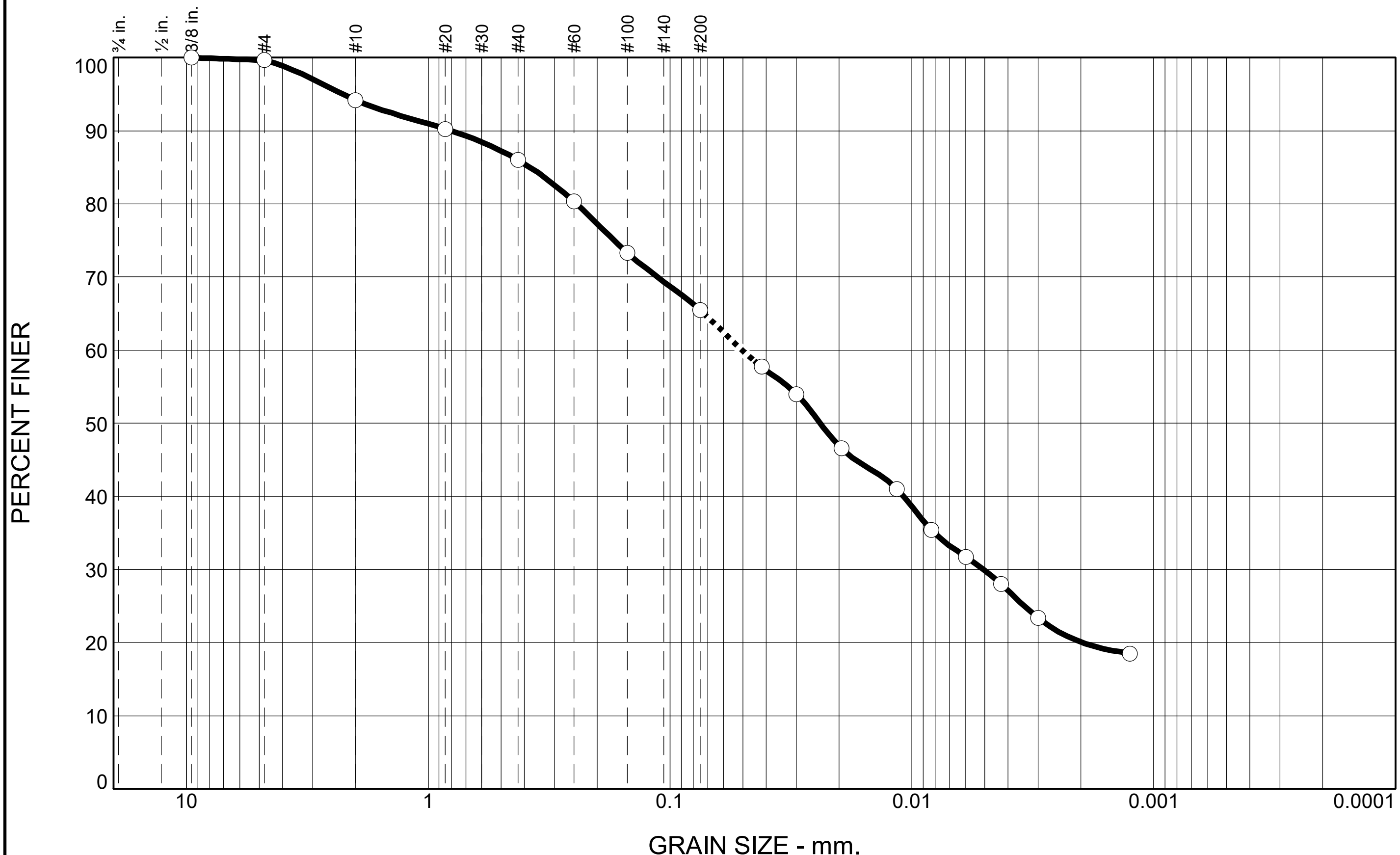
Source of Sample: SB-300 **Depth:** 105.0'-107.0'
Sample Number: 1350 **Date:** 3-2-21

Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION
Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.4	5.4	8.2	20.6	35.5	29.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.6		
#10	94.2		
#20	90.2		
#40	86.0		
#60	80.3		
#100	73.3		
#200	65.4		
0.0418 mm.	57.7		
0.0300 mm.	54.0		
0.0196 mm.	46.6		
0.0115 mm.	41.0		
0.0083 mm.	35.4		
0.0060 mm.	31.7		
0.0043 mm.	28.0		
0.0030 mm.	23.4		
0.0013 mm.	18.5		

* (no specification provided)

Soil Description

BROWN AND GRAY SANDY LEAN CLAY

Atterberg Limits

PL= 14 LL= 27 PI= 13

Coefficients

D_{90}= 0.8050 D_{85}= 0.3797 D_{60}= 0.0504
D_{50}= 0.0239 D_{30}= 0.0051 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(6)

Remarks

F.M.=0.69

Source of Sample: SB-301 **Depth:** 48.0'-50.0'
Sample Number: 1330 **Date:** 2-26-21

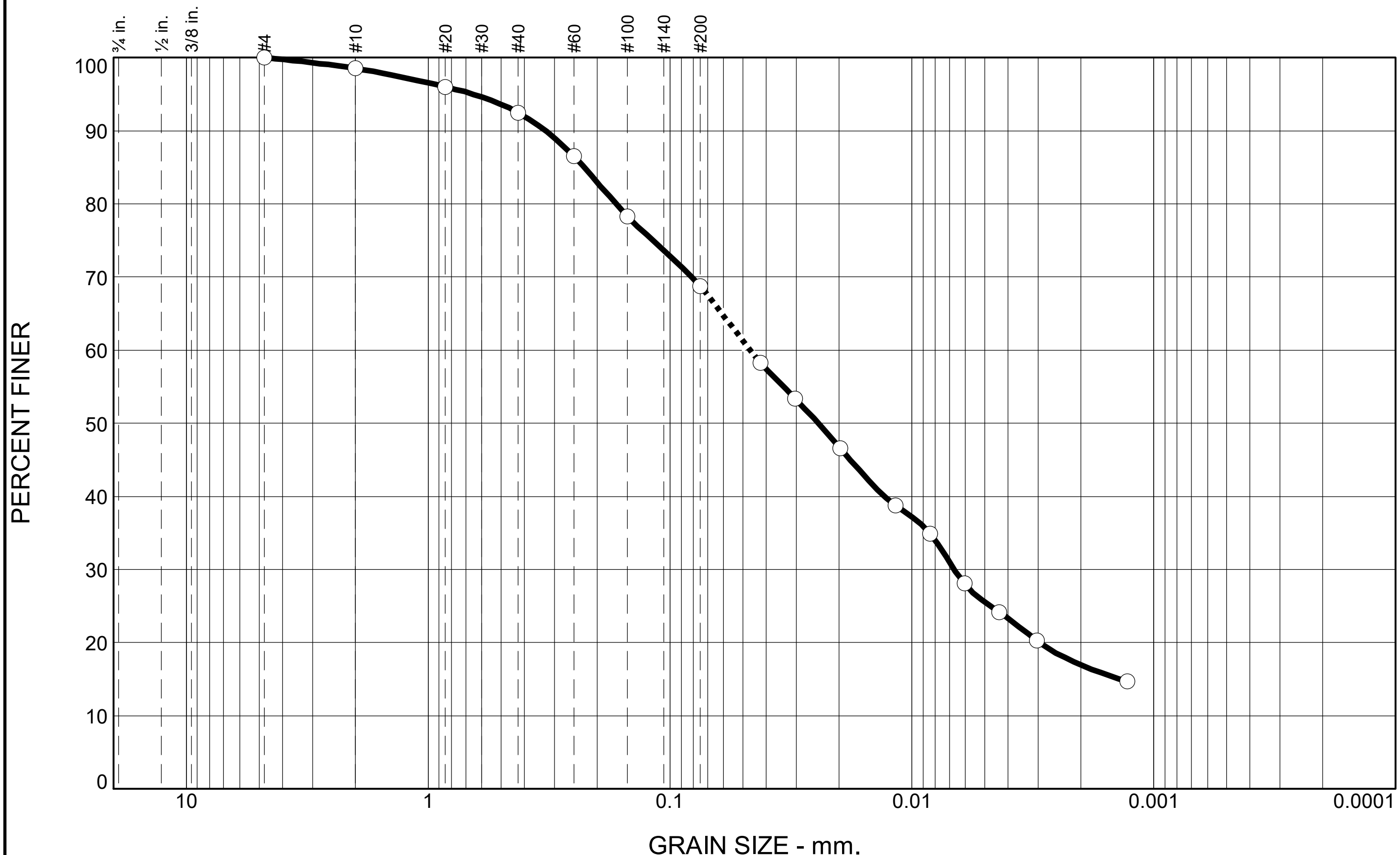
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.5	6.0	23.8	43.2	25.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.5		
#20	96.0		
#40	92.5		
#60	86.5		
#100	78.3		
#200	68.7		
0.0422 mm.	58.3		
0.0304 mm.	53.4		
0.0197 mm.	46.6		
0.0117 mm.	38.8		
0.0084 mm.	34.9		
0.0061 mm.	28.1		
0.0043 mm.	24.2		
0.0030 mm.	20.3		
0.0013 mm.	14.7		

* (no specification provided)

Soil Description

GRAY SANDY LEAN CLAY

Atterberg Limits

PL= 14 LL= 23 PI= 9

Coefficients

D_{90}= 0.3271 D_{85}= 0.2265 D_{60}= 0.0466
D_{50}= 0.0243 D_{30}= 0.0067 D_{15}= 0.0014
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-4(3)

Remarks

F.M.=0.42

Source of Sample: SB-301 **Depth:** 68.5'-69.0'
Sample Number: 1600

Date: 3-31-21

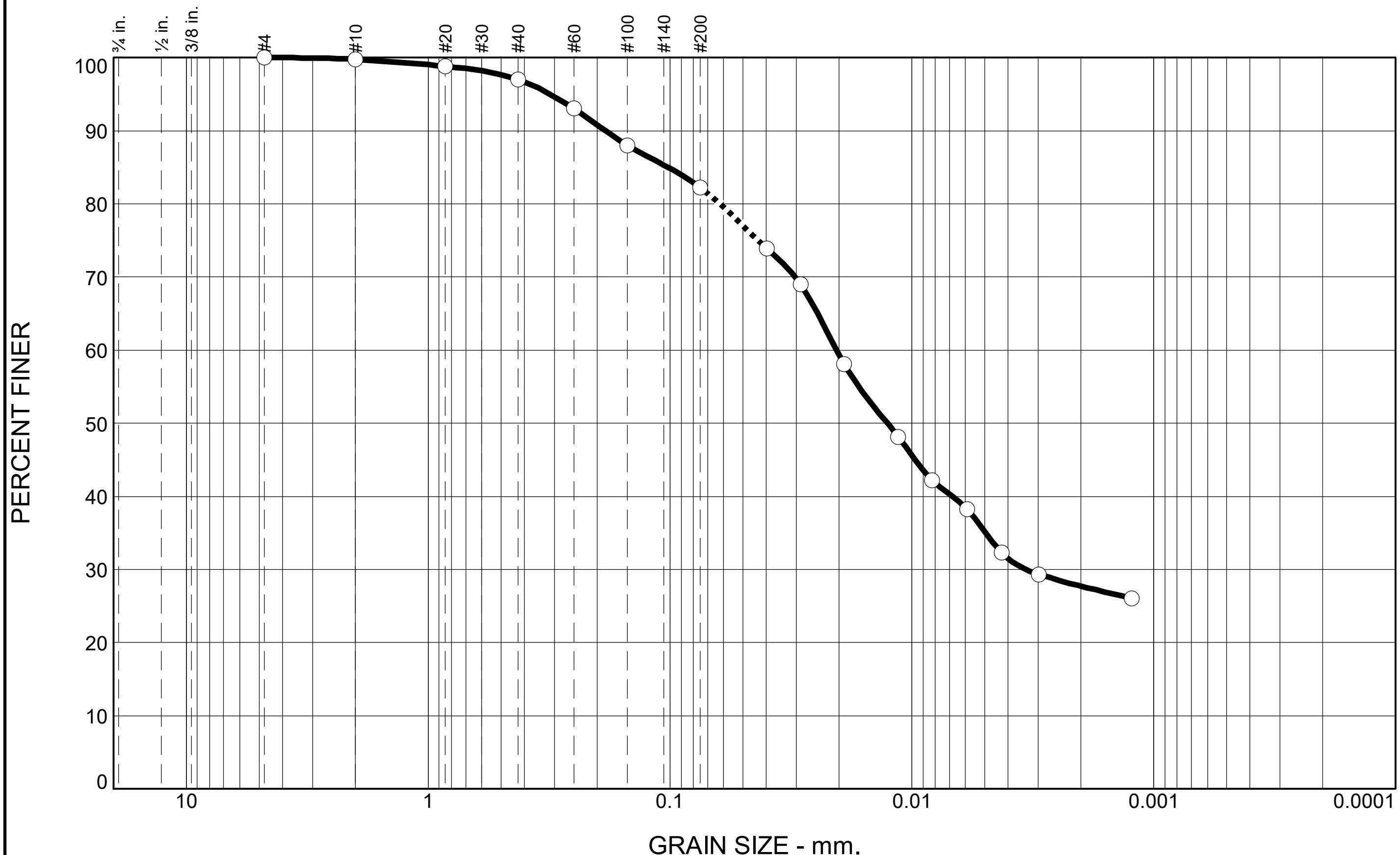
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	2.8	14.8	47.0	35.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.8		
#20	98.8		
#40	97.0		
#60	93.0		
#100	88.0		
#200	82.2		
0.0398 mm.	73.9		
0.0288 mm.	69.0		
0.0190 mm.	58.1		
0.0114 mm.	48.2		
0.0082 mm.	42.2		
0.0059 mm.	38.3		
0.0043 mm.	32.3		
0.0030 mm.	29.3		
0.0012 mm.	26.1		

* (no specification provided)

Soil Description

DARK BROWN TO DARK GRAY LEAN CLAY WITH SAND

Atterberg Limits

PL= 15 LL= 37 PI= 22

Coefficients

D_{90}= 0.1848 D_{85}= 0.1019 D_{60}= 0.0205
D_{50}= 0.0126 D_{30}= 0.0034 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(17)

Remarks

F.M.=0.20

Source of Sample: SB-301 **Depth:** 98.0'-100.0'
Sample Number: 0946

Date: 3-2-21

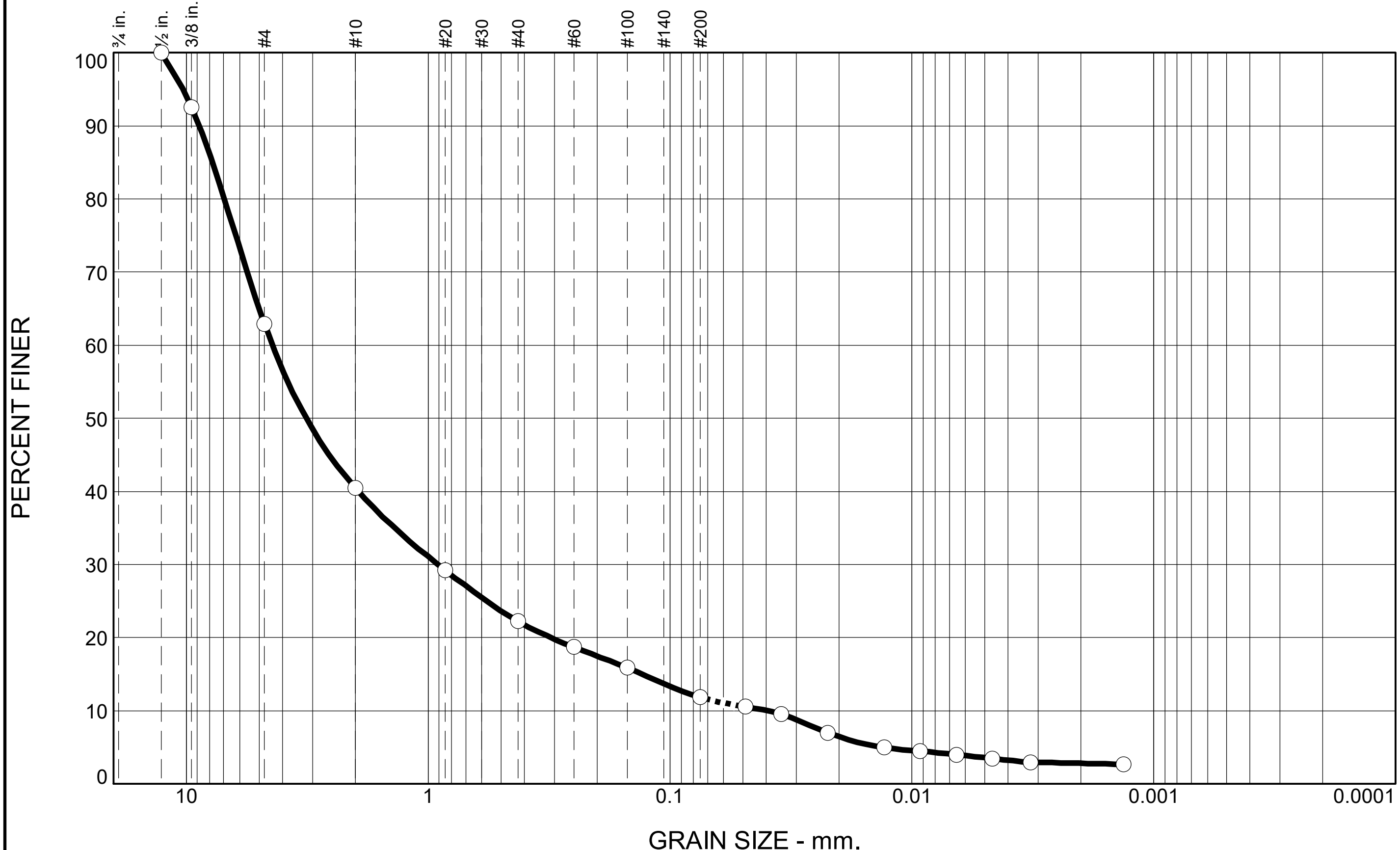
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	37.1	22.4	18.2	10.5	8.2	3.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	92.6		
#4	62.9		
#10	40.5		
#20	29.2		
#40	22.3		
#60	18.7		
#100	15.9		
#200	11.8		
0.0489 mm.	10.5		
0.0348 mm.	9.5		
0.0223 mm.	7.0		
0.0130 mm.	5.0		
0.0092 mm.	4.5		
0.0065 mm.	4.0		
0.0046 mm.	3.5		
0.0032 mm.	2.9		
0.0013 mm.	2.7		

* (no specification provided)

Soil Description

DARK GRAY AND BROWN POORLY GRADED SAND WITH SILT AND GRAVEL

Atterberg Limits

PL= 57 LL= 47 PI= NP

Coefficients

D_{90}= 8.8427 D_{85}= 7.7995 D_{60}= 4.4077
D_{50}= 3.1925 D_{30}= 0.9113 D_{15}= 0.1303
D_{10}= 0.0394 C_u= 111.78 C_c= 4.78

Classification

USCS= SP-SM AASHTO= A-1-a

Remarks

F.M.=4.07

Source of Sample: XPW-01 **Depth:** 8.5'-9.0'
Sample Number: 0820

Date: 3-16-21

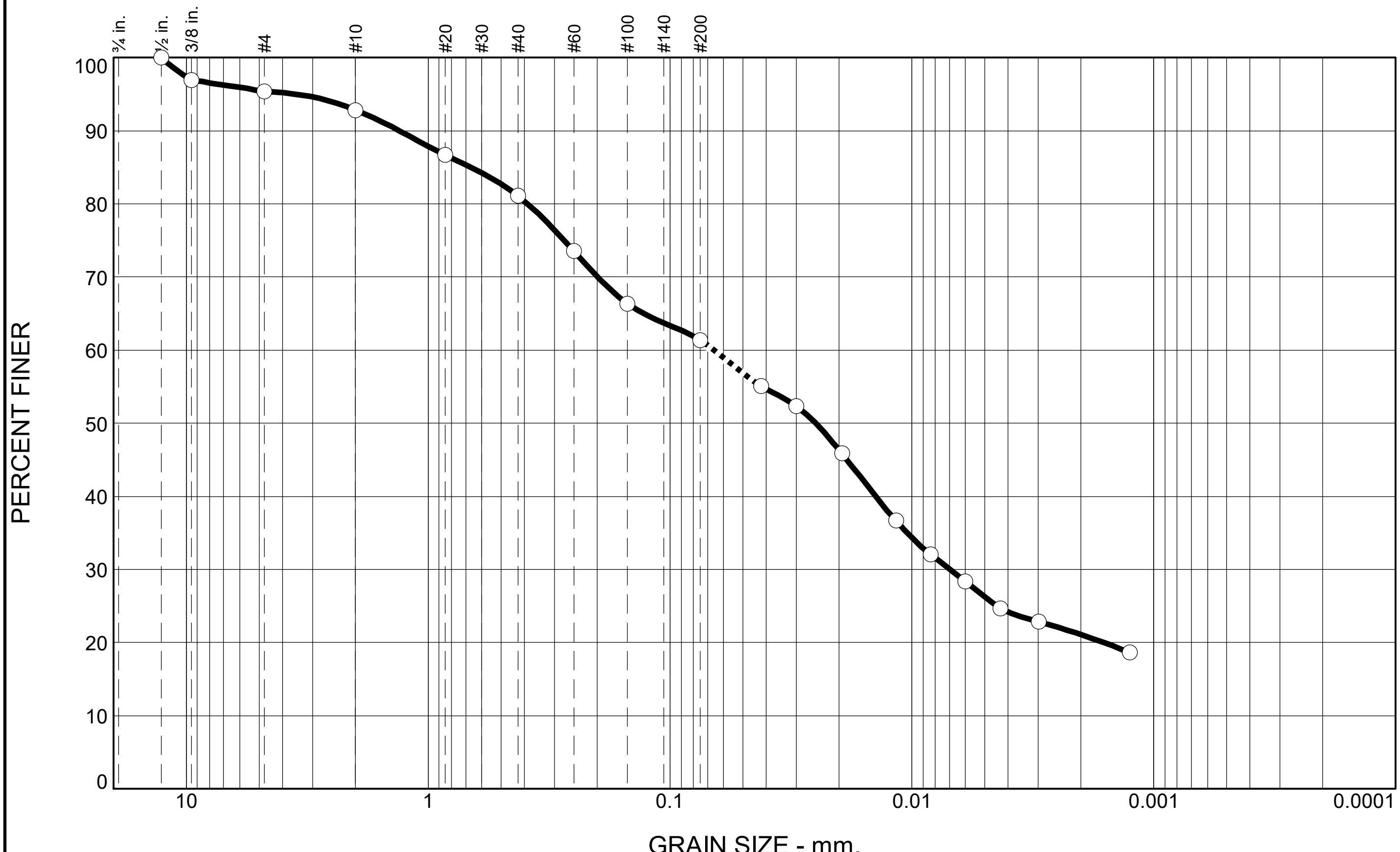
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.6	2.6	11.7	19.8	35.1	26.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	96.9		
#4	95.4		
#10	92.8		
#20	86.7		
#40	81.1		
#60	73.5		
#100	66.3		
#200	61.3		
0.0419 mm.	55.1		
0.0300 mm.	52.3		
0.0195 mm.	45.9		
0.0116 mm.	36.7		
0.0084 mm.	32.1		
0.0060 mm.	28.4		
0.0043 mm.	24.7		
0.0030 mm.	22.9		
0.0013 mm.	18.7		

* (no specification provided)

Soil Description

GRAY AND BROWN SANDY LEAN CLAY

Atterberg Limits

PL= 17 LL= 35 PI= 18

Coefficients

D_{90}= 1.3206 D_{85}= 0.6662 D_{60}= 0.0657
D_{50}= 0.0250 D_{30}= 0.0070 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(8)

Remarks

F.M.=0.98

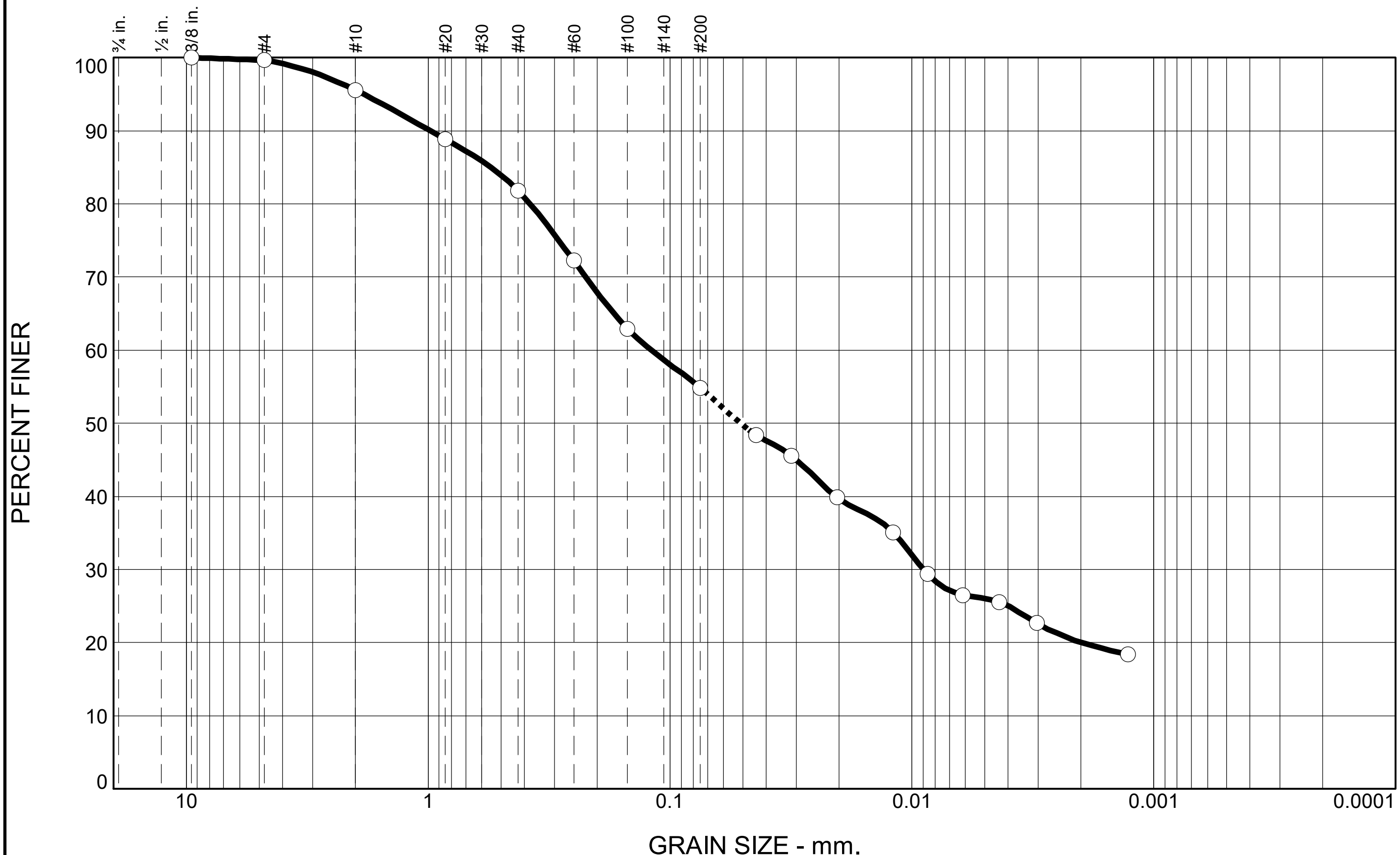
Source of Sample: XPW-01 **Depth:** 15.5'-16.0'
Sample Number: 0840 **Date:** 3-16-21

Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION
Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.3	4.1	13.8	26.9	28.9	26.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.7		
#10	95.6		
#20	88.8		
#40	81.8		
#60	72.2		
#100	62.9		
#200	54.9		
0.0440 mm.	48.4		
0.0315 mm.	45.5		
0.0203 mm.	39.8		
0.0119 mm.	35.1		
0.0086 mm.	29.4		
0.0061 mm.	26.5		
0.0044 mm.	25.5		
0.0030 mm.	22.7		
0.0013 mm.	18.4		

* (no specification provided)

Soil Description

VERY DARK GRAY, GRAY AND BROWN SANDY LEAN CLAY

Atterberg Limits

PL= 16 LL= 36 PI= 20

Coefficients

D_{90}= 0.9818 D_{85}= 0.5511 D_{60}= 0.1197
D_{50}= 0.0512 D_{30}= 0.0090 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(8)

Remarks

F.M.=0.88

Source of Sample: XPW-02 **Depth:** 8.0'-8.5'
Sample Number: 1530

Date: 3-16-21

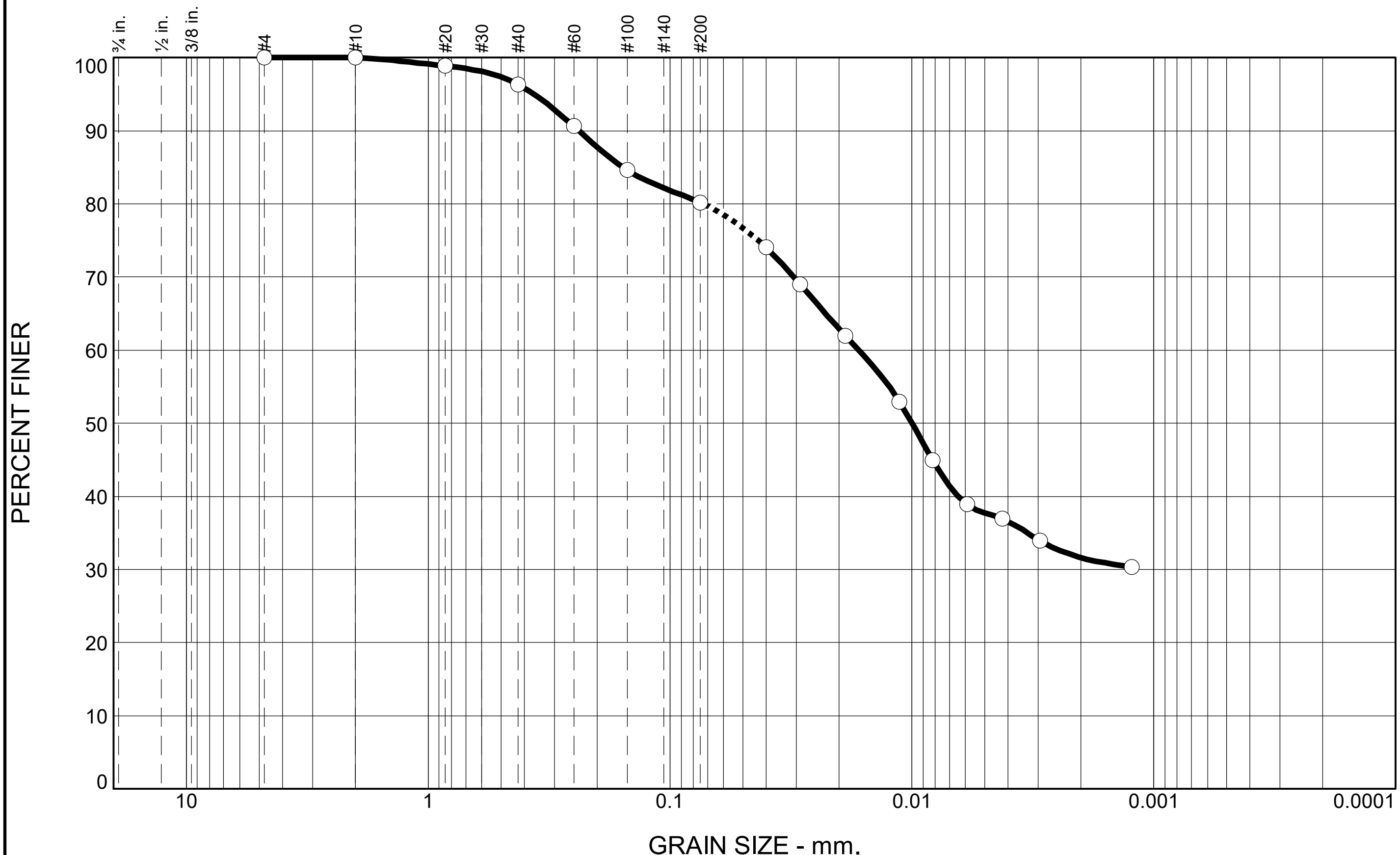
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	3.7	16.1	42.5	37.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	98.9		
#40	96.3		
#60	90.6		
#100	84.6		
#200	80.2		
0.0401 mm.	74.0		
0.0290 mm.	69.0		
0.0189 mm.	62.0		
0.0113 mm.	53.0		
0.0082 mm.	44.9		
0.0059 mm.	38.9		
0.0042 mm.	36.9		
0.0030 mm.	33.9		
0.0012 mm.	30.4		

* (no specification provided)

Soil Description

GRAY AND DARK BROWN LEAN CLAY WITH SAND

Atterberg Limits

PL= 14 LL= 36 PI= 22

Coefficients

D_{90}= 0.2379 D_{85}= 0.1563 D_{60}= 0.0166
D_{50}= 0.0100 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(16)

Remarks

F.M.=0.25

Source of Sample: XPW-02 **Depth:** 16.5'-17.0'
Sample Number: 1545

Date: 3-16-21

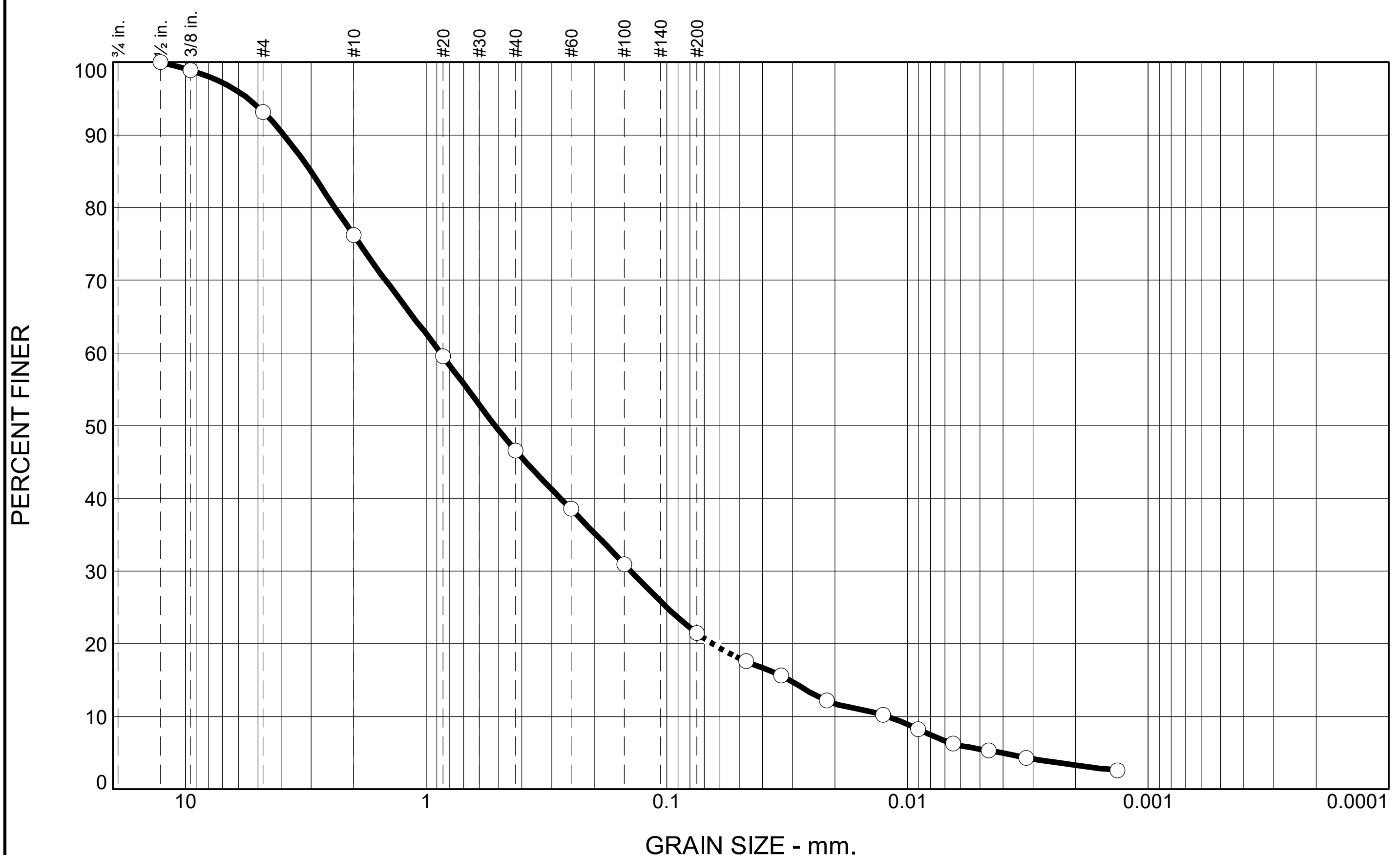
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.8	17.0	29.6	25.1	16.0	5.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	98.9		
#4	93.2		
#10	76.2		
#20	59.5		
#40	46.6		
#60	38.6		
#100	30.9		
#200	21.5		
0.0468 mm.	17.6		
0.0335 mm.	15.6		
0.0217 mm.	12.2		
0.0127 mm.	10.2		
0.0091 mm.	8.3		
0.0065 mm.	6.3		
0.0046 mm.	5.3		
0.0032 mm.	4.3		
0.0013 mm.	2.6		

* (no specification provided)

Soil Description

DARK BROWNISH GRAY SILTY SAND

Atterberg Limits

PL= 27 LL= 33 PI= 6

Coefficients

D_{90}= 3.8998 D_{85}= 3.0199 D_{60}= 0.8711
D_{50}= 0.5157 D_{30}= 0.1410 D_{15}= 0.0309
D_{10}= 0.0121 C_u= 72.20 C_c= 1.89

Classification

USCS= SM AASHTO= A-1-b

Remarks

F.M.=2.37

Source of Sample: XPW-03 **Depth:** 6.0'-6.5'
Sample Number: 1355 **Date:** 3-16-21

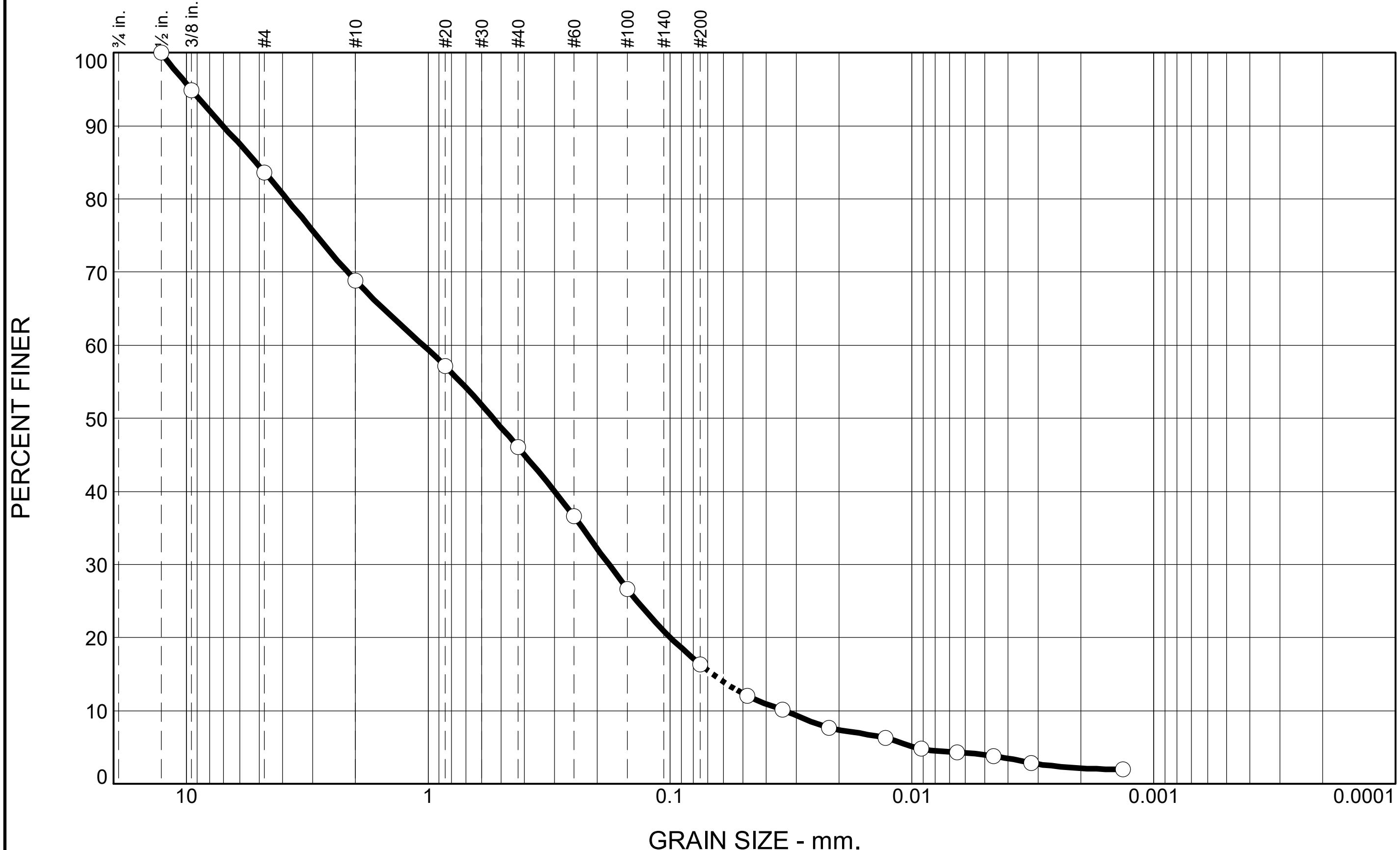
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	16.4	14.8	22.7	29.8	12.3	4.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	94.9		
#4	83.6		
#10	68.8		
#20	57.1		
#40	46.1		
#60	36.6		
#100	26.6		
#200	16.3		
0.0480 mm.	12.0		
0.0343 mm.	10.1		
0.0220 mm.	7.7		
0.0128 mm.	6.2		
0.0091 mm.	4.8		
0.0065 mm.	4.3		
0.0046 mm.	3.8		
0.0032 mm.	2.9		
0.0013 mm.	2.0		

* (no specification provided)

Soil Description

BROWNISH GRAY SILTY SAND WITH GRAVEL

Atterberg Limits

PL= 19 LL= 12 PI= NP

Coefficients

D_{90}= 7.0585 D_{85}= 5.1581 D_{60}= 1.0482
D_{50}= 0.5380 D_{30}= 0.1789 D_{15}= 0.0667
D_{10}= 0.0337 C_u= 31.15 C_c= 0.91

Classification

USCS= SM AASHTO= A-1-b

Remarks

F.M.=2.70

Source of Sample: XPW-03 **Depth:** 15.5'-16.0'
Sample Number: 1315 **Date:** 3-11-21

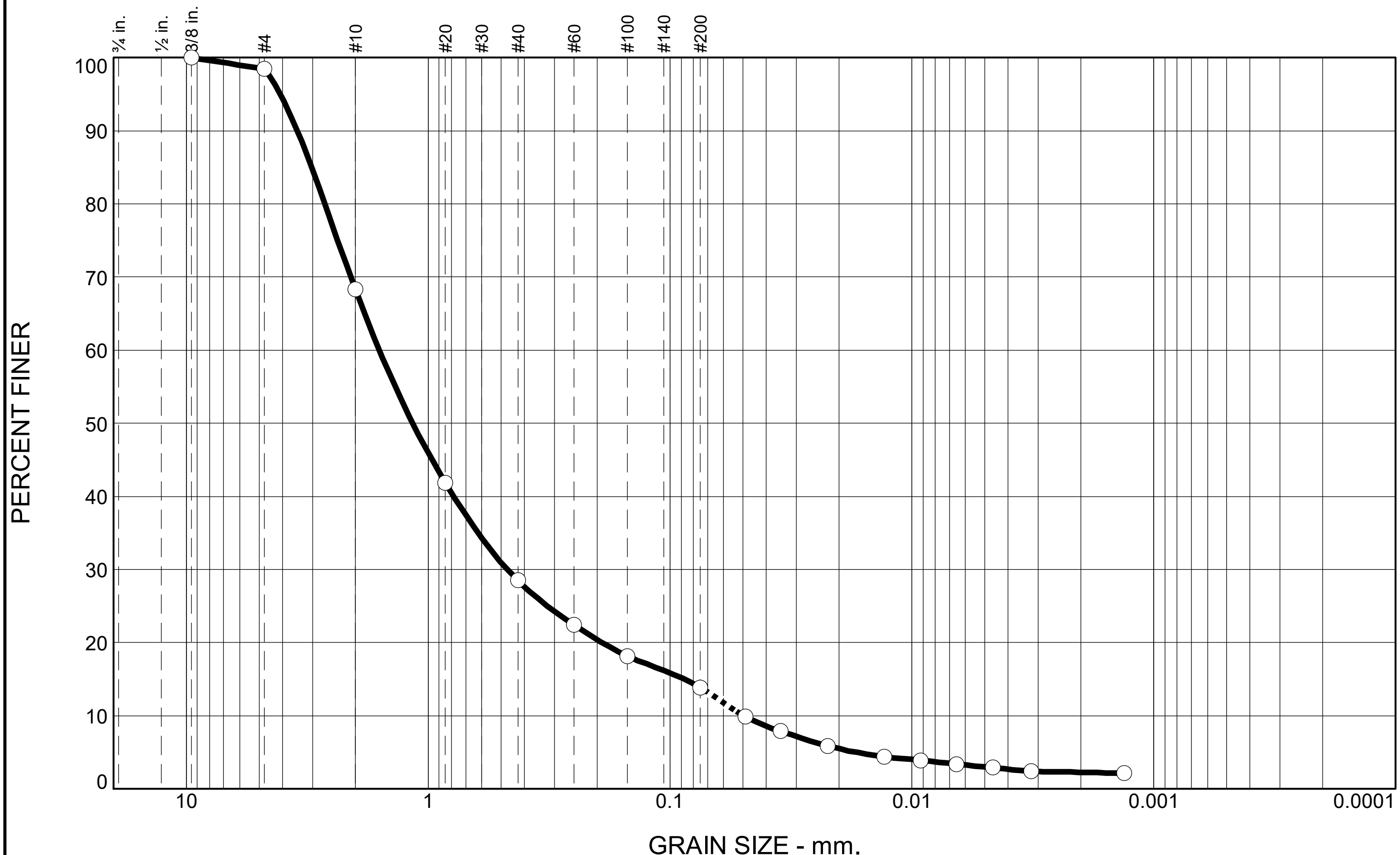
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.6	30.1	39.8	14.6	10.9	3.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	98.4		
#10	68.3		
#20	41.9		
#40	28.5		
#60	22.4		
#100	18.2		
#200	13.9		
0.0487 mm.	9.9		
0.0348 mm.	7.9		
0.0223 mm.	5.9		
0.0130 mm.	4.4		
0.0092 mm.	3.9		
0.0065 mm.	3.4		
0.0046 mm.	2.9		
0.0032 mm.	2.4		
0.0013 mm.	2.1		

* (no specification provided)

Soil Description

GRAY SILTY SAND

Atterberg Limits

PL= 38 LL= 41 PI= 3

Coefficients

D_{90}= 3.4781 D_{85}= 3.0339 D_{60}= 1.5927
D_{50}= 1.1581 D_{30}= 0.4698 D_{15}= 0.0872
D_{10}= 0.0496 C_u= 32.14 C_c= 2.80

Classification

USCS= SM AASHTO= A-1-b

Remarks

F.M.=2.99

Source of Sample: XPW-04 **Depth:** 6.5'-7.0'
Sample Number: 1000

Date: 3-16-21

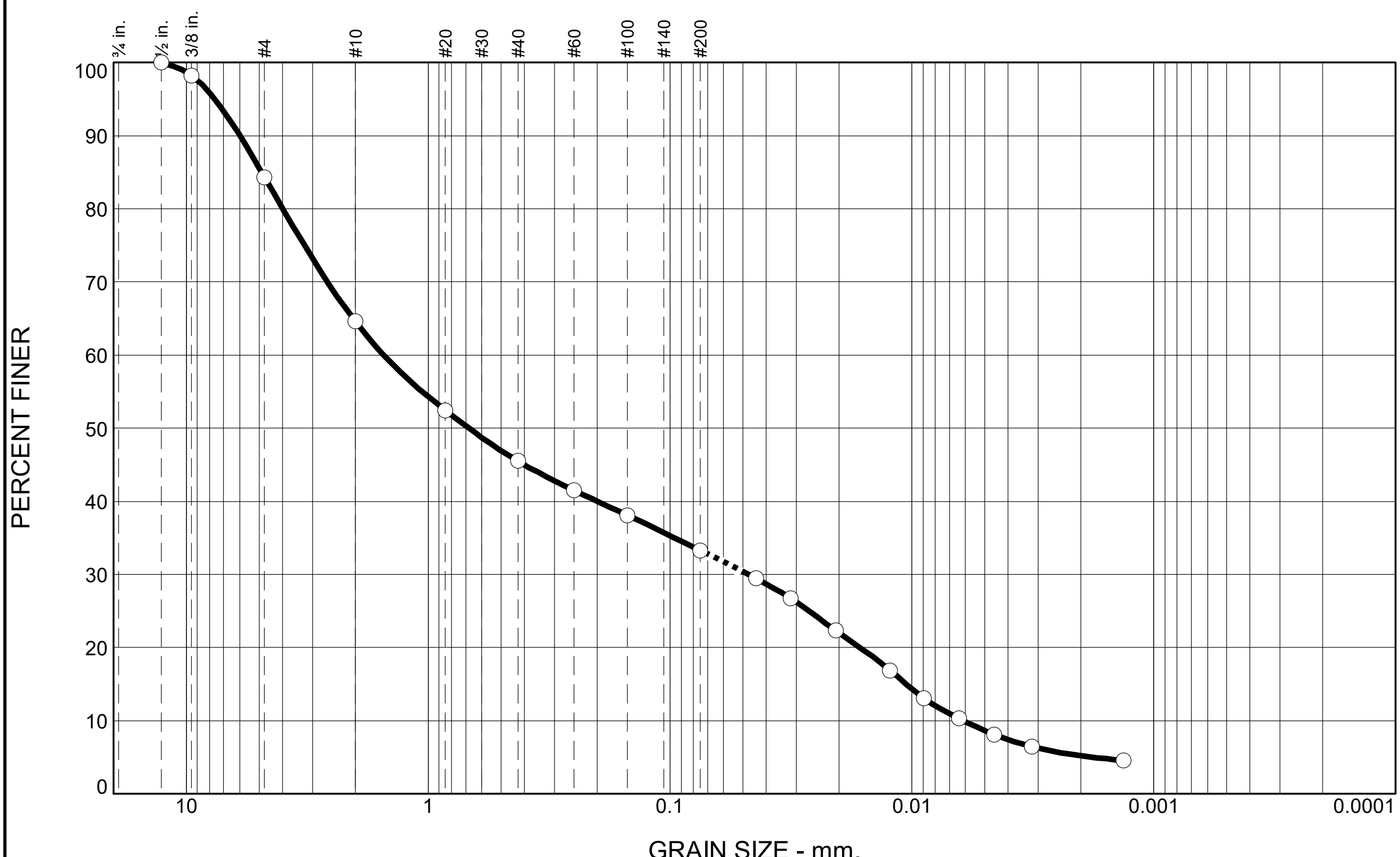
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION

Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	15.7	19.7	19.1	12.2	24.7	8.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	98.2		
#4	84.3		
#10	64.6		
#20	52.4		
#40	45.5		
#60	41.5		
#100	38.1		
#200	33.3		
0.0441 mm.	29.5		
0.0318 mm.	26.7		
0.0207 mm.	22.3		
0.0123 mm.	16.9		
0.0089 mm.	13.0		
0.0064 mm.	10.3		
0.0046 mm.	8.1		
0.0032 mm.	6.5		
0.0013 mm.	4.5		

* (no specification provided)

Soil Description

DARK BROWNISH GRAY SILTY SAND WITH GRAVEL

Atterberg Limits

PL= 42 LL= 46 PI= 4

Coefficients

D_{90}= 6.0007 D_{85}= 4.8822 D_{60}= 1.5250
D_{50}= 0.6794 D_{30}= 0.0473 D_{15}= 0.0106
D_{10}= 0.0061 C_u= 248.95 C_c= 0.24

Classification

USCS= SM AASHTO= A-2-5(0)

Remarks

F.M.=2.64

Source of Sample: XPW-04 **Depth:** 15.5'-16.0'
Sample Number: 1020 **Date:** 3-16-21

Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: NEWTON POWER STATION
Project No: 11215019 **Figure**

Tested By: SJH **Checked By:** WPQ

Terracon

Hydraulic Conductivity of Saturated Porous Materials
Using a Flexible-Wall Permeameter
ASTM D5084

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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. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP.**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. APW-11

TIME SAMPLED: 8:05

DEPTH: 10.0'-12.0'

CLASSIFICATION BROWN SANDY LEAN CLAY

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	111.7	112.0
WATER CONTENT (%)	17.8	17.7
DIAMETER (cm)	7.131	7.163
LENGTH (cm)	10.248	10.130
B VALUE PARAMETER:	0.99	
HYDRAULIC GRADIENT (MAXIMUM)	19.49	
PERCENT SATURATION	99.5	
HYDRAULIC CONDUCTIVITY k (cm/sec)	8.57E-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
Consulting Engineers & Scientists

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.	**11215019**	**4/9/2021**
PROJECT NAME:	**NEWTON POWER STATION**	
CLIENT:	**RAMBOLL ENVIRON US CORP.**	
LOCATION :	**NEWTON, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	APW-11
TIME SAMPLED:	10:50
DEPTH:	60.5'-61.0'
CLASSIFICATION	GRAYISH BROWN LEAN CLAY WITH SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	110.5	117.8
WATER CONTENT (%)	17.8	15.6
DIAMETER (cm)	6.070	5.968
LENGTH (cm)	14.172	13.755
B VALUE PARAMETER:	0.99	
HYDRAULIC GRADIENT (MAXIMUM)	16.57	
PERCENT SATURATION	99.5	
HYDRAULIC CONDUCTIVITY k (cm/sec)	1.87E-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. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP.**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. APW-11

TIME SAMPLED: 11:15

DEPTH: 80.0'-82.0'

CLASSIFICATION DARK GRAY LEAN CLAY WITH SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	116.1	117.2
WATER CONTENT (%)	16.5	16.0
DIAMETER (cm)	7.258	7.230
LENGTH (cm)	10.762	10.739
B VALUE PARAMETER:	0.98	
HYDRAULIC GRADIENT (MAXIMUM)	18.56	
PERCENT SATURATION	99.2	
HYDRAULIC CONDUCTIVITY k (cm/sec)	2.94E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. APW-12

TIME SAMPLED: 8:20

DEPTH: 20.0'-22.0'

CLASSIFICATION BROWN AND RUST BROWN CLAYEY SAND - ROOTS NOTED

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	118.3	120.4
WATER CONTENT (%)	15.1	14.5
DIAMETER (cm)	7.256	7.229
LENGTH (cm)	8.539	8.448
B VALUE PARAMETER:	0.96	
HYDRAULIC GRADIENT (MAXIMUM)	23.39	
PERCENT SATURATION	99.6	
HYDRAULIC CONDUCTIVITY k (cm/sec)	1.07E-07	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

TERRACON PROJECT NO. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. APW-12

TIME SAMPLED: 8:45

DEPTH: 26.0'-26.5'

CLASSIFICATION BROWN SILTY SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	113.0	114.8
WATER CONTENT (%)	8.4	16.3
DIAMETER (cm)	6.163	6.121
LENGTH (cm)	15.243	15.219
B VALUE PARAMETER:	0.95	
HYDRAULIC GRADIENT (MAXIMUM)	3.88	
PERCENT SATURATION	98.4	
HYDRAULIC CONDUCTIVITY k (cm/sec)	8.43E-06	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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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.	**11215019**	**4/9/2021**
PROJECT NAME:	**NEWTON POWER STATION**	
CLIENT:	**RAMBOLL ENVIRON US CORP**	
LOCATION :	**NEWTON, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	APW-12
TIME SAMPLED:	12:45
DEPTH:	85.0'-87.0'
CLASSIFICATION	DARK GRAY LEAN CLAY WITH SAND - SILT POCKETS NOTED

SPECIMEN PHOTO

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	116.4	118.0
WATER CONTENT (%)	14.4	15.9
DIAMETER (cm)	7.234	7.202
LENGTH (cm)	7.464	7.431
B VALUE PARAMETER:	0.95	
HYDRAULIC GRADIENT (MAXIMUM)	22.05	
PERCENT SATURATION	99.8	
HYDRAULIC CONDUCTIVITY k (cm/sec)	2.36E-08	

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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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.	**11215019**	**4/9/2021**
PROJECT NAME:	**NEWTON POWER STATION**	
CLIENT:	**RAN=MBOLL ENVIRON US CORP**	
LOCATION :	**NEWTON, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	APW-13
TIME SAMPLED:	8:45
DEPTH:	85.0'-87.0'
CLASSIFICATION	DARK GRAY AND GRAY POORLY GRADED SAND WITH SILT

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	87.1	89.2
WATER CONTENT (%)	21.2	32.0
DIAMETER (cm)	7.090	7.039
LENGTH (cm)	9.808	9.718
B VALUE PARAMETER:	0.96	
HYDRAULIC GRADIENT (MAXIMUM)	6.03	
PERCENT SATURATION	99.7	
HYDRAULIC CONDUCTIVITY k (cm/sec)	9.63E-05	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

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TERRACON PROJECT NO. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. APW-13

TIME SAMPLED: 13:45

DEPTH: 61.0'-61.5'

CLASSIFICATION BROWN SILTY SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	114.3	117.3
WATER CONTENT (%)	14.5	15.4
DIAMETER (cm)	6.038	6.126
LENGTH (cm)	10.971	10.386
B VALUE PARAMETER:	0.96	
HYDRAULIC GRADIENT (MAXIMUM)	5.39	
PERCENT SATURATION	99.5	
HYDRAULIC CONDUCTIVITY k (cm/sec)	2.18E-04	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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TERRACON PROJECT NO. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. APW-14

TIME SAMPLED: 9:55

DEPTH: 45.0'-47.0'

CLASSIFICATION BROWN SANDY LEAN CLAY

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	119.6	120.3
WATER CONTENT (%)	12.4	14.2
DIAMETER (cm)	7.380	7.372
LENGTH (cm)	10.775	10.736
B VALUE PARAMETER:	0.98	
HYDRAULIC GRADIENT (MAXIMUM)	18.54	
PERCENT SATURATION	100.5	
HYDRAULIC CONDUCTIVITY k (cm/sec)	9.65E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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TERRACON PROJECT NO. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. APW-14

TIME SAMPLED: 10:35

DEPTH: 56.0'-56.5'

CLASSIFICATION GRAY AND BROWNISH GRAY LEAN CLAY WITH SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	104.6	107.9
WATER CONTENT (%)	18.0	20.7
DIAMETER (cm)	6.049	6.023
LENGTH (cm)	9.965	9.749
B VALUE PARAMETER:	0.97	
HYDRAULIC GRADIENT (MAXIMUM)	20.05	
PERCENT SATURATION	99.6	
HYDRAULIC CONDUCTIVITY k (cm/sec)	2.74E-07	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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TERRACON PROJECT NO. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. APW-15

TIME SAMPLED: 10:05

DEPTH: 20.0'-22.0'

CLASSIFICATION BROWN SANDY LEAN CLAY

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	109.8	109.9
WATER CONTENT (%)	18.5	19.0
DIAMETER (cm)	7.189	7.201
LENGTH (cm)	8.227	8.190
B VALUE PARAMETER:	0.95	
HYDRAULIC GRADIENT (MAXIMUM)	24.28	
PERCENT SATURATION	97.7	
HYDRAULIC CONDUCTIVITY k (cm/sec)	3.21E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

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TERRACON PROJECT NO. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. APW-15

TIME SAMPLED: 7:55

DEPTH: 101.0'-101.5'

CLASSIFICATION GRAY SILTY SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	116.4	122.2
WATER CONTENT (%)	12.1	13.4
DIAMETER (cm)	5.990	5.964
LENGTH (cm)	10.539	10.126
B VALUE PARAMETER:	0.96	
HYDRAULIC GRADIENT (MAXIMUM)	8.95	
PERCENT SATURATION	97.6	
HYDRAULIC CONDUCTIVITY k (cm/sec)	3.50E-06	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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TERRACON PROJECT NO. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. APW-15

TIME SAMPLED: 9:05

DEPTH: 105.0'-107.0'

CLASSIFICATION DARK GRAY LEAN CLAY WITH SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	107.8	109.3
WATER CONTENT (%)	19.1	19.6
DIAMETER (cm)	7.178	7.136
LENGTH (cm)	5.565	5.551
B VALUE PARAMETER:	0.96	
HYDRAULIC GRADIENT (MAXIMUM)	29.58	
PERCENT SATURATION	99.5	
HYDRAULIC CONDUCTIVITY k (cm/sec)	8.20E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

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TERRACON PROJECT NO. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. APW-17

TIME SAMPLED: 9:45

DEPTH: 40.0'-42.0'

CLASSIFICATION GRAY LEAN CLAY WITH SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	108.8	109.5
WATER CONTENT (%)	16.6	19.6
DIAMETER (cm)	7.262	7.262
LENGTH (cm)	9.605	9.545
B VALUE PARAMETER:	0.98	
HYDRAULIC GRADIENT (MAXIMUM)	28.12	
PERCENT SATURATION	98.4	
HYDRAULIC CONDUCTIVITY k (cm/sec)	3.34E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

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TERRACON PROJECT NO. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRN US CORP**
LOCATION : **NEWTON , IL**

SUMMARY OF TEST RESULTS

BORING NO. SB-300

TIME SAMPLED: 8:25

DEPTH: 50.0'-52.0'

CLASSIFICATION GRAY LEAN CLAY WITH SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	122.7	123.5
WATER CONTENT (%)	12.9	13.3
DIAMETER (cm)	7.242	7.217
LENGTH (cm)	10.288	10.288
B VALUE PARAMETER:	0.98	
HYDRAULIC GRADIENT (MAXIMUM)	19.42	
PERCENT SATURATION	99.1	
HYDRAULIC CONDUCTIVITY k (cm/sec)	7.29E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

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TERRACON PROJECT NO. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON , IL**

SUMMARY OF TEST RESULTS

BORING NO. SB-300

TIME SAMPLED: 9:05

DEPTH: 61.5'-62.0'

CLASSIFICATION GRAYISH BROWN SILTY SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	109.6	113.2
WATER CONTENT (%)	13.6	17.7
DIAMETER (cm)	5.903	5.916
LENGTH (cm)	7.615	7.338
B VALUE PARAMETER:	0.98	
HYDRAULIC GRADIENT (MAXIMUM)	26.23	
PERCENT SATURATION	99.7	
HYDRAULIC CONDUCTIVITY k (cm/sec)	1.85E-05	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

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TERRACON PROJECT NO. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. SB-300

TIME SAMPLED: 9:20

DEPTH: 62.0'-62.5'

CLASSIFICATION GRAYISH BROWN SANDY SILTY CLAY

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	124.6	128.9
WATER CONTENT (%)	11.1	13.3
DIAMETER (cm)	6.067	6.043
LENGTH (cm)	13.366	13.026
B VALUE PARAMETER:	0.98	
HYDRAULIC GRADIENT (MAXIMUM)	7.06	
PERCENT SATURATION	119.5	
HYDRAULIC CONDUCTIVITY k (cm/sec)	4.32E-06	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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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. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. SB-300

TIME SAMPLED: 13:50

DEPTH: 105.0'-107.0'

CLASSIFICATION DARK GRAY SANDY LEAN CLAY

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	116.4	116.5
WATER CONTENT (%)	14.1	16.4
DIAMETER (cm)	7.328	7.336
LENGTH (cm)	7.558	7.534
B VALUE PARAMETER:	0.96	
HYDRAULIC GRADIENT (MAXIMUM)	26.43	
PERCENT SATURATION	98.8	
HYDRAULIC CONDUCTIVITY k (cm/sec)	4.28E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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TERRACON PROJECT NO. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. SB-301

TIME SAMPLED: 13:30

DEPTH: 48.0'-50.0'

CLASSIFICATION BROWN AND GRAY SANDY LEAN CLAY

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	117.3	117.7
WATER CONTENT (%)	14.1	15.8
DIAMETER (cm)	7.204	7.230
LENGTH (cm)	10.348	10.239
B VALUE PARAMETER:	0.99	
HYDRAULIC GRADIENT (MAXIMUM)	19.30	
PERCENT SATURATION	99.6	
HYDRAULIC CONDUCTIVITY k (cm/sec)	6.63E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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TERRACON PROJECT NO. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. SB-301

TIME SAMPLED: 16:00

DEPTH: 68.5'-69.0'

CLASSIFICATION GRAY LEAN CLAY WITH SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	121.3	124.0
WATER CONTENT (%)	13.1	13.4
DIAMETER (cm)	6.062	6.049
LENGTH (cm)	8.581	8.434
B VALUE PARAMETER:	0.96	
HYDRAULIC GRADIENT (MAXIMUM)	23.28	
PERCENT SATURATION	99.2	
HYDRAULIC CONDUCTIVITY k (cm/sec)	4.05E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

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TERRACON PROJECT NO.	**11215019**	**4/9/2021**
PROJECT NAME:	**NEWTON POWER STATION**	
CLIENT:	**RAMBOLL ENVIRON US CORP**	
LOCATION :	**NEWTON, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	SB-301
TIME SAMPLED:	9:46
DEPTH:	98.0'-100.0'
CLASSIFICATION	DARK BROWN TO DARK GRAY LEAN CLAY WITH SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	118.2	119.1
WATER CONTENT (%)	15.7	15.9
DIAMETER (cm)	7.200	7.196
LENGTH (cm)	9.694	9.629
B VALUE PARAMETER:	0.96	
HYDRAULIC GRADIENT (MAXIMUM)	16.98	
PERCENT SATURATION	102.5	
HYDRAULIC CONDUCTIVITY k (cm/sec)	6.13E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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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. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. SB-301

TIME SAMPLED: 9:46

DEPTH: 98.0'-100.0'

CLASSIFICATION DARK BROWN TO DARK GRAY LEAN CLAY WITH SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	118.2	119.1
WATER CONTENT (%)	15.7	15.9
DIAMETER (cm)	7.200	7.196
LENGTH (cm)	9.694	9.629
B VALUE PARAMETER:	0.96	
HYDRAULIC GRADIENT (MAXIMUM)	16.98	
PERCENT SATURATION	102.5	
HYDRAULIC CONDUCTIVITY k (cm/sec)	6.13E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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.	**11215019**	**4/9/2021**
PROJECT NAME:	**NEWTON POWER STATION**	
CLIENT:	**RAMBOLL ENVIRON US CORP**	
LOCATION :	**NEWTON, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	XPW-01
TIME SAMPLED:	8:40
DEPTH:	15.0'-15.5'
CLASSIFICATION	GRAY AND BROWN SANDY LEAN CLAY
NOTE:	SAMPLE DISTURBED, SAND LAYERS NOTED

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	84.4	85.6
WATER CONTENT (%)	12.6	31.3
DIAMETER (cm)	6.152	6.120
LENGTH (cm)	15.217	15.168
B VALUE PARAMETER:	0.96	
HYDRAULIC GRADIENT (MAXIMUM)	13.13	
PERCENT SATURATION	86.1	
HYDRAULIC CONDUCTIVITY k (cm/sec)	1.58E-05	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. XPW-02

TIME SAMPLED: 15:30

DEPTH: 7.5'-8.0'

CLASSIFICATION VERY DARK GRAY TO GRAY AND BROWN SANDY LEAN CLAY

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	92.9	98.3
WATER CONTENT (%)	29.1	26.1
DIAMETER (cm)	6.069	6.042
LENGTH (cm)	12.025	11.469
B VALUE PARAMETER:	0.98	
HYDRAULIC GRADIENT (MAXIMUM)	13.69	
PERCENT SATURATION	99.5	
HYDRAULIC CONDUCTIVITY k (cm/sec)	6.07E-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. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. XPW-02

TIME SAMPLED: 15:45

DEPTH: 16.0'-16.5'

CLASSIFICATION GRAY AND DARK BROWN LEAN CLAY WITH SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	103.7	106.6
WATER CONTENT (%)	21.8	20.9
DIAMETER (cm)	6.002	5.979
LENGTH (cm)	11.395	11.179
B VALUE PARAMETER:	0.97	
HYDRAULIC GRADIENT (MAXIMUM)	17.53	
PERCENT SATURATION	98.2	
HYDRAULIC CONDUCTIVITY k (cm/sec)	7.38E-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 Consulting Engineers & Scientists

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

TERRACON PROJECT NO. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON , IL**

SUMMARY OF TEST RESULTS

BORING NO. XPW-02

TIME SAMPLED: 15:45

DEPTH: 16.0'-16.5'

CLASSIFICATION GRAY AND DARK BROWN LEAN CLAY WITH SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	103.7	106.6
WATER CONTENT (%)	21.8	20.9
DIAMETER (cm)	6.002	5.979
LENGTH (cm)	11.395	11.179
B VALUE PARAMETER:	0.97	
HYDRAULIC GRADIENT (MAXIMUM)	17.53	
PERCENT SATURATION	98.2	
HYDRAULIC CONDUCTIVITY k (cm/sec)	7.38E-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
Consulting Engineers & Scientists

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.	**11215019**	**4/9/2021**
PROJECT NAME:	**NEWTON POWER STATION**	
CLIENT:	**RAMBOLL ENVIRON US CORP**	
LOCATION :	**NEWTON, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	XPW-04
TIME SAMPLED:	10:00
DEPTH:	7.0'-7.5'
CLASSIFICATION	GRAY SILTY SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	73.9	75.6
WATER CONTENT (%)	31.1	45.1
DIAMETER (cm)	6.133	6.116
LENGTH (cm)	15.283	15.019
B VALUE PARAMETER:	0.95	
HYDRAULIC GRADIENT (MAXIMUM)	6.17	
PERCENT SATURATION	99.7	
HYDRAULIC CONDUCTIVITY k (cm/sec)	1.61E-04	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

TERRACON PROJECT NO. **11215019** **4/9/2021**
PROJECT NAME: **NEWTON POWER STATION**
CLIENT: **RAMBOLL ENVIRON US CORP**
LOCATION : **NEWTON, IL**

SUMMARY OF TEST RESULTS

BORING NO. XPW-04

TIME SAMPLED: 10:20

DEPTH: 16.0'-16.5'

CLASSIFICATION DARK BROWN GRAY SILTY SAND WITH GRAVEL

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	80.8	84.8
WATER CONTENT (%)	31.1	35.6
DIAMETER (cm)	6.118	6.068
LENGTH (cm)	14.041	13.607
B VALUE PARAMETER:	0.95	
HYDRAULIC GRADIENT (MAXIMUM)	6.72	
PERCENT SATURATION	97.9	
HYDRAULIC CONDUCTIVITY k (cm/sec)	7.83E-05	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

Permeability of Granular Soils (Constant Head)
ASTM D2434

Terracon
Consulting Engineers & Scientists

PERMEABILITY OF GRANULAR SOILS
CONSTANT HEAD METHOD IN RIGID WALL PERMEAMETER
ASTM D 2434

Laboratory Services Group 192 Exchange Blvd Glendale Heights, Illinois 60139 Ph. (630) 717-4263

PROJECT NO.:	11215019
PROJECT:	NEWTON POWER STATION
DATE:	3/18/2021

SAMPLE INFORMATION

BORING NO.	APW-17
TIME SAMPLED:	10:45
DEPTH:	70.5'-71.0'
CLASSIFICATION	GRAY WELL GRADED SAND WITH SILT

	INITIAL
DRY UNIT WEIGHT (pcf)	110.2
WATER CONTENT (%)	7.8
DIAMETER (cm)	2.57
LENGTH (cm)	11.85

SPECIMEN PHOTO

SUMMARY OF TEST RESULTS

HYDRAULIC GRADIENT	1.3
HEAD HEIGHT (cm)	15.00
VOID RATIO	0.577
HYDRAULIC CONDUCTIVITY k (cm/sec)	**7.21E-04**

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Consulting Engineers & Scientists

PERMEABILITY OF GRANULAR SOILS
CONSTANT HEAD METHOD IN RIGID WALL PERMEAMETER
ASTM D 2434

Laboratory Services Group | 192 Exchange Blvd | Glendale Heights, Illinois 60139 | Ph. (630) 717-4263

PROJECT NO.:	11215019
PROJECT:	NEWTON POWER STATION
DATE:	3/18/2021

SAMPLE INFORMATION

BORING NO.	APW-17
TIME SAMPLED:	12:00
DEPTH:	91.0'-91.5'
CLASSIFICATION	GRAY WELL GRADED SAND WITH SILT

	INITIAL
DRY UNIT WEIGHT (pcf)	116.8
WATER CONTENT (%)	6.1
DIAMETER (cm)	2.57
LENGTH (cm)	11.85

SPECIMEN PHOTO

SUMMARY OF TEST RESULTS

HYDRAULIC GRADIENT	1.3
HEAD HEIGHT (cm)	15.00
VOID RATIO	0.488
HYDRAULIC CONDUCTIVITY k (cm/sec)	**6.39E-04**

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PERMEABILITY OF GRANULAR SOILS
CONSTANT HEAD METHOD IN RIGID WALL PERMEAMETER
ASTM D 2434

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

PROJECT NO.: 11215019

PROJECT: NEWTON POWER STATION

DATE: 3/18/2021

SAMPLE INFORMATION

BORING NO. XPW-03

TIME SAMPLED: 12:55

DEPTH: 5.5'-6.0'

CLASSIFICATION DARK BROWNISH GRAY SILTY SAND

	INITIAL
DRY UNIT WEIGHT (pcf)	75.3
WATER CONTENT (%)	17.4
DIAMETER (cm)	2.57
LENGTH (cm)	11.85

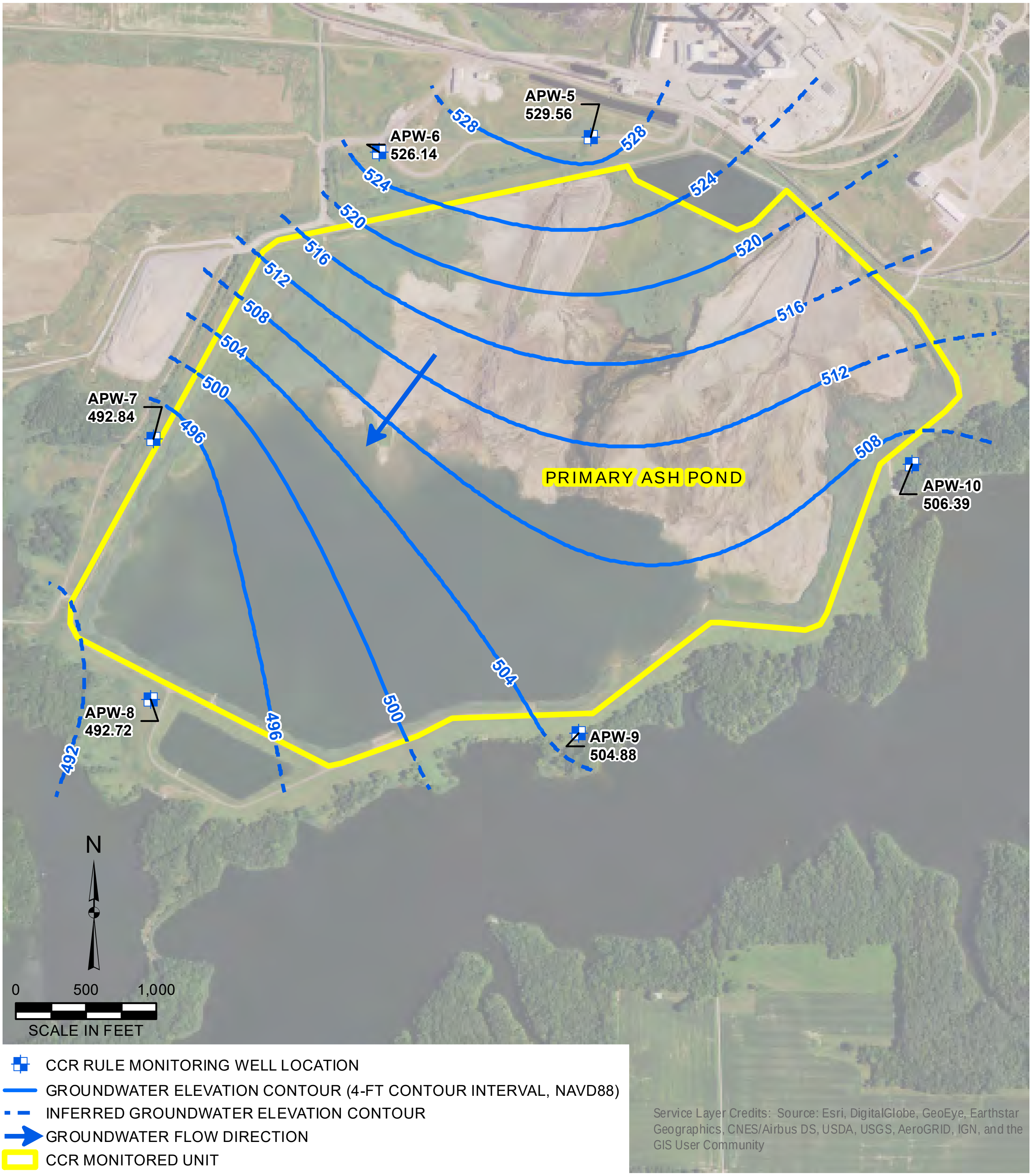
SPECIMEN PHOTO

SUMMARY OF TEST RESULTS

HYDRAULIC GRADIENT	1.3
HEAD HEIGHT (cm)	15.00
VOID RATIO	1.202
HYDRAULIC CONDUCTIVITY k (cm/sec)	**1.34E-03**

APPENDIX E
GROUNDWATER CONTOUR MAPS AND ELEVATIONS

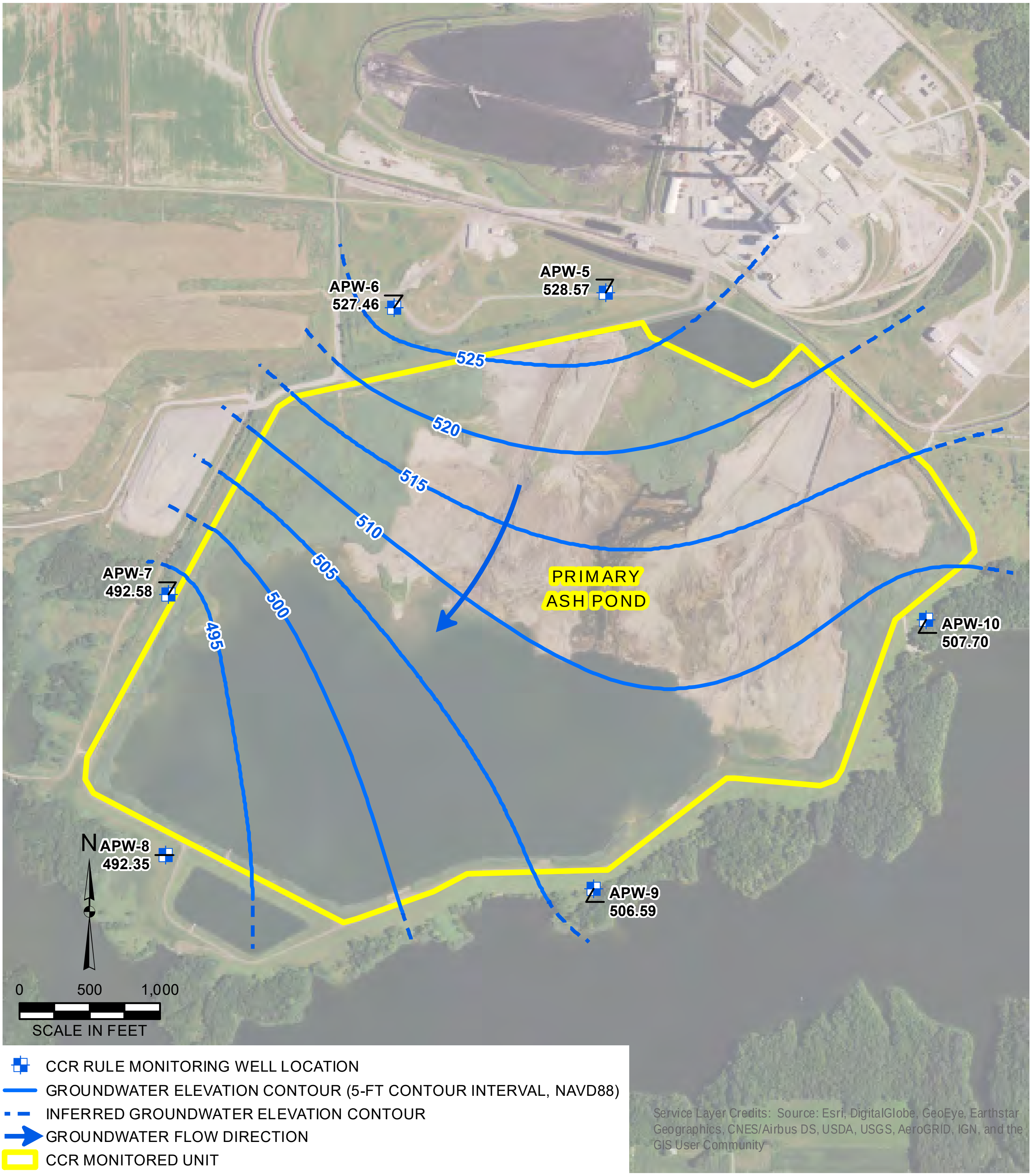
GROUNDWATER CONTOUR MAPS



CCR RULE MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (4-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR MONITORED UNIT

Y:\Mapping\Projects\22\2285\MXD\GW_Contours\Round_01\R1_NewtonPAP_GW_Contours.mxd Author: sstolz; Date/Time: 3/2/2017, 3:09:40 PM

DRAWN BY/DATE: SDS 1/23/17 REVIEWED BY/DATE: TBN 1/25/17 APPROVED BY/DATE: JJW 2/7/17	**NEWTON PRIMARY ASH POND (UNIT ID: 501) UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP ROUND 1: DECEMBER 14, 2015** DYNEGY CCR RULE GROUNDWATER MONITORING NEWTON POWER STATION NEWTON, ILLINOIS	PROJECT NO: 2285 FIGURE NO: 1 Natural Resource Technology AN OBG COMPANY



DRAWN BY/DATE:
SDS 1/23/17
REVIEWED BY/DATE:
TBN 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

NEWTON PRIMARY ASH POND (UNIT ID: 501)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 2: JANUARY 18, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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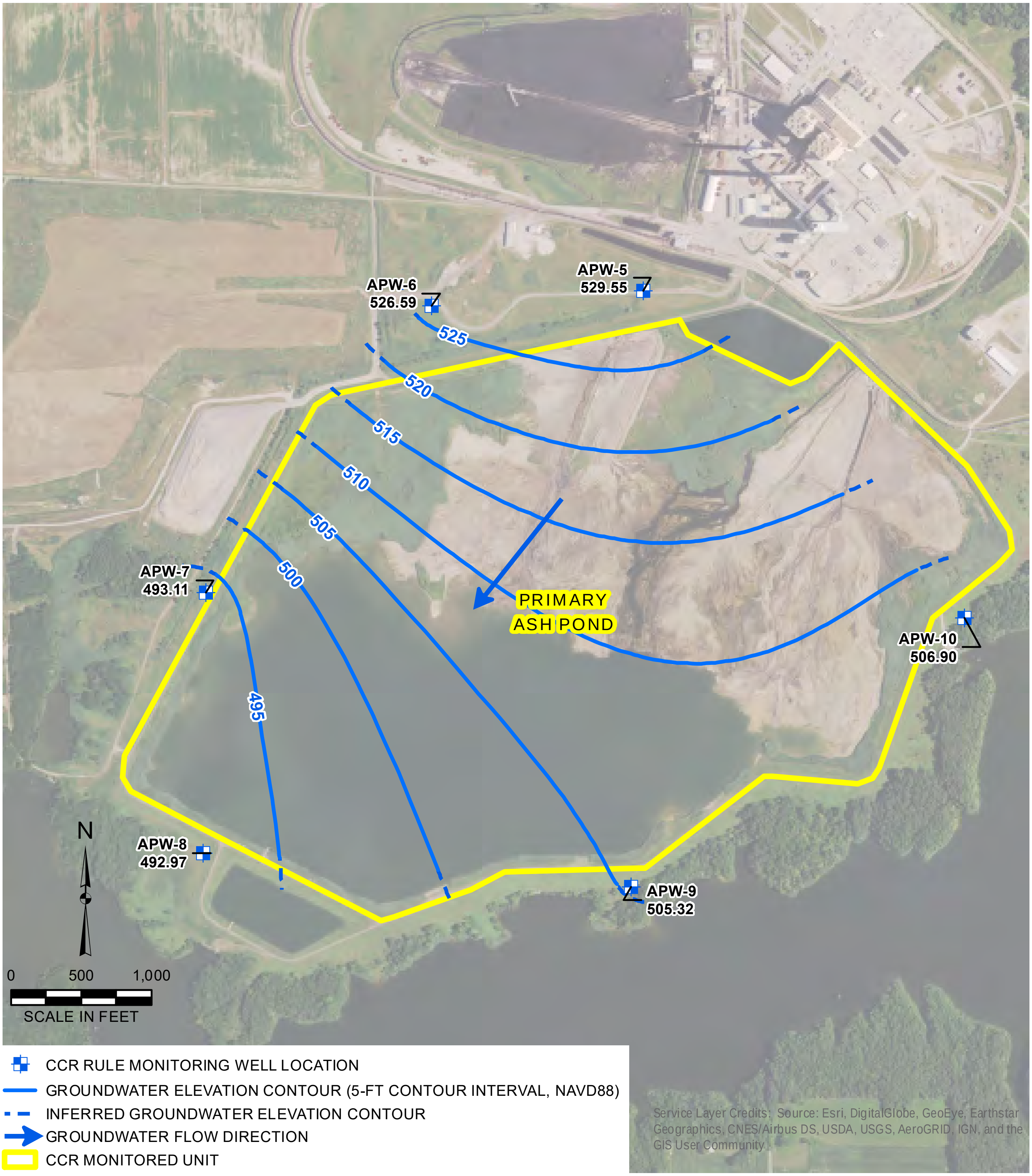

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REVIEWED BY/DATE:
TBN 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

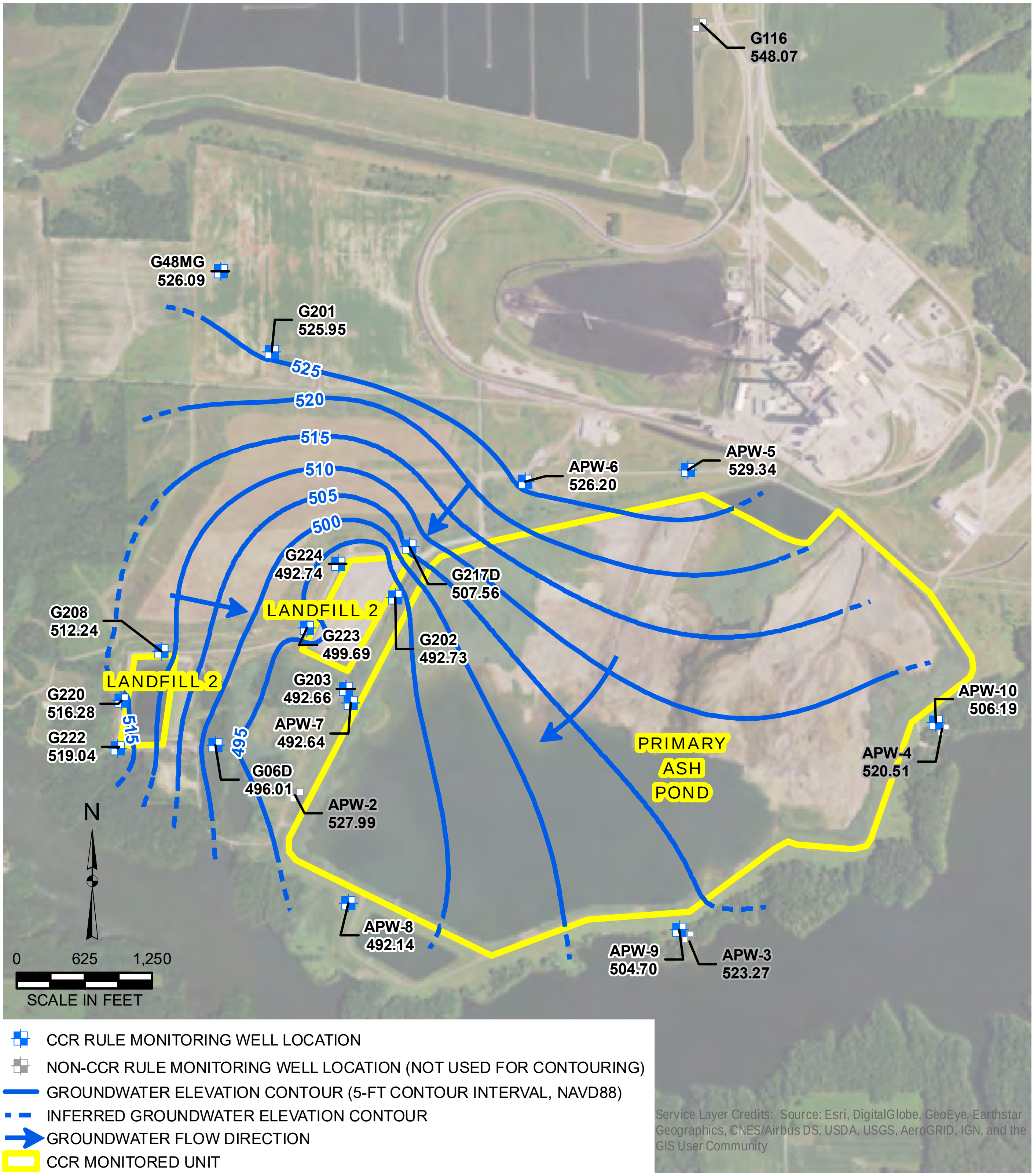
NEWTON PRIMARY ASH POND (UNIT ID: 501)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 3: APRIL 25, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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REVIEWED BY/DATE:
TBN 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

NEWTON PRIMARY ASH POND (UNIT ID: 501) AND NEWTON LANDFILL 2 (UNIT ID: 502)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 4: JULY 25, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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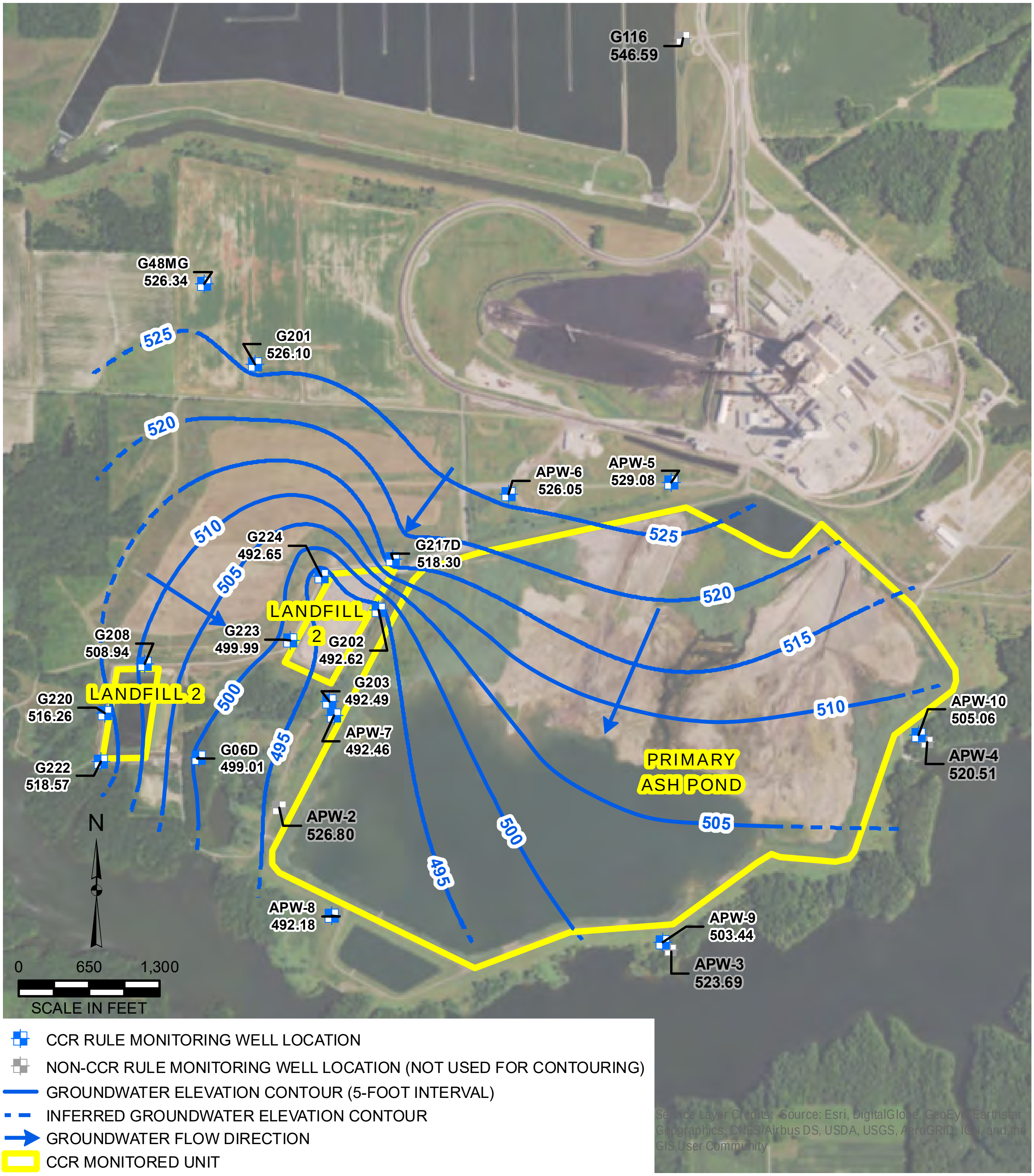

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REVIEWED BY/DATE:
TBN 3/6/17
APPROVED BY/DATE:
JJW 8/30/17

NEWTON PRIMARY ASH POND (UNIT ID: 501) AND LANDFILL 2 (UNIT ID: 502)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 5: OCTOBER 17, 2016
DYNEGY CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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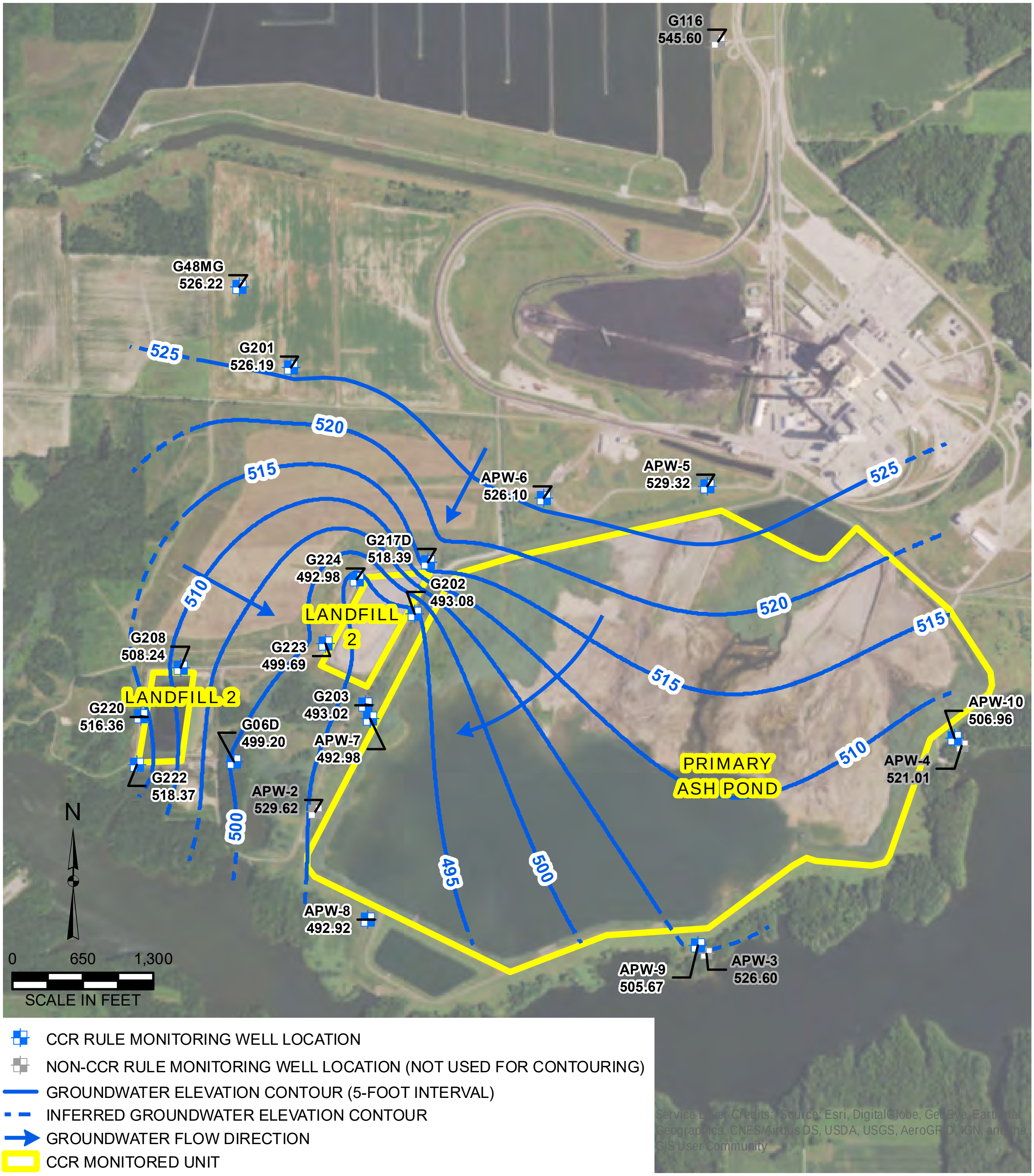

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REVIEWED BY/DATE:
TBN 3/6/17
APPROVED BY/DATE:
JJW 8/30/17

NEWTON PRIMARY ASH POND (UNIT ID: 501) AND LANDFILL 2 (UNIT ID: 502)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 6: JANUARY 16, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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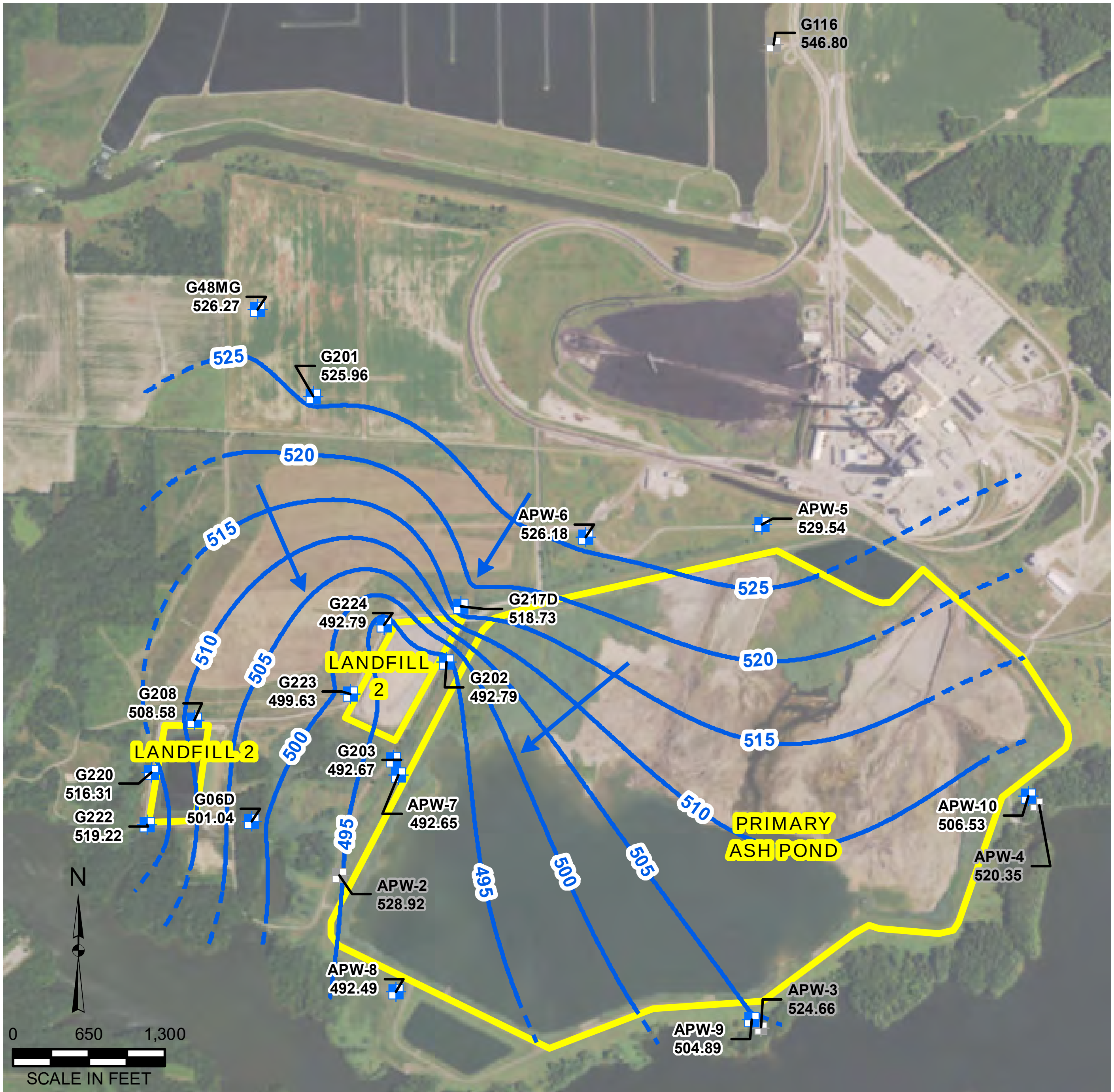

CCR RULE MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION (NOT USED FOR CONTOURING)
GROUNDWATER ELEVATION CONTOUR (5-FOOT INTERVAL)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR MONITORED UNIT

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DRAWN BY/DATE:
SDS 7/10/17
REVIEWED BY/DATE:
TBN 7/10/17
APPROVED BY/DATE:
JJW 8/30/17

NEWTON PRIMARY ASH POND (UNIT ID: 501) AND LANDFILL 2 (UNIT ID: 502)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 7: APRIL 17, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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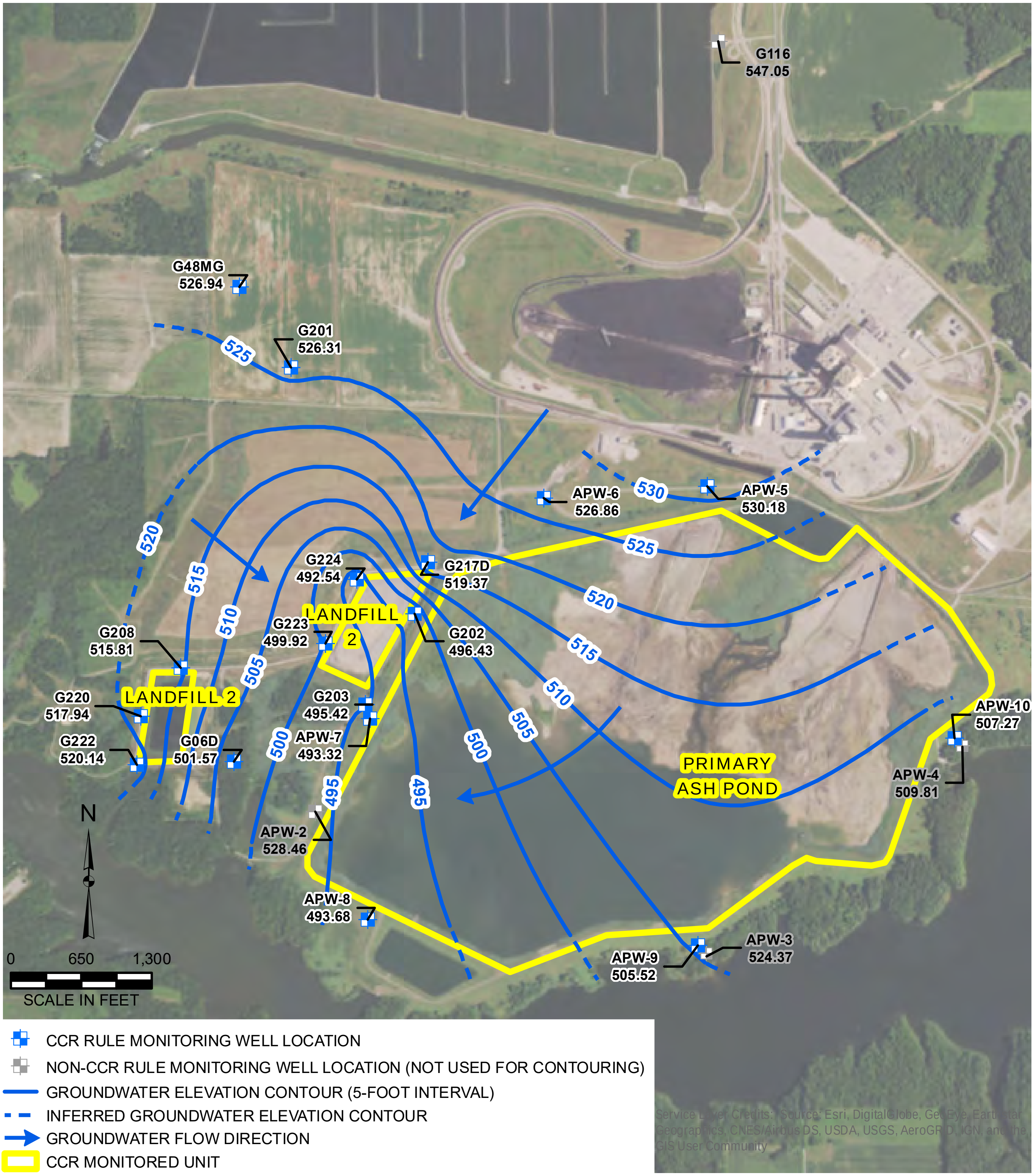

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REVIEWED BY/DATE:
TBN 8/12/17
APPROVED BY/DATE:
JJW 8/30/17

NEWTON PRIMARY ASH POND (UNIT ID: 501) AND LANDFILL 2 (UNIT ID: 502)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 8: JUNE 12, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

NEWTON PRIMARY ASH POND (UNIT ID: 501)
AND LANDFILL 2 (UNIT ID: 502)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 14, 2017

CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW

CCR MONITORED UNIT

NEWTON PRIMARY ASH POND (UNIT ID: 501)
AND LANDFILL 2 (UNIT ID: 502)
GROUNDWATER ELEVATION CONTOUR MAP
MAY 17, 2018

CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

8/14/2020 12:15:54 AM

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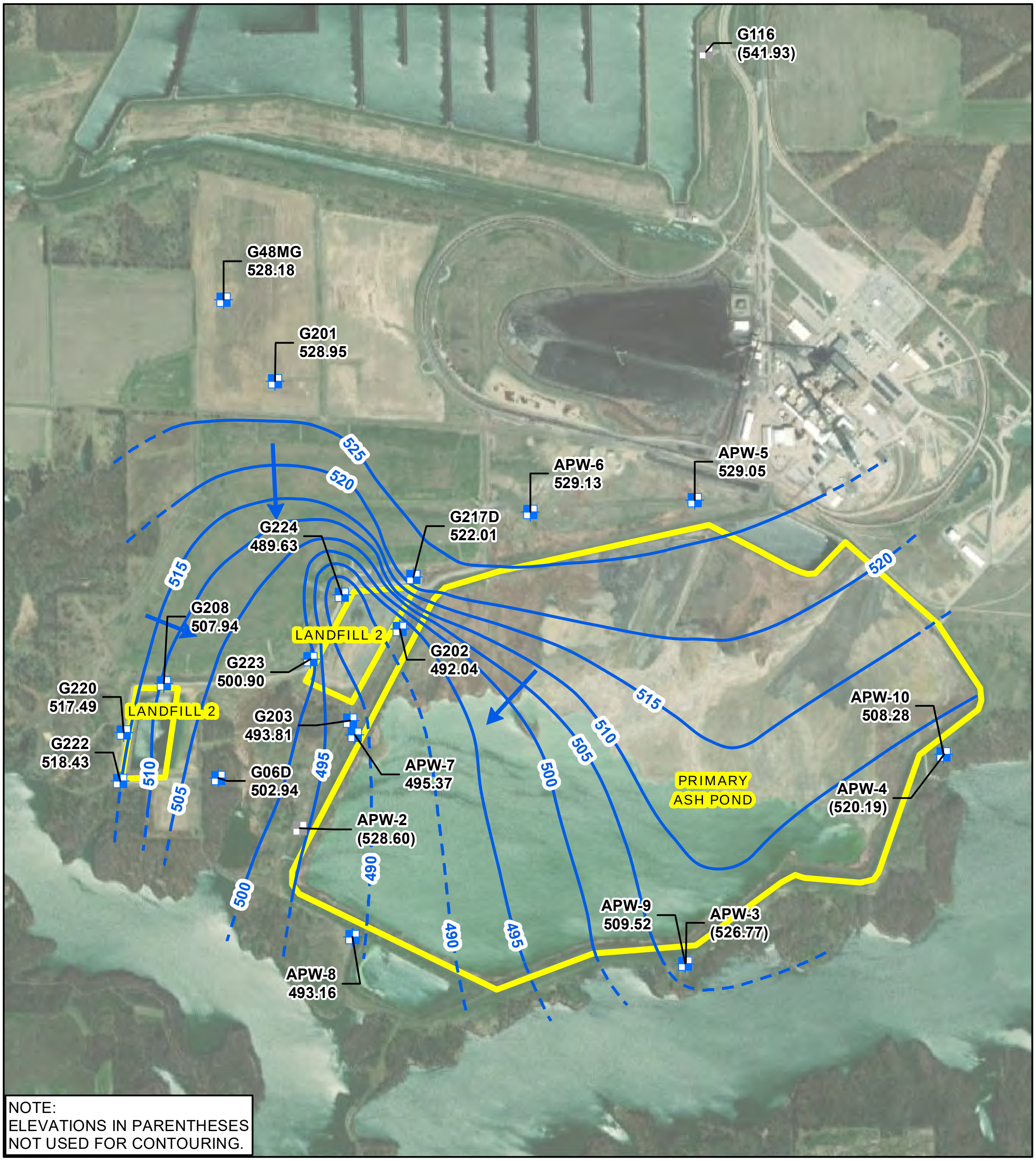


CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW

CCR MONITORED UNIT

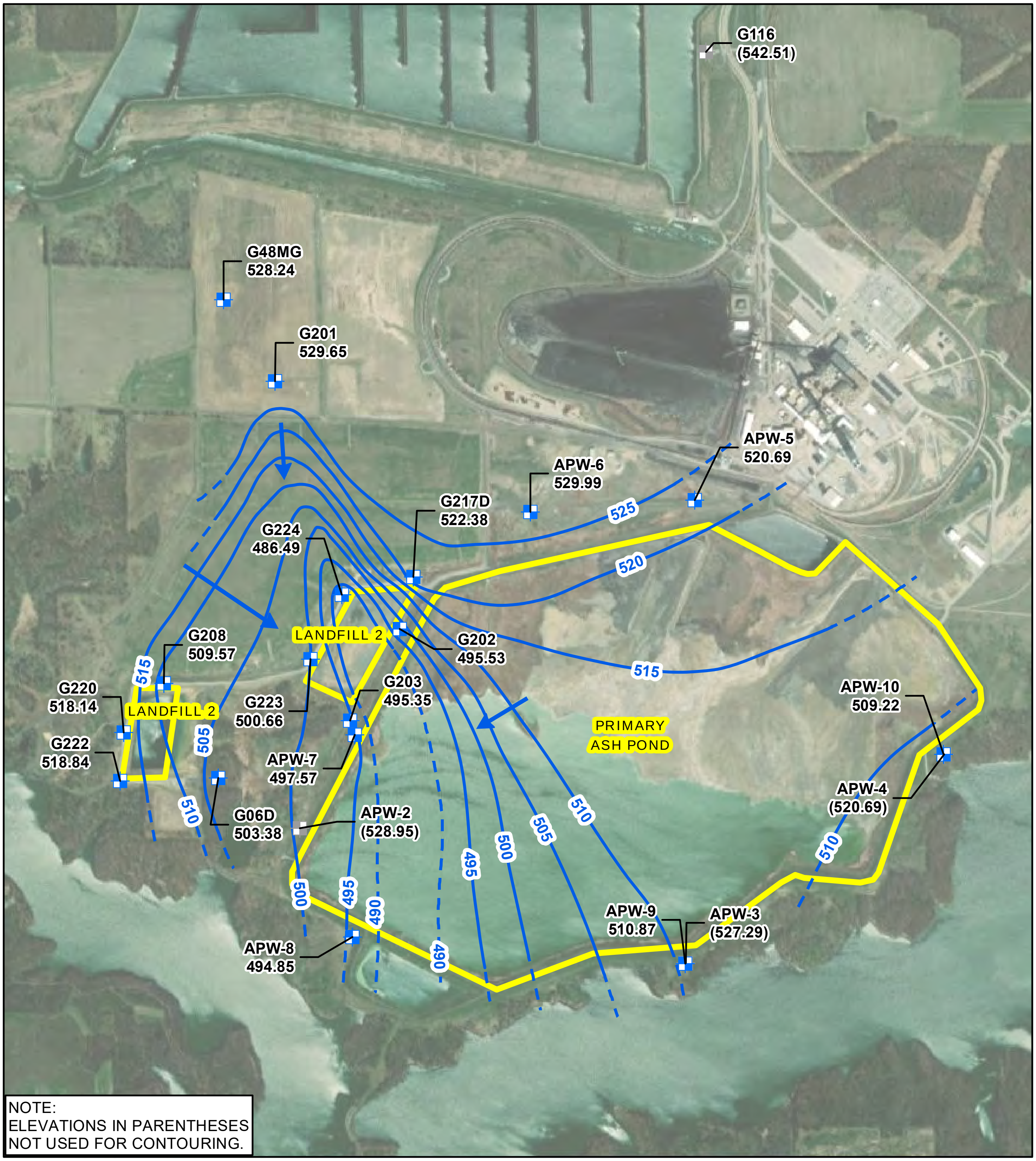
NEWTON PRIMARY ASH POND (UNIT ID: 501)
AND LANDFILL 2 (UNIT ID: 502)
GROUNDWATER ELEVATION CONTOUR MAP
AUGUST 14, 2018

CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

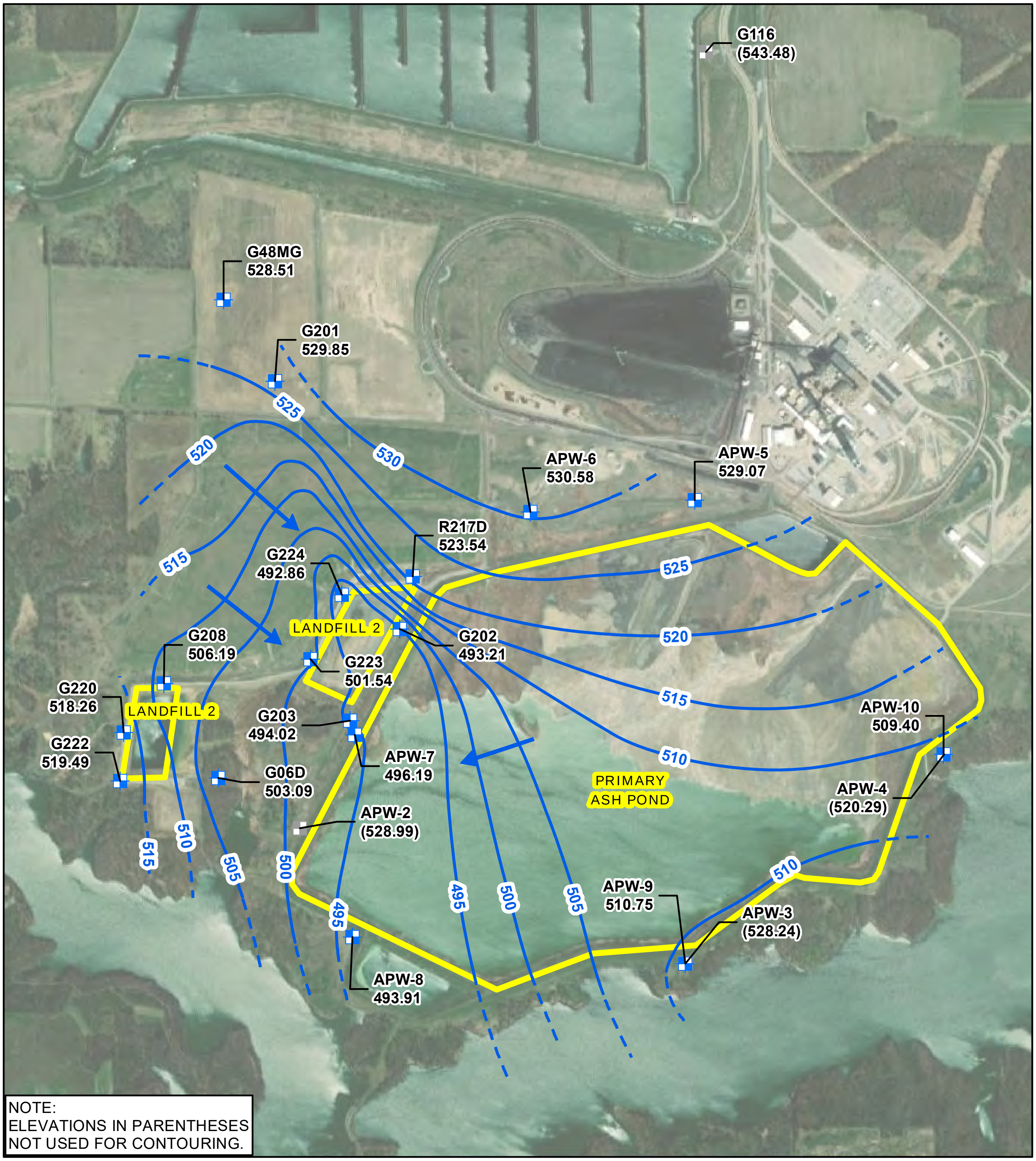
NEWTON PRIMARY ASH POND (UNIT ID: 501)
AND LANDFILL 2 (UNIT ID: 502)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 8, 2018

CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

N

0 325 650 1,300
Feet

O'BRIEN & GERE ENGINEERS, INC.



CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

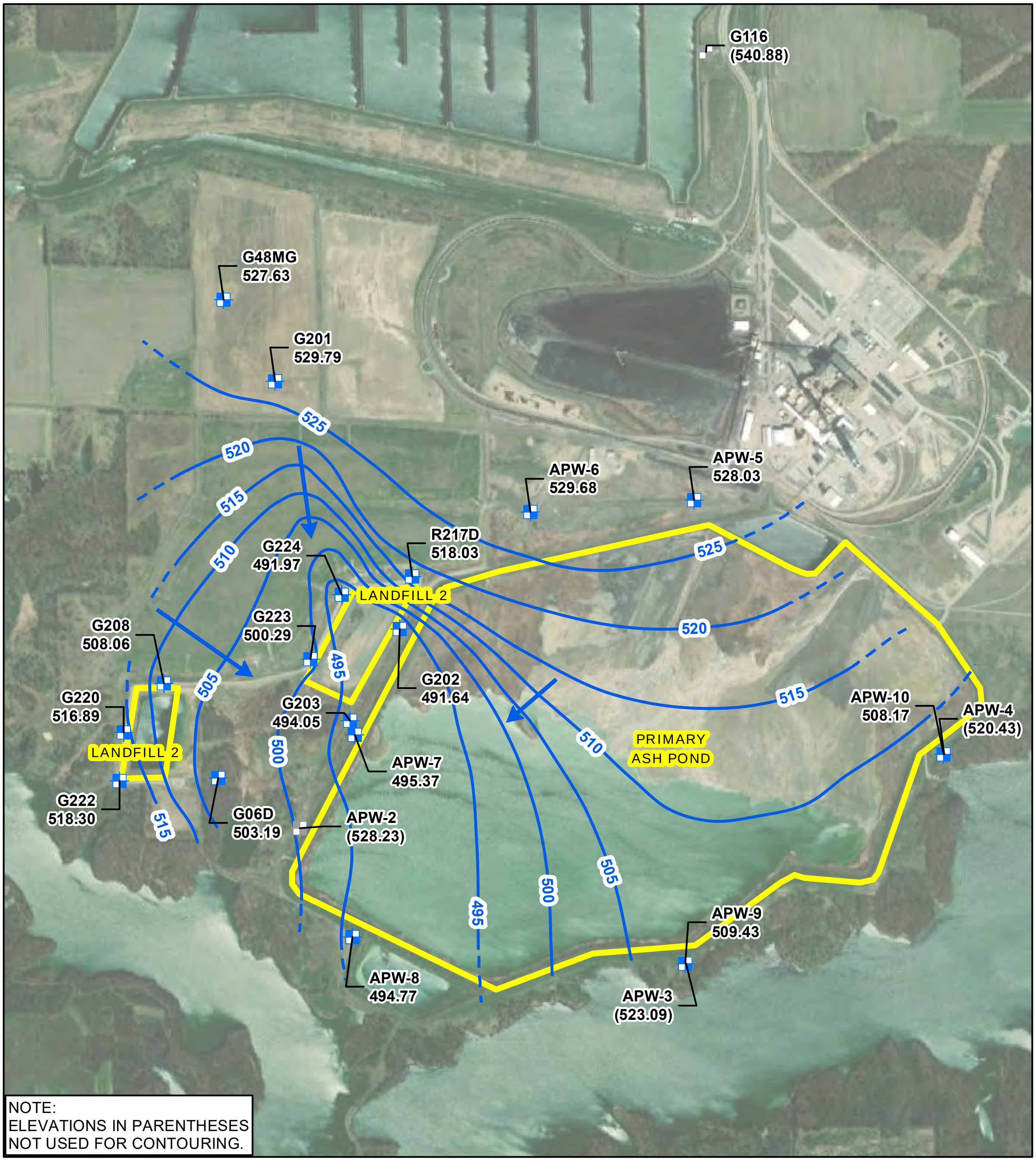
NEWTON PRIMARY ASH POND (UNIT ID: 501) AND LANDFILL 2 (UNIT ID: 502) GROUNDWATER ELEVATION CONTOUR MAP FEBRUARY 18, 2019

CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

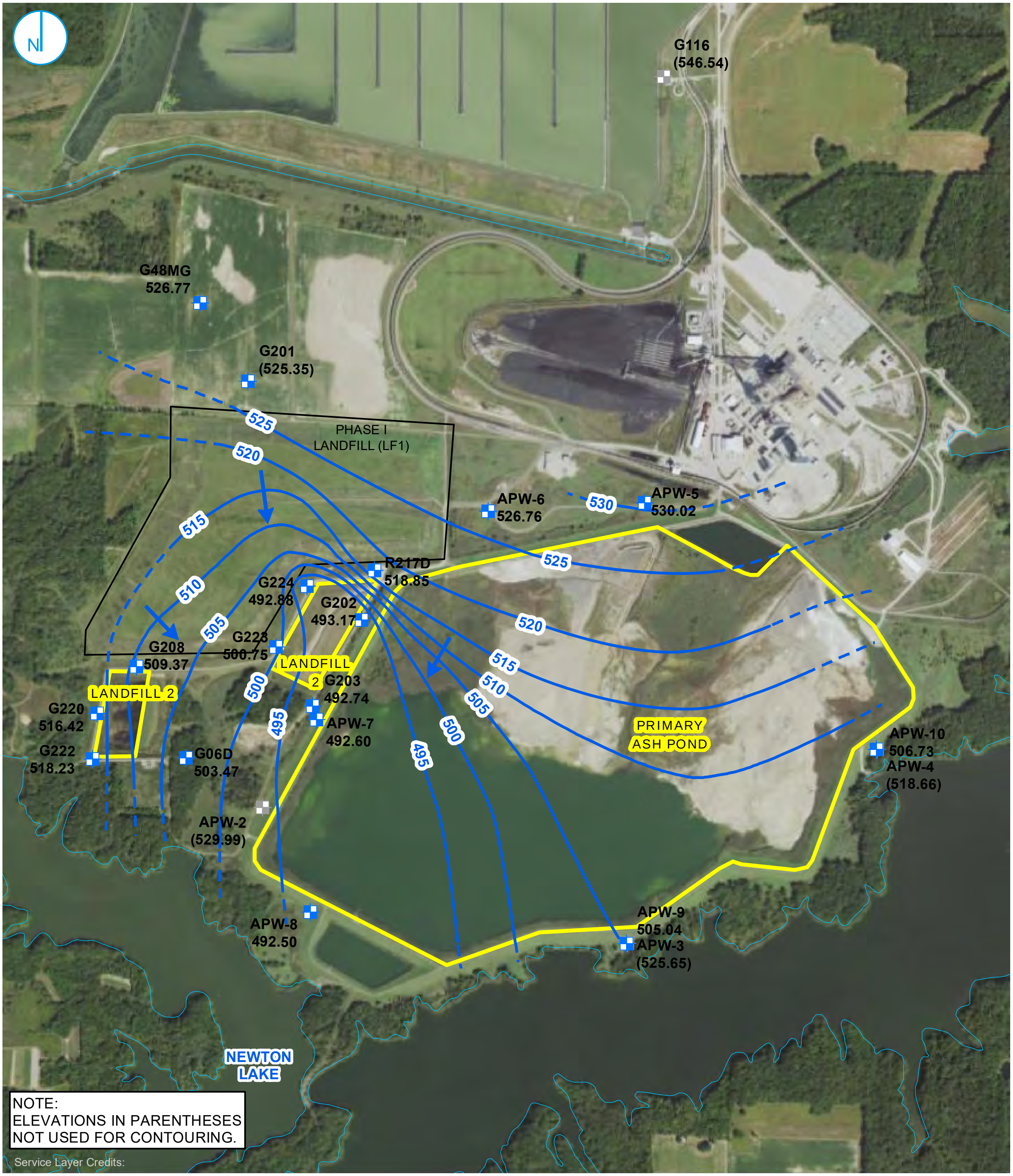
NEWTON PRIMARY ASH POND (UNIT ID: 501)
AND LANDFILL 2 (UNIT ID: 502)
GROUNDWATER ELEVATION CONTOUR MAP
AUGUST 21, 2019

CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



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PROJECT: 169000XXXX | DATED: 8/14/2020 | DESIGNER: STOLZSD

CCR RULE MONITORING WELL
NON-CCR RULE MONITORING WELL
GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
SURFACE WATER FEATURE
CCR MONITORED UNIT
NON-CCR UNIT

0 650 1,300 Feet

GROUNDWATER ELEVATION CONTOUR MAP
FEBRUARY 3, 2020

NEWTON PRIMARY ASH POND (UNIT ID: 501) AND LANDFILL 2 (UNIT ID: 502)
NEWTON POWER STATION
NEWTON, ILLINOIS

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

TABLE E-1. GROUNDWATER ELEVATION RESULTS

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
APW02	10/07/2015	524.93
APW02	12/14/2015	528.13
APW02	07/25/2016	527.99
APW02	10/17/2016	526.80
APW02	01/16/2017	529.62
APW02	04/17/2017	528.92
APW02	06/12/2017	528.46
APW02	11/14/2017	528.98
APW02	05/17/2018	529.03
APW02	08/14/2018	528.60
APW02	11/08/2018	528.95
APW02	02/18/2019	528.99
APW02	08/21/2019	528.23
APW02	02/03/2020	529.99
APW02	07/27/2020	529.01
APW02	10/22/2020	528.20
APW02	02/04/2021	530.41
APW02	02/15/2021	529.17
APW02	02/17/2021	529.17
APW02	03/09/2021	529.13
APW02	03/10/2021	529.13
APW02	03/29/2021	529.99
APW02	03/30/2021	529.99
APW02	04/27/2021	528.63
APW02	04/29/2021	529.37
APW02	05/24/2021	528.50
APW02	05/25/2021	528.49
APW02	06/15/2021	528.15
APW02	06/16/2021	528.15
APW02	06/24/2021	527.93
APW02	06/30/2021	526.56
APW02	07/14/2021	528.58
APW02	07/15/2021	528.53
APW02	08/02/2021	528.44
APW03	10/07/2015	520.82
APW03	12/14/2015	525.99
APW03	10/17/2016	523.69
APW03	01/16/2017	526.60
APW03	04/17/2017	524.66
APW03	06/12/2017	524.37
APW03	07/25/2017	523.27
APW03	11/14/2017	526.05
APW03	05/17/2018	526.06
APW03	08/14/2018	526.77
APW03	11/08/2018	527.29

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TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
APW03	02/18/2019	528.24
APW03	08/21/2019	523.09
APW03	02/03/2020	525.65
APW03	07/27/2020	525.19
APW03	10/22/2020	523.49
APW03	02/04/2021	526.54
APW03	02/15/2021	523.58
APW03	02/18/2021	523.58
APW03	03/09/2021	524.93
APW03	03/10/2021	524.93
APW03	03/29/2021	526.00
APW03	03/31/2021	526.00
APW03	04/27/2021	524.25
APW03	04/29/2021	524.93
APW03	05/25/2021	523.85
APW03	06/15/2021	523.41
APW03	06/17/2021	523.41
APW03	06/24/2021	523.18
APW03	06/30/2021	523.07
APW03	07/14/2021	523.70
APW03	07/15/2021	523.71
APW03	08/02/2021	523.92
APW04	10/07/2015	518.82
APW04	12/14/2015	521.12
APW04	10/17/2016	520.51
APW04	01/16/2017	521.01
APW04	04/17/2017	520.35
APW04	06/12/2017	509.81
APW04	07/25/2017	520.51
APW04	11/14/2017	520.31
APW04	05/17/2018	520.07
APW04	08/14/2018	520.19
APW04	11/08/2018	520.69
APW04	02/18/2019	520.29
APW04	08/21/2019	520.43
APW04	02/03/2020	518.66
APW04	07/27/2020	520.41
APW04	10/22/2020	520.08
APW04	02/04/2021	520.64
APW04	02/15/2021	518.19
APW04	02/18/2021	518.19
APW04	03/09/2021	519.50
APW04	03/11/2021	519.50
APW04	03/29/2021	520.34
APW04	03/31/2021	520.34

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
APW04	04/27/2021	519.87
APW04	04/29/2021	520.51
APW04	05/24/2021	519.72
APW04	05/25/2021	519.73
APW04	06/15/2021	519.68
APW04	06/17/2021	519.71
APW04	06/24/2021	519.64
APW04	06/30/2021	519.69
APW04	07/14/2021	519.99
APW04	07/15/2021	520.02
APW04	08/02/2021	520.00
APW05	12/14/2015	529.56
APW05	01/18/2016	528.57
APW05	04/25/2016	529.55
APW05	07/25/2016	529.34
APW05	10/17/2016	529.08
APW05	01/16/2017	529.32
APW05	04/17/2017	529.54
APW05	06/12/2017	530.18
APW05	11/14/2017	528.57
APW05	05/17/2018	529.06
APW05	08/14/2018	529.05
APW05	11/08/2018	530.19
APW05	02/18/2019	529.07
APW05	08/21/2019	528.03
APW05	02/03/2020	530.02
APW05	06/11/2020	529.71
APW05	07/27/2020	529.77
APW05	10/22/2020	529.54
APW05	02/04/2021	530.11
APW05	02/09/2021	530.11
APW05	02/15/2021	529.83
APW05	02/17/2021	529.83
APW05	03/09/2021	529.61
APW05	03/10/2021	529.61
APW05	03/29/2021	529.68
APW05	03/30/2021	529.68
APW05	04/27/2021	529.73
APW05	04/28/2021	529.72
APW05	05/24/2021	530.82
APW05	05/25/2021	529.51
APW05	06/15/2021	529.42
APW05	06/17/2021	529.43
APW05	06/24/2021	529.38
APW05	06/30/2021	529.38

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TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
APW05	07/14/2021	529.33
APW05	07/15/2021	529.40
APW05	08/02/2021	529.28
APW05S	02/04/2021	534.37
APW05S	02/15/2021	533.90
APW05S	02/17/2021	533.90
APW05S	03/09/2021	533.71
APW05S	03/10/2021	533.71
APW05S	03/29/2021	533.91
APW05S	04/27/2021	533.56
APW05S	04/29/2021	533.74
APW05S	05/25/2021	533.23
APW05S	06/15/2021	532.54
APW05S	06/17/2021	532.53
APW05S	06/24/2021	531.93
APW05S	06/30/2021	531.68
APW05S	07/14/2021	532.16
APW05S	07/15/2021	532.31
APW06	12/14/2015	526.14
APW06	01/18/2016	527.46
APW06	04/25/2016	526.59
APW06	07/25/2016	526.20
APW06	10/17/2016	526.05
APW06	01/16/2017	526.10
APW06	04/17/2017	526.18
APW06	06/12/2017	526.86
APW06	11/14/2017	525.40
APW06	05/17/2018	526.39
APW06	08/14/2018	529.13
APW06	11/08/2018	529.99
APW06	02/18/2019	530.58
APW06	08/21/2019	529.68
APW06	02/03/2020	526.76
APW06	06/11/2020	526.74
APW06	07/27/2020	526.78
APW06	10/22/2020	526.37
APW06	02/04/2021	526.82
APW06	02/09/2021	526.82
APW06	02/15/2021	526.48
APW06	02/17/2021	526.48
APW06	03/09/2021	526.46
APW06	03/10/2021	526.46
APW06	03/29/2021	526.49
APW06	03/30/2021	526.49
APW06	04/27/2021	526.68

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TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
APW06	04/29/2021	526.90
APW06	05/24/2021	537.51
APW06	05/25/2021	526.54
APW06	06/15/2021	526.45
APW06	06/16/2021	526.45
APW06	06/24/2021	526.42
APW06	06/30/2021	526.38
APW06	07/14/2021	526.31
APW06	07/15/2021	526.41
APW06	08/02/2021	526.31
APW07	12/14/2015	492.84
APW07	01/18/2016	492.58
APW07	04/25/2016	493.11
APW07	07/25/2016	492.64
APW07	10/17/2016	492.46
APW07	01/16/2017	492.98
APW07	04/17/2017	492.65
APW07	06/12/2017	493.32
APW07	11/14/2017	491.34
APW07	05/17/2018	491.73
APW07	08/14/2018	495.37
APW07	11/08/2018	497.57
APW07	02/18/2019	496.19
APW07	08/21/2019	495.37
APW07	02/03/2020	492.60
APW07	06/11/2020	491.90
APW07	07/27/2020	491.97
APW07	10/22/2020	491.50
APW07	02/04/2021	492.72
APW07	02/10/2021	492.72
APW07	02/15/2021	492.16
APW07	03/09/2021	491.93
APW07	03/29/2021	492.17
APW07	04/27/2021	492.19
APW07	05/24/2021	491.88
APW07	06/15/2021	491.85
APW07	06/24/2021	491.75
APW07	07/14/2021	491.77
APW07	08/02/2021	492.27
APW08	12/14/2015	492.72
APW08	01/18/2016	492.35
APW08	04/25/2016	492.97
APW08	07/25/2016	492.14
APW08	10/17/2016	492.18
APW08	01/16/2017	492.92

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
APW08	04/17/2017	492.49
APW08	06/12/2017	493.68
APW08	11/14/2017	491.77
APW08	05/17/2018	492.22
APW08	08/14/2018	493.16
APW08	11/08/2018	494.85
APW08	02/18/2019	493.91
APW08	08/21/2019	494.77
APW08	02/03/2020	492.50
APW08	06/11/2020	491.65
APW08	07/27/2020	491.82
APW08	10/22/2020	491.28
APW08	02/04/2021	492.46
APW08	02/10/2021	492.46
APW08	02/15/2021	491.90
APW08	03/09/2021	491.72
APW08	03/29/2021	491.93
APW08	04/27/2021	491.98
APW08	05/24/2021	491.68
APW08	06/15/2021	491.64
APW08	06/24/2021	491.56
APW08	07/14/2021	491.61
APW08	08/02/2021	491.59
APW09	12/14/2015	504.88
APW09	01/18/2016	506.59
APW09	04/25/2016	505.32
APW09	07/25/2016	504.70
APW09	10/17/2016	503.44
APW09	01/16/2017	505.67
APW09	04/17/2017	504.89
APW09	06/12/2017	505.52
APW09	11/14/2017	504.77
APW09	05/17/2018	505.34
APW09	08/14/2018	509.52
APW09	11/08/2018	510.87
APW09	02/18/2019	510.75
APW09	08/21/2019	509.43
APW09	02/03/2020	505.04
APW09	06/11/2020	504.64
APW09	07/27/2020	505.31
APW09	10/22/2020	503.83
APW09	02/04/2021	505.69
APW09	02/11/2021	505.69
APW09	02/15/2021	504.93
APW09	03/09/2021	505.10

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
APW09	03/29/2021	505.23
APW09	04/27/2021	504.74
APW09	05/24/2021	504.72
APW09	06/15/2021	504.63
APW09	06/24/2021	504.48
APW09	07/14/2021	505.24
APW09	08/02/2021	504.77
APW10	12/14/2015	506.39
APW10	01/18/2016	507.70
APW10	04/25/2016	506.90
APW10	07/25/2016	506.19
APW10	10/17/2016	505.06
APW10	01/16/2017	506.96
APW10	04/17/2017	506.53
APW10	06/12/2017	507.27
APW10	11/14/2017	506.18
APW10	05/17/2018	506.25
APW10	08/14/2018	508.28
APW10	11/08/2018	509.22
APW10	02/18/2019	509.40
APW10	08/21/2019	508.17
APW10	02/03/2020	506.73
APW10	06/11/2020	506.31
APW10	07/27/2020	506.76
APW10	10/22/2020	505.44
APW10	02/04/2021	507.12
APW10	02/11/2021	507.12
APW10	02/15/2021	506.65
APW10	03/09/2021	506.84
APW10	03/29/2021	506.94
APW10	04/27/2021	506.53
APW10	05/24/2021	506.35
APW10	06/15/2021	506.26
APW10	06/17/2021	506.31
APW10	06/24/2021	506.12
APW10	06/30/2021	506.05
APW10	07/14/2021	506.59
APW10	07/29/2021	506.48
APW10	08/02/2021	506.37
APW11	02/04/2021	514.71
APW11	02/15/2021	514.13
APW11	02/18/2021	514.13
APW11	03/09/2021	514.49
APW11	03/29/2021	514.55
APW11	04/27/2021	487.33

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TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
APW11	04/28/2021	514.50
APW11	05/24/2021	514.16
APW11	06/15/2021	514.02
APW11	06/16/2021	514.02
APW11	06/24/2021	513.90
APW11	06/30/2021	513.86
APW11	07/14/2021	513.96
APW11	07/15/2021	514.00
APW12	02/04/2021	533.12
APW12	02/15/2021	532.41
APW12	02/17/2021	532.41
APW12	03/09/2021	532.48
APW12	03/29/2021	532.91
APW12	04/27/2021	532.12
APW12	04/28/2021	532.31
APW12	05/24/2021	531.87
APW12	05/25/2021	531.82
APW12	06/15/2021	531.53
APW12	06/16/2021	528.83
APW12	06/24/2021	531.37
APW12	06/30/2021	531.28
APW12	07/14/2021	531.29
APW12	07/15/2021	531.34
APW13	02/04/2021	506.52
APW13	02/15/2021	505.94
APW13	02/22/2021	505.94
APW13	03/09/2021	506.06
APW13	03/10/2021	506.06
APW13	03/29/2021	506.10
APW13	03/31/2021	506.10
APW13	04/27/2021	505.69
APW13	04/29/2021	505.97
APW13	05/24/2021	505.62
APW13	05/25/2021	505.78
APW13	06/15/2021	505.44
APW13	06/17/2021	505.44
APW13	06/24/2021	505.27
APW13	06/30/2021	505.20
APW13	07/14/2021	505.63
APW13	07/15/2021	505.73
APW14	02/04/2021	506.29
APW14	02/15/2021	505.55
APW14	02/22/2021	505.55
APW14	03/09/2021	505.69
APW14	03/10/2021	505.69

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
APW14	03/29/2021	505.76
APW14	03/31/2021	505.76
APW14	04/27/2021	505.29
APW14	04/28/2021	505.37
APW14	05/24/2021	505.30
APW14	05/25/2021	505.41
APW14	06/15/2021	514.14
APW14	06/17/2021	505.16
APW14	06/24/2021	505.00
APW14	06/30/2021	504.93
APW14	07/14/2021	505.62
APW14	07/15/2021	505.63
APW15	02/04/2021	500.60
APW15	02/15/2021	500.54
APW15	02/23/2021	500.54
APW15	03/09/2021	501.19
APW15	03/10/2021	501.19
APW15	03/29/2021	501.88
APW15	03/31/2021	501.88
APW15	04/27/2021	502.40
APW15	04/28/2021	502.44
APW15	05/24/2021	502.69
APW15	06/15/2021	502.71
APW15	06/17/2021	502.77
APW15	06/24/2021	502.75
APW15	06/30/2021	502.76
APW15	07/14/2021	502.81
APW16	02/04/2021	492.13
APW16	02/15/2021	491.48
APW16	02/23/2021	491.48
APW16	03/09/2021	491.41
APW16	03/10/2021	491.41
APW16	03/29/2021	491.62
APW16	03/30/2021	491.62
APW16	04/27/2021	491.49
APW16	04/28/2021	491.49
APW16	05/24/2021	491.29
APW16	06/15/2021	491.23
APW16	06/16/2021	491.23
APW16	06/24/2021	491.17
APW16	06/30/2021	491.06
APW16	07/14/2021	491.20
APW16	07/15/2021	491.21
APW17	02/04/2021	492.56
APW17	02/15/2021	492.02

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TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
APW17	02/23/2021	492.02
APW17	03/09/2021	491.74
APW17	03/10/2021	491.74
APW17	03/29/2021	491.95
APW17	03/30/2021	491.95
APW17	04/27/2021	491.87
APW17	04/29/2021	492.19
APW17	05/24/2021	491.69
APW17	06/15/2021	491.57
APW17	06/16/2021	491.57
APW17	06/24/2021	491.52
APW17	06/30/2021	491.42
APW17	07/14/2021	491.58
APW17	07/15/2021	491.59
APW18	02/04/2021	492.73
APW18	02/15/2021	492.20
APW18	02/23/2021	492.20
APW18	03/09/2021	491.92
APW18	03/10/2021	491.92
APW18	03/29/2021	492.14
APW18	03/30/2021	492.14
APW18	04/27/2021	492.06
APW18	04/29/2021	492.37
APW18	05/24/2021	491.97
APW18	06/15/2021	491.82
APW18	06/16/2021	491.84
APW18	06/24/2021	491.76
APW18	06/30/2021	491.67
APW18	07/14/2021	491.76
APW18	07/15/2021	491.85
G48MG	12/14/2015	526.29
G48MG	01/18/2016	525.50
G48MG	04/25/2016	526.21
G48MG	07/25/2016	526.09
G48MG	10/17/2016	526.34
G48MG	01/16/2017	526.22
G48MG	04/17/2017	526.27
G48MG	06/12/2017	526.94
G48MG	11/14/2017	525.55
G48MG	05/17/2018	527.32
G48MG	08/14/2018	528.18
G48MG	11/08/2018	528.24
G48MG	02/18/2019	528.51
G48MG	08/21/2019	527.63
G48MG	02/03/2020	526.77

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G48MG	06/11/2020	526.32
G48MG	07/27/2020	526.54
G48MG	10/22/2020	526.31
G48MG	02/04/2021	526.83
G48MG	02/10/2021	526.83
G48MG	02/15/2021	526.30
G48MG	03/09/2021	526.15
G48MG	03/29/2021	526.35
G48MG	04/27/2021	526.56
G48MG	05/24/2021	526.40
G48MG	06/15/2021	526.42
G48MG	06/24/2021	539.15
G48MG	07/14/2021	526.32
G48MG	08/02/2021	526.35
G202	01/14/2015	492.88
G202	04/21/2015	493.71
G202	07/15/2015	494.53
G202	10/06/2015	492.29
G202	12/14/2015	492.94
G202	01/18/2016	496.48
G202	01/20/2016	492.80
G202	04/25/2016	493.23
G202	04/28/2016	493.46
G202	07/25/2016	492.73
G202	07/27/2016	493.28
G202	10/17/2016	492.62
G202	10/19/2016	492.72
G202	01/16/2017	493.08
G202	01/18/2017	493.42
G202	04/17/2017	492.79
G202	04/20/2017	493.45
G202	06/12/2017	496.43
G202	08/02/2017	493.09
G202	11/14/2017	491.83
G202	11/15/2017	492.29
G202	02/22/2018	494.31
G202	05/17/2018	492.39
G202	05/23/2018	492.87
G202	08/14/2018	492.04
G202	08/21/2018	492.55
G202	11/08/2018	495.53
G202	11/14/2018	496.05
G202	02/18/2019	493.21
G202	02/21/2019	496.68
G202	05/21/2019	492.70

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G202	08/21/2019	491.64
G202	08/22/2019	492.13
G202	02/03/2020	493.17
G202	07/28/2020	492.09
G202	10/22/2020	491.67
G202	02/04/2021	492.90
G202	02/08/2021	492.85
G202	03/09/2021	492.08
G202	03/29/2021	492.47
G202	04/27/2021	492.30
G202	05/24/2021	502.48
G202	06/15/2021	492.01
G202	06/24/2021	491.99
G202	07/14/2021	492.05
G203	01/14/2015	492.91
G203	04/21/2015	493.70
G203	07/15/2015	494.18
G203	10/06/2015	506.02
G203	12/16/2015	492.72
G203	01/18/2016	495.02
G203	01/20/2016	492.74
G203	04/25/2016	493.16
G203	04/28/2016	493.44
G203	07/25/2016	492.66
G203	07/27/2016	493.17
G203	10/17/2016	492.49
G203	10/19/2016	492.64
G203	01/16/2017	493.02
G203	01/19/2017	493.56
G203	04/17/2017	492.67
G203	04/20/2017	493.31
G203	06/12/2017	495.42
G203	08/02/2017	492.96
G203	11/14/2017	490.99
G203	11/15/2017	491.46
G203	02/22/2018	496.37
G203	05/17/2018	492.26
G203	05/23/2018	492.73
G203	08/14/2018	493.81
G203	08/21/2018	494.30
G203	11/08/2018	495.35
G203	11/14/2018	496.00
G203	02/18/2019	494.02
G203	02/21/2019	494.50
G203	05/21/2019	493.10

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G203	08/21/2019	494.05
G203	08/22/2019	494.54
G203	02/03/2020	492.74
G203	05/21/2020	491.49
G203	07/27/2020	491.99
G203	10/22/2020	491.63
G203	02/04/2021	492.84
G203	02/08/2021	492.73
G203	03/09/2021	492.10
G203	03/29/2021	492.33
G203	05/24/2021	501.18
G203	06/15/2021	491.99
G203	06/24/2021	491.93
G203	07/14/2021	491.92
G203	08/02/2021	491.95
G208	01/14/2015	513.98
G208	04/21/2015	514.82
G208	07/15/2015	514.55
G208	10/06/2015	513.51
G208	12/14/2015	513.41
G208	01/18/2016	514.11
G208	01/19/2016	515.99
G208	04/25/2016	507.69
G208	04/28/2016	508.77
G208	07/25/2016	512.24
G208	07/29/2016	513.14
G208	10/17/2016	508.94
G208	10/25/2016	509.54
G208	01/16/2017	508.24
G208	01/24/2017	509.27
G208	04/17/2017	508.58
G208	04/20/2017	509.15
G208	06/12/2017	515.81
G208	08/03/2017	511.82
G208	11/14/2017	512.07
G208	11/17/2017	512.48
G208	02/22/2018	509.43
G208	05/17/2018	507.59
G208	05/23/2018	508.02
G208	08/14/2018	507.94
G208	08/20/2018	508.43
G208	11/08/2018	509.57
G208	11/13/2018	510.19
G208	02/18/2019	508.19
G208	02/20/2019	508.68

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TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G208	05/22/2019	509.50
G208	08/21/2019	508.06
G208	08/22/2019	508.55
G208	02/03/2020	509.37
G208	05/20/2020	510.57
G208	07/27/2020	508.69
G208	10/22/2020	509.96
G208	02/04/2021	509.91
G208	02/09/2021	509.82
G208	02/15/2021	504.88
G208	03/09/2021	528.57
G208	03/29/2021	509.53
G208	04/27/2021	510.25
G208	05/24/2021	510.44
G208	06/15/2021	506.19
G208	06/24/2021	507.44
G208	07/14/2021	508.84
G208	08/02/2021	509.68
G217S	01/14/2015	531.59
G217S	04/21/2015	532.93
G217S	07/14/2015	528.58
G217S	10/07/2015	530.44
G217S	01/20/2016	531.63
G217S	04/26/2016	532.84
G217S	07/26/2016	531.14
G217S	10/19/2016	530.90
G217S	01/18/2017	531.47
G217S	04/18/2017	532.00
G217S	08/02/2017	531.46
G217S	11/28/2017	530.70
G217S	02/21/2018	533.36
G217S	05/23/2018	530.75
G217S	08/22/2018	533.49
G217S	11/16/2018	533.75
G217S	02/21/2019	535.19
G217S	05/23/2019	535.44
G217S	08/23/2019	530.94
G217S	07/27/2020	530.95
G217S	10/22/2020	530.14
G217S	02/04/2021	532.08
G217S	02/15/2021	531.41
G217S	03/09/2021	531.50
G217S	03/29/2021	532.14
G217S	04/27/2021	531.48
G217S	05/24/2021	531.26

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G217S	06/15/2021	531.16
G217S	06/24/2021	531.48
G217S	07/14/2021	530.77
G217S	08/02/2021	531.18
G217D	12/14/2015	518.26
G217D	01/18/2016	518.86
G217D	04/25/2016	518.70
G217D	07/25/2016	507.56
G217D	10/17/2016	518.30
G217D	01/16/2017	518.39
G217D	04/17/2017	518.73
G217D	06/12/2017	519.37
G222	01/14/2015	518.19
G222	04/21/2015	519.68
G222	07/15/2015	520.13
G222	10/06/2015	518.71
G222	12/14/2015	516.93
G222	01/18/2016	516.75
G222	01/19/2016	520.02
G222	04/25/2016	517.61
G222	04/28/2016	518.78
G222	07/25/2016	519.04
G222	07/28/2016	519.51
G222	10/17/2016	518.57
G222	10/25/2016	518.61
G222	01/16/2017	518.37
G222	01/24/2017	519.07
G222	04/17/2017	519.22
G222	04/25/2017	520.00
G222	06/12/2017	520.14
G222	08/02/2017	519.66
G222	11/14/2017	517.84
G222	11/15/2017	518.18
G222	02/20/2018	519.16
G222	05/17/2018	517.88
G222	05/22/2018	518.34
G222	08/14/2018	518.43
G222	08/16/2018	518.93
G222	11/08/2018	518.84
G222	11/12/2018	519.42
G222	02/18/2019	519.49
G222	02/20/2019	519.98
G222	05/22/2019	520.72
G222	08/21/2019	518.30
G222	02/03/2020	518.23

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G222	05/20/2020	520.24
G222	07/27/2020	519.20
G222	10/22/2020	518.18
G222	02/04/2021	518.42
G222	02/09/2021	518.33
G222	02/15/2021	517.25
G222	03/09/2021	518.78
G222	03/29/2021	519.17
G222	04/27/2021	519.73
G222	05/24/2021	519.66
G222	06/15/2021	519.44
G222	06/24/2021	519.57
G222	07/14/2021	519.45
G222	08/02/2021	519.09
G223	01/14/2015	499.35
G223	04/21/2015	500.45
G223	07/15/2015	499.77
G223	10/06/2015	500.15
G223	12/14/2015	500.21
G223	01/18/2016	498.87
G223	01/20/2016	499.89
G223	04/25/2016	499.88
G223	04/28/2016	500.33
G223	07/25/2016	499.69
G223	07/28/2016	500.65
G223	10/17/2016	499.99
G223	10/20/2016	500.21
G223	01/16/2017	499.69
G223	01/24/2017	500.40
G223	04/17/2017	499.63
G223	04/26/2017	500.80
G223	06/12/2017	499.92
G223	08/03/2017	500.40
G223	11/14/2017	498.51
G223	11/28/2017	498.95
G223	02/20/2018	502.87
G223	05/17/2018	499.01
G223	05/23/2018	495.64
G223	08/14/2018	500.90
G223	08/21/2018	501.42
G223	11/08/2018	500.66
G223	11/13/2018	501.54
G223	02/18/2019	501.54
G223	02/21/2019	502.05
G223	05/22/2019	504.22

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TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G223	08/21/2019	500.29
G223	08/22/2019	500.80
G223	02/03/2020	500.75
G223	05/20/2020	500.97
G223	07/27/2020	500.50
G223	10/22/2020	500.55
G223	02/04/2021	500.95
G223	02/08/2021	500.91
G223	02/15/2021	500.22
G223	03/09/2021	500.22
G223	03/29/2021	500.40
G223	04/27/2021	500.70
G223	05/24/2021	500.60
G223	06/15/2021	500.44
G223	06/24/2021	500.51
G223	07/14/2021	500.40
G223	08/02/2021	500.53
G224	01/14/2015	493.02
G224	04/21/2015	493.99
G224	07/14/2015	492.79
G224	10/06/2015	492.68
G224	12/14/2015	492.96
G224	01/18/2016	492.12
G224	01/21/2016	492.70
G224	04/25/2016	493.24
G224	04/28/2016	493.70
G224	07/25/2016	492.74
G224	07/28/2016	492.41
G224	10/17/2016	492.65
G224	10/20/2016	492.15
G224	01/16/2017	492.98
G224	01/24/2017	493.71
G224	04/17/2017	492.79
G224	04/20/2017	493.55
G224	06/12/2017	492.54
G224	08/02/2017	493.10
G224	11/14/2017	491.90
G224	11/15/2017	492.41
G224	02/20/2018	495.01
G224	05/17/2018	492.11
G224	05/23/2018	492.66
G224	08/14/2018	489.63
G224	08/21/2018	493.21
G224	11/08/2018	486.49
G224	11/15/2018	486.96

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G224	02/18/2019	492.86
G224	02/21/2019	493.43
G224	05/22/2019	493.43
G224	08/21/2019	491.97
G224	08/22/2019	492.46
G224	02/03/2020	492.88
G224	05/21/2020	492.78
G224	07/27/2020	492.11
G224	10/22/2020	491.63
G224	02/04/2021	492.84
G224	02/09/2021	492.80
G224	02/15/2021	492.16
G224	03/09/2021	492.07
G224	03/29/2021	492.33
G224	04/27/2021	492.31
G224	05/24/2021	492.04
G224	06/15/2021	492.04
G224	06/24/2021	491.99
G224	07/14/2021	491.99
G224	08/02/2021	491.95
R202	05/21/2020	492.85
R202	02/08/2021	493.31
R217D	11/14/2017	517.88
R217D	11/28/2017	518.07
R217D	02/21/2018	521.40
R217D	05/17/2018	517.74
R217D	05/23/2018	517.82
R217D	08/14/2018	522.01
R217D	08/22/2018	522.14
R217D	11/08/2018	522.38
R217D	11/16/2018	522.14
R217D	02/18/2019	523.54
R217D	02/21/2019	523.68
R217D	05/23/2019	527.35
R217D	08/21/2019	518.03
R217D	02/03/2020	518.85
R217D	05/20/2020	519.36
R217D	07/27/2020	518.82
R217D	10/22/2020	518.53
R217D	02/04/2021	518.79
R217D	02/08/2021	518.79
R217D	02/15/2021	518.70
R217D	03/09/2021	518.63
R217D	03/29/2021	518.82
R217D	04/27/2021	518.82

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
R217D	05/24/2021	518.68
R217D	06/15/2021	518.63
R217D	06/24/2021	518.61
R217D	07/14/2021	518.61
R217D	08/02/2021	518.56
XPW01	02/04/2021	546.73
XPW01	02/15/2021	539.56
XPW01	02/17/2021	539.56
XPW01	03/09/2021	539.75
XPW01	03/29/2021	539.85
XPW01	03/30/2021	539.85
XPW01	04/27/2021	539.38
XPW01	04/28/2021	539.31
XPW01	05/24/2021	539.26
XPW01	06/15/2021	539.65
XPW01	06/24/2021	539.35
XPW01	07/14/2021	539.85
XPW02	02/04/2021	546.49
XPW02	02/15/2021	546.49
XPW02	02/17/2021	546.49
XPW02	03/09/2021	545.83
XPW02	03/29/2021	546.69
XPW02	03/30/2021	546.69
XPW02	04/27/2021	545.15
XPW02	04/28/2021	545.14
XPW02	05/24/2021	545.92
XPW02	06/15/2021	545.31
XPW02	06/24/2021	544.91
XPW02	07/14/2021	545.96
XPW03	02/04/2021	544.43
XPW03	02/15/2021	544.13
XPW03	02/17/2021	544.13
XPW03	03/09/2021	544.28
XPW03	03/29/2021	544.16
XPW03	03/30/2021	544.16
XPW03	04/27/2021	543.39
XPW03	04/28/2021	543.43
XPW03	05/24/2021	543.77
XPW03	06/15/2021	543.43
XPW03	06/24/2021	543.31
XPW03	07/14/2021	543.99
XPW04	02/04/2021	542.52
XPW04	02/15/2021	542.21
XPW04	02/17/2021	542.21
XPW04	03/09/2021	542.30

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

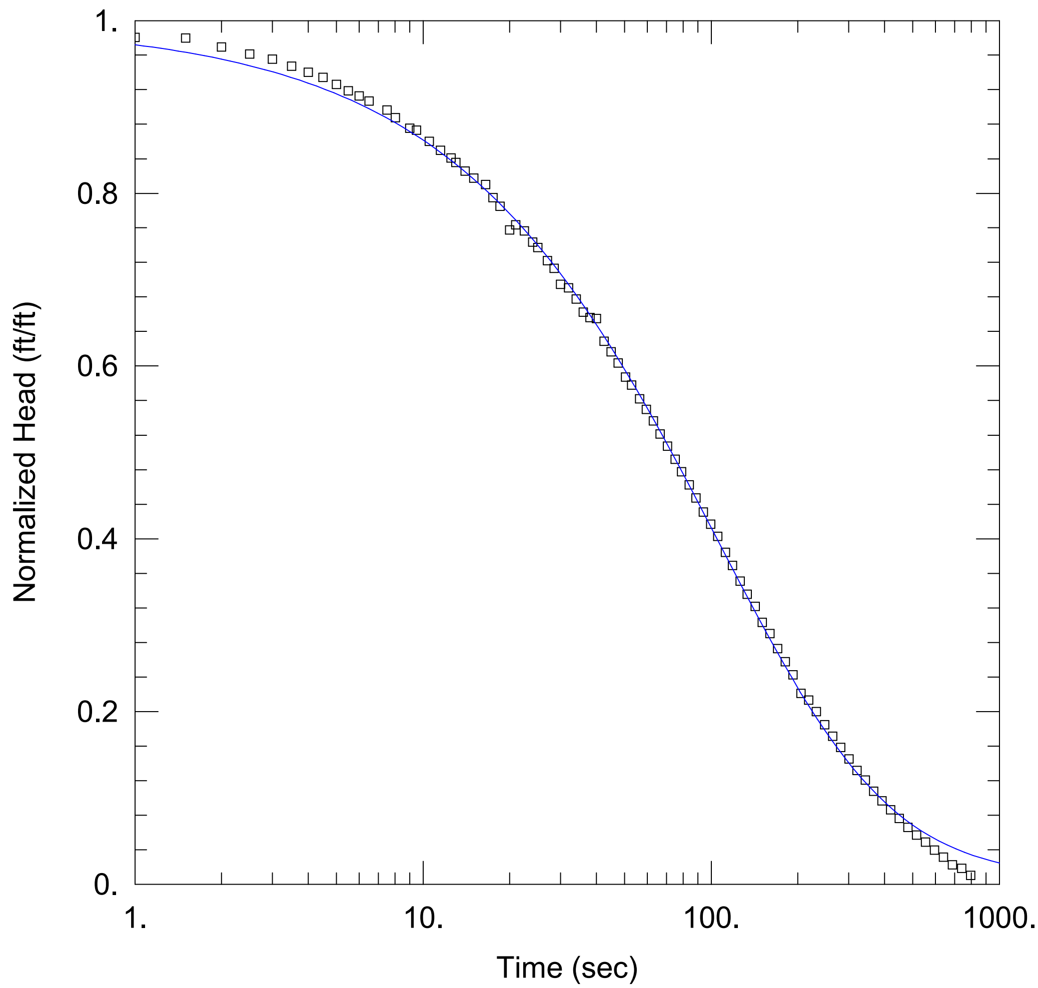
Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
XPW04	03/29/2021	542.33
XPW04	04/27/2021	541.98
XPW04	04/28/2021	542.03
XPW04	05/24/2021	542.03
XPW04	06/15/2021	541.91
XPW04	06/24/2021	541.80
XPW04	07/14/2021	542.27
XSG01	02/15/2021	536.17
XSG01	03/09/2021	536.17
XSG01	03/29/2021	536.17
XSG01	07/14/2021	535.40
SG02	02/15/2021	504.42
SG02	03/09/2021	504.84
SG02	03/29/2021	504.72

Notes:
ft NAVD88 = feet relative to the North American Vertical Datum 1988, GEOID 12A

generated 10/05/2021, 4:09:16 PM CDT

APPENDIX F
HYDRAULIC CONDUCTIVITY TEST DATA

2021 HYDRAULIC CONDUCTIVITY TEST DATA



APW-5S FH1

Data Set: \...\NEW_APW-5S FH1_07202021.aqt
Date: 10/21/21 Time: 14:56:12

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-5S
Test Date: 2/16/2021

AQUIFER DATA

Saturated Thickness: 3.2 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW-5S)

Initial Displacement: 0.986 ft
Total Well Penetration Depth: 3.2 ft
Casing Radius: 0.08625 ft
Static Water Column Height: 12.6 ft
Screen Length: 3.2 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

T = 0.087 cm^2/sec
S = 0.000403

SOLUTION

Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.087	cm^2/sec
S	0.000403	

K = T/b = 0.000892 cm/sec
Ss = S/b = 0.0001259 1/ft

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
T	0.08962	0.02397	+/- 0.04765	3.739	cm^2/sec

S	0.0003389	0.000496	+/- 0.0009861	0.6832

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

K = T/b = 0.0009188 cm/sec
Ss = S/b = 0.0001059 1/ft

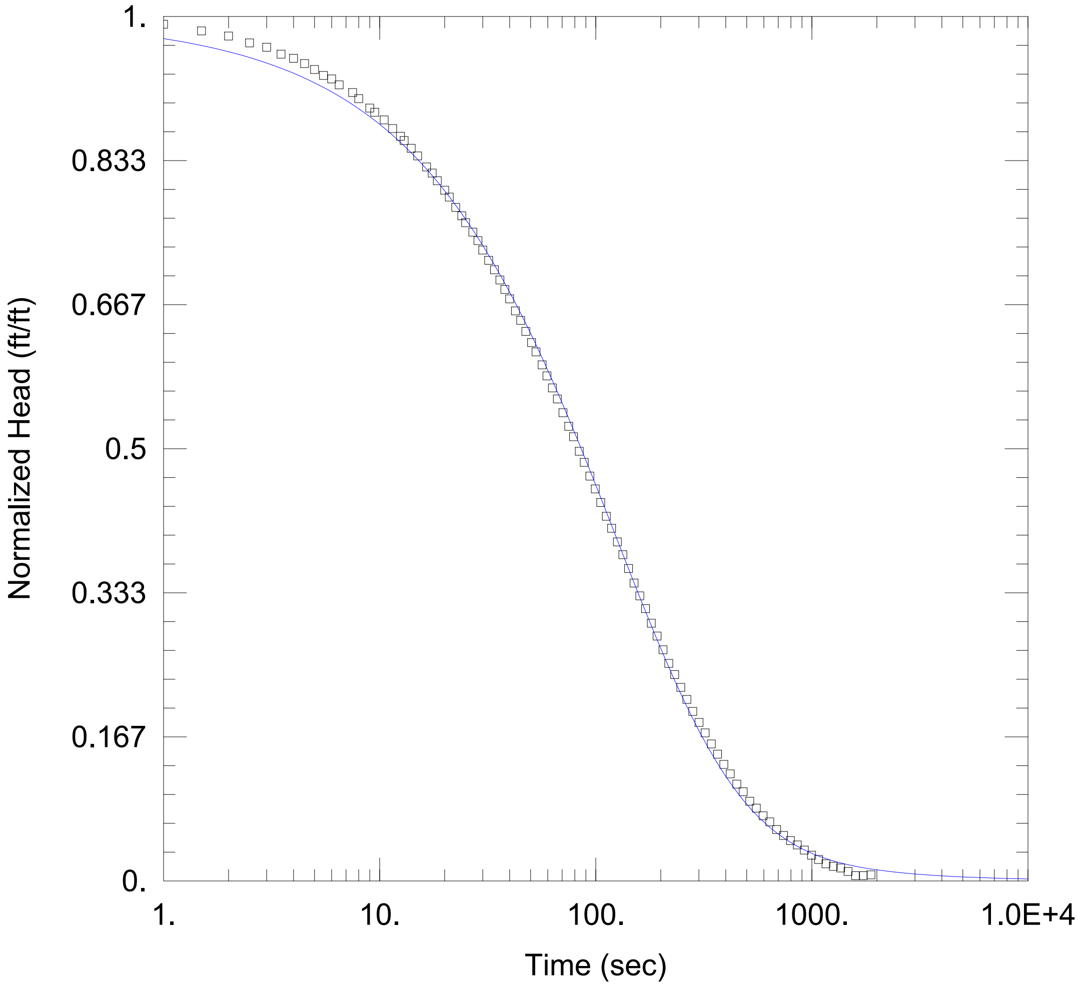
Parameter Correlations

	T	S
T	1.00	-0.97
S	-0.97	1.00

Residual Statistics

for weighted residuals

Sum of Squares ..... 0.9777 ft^2
Variance .... 0.01124 ft^2
Std. Deviation .... 0.106 ft
Mean .... 0.01073 ft
No. of Residuals..... 89
No. of Estimates..... 2



APW-5S FH2

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-5S
Test Date: 2/16/2021

AQUIFER DATA

Saturated Thickness: 3.2 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW-5S)

Initial Displacement: 1.01 ft
Total Well Penetration Depth: 3.2 ft
Casing Radius: 0.086 ft
Static Water Column Height: 12.6 ft
Screen Length: 3.2 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

T = 0.0718 cm^2/sec
S = 0.000454

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
21.	0.799	419.5	0.125
22.5	0.787	449.5	0.113
24.	0.777	481.5	0.104
25.	0.769	516.5	0.093
27.	0.758	554.	0.085
28.5	0.748	595.	0.076
30.	0.737	639.5	0.069
32.	0.725	687.5	0.06
34.	0.714	739.5	0.053
36.	0.702	796.	0.047
38.	0.691	857.5	0.042
40.	0.68	924.	0.036
42.5	0.666	997.	0.03
45.	0.655	1076.	0.025
47.5	0.642	1162.5	0.02
50.5	0.629	1257.	0.017
53.	0.618	1360.	0.015
56.5	0.603	1472.5	0.011
59.5	0.59	1595.5	0.006
63.	0.576	1730.	0.006
66.5	0.563	1877.5	0.007

SOLUTION

Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.0718	cm^2/sec
S	0.000454	

K = T/b = 0.0007361 cm/sec
Ss = S/b = 0.0001419 1/ft

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
T	0.07177	0.01724	+/- 0.03421	4.163	cm^2/sec
S	0.0004536	0.0005595	+/- 0.00111	0.8107	

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

K = T/b = 0.0007359 cm/sec
Ss = S/b = 0.0001418 1/ft

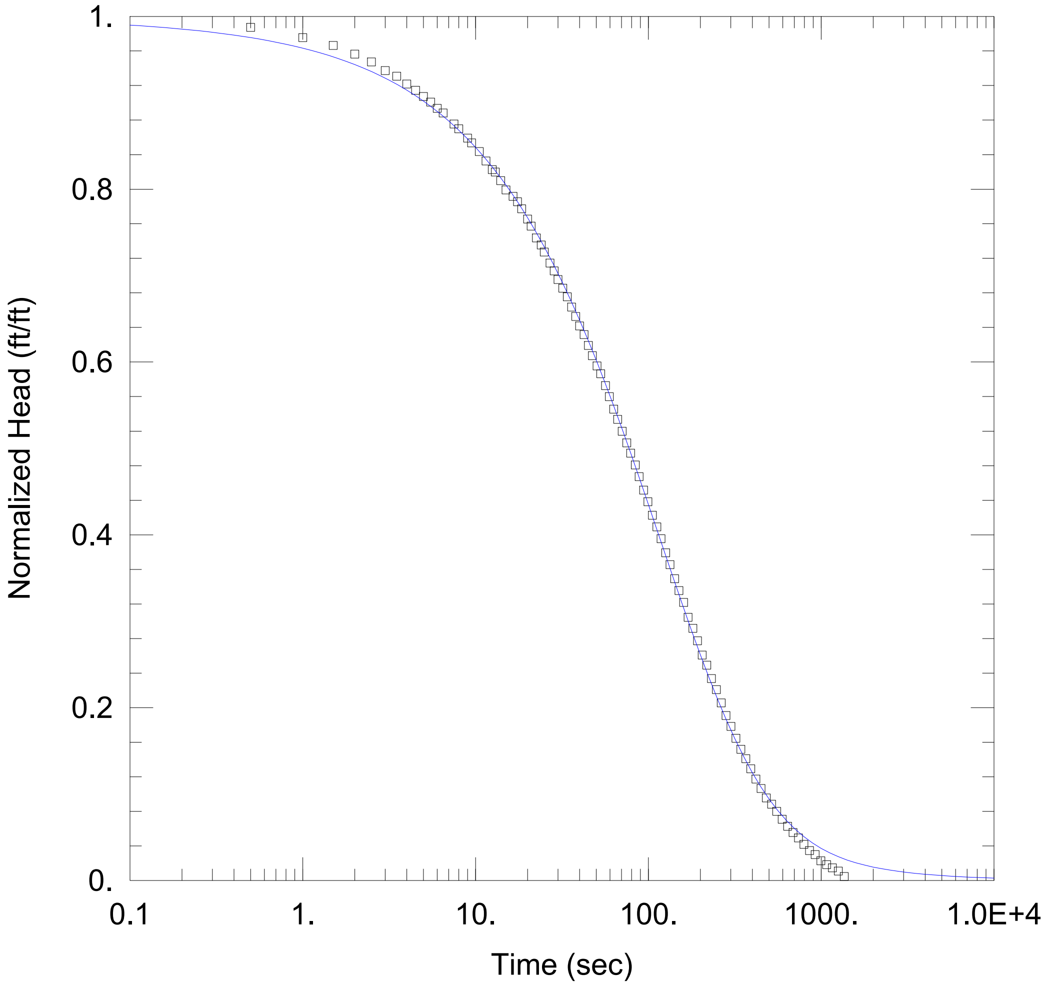
Parameter Correlations

	T	S
T	1.00	-0.97
S	-0.97	1.00

Residual Statistics

for weighted residuals

Sum of Squares . . . . . . 1.028 ft^2
Variance . . . . 0.01049 ft^2



APW-5S RH1

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-5S
Test Date: 2/16/2021

AQUIFER DATA

Saturated Thickness: 3.2 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW-5S)

Initial Displacement: 1.1 ft
Total Well Penetration Depth: 3.2 ft
Casing Radius: 0.08625 ft
Static Water Column Height: 12.6 ft
Screen Length: 3.2 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

T = 0.0591 cm^2/sec
S = 0.00178

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
20.	0.842	366.5	0.155
21.	0.833	392.	0.142
22.5	0.818	419.5	0.129
24.	0.809	449.5	0.117
25.	0.8	481.5	0.105
27.	0.786	516.5	0.097
28.5	0.776	554.	0.088
30.	0.765	595.	0.078
32.	0.754	639.5	0.069
34.	0.743	687.5	0.061
36.	0.73	739.5	0.054
38.	0.718	796.	0.046
40.	0.706	857.5	0.038
42.5	0.695	924.	0.033
45.	0.681	997.	0.025
47.5	0.668	1076.	0.02
50.5	0.655	1162.5	0.016
53.	0.645	1257.	0.012
56.5	0.63	1360.	0.005
59.5	0.616		

SOLUTION

Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.0591	cm^2/sec
S	0.00178	

K = T/b = 0.0006059 cm/sec
Ss = S/b = 0.0005562 1/ft

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
T	0.05907	0.01974	+/- 0.03919	2.992	cm^2/sec
S	0.001784	0.002265	+/- 0.004496	0.7877	

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

K = T/b = 0.0006056 cm/sec
Ss = S/b = 0.0005575 1/ft

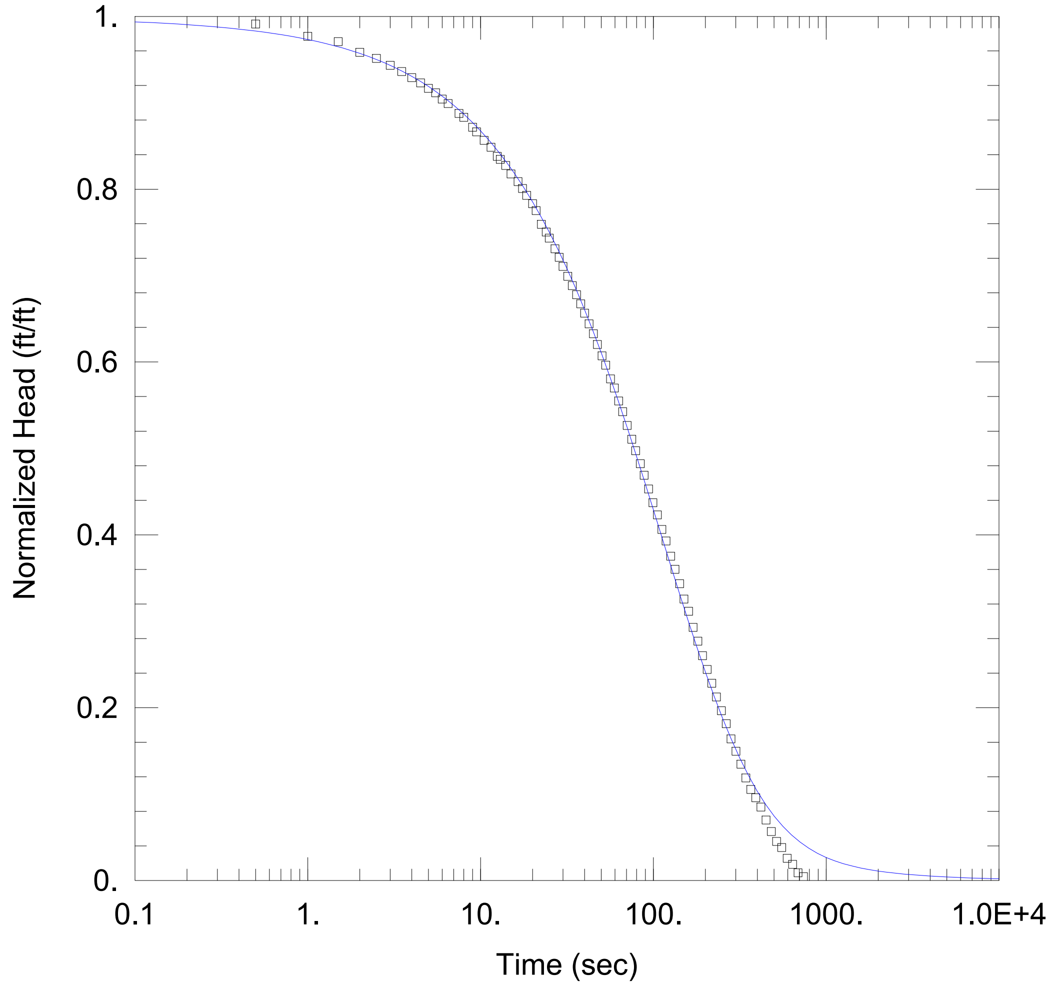
Parameter Correlations

	T	S
T	1.00	-0.96
S	-0.96	1.00

Residual Statistics

for weighted residuals

Sum of Squares . . . . . . 2.725 ft^2
Variance . . . . 0.02869 ft^2
Std. Deviation . . . . 0.1694 ft



APW-5S RH2

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-5S
Test Date: 2/16/2021

AQUIFER DATA

Saturated Thickness: 3.2 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW-5S)

Initial Displacement: 1.13 ft
Total Well Penetration Depth: 3.2 ft
Casing Radius: 0.08625 ft

Static Water Column Height: 12.6 ft
Screen Length: 3.2 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined

Solution Method: Cooper-Bredehoeft-Papadopulos

T = 0.0825 cm^2/sec

S = 0.000391

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
20.	0.885	281.5	0.185
21.	0.876	300.5	0.169
22.5	0.858	321.	0.152
24.	0.848	343.	0.134
25.	0.84	366.5	0.119
27.	0.826	392.	0.108
28.5	0.815	419.5	0.096
30.	0.803	449.5	0.079
32.	0.79	481.5	0.064
34.	0.778	516.5	0.051
36.	0.766	554.	0.043
38.	0.754	595.	0.029
40.	0.742	639.5	0.021
42.5	0.728	687.5	0.01
45.	0.715	739.5	0.005
47.5	0.701		

SOLUTION

Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.0825	cm^2/sec
S	0.000391	

K = T/b = 0.0008458 cm/sec
Ss = S/b = 0.0001222 1/ft

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
T	0.08245	0.03155	+/- 0.06271	2.614	cm^2/sec
S	0.0003915	0.0007946	+/- 0.00158	0.4927	

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

K = T/b = 0.0008454 cm/sec
Ss = S/b = 0.0001223 1/ft

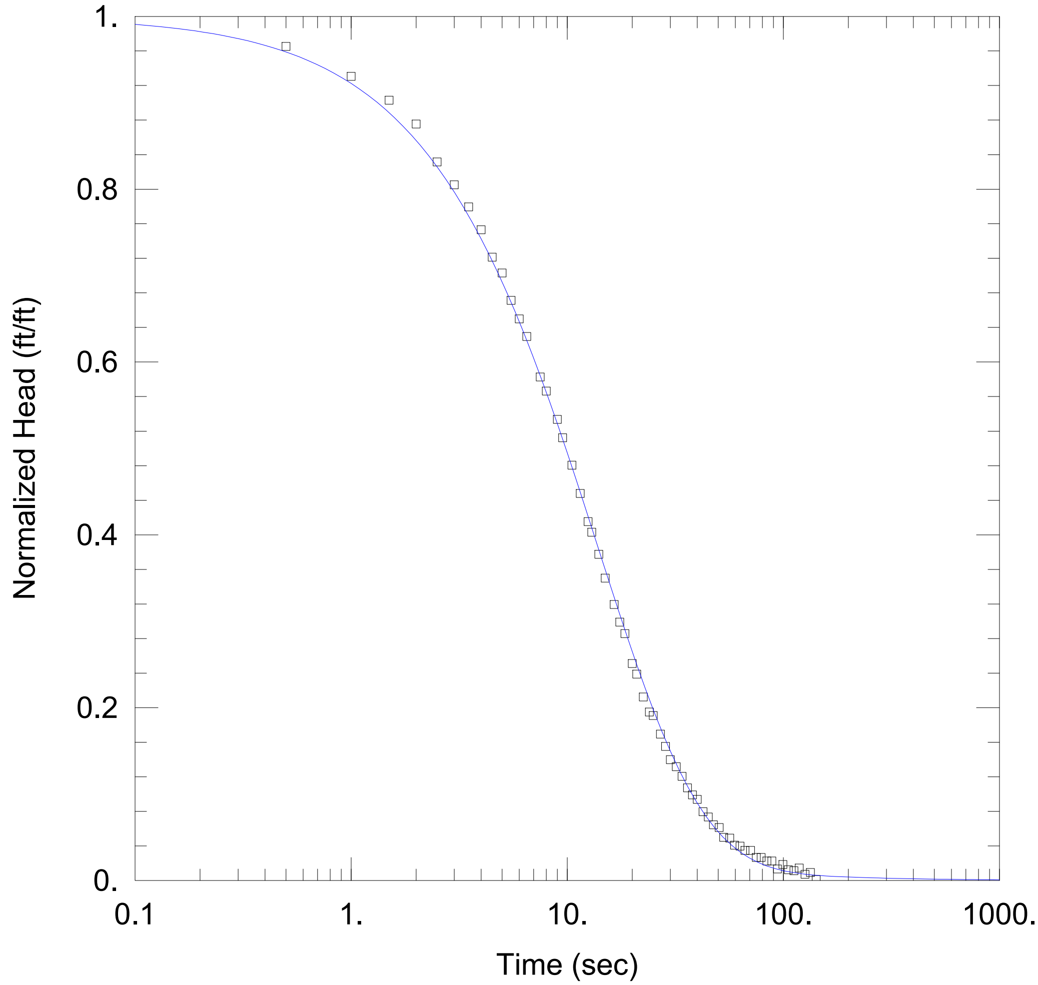
Parameter Correlations

	T	S
T	1.00	-0.97
S	-0.97	1.00

Residual Statistics

for weighted residuals

Sum of Squares . . . . . . 2.682 ft^2
Variance . . . . 0.03083 ft^2
Std. Deviation . . . . 0.1756 ft
Mean . . . . -0.02888 ft
No. of Residuals 89
No. of Estimates 2



APW-11 FH1

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-11
Test Date: 3/11/2021

AQUIFER DATA

Saturated Thickness: 9.2 ft

WELL DATA (APW-11)

Initial Displacement: 0.98 ft
Total Well Penetration Depth: 7. ft
Casing Radius: 0.086 ft

Static Water Column Height: 43.37 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

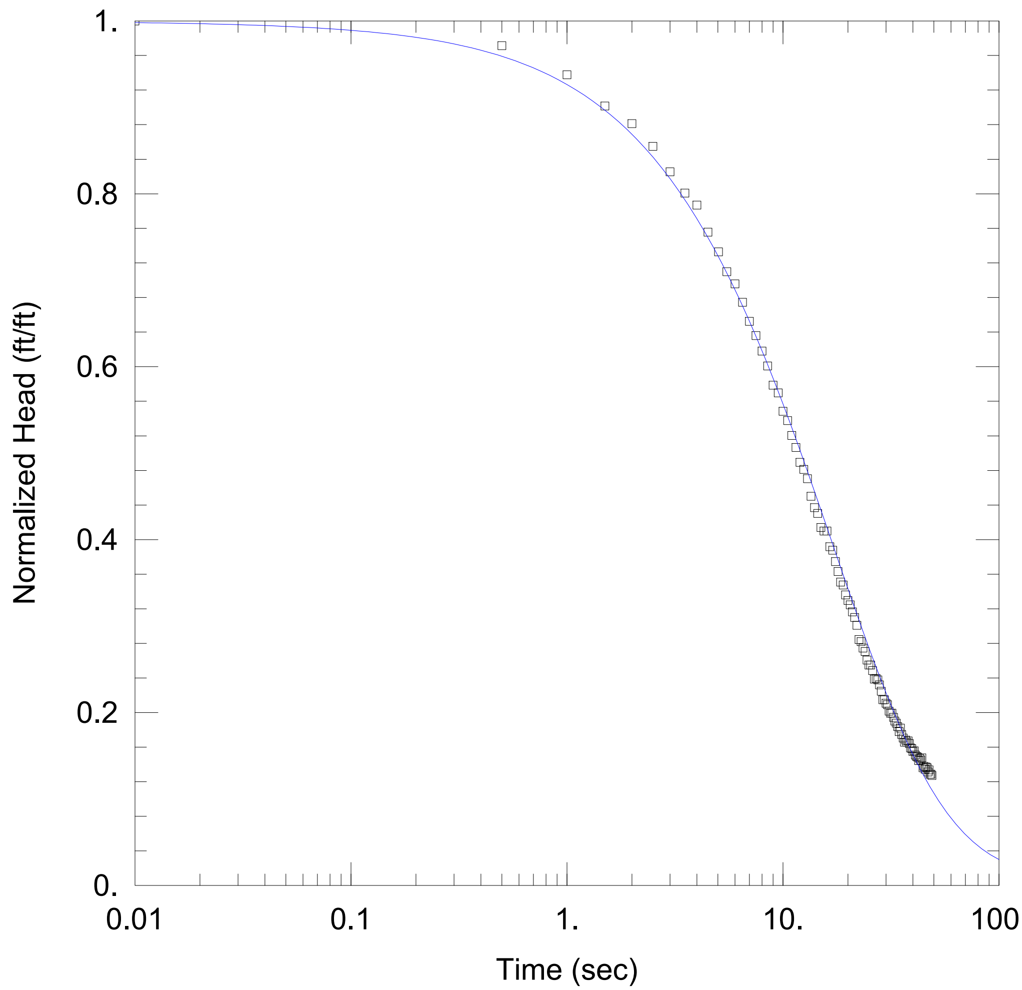
SOLUTION

Aquifer Model: Confined

Solution Method: KGS Model

Kr = 0.0078 cm/sec
Kz/Kr = 1.

Ss = 1.09E-9 ft^{-1}



APW-11 FH02

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-11
Test Date: 3/11/2021

AQUIFER DATA

Saturated Thickness: 9.2 ft

WELL DATA (APW-11)

Initial Displacement: 1.22 ft
Total Well Penetration Depth: 7. ft
Casing Radius: 0.086 ft

Static Water Column Height: 43.53 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

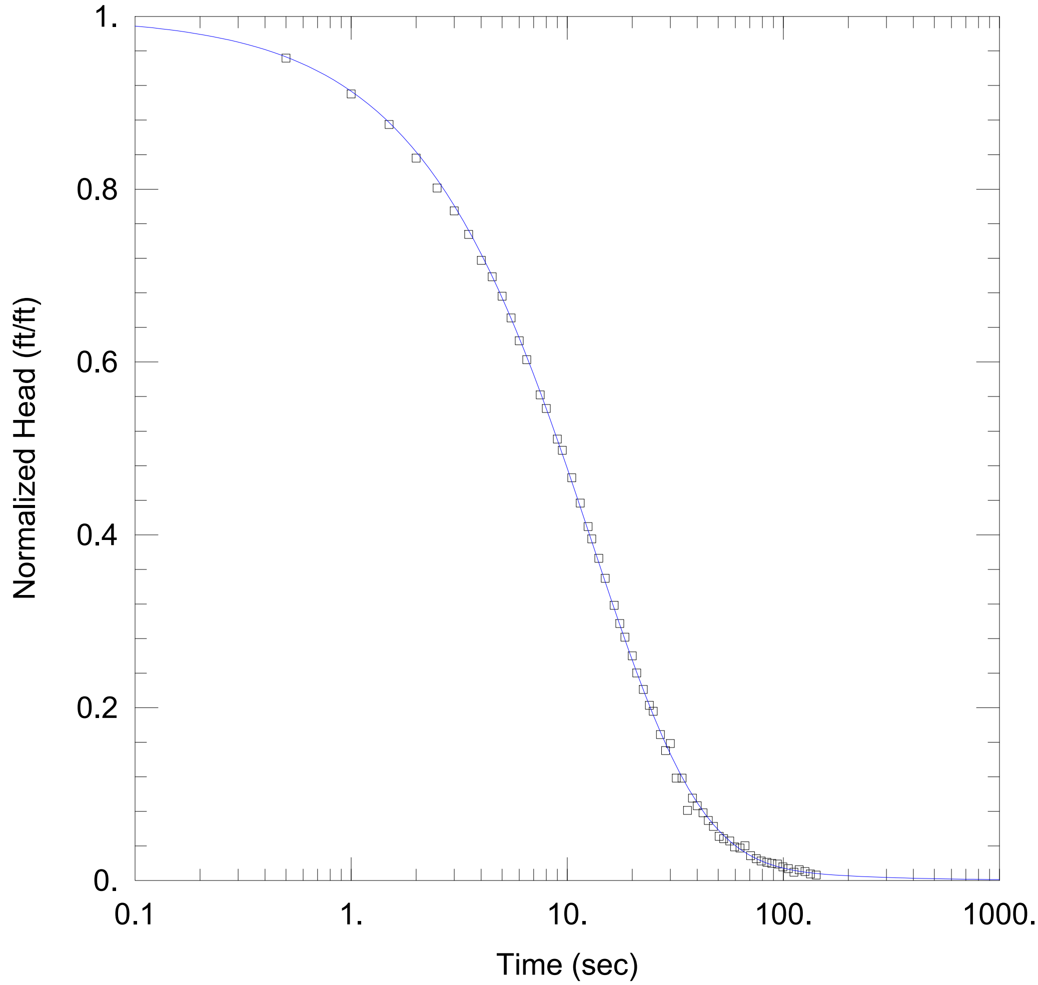
SOLUTION

Aquifer Model: Confined

Solution Method: KGS Model

Kr = 0.00351 cm/sec
Kz/Kr = 1.

Ss = 6.23E-6 ft^{-1}



APW-11 RH01

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-11
Test Date: 3/11/2021

AQUIFER DATA

Saturated Thickness: 9.2 ft

WELL DATA (APW-11)

Initial Displacement: 1.47 ft
Total Well Penetration Depth: 7. ft
Casing Radius: 0.086 ft

Static Water Column Height: 43.48 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

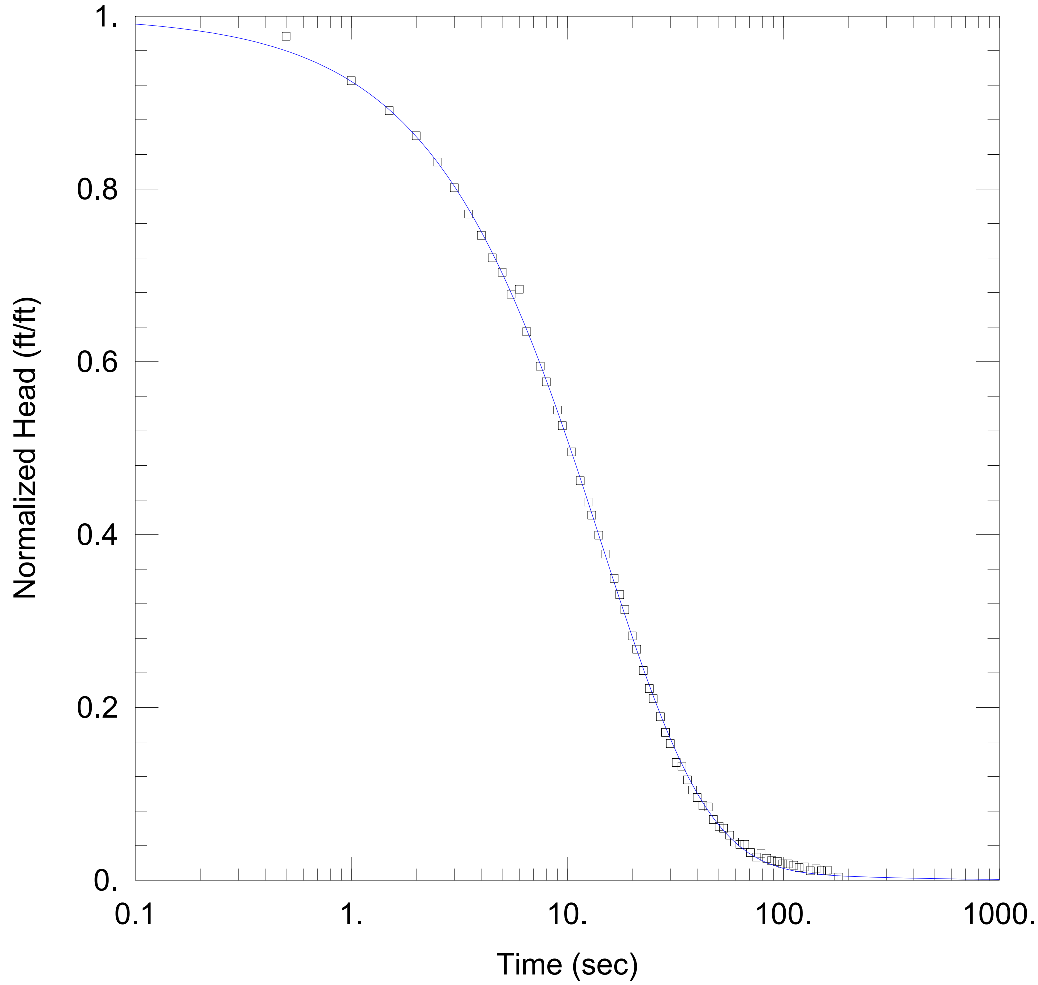
SOLUTION

Aquifer Model: Confined

Solution Method: KGS Model

Kr = 0.00588 cm/sec
Kz/Kr = 1.

Ss = 3.02E-7 ft^{-1}



APW-11 RH02

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-11
Test Date: 3/11/2021

AQUIFER DATA

Saturated Thickness: 9.2 ft

WELL DATA (APW-11 RH02)

Initial Displacement: 1.38 ft
Total Well Penetration Depth: 7. ft
Casing Radius: 0.086 ft

Static Water Column Height: 43.53 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

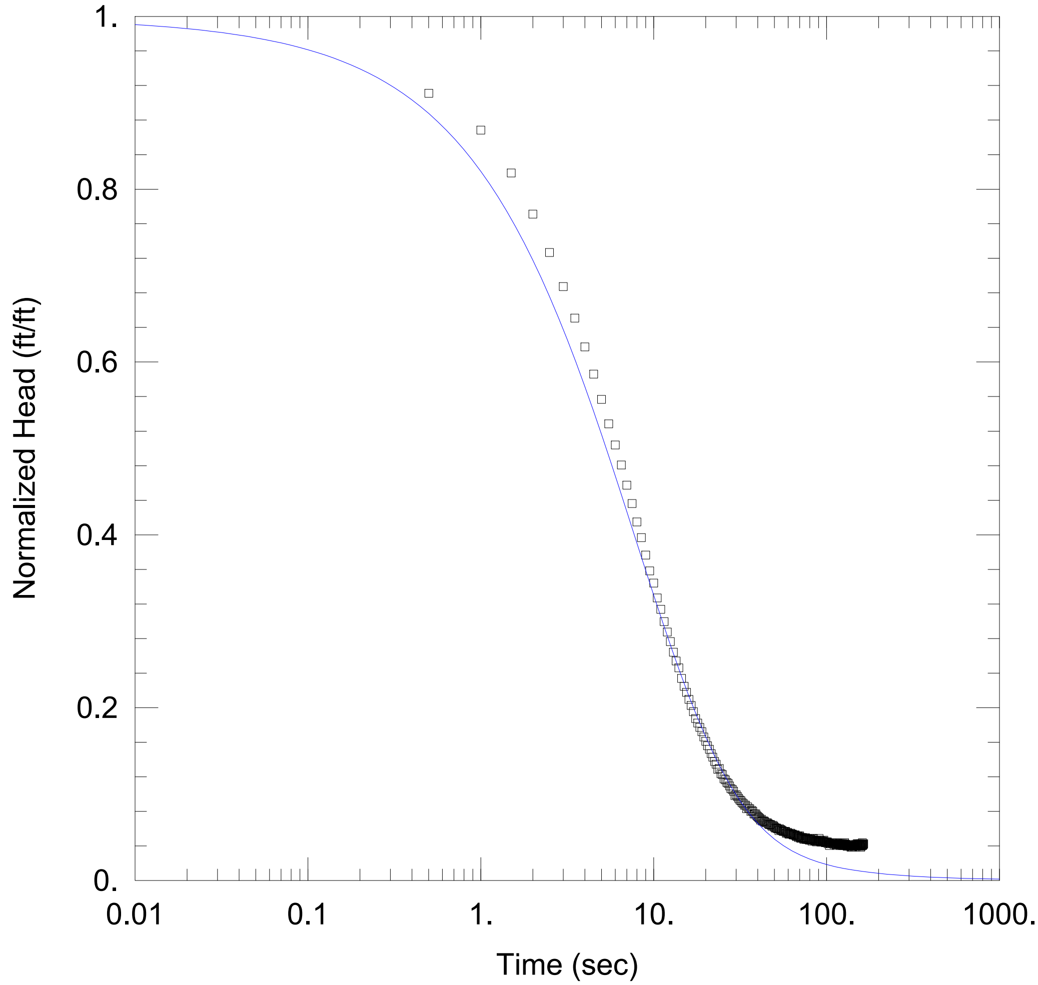
SOLUTION

Aquifer Model: Confined

Solution Method: KGS Model

Kr = 0.00676 cm/sec
Kz/Kr = 1.

Ss = 6.55E-9 ft^{-1}



APW-12 FH1

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-12
Test Date: 3/12/2021

AQUIFER DATA

Saturated Thickness: 3.5 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW-12)

Initial Displacement: 0.988 ft
Total Well Penetration Depth: 3.5 ft
Casing Radius: 0.086 ft

Static Water Column Height: 19.03 ft
Screen Length: 3.5 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined

Solution Method: Cooper-Bredehoeft-Papadopulos

T = 1.05 cm^2/sec

S = 0.000733

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
75.5	0.049	160.5	0.041
76.	0.047	161.	0.04
76.5	0.047	161.5	0.043
77.	0.047	162.	0.04
77.5	0.048	162.5	0.041
78.	0.047	163.	0.041
78.5	0.047	163.5	0.041
79.	0.047	164.	0.042
79.5	0.046		

SOLUTION

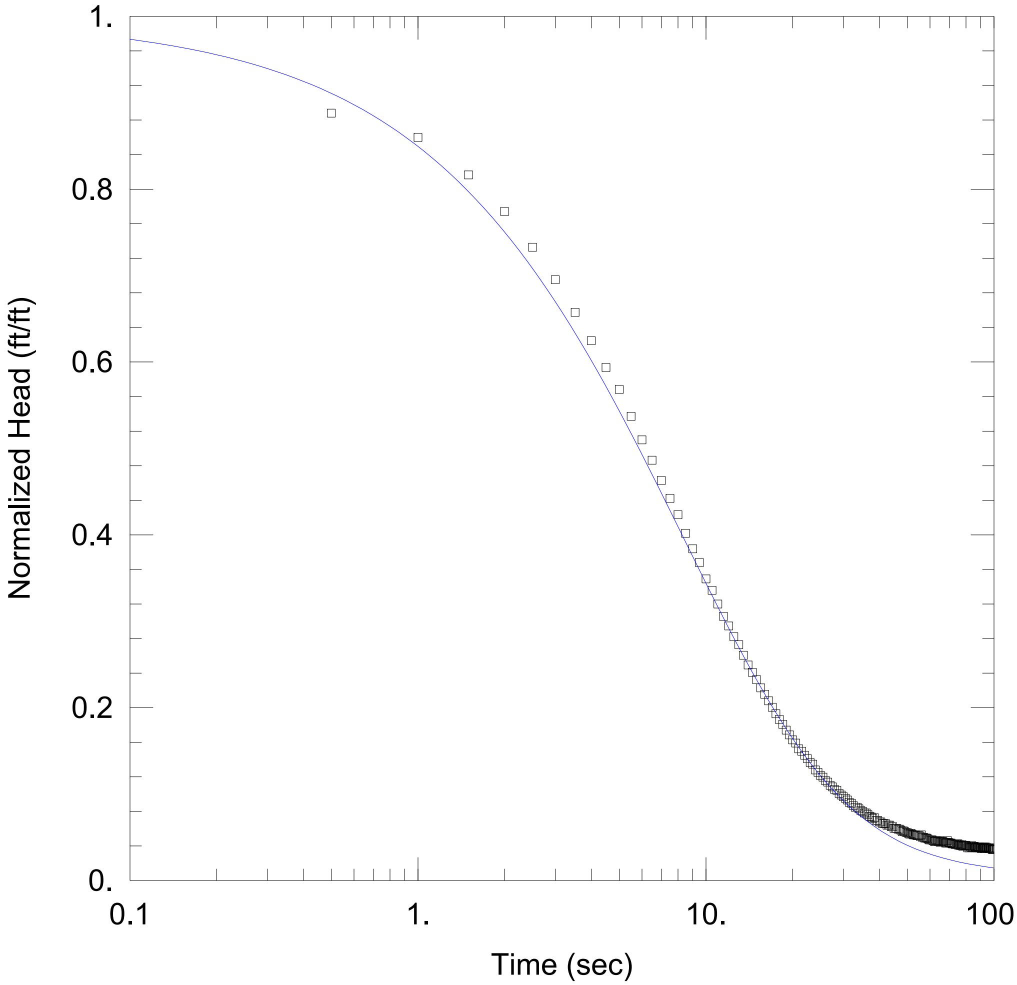
Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	1.05	cm^2/sec
S	0.000733	

K = T/b = 0.009843 cm/sec
Ss = S/b = 0.0002094 1/ft



APW-12 FH02

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-12
Test Date: 3/12/2021

AQUIFER DATA

Saturated Thickness: 3.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW-12)

Initial Displacement: 1.063 ft
Static Water Column Height: 19.06 ft
Total Well Penetration Depth: 3.5 ft
Screen Length: 3.5 ft
Casing Radius: 0.08625 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

T = 1.35 cm^2/sec
S = 0.000108

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
40.	0.072	94.5	0.04
40.5	0.072	95.	0.04
41.	0.07	95.5	0.04
41.5	0.07	96.	0.04
42.	0.07	96.5	0.039
42.5	0.068	97.	0.039
43.	0.068	97.5	0.039
43.5	0.068	98.	0.04
44.	0.066	98.5	0.038
44.5	0.066	99.	0.038
45.	0.064	99.5	0.038
45.5	0.064	100.	0.039
46.	0.064	100.5	0.036
46.5	0.063	101.	0.038

SOLUTION

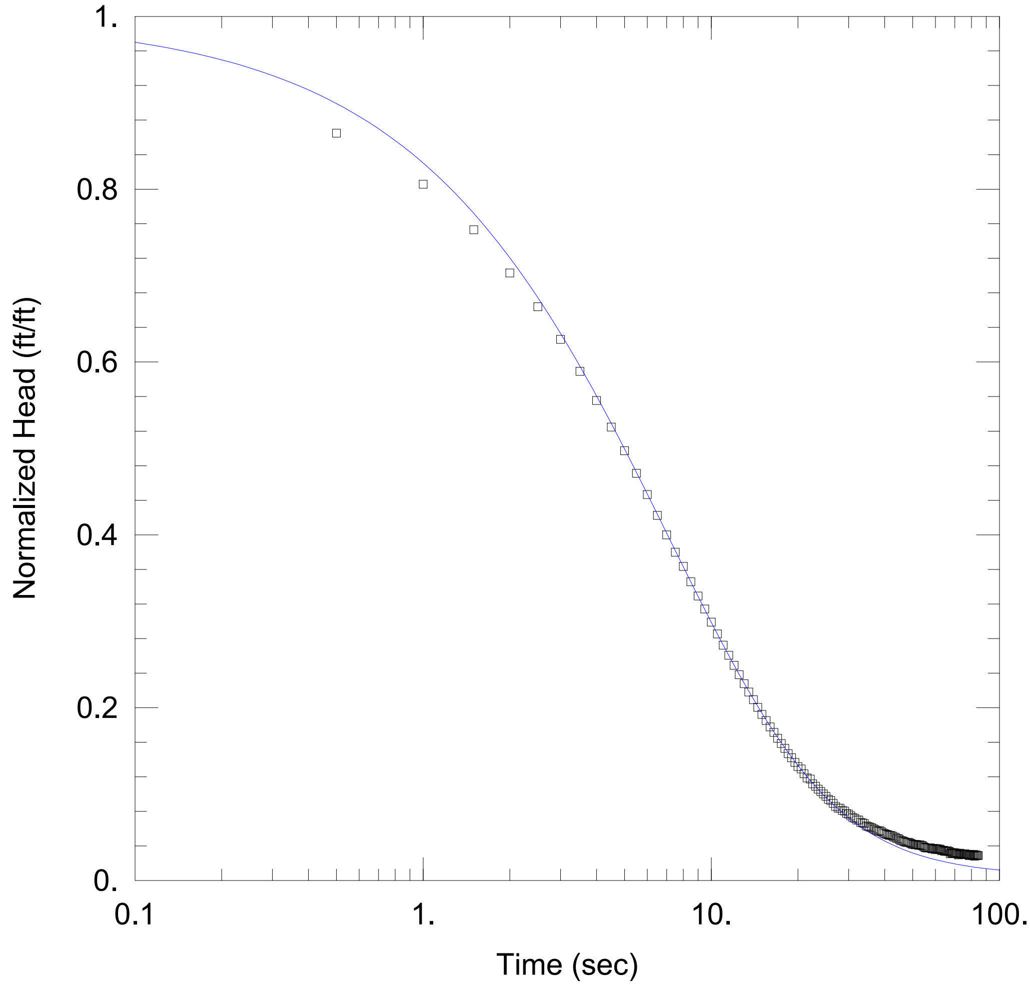
Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	1.35	cm^2/sec
S	0.000108	

K = T/b = 0.01265 cm/sec
Ss = S/b = 3.086E-5 1/ft



APW-12 RH01

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-12
Test Date: 3/12/2021

AQUIFER DATA

Saturated Thickness: 3.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW-12)

Initial Displacement: -1.458 ft
Static Water Column Height: 19.06 ft
Total Well Penetration Depth: 3.5 ft
Screen Length: 3.5 ft
Casing Radius: 0.08625 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

T = 1.57 cm^2/sec
S = 0.000114

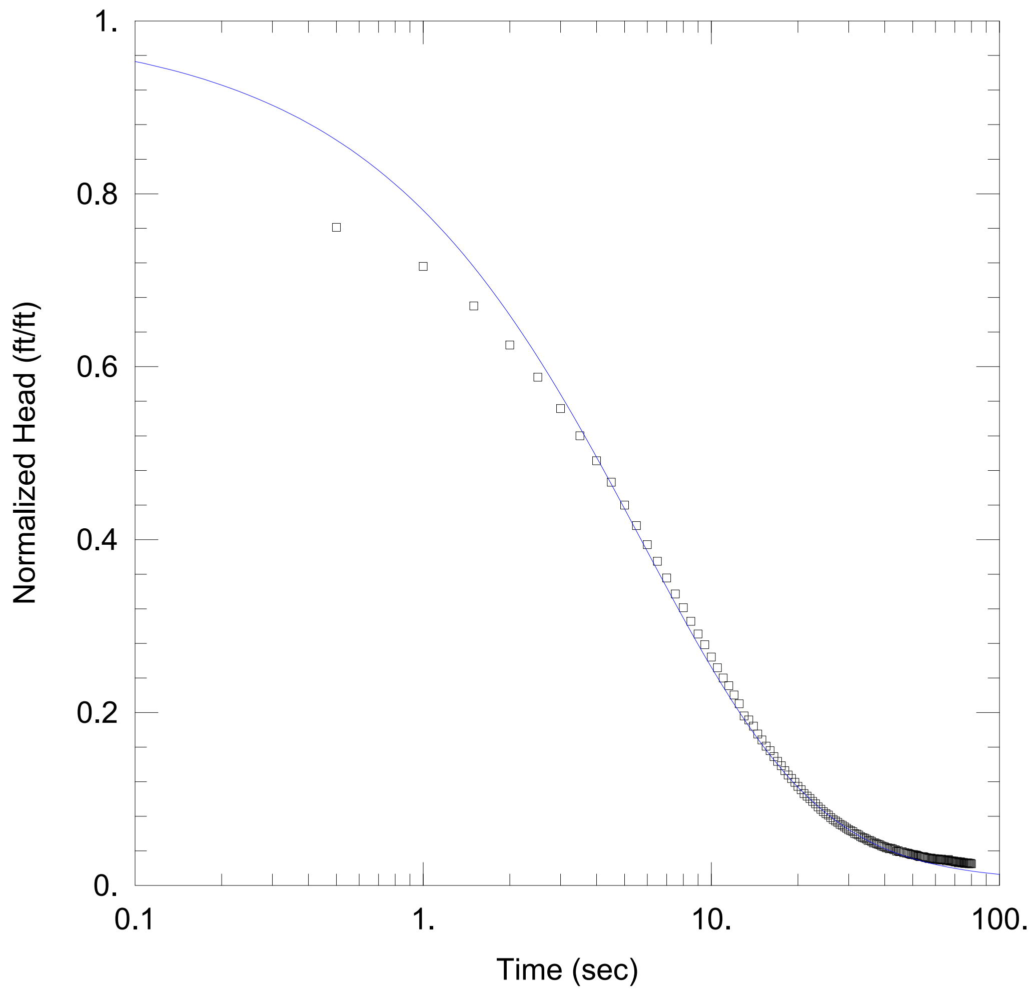
Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	1.57	cm^2/sec
S	0.000114	

K = T/b = 0.01472 cm/sec
Ss = S/b = 3.257E-5 1/ft



APW-12 RH2	

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-12
Test Date: 3/12/2021

AQUIFER DATA

Saturated Thickness: 3.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW-12)

Initial Displacement: -1.771 ft
Total Well Penetration Depth: 3.5 ft
Casing Radius: 0.08625 ft
Static Water Column Height: 19.06 ft
Screen Length: 3.5 ft
Well Radius: 0.25 ft

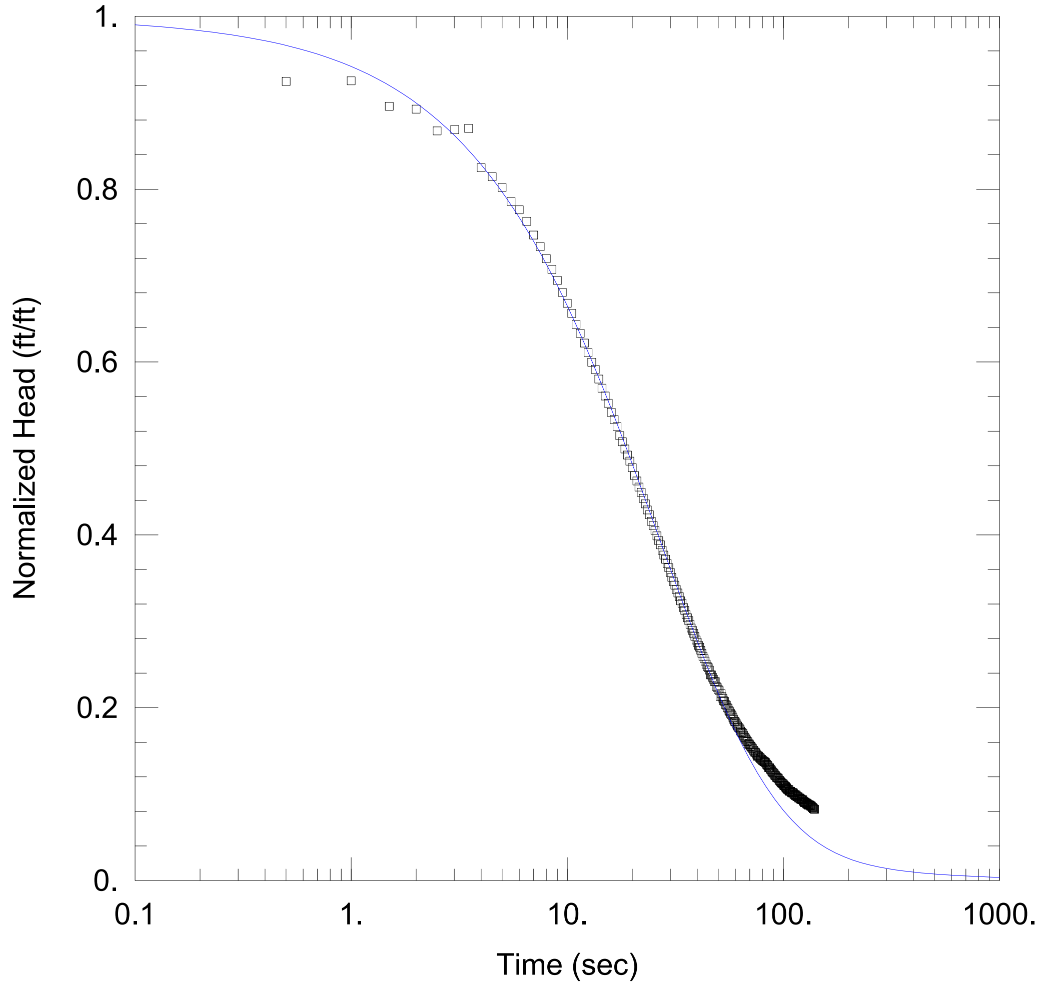
SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 1.433 cm^2/sec
S = 0.000733

Estimated Parameters

Parameter	Estimate	
T	1.433	cm^2/sec
S	0.000733	

K = T/b = 0.01343 cm/sec
Ss = S/b = 0.0002094 1/ft



APW-13 FH-01

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-13
Test Date: 3/12/2021

AQUIFER DATA

Saturated Thickness: 7.4 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW-13)

Initial Displacement: 1.434 ft
Total Well Penetration Depth: 5.9 ft
Casing Radius: 0.08625 ft
Static Water Column Height: 34.23 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

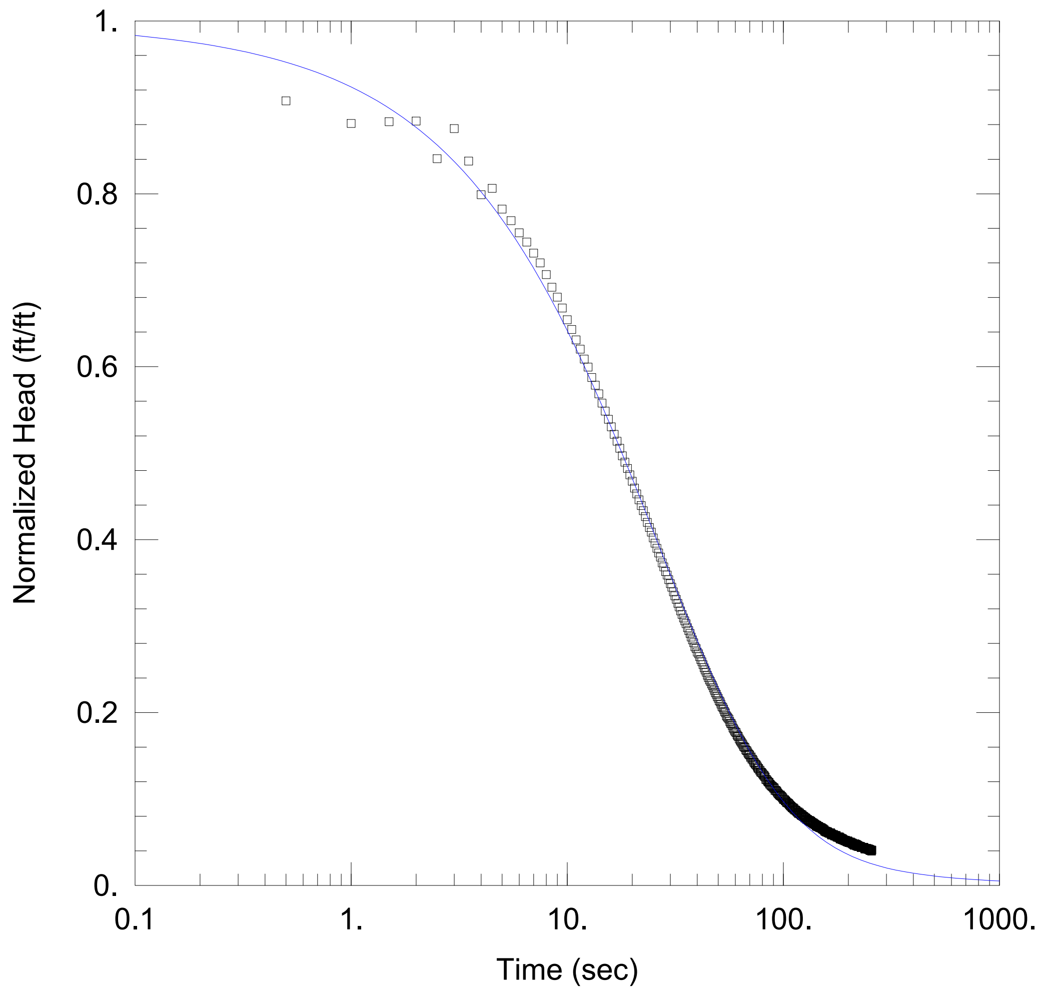
SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

T = 0.475 cm^2/sec
S = 4.47E-5

S	4.47E-5

K = T/b = 0.002106 cm/sec
Ss = S/b = 6.041E-6 1/ft



APW-13 FH02

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-13
Test Date: 3/12/2021

AQUIFER DATA

Saturated Thickness: 7.4 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW-13)

Initial Displacement: 1.493 ft
Total Well Penetration Depth: 5.9 ft
Casing Radius: 0.086 ft
Static Water Column Height: 34.26 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

T = 0.329 cm^2/sec
S = 0.000562

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
106.	0.141	238.5	0.064
106.5	0.14	239.	0.063
107.	0.139	239.5	0.064
107.5	0.138	240.	0.063
108.	0.137	240.5	0.064
108.5	0.137	241.	0.063
109.	0.136	241.5	0.063
109.5	0.135	242.	0.063
110.	0.134	242.5	0.064
110.5	0.134	243.	0.063
111.	0.134	243.5	0.063
111.5	0.132	244.	0.064
112.	0.133	244.5	0.063
112.5	0.131	245.	0.063
113.	0.13	245.5	0.063
113.5	0.13	246.	0.062
114.	0.13	246.5	0.063
114.5	0.129	247.	0.063
115.	0.129	247.5	0.063
115.5	0.127	248.	0.062
116.	0.127	248.5	0.062
116.5	0.126	249.	0.063
117.	0.127	249.5	0.062
117.5	0.124	250.	0.062
118.	0.125	250.5	0.061
118.5	0.125	251.	0.062
119.	0.125	251.5	0.062
119.5	0.123	252.	0.06
120.	0.123	252.5	0.061
120.5	0.123	253.	0.061
121.	0.121	253.5	0.06
121.5	0.121	254.	0.061
122.	0.122	254.5	0.061
122.5	0.12	255.	0.061
123.	0.12	255.5	0.06
123.5	0.119	256.	0.059
124.	0.119	256.5	0.061
124.5	0.119	257.	0.061

SOLUTION

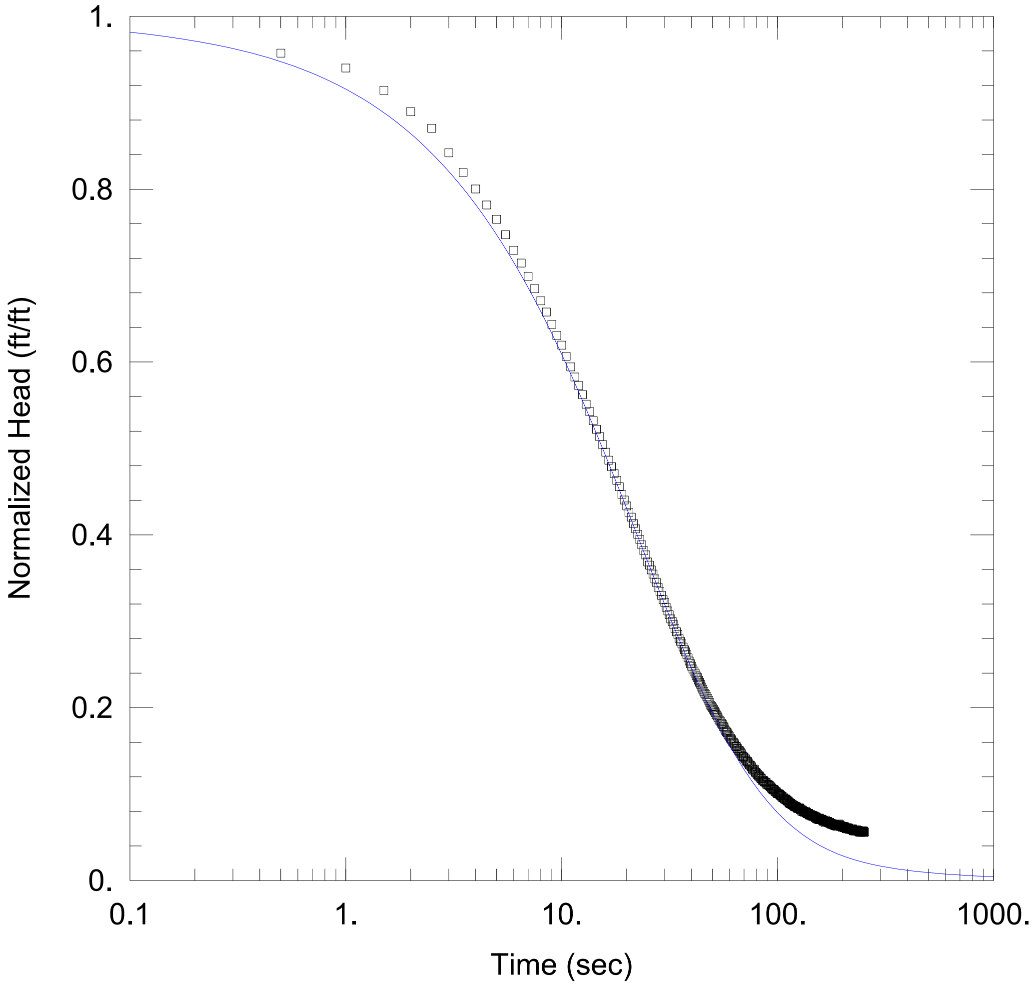
Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.329	cm^2/sec
S	0.000562	

K = T/b = 0.001459 cm/sec
Ss = S/b = 7.595E-5 1/ft



APW-13 RH01

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-13
Test Date: 3/12/2021

AQUIFER DATA

Saturated Thickness: 7.4 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW-13)

Initial Displacement: -1.622 ft
Total Well Penetration Depth: 5.9 ft
Casing Radius: 0.086 ft
Static Water Column Height: 34.22 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.384 cm^2/sec
S = 0.000541

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
106.5	-0.155	236.5	-0.093
107.	-0.155	237.	-0.094
107.5	-0.153	237.5	-0.093
108.	-0.153	238.	-0.092
108.5	-0.152	238.5	-0.091
109.	-0.153	239.	-0.092
109.5	-0.152	239.5	-0.092
110.	-0.151	240.	-0.091
110.5	-0.15	240.5	-0.092
111.	-0.149	241.	-0.092
111.5	-0.149	241.5	-0.093
112.	-0.149	242.	-0.092
112.5	-0.147	242.5	-0.09
113.	-0.146	243.	-0.092
113.5	-0.146	243.5	-0.092
114.	-0.144	244.	-0.091
114.5	-0.145	244.5	-0.093
115.	-0.145	245.	-0.091
115.5	-0.144	245.5	-0.093
116.	-0.143	246.	-0.093
116.5	-0.142	246.5	-0.092
117.	-0.142	247.	-0.092
117.5	-0.142	247.5	-0.093
118.	-0.141	248.	-0.092
118.5	-0.141	248.5	-0.092
119.	-0.14	249.	-0.092
119.5	-0.14	249.5	-0.093
120.	-0.138	250.	-0.092
120.5	-0.139	250.5	-0.092
121.	-0.139	251.	-0.091
121.5	-0.139	251.5	-0.09
122.	-0.138	252.	-0.091
122.5	-0.138	252.5	-0.091

SOLUTION

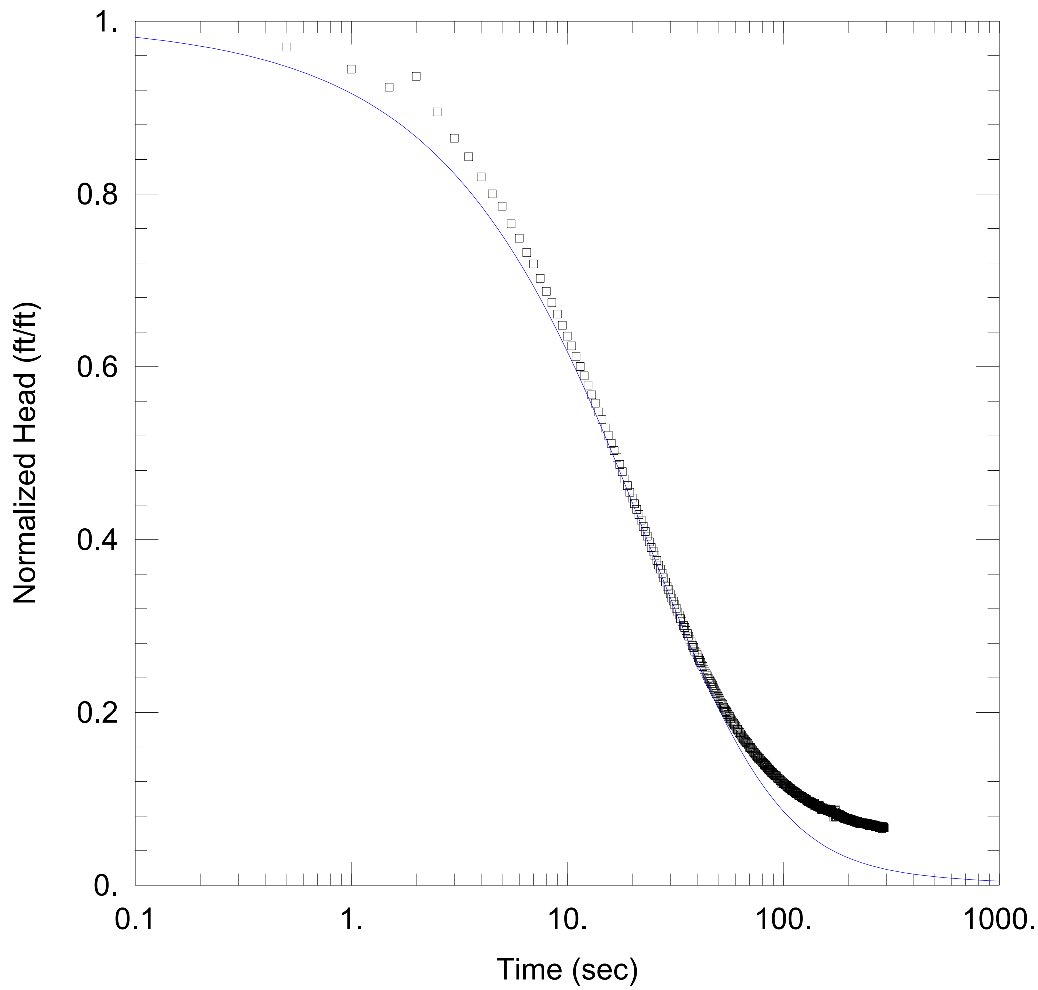
Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.384	cm^2/sec
S	0.000541	

K = T/b = 0.001702 cm/sec
Ss = S/b = 7.311E-5 1/ft



APW-13 RH02

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-13
Test Date: 3/12/2021

AQUIFER DATA

Saturated Thickness: 7.4 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW-13)

Initial Displacement: -1.676 ft
Total Well Penetration Depth: 5.9 ft
Casing Radius: 0.086 ft
Static Water Column Height: 34.26 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

T = 0.353 cm^2/sec
S = 0.000661

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
140.	-0.157	290.5	-0.111
140.5	-0.156	291.	-0.112
141.	-0.155	291.5	-0.113
141.5	-0.155	292.	-0.112
142.	-0.155	292.5	-0.111
142.5	-0.155	293.	-0.112
143.	-0.154	293.5	-0.111
143.5	-0.153		

SOLUTION

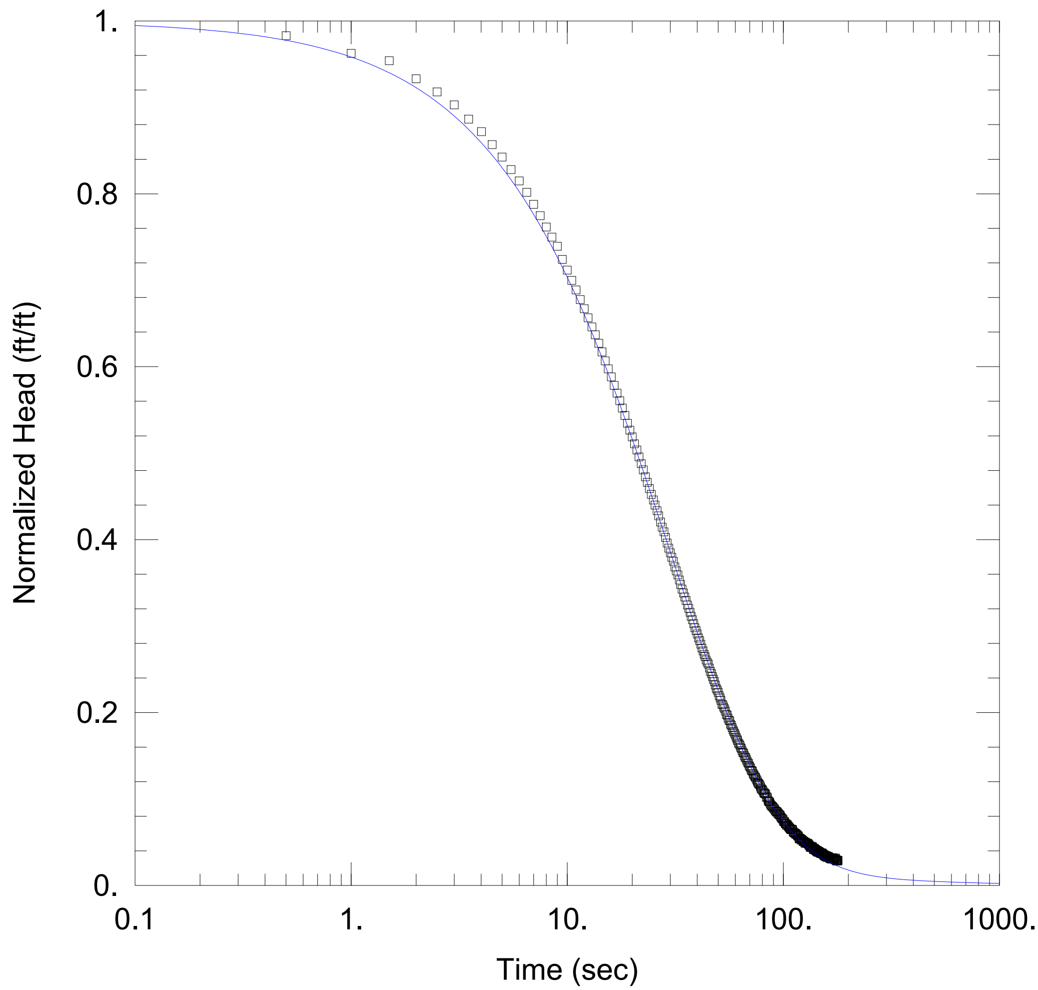
Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.353	cm^2/sec
S	0.000661	

K = T/b = 0.001565 cm/sec
Ss = S/b = 8.932E-5 1/ft



APW-14 FH01

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-14
Test Date: 3/31/2021

AQUIFER DATA

Saturated Thickness: 6.3 ft

WELL DATA (APW-14)

Initial Displacement: 1.523 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.086 ft

Static Water Column Height: 36.72 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

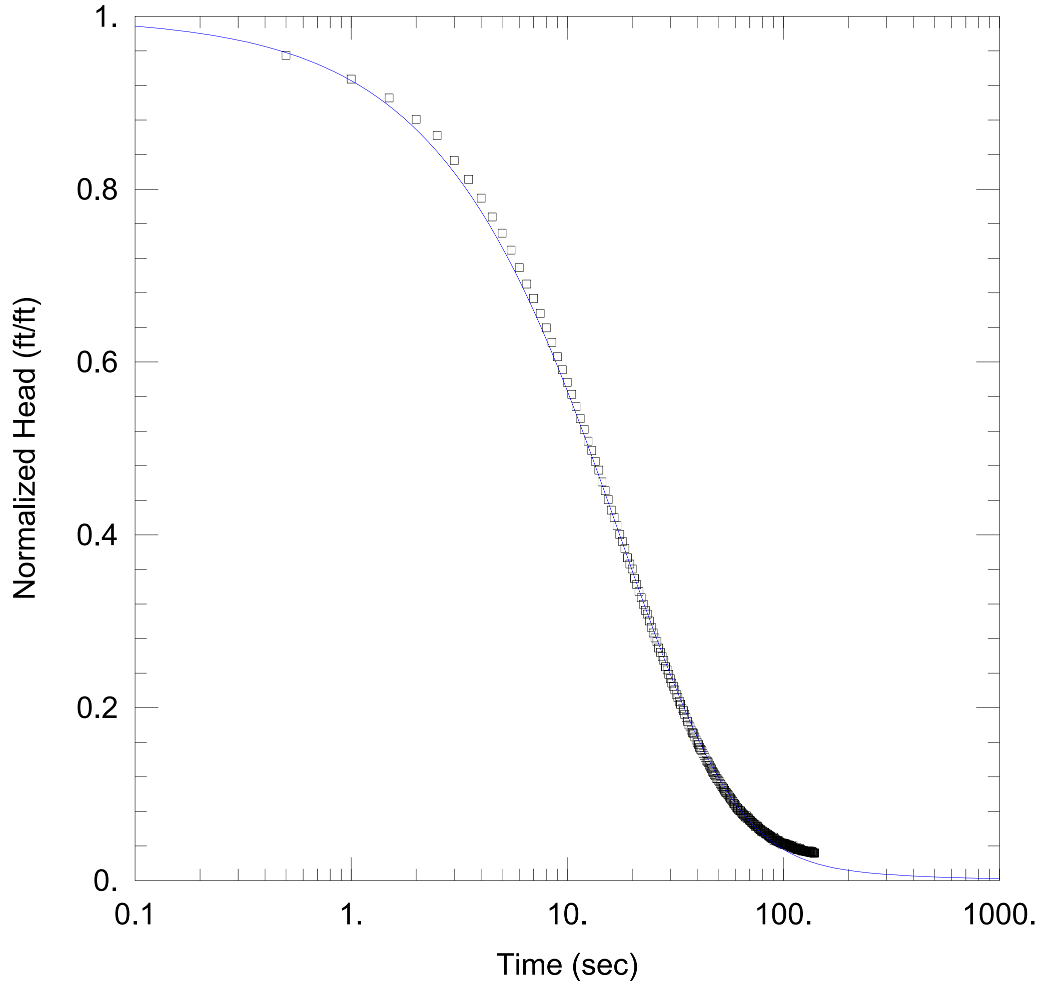
SOLUTION

Aquifer Model: Confined

Kr = 0.00388 cm/sec
Kz/Kr = 1.

Solution Method: KGS Model

Ss = 4.23E-8 ft^{-1}



APW-14 FH02

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-14
Test Date: 3/31/2021

AQUIFER DATA

Saturated Thickness: 6.3 ft

WELL DATA (APW-14)

Initial Displacement: 1.379 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.086 ft

Static Water Column Height: 36.73 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

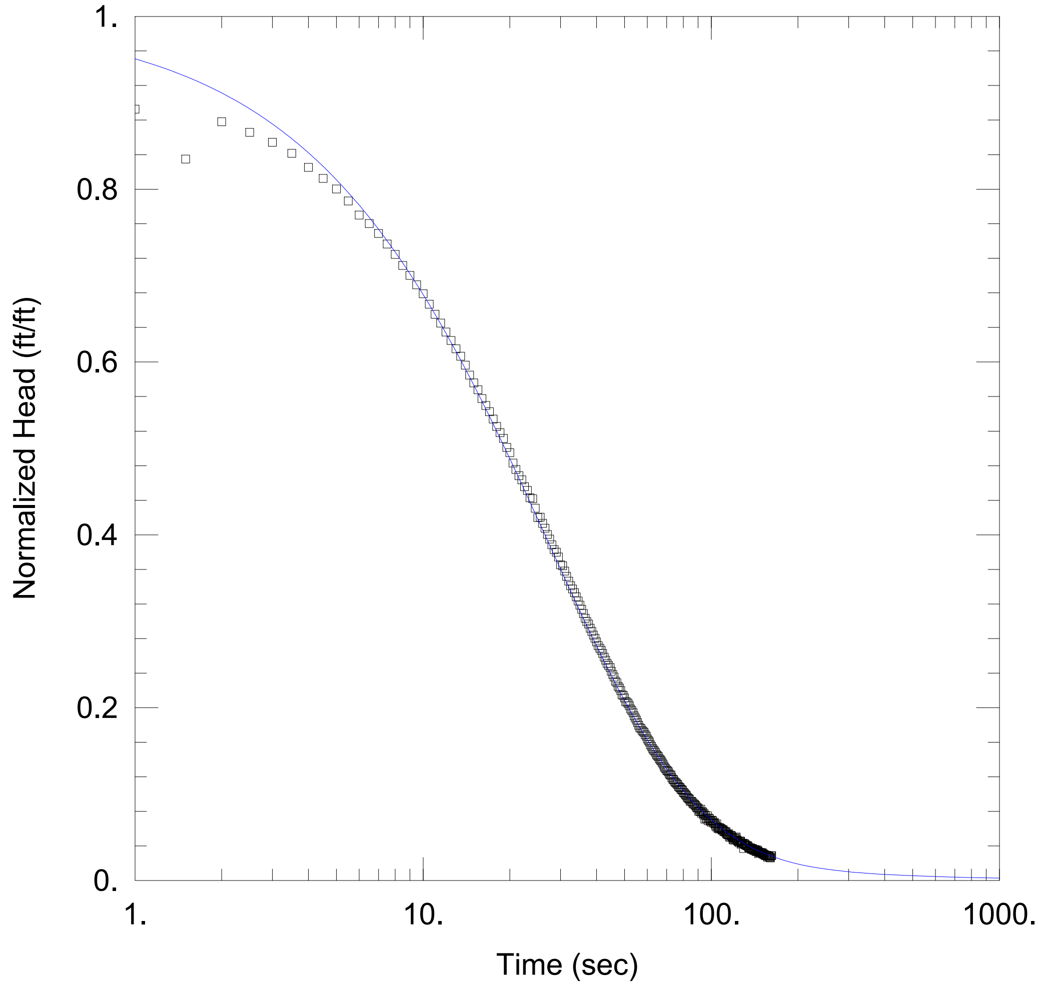
SOLUTION

Aquifer Model: Confined

Solution Method: KGS Model

Kr = 0.00433 cm/sec
Kz/Kr = 1.

Ss = 4.29E-6 ft^{-1}



APW-14 FH3

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-14
Test Date: 3/31/2021

AQUIFER DATA

Saturated Thickness: 6.3 ft

WELL DATA (APW-14)

Initial Displacement: 1.648 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.086 ft

Static Water Column Height: 36.72 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

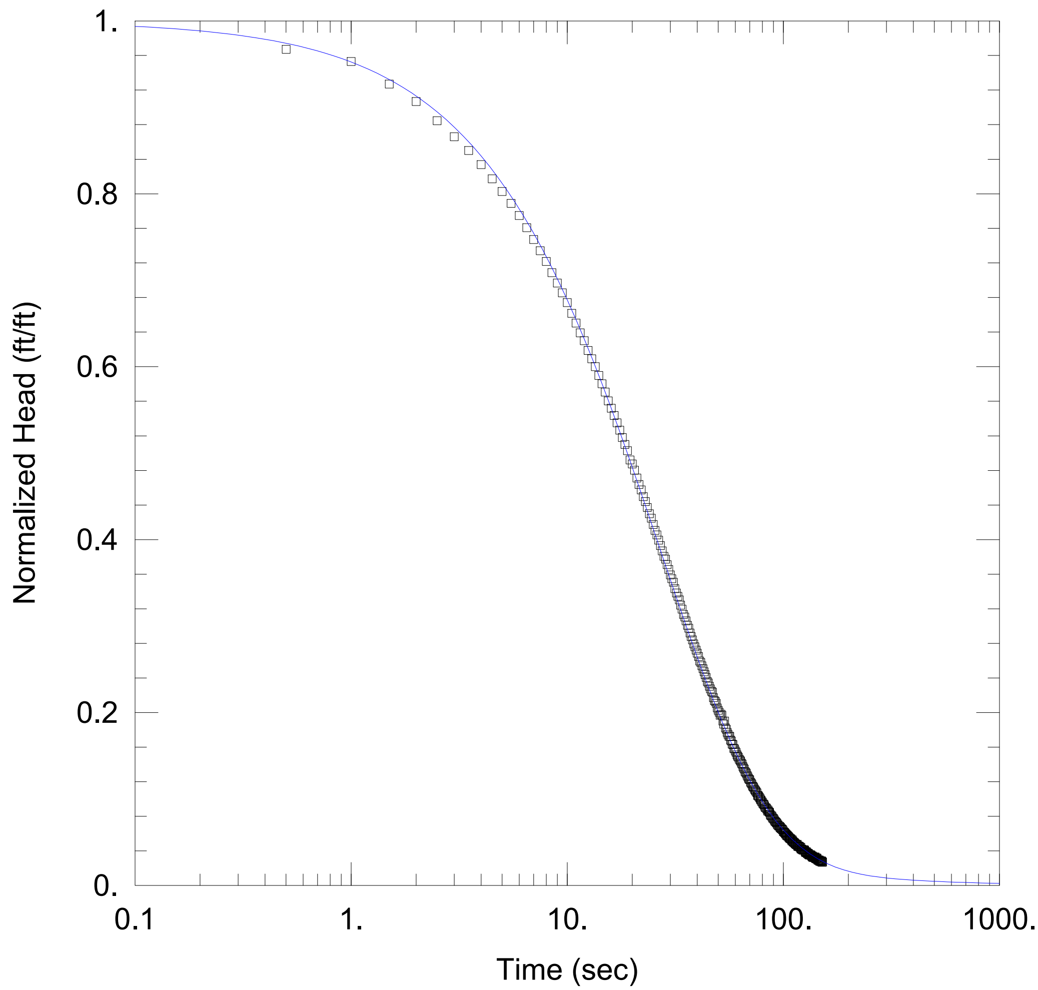
SOLUTION

Aquifer Model: Confined

Solution Method: KGS Model

Kr = 0.00332 cm/sec
Kz/Kr = 1.

Ss = 8.98E-7 ft^{-1}



APW-14 RH1

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-14
Test Date: 3/31/2021

AQUIFER DATA

Saturated Thickness: 6.3 ft

WELL DATA (APW-14)

Initial Displacement: -1.768 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.086 ft

Static Water Column Height: 36.76 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

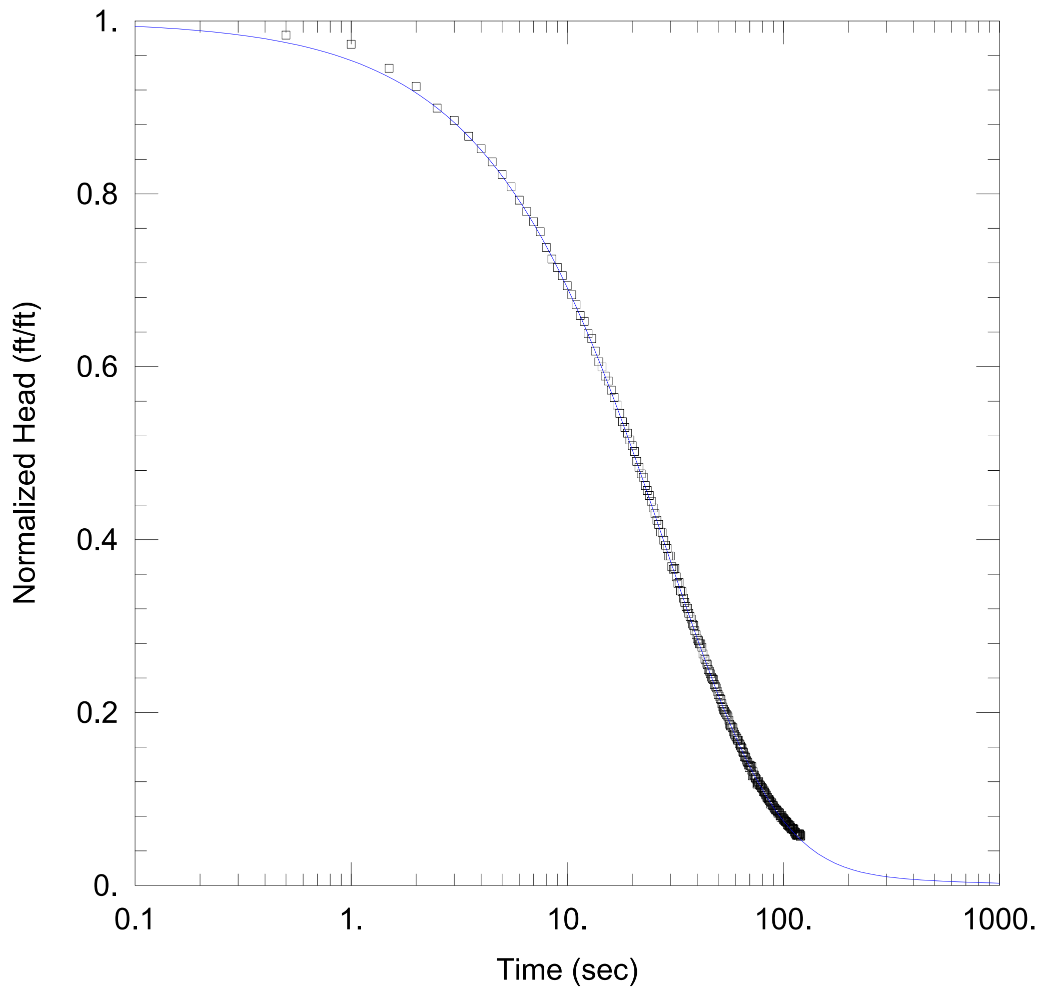
SOLUTION

Aquifer Model: Confined

Solution Method: KGS Model

Kr = 0.00381 cm/sec
Kz/Kr = 1.

Ss = 2.12E-7 ft^{-1}



APW-14 RH2

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-14
Test Date: 3/31/2021

AQUIFER DATA

Saturated Thickness: 6.3 ft

WELL DATA (APW-14)

Initial Displacement: -1.042 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.086 ft

Static Water Column Height: 36.72 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

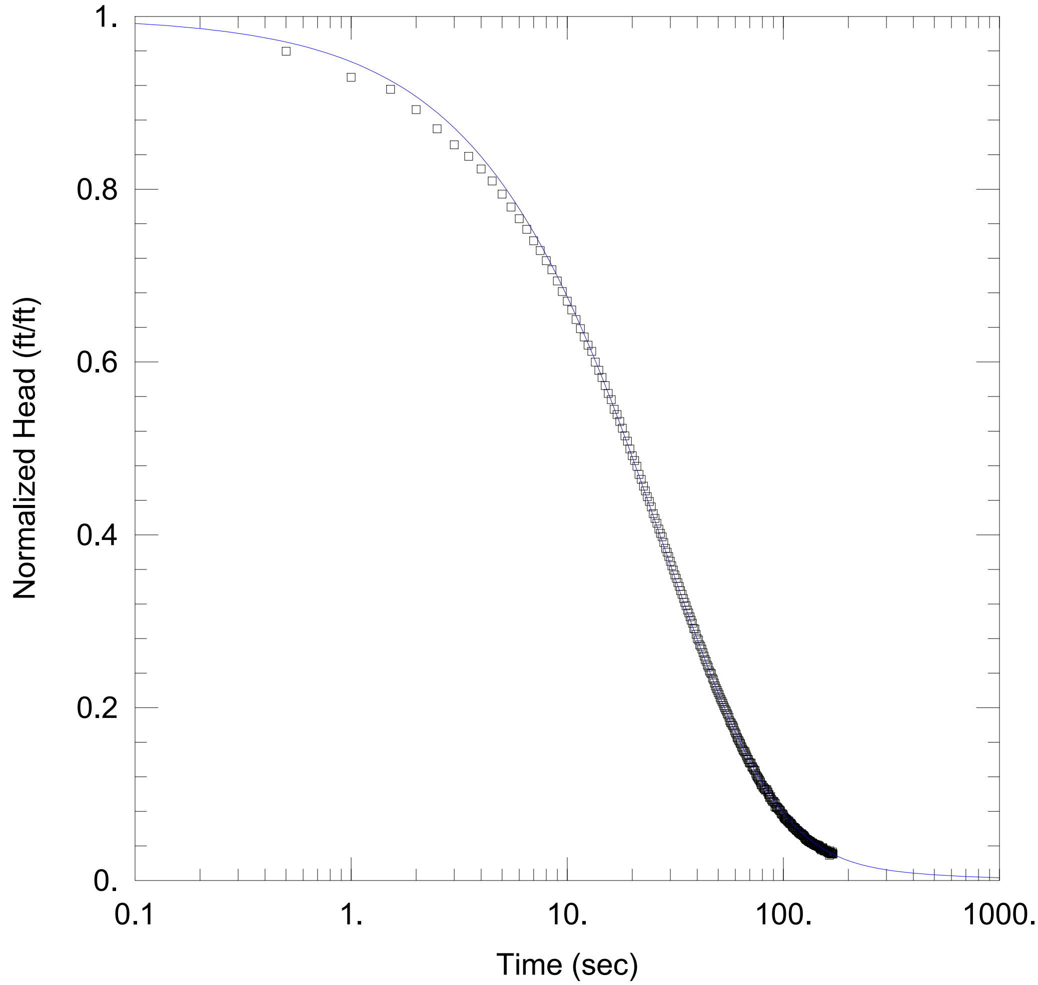
SOLUTION

Aquifer Model: Confined

Solution Method: KGS Model

Kr = 0.00336 cm/sec
Kz/Kr = 1.

Ss = 4.36E-7 ft^{-1}



APW-14 RH3

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-14
Test Date: 3/31/2021

AQUIFER DATA

Saturated Thickness: 6.3 ft

WELL DATA (APW-14)

Initial Displacement: -1.79 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.08625 ft

Static Water Column Height: 36.75 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

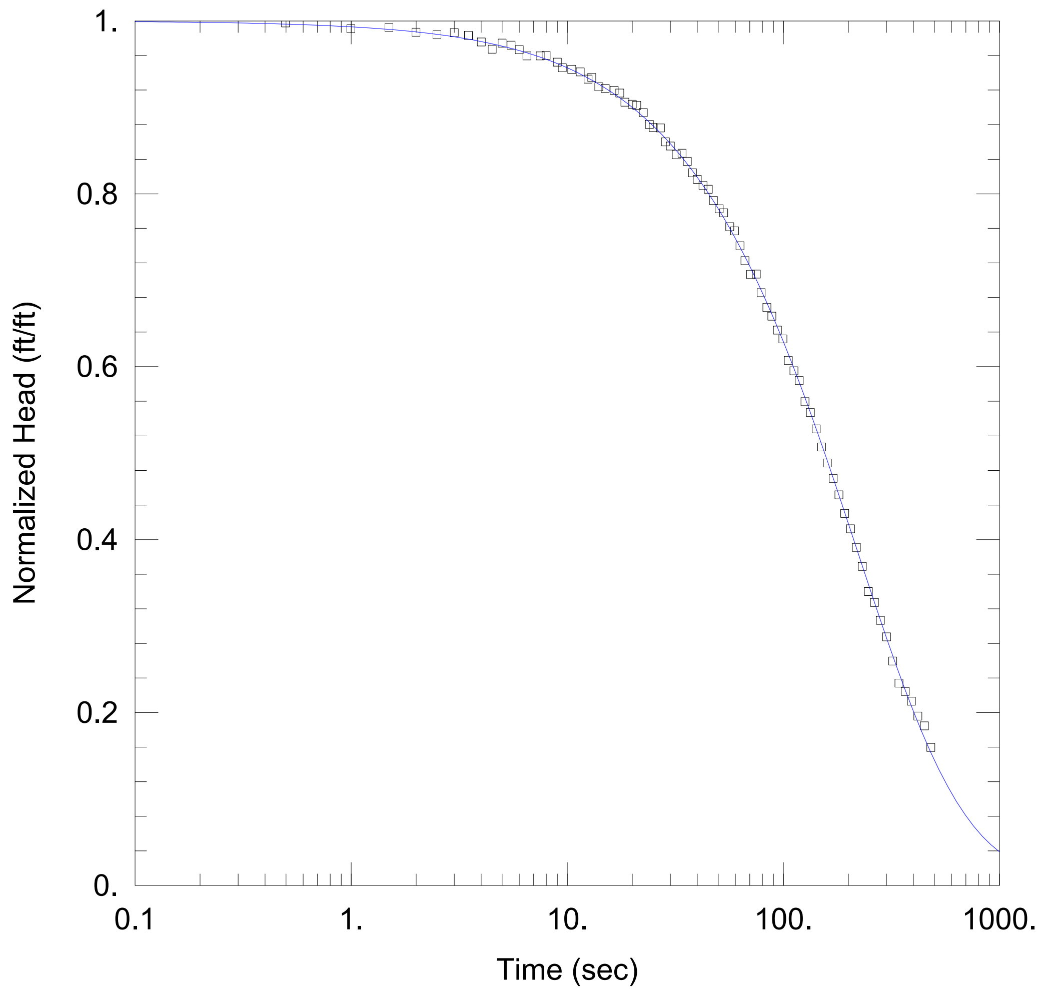
SOLUTION

Aquifer Model: Confined

Solution Method: KGS Model

Kr = 0.0028 cm/sec
Kz/Kr = 1.

Ss = 4.94E-6 ft^{-1}



APW-15 FH01

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-15
Test Date: 3/31/2021

AQUIFER DATA

Saturated Thickness: 7.1 ft

WELL DATA (APW-15)

Initial Displacement: 1.68 ft
Total Well Penetration Depth: 50.5 ft
Casing Radius: 0.086 ft

Static Water Column Height: 82.47 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

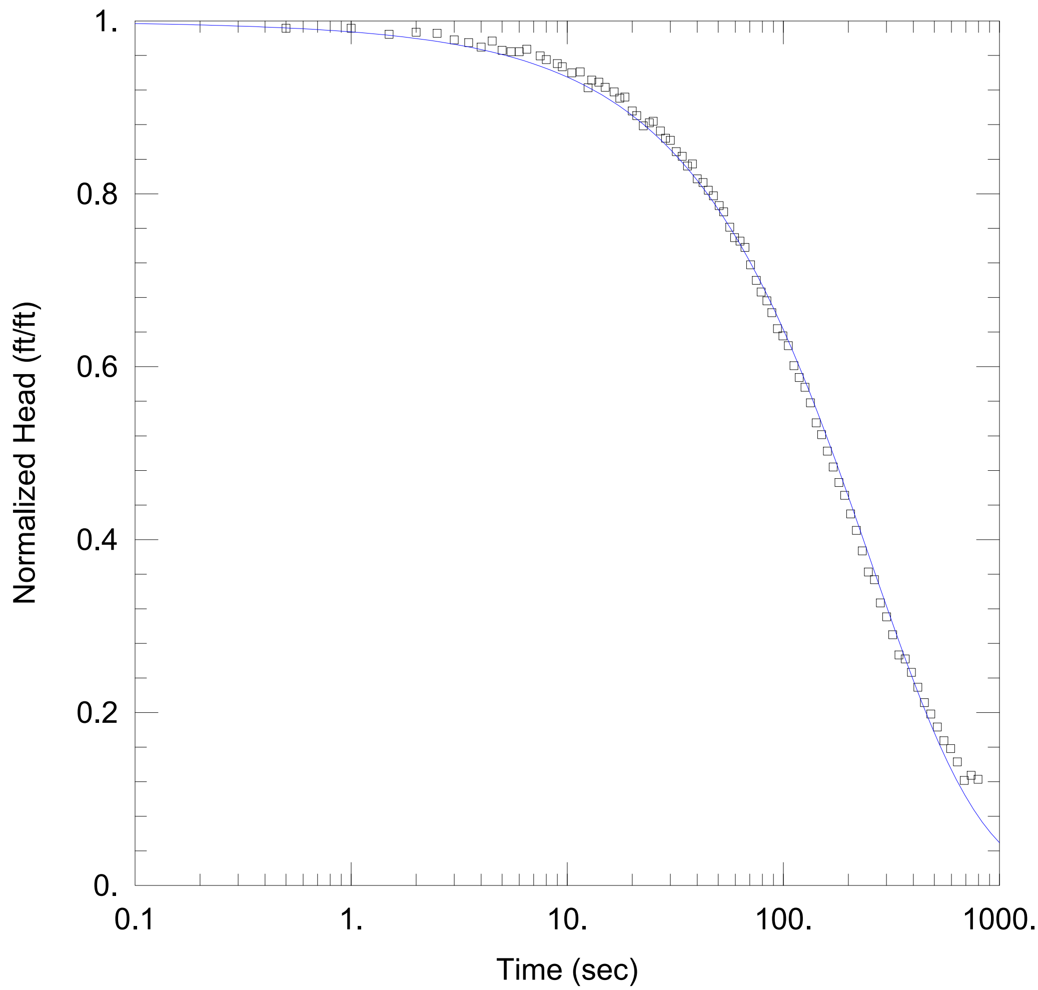
SOLUTION

Aquifer Model: Confined

Solution Method: KGS Model

Kr = 0.000485 cm/sec
Kz/Kr = 1.

Ss = 3.29E-7 ft^{-1}



APW-15 FH2

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-15
Test Date: 3/31/2021

AQUIFER DATA

Saturated Thickness: 51.8 ft

WELL DATA (APW-15)

Initial Displacement: 1.68 ft
Total Well Penetration Depth: 50.5 ft
Casing Radius: 0.086 ft

Static Water Column Height: 82.32 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

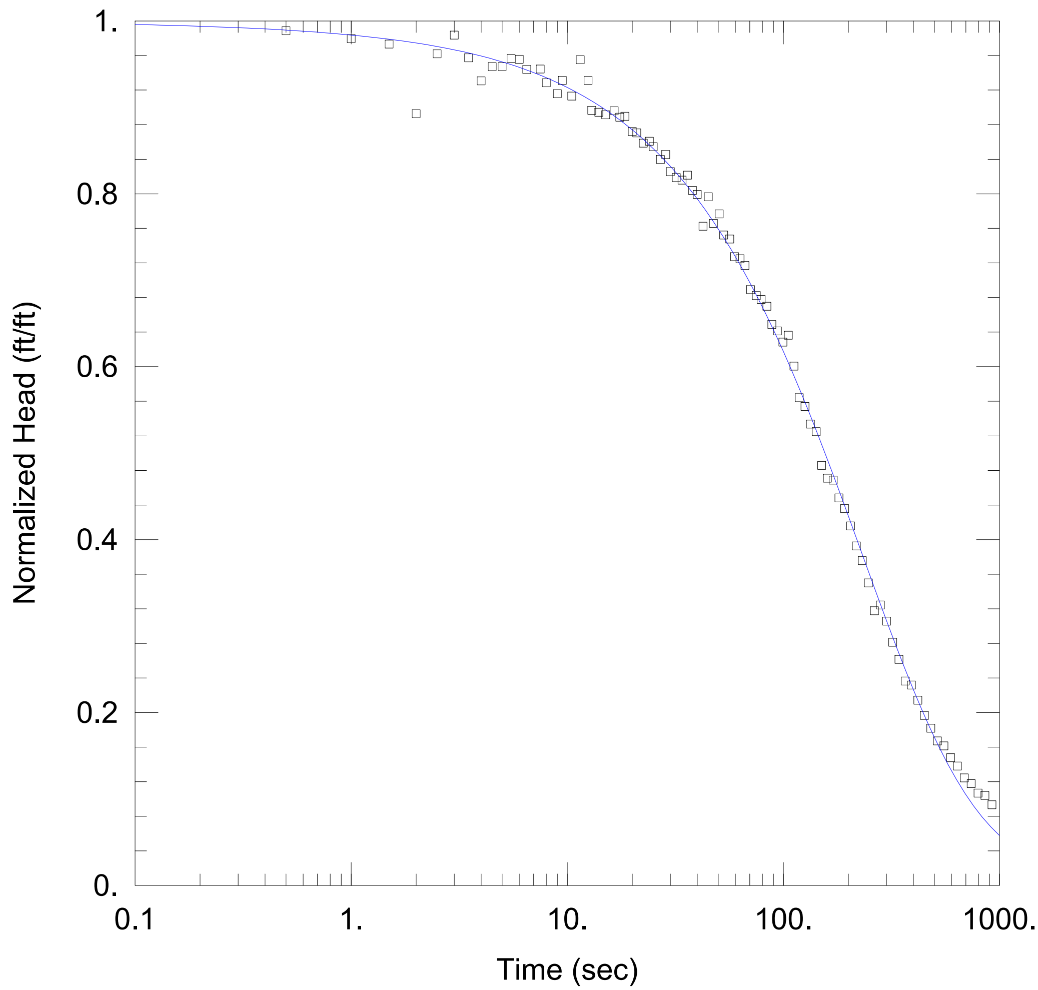
SOLUTION

Aquifer Model: Confined

Solution Method: KGS Model

Kr = 0.0002 cm/sec
Kz/Kr = 1.

Ss = 5.25E-5 ft^{-1}



APW-15 RH-01

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-15
Test Date: 3/31/2021

AQUIFER DATA

Saturated Thickness: 7.1 ft

WELL DATA (APW-15)

Initial Displacement: 1.76 ft
Total Well Penetration Depth: 50.5 ft
Casing Radius: 0.086 ft

Static Water Column Height: 82.59 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

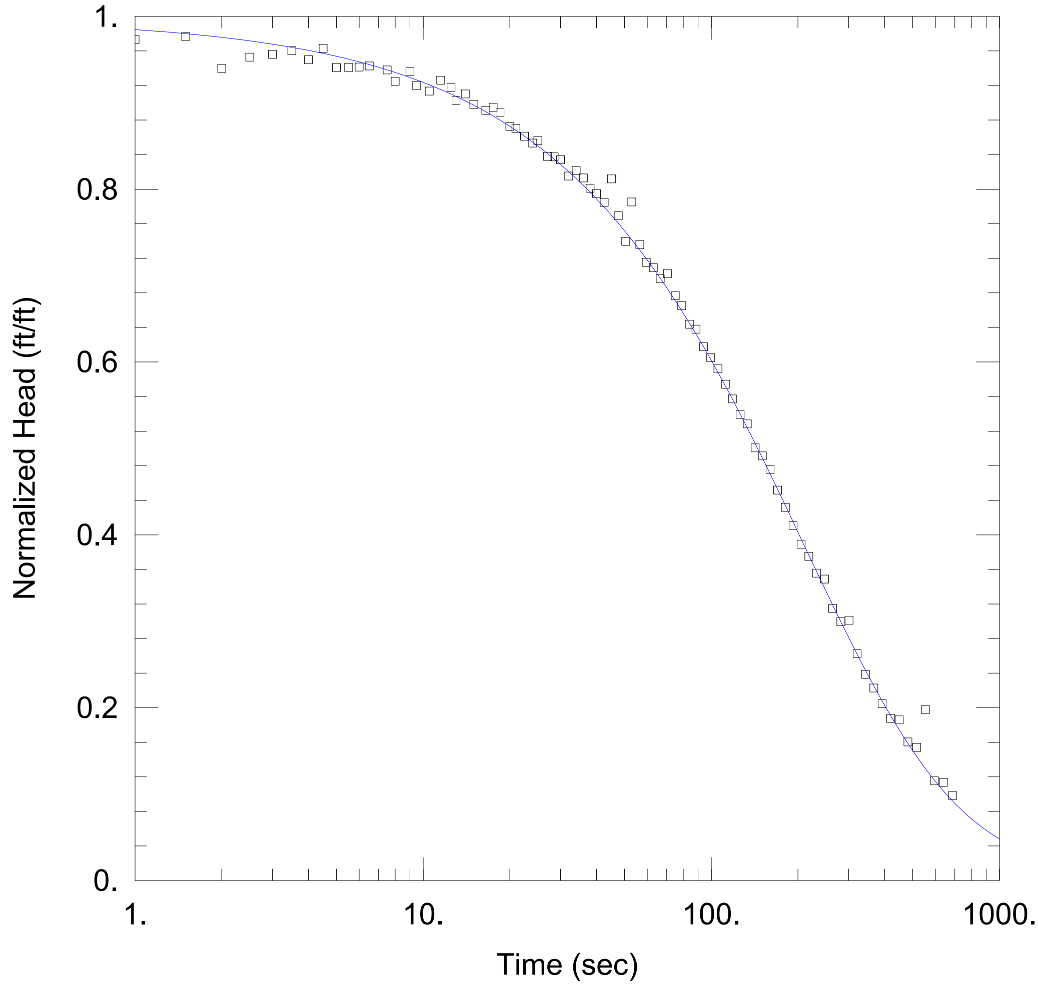
SOLUTION

Aquifer Model: Confined

Kr = 0.000281 cm/sec
Kz/Kr = 1.

Solution Method: KGS Model

Ss = 0.000132 ft^{-1}



APW-15 RH2

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-15
Test Date: 3/31/2021

AQUIFER DATA

Saturated Thickness: 7.1 ft

WELL DATA (APW-15)

Initial Displacement: 1.76 ft
Total Well Penetration Depth: 50.5 ft
Casing Radius: 0.086 ft

Static Water Column Height: 82.52 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

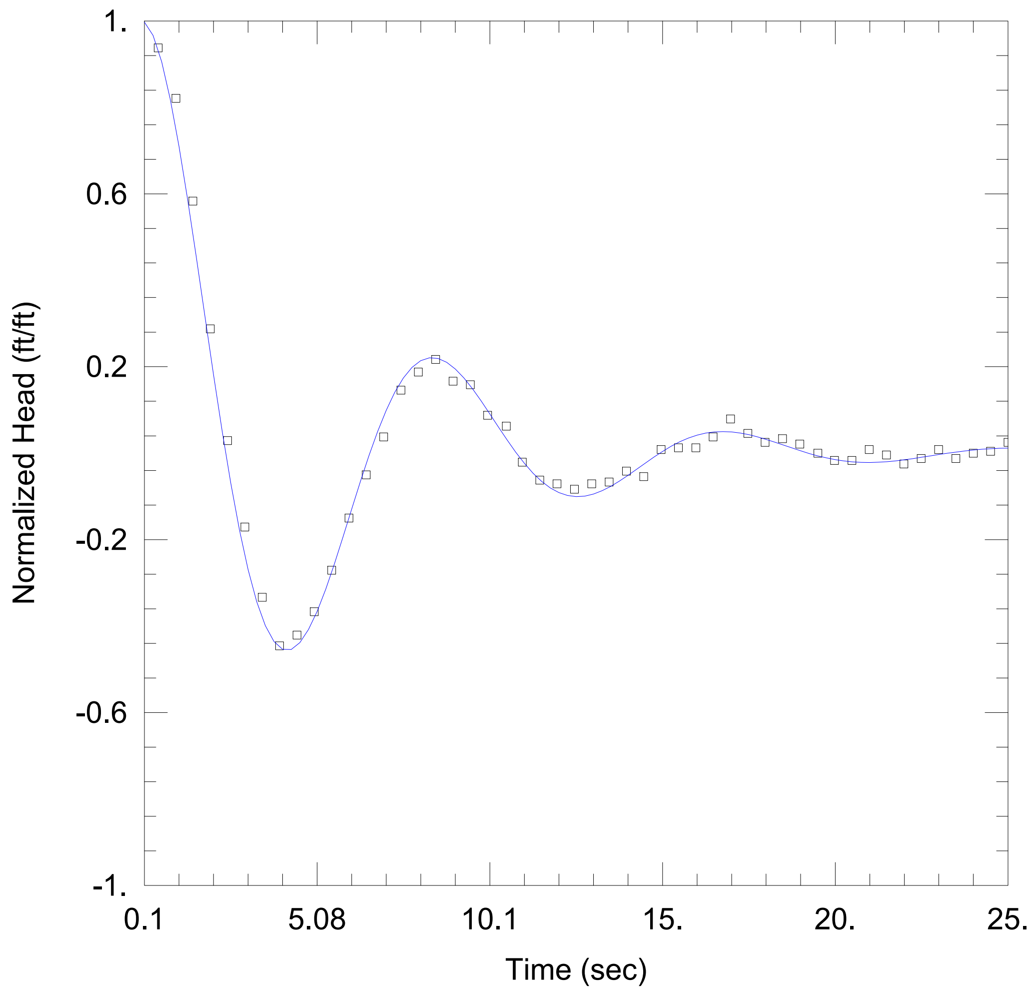
SOLUTION

Aquifer Model: Confined

Solution Method: KGS Model

Kr = 0.00032 cm/sec
Kz/Kr = 1.

Ss = 8.48E-5 ft^{-1}



APW-16 FH01

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-16
Test Date: 3/11/2021

AQUIFER DATA

Saturated Thickness: 16.4 ft
Anisotropy Ratio (Kz/Kr): 1.

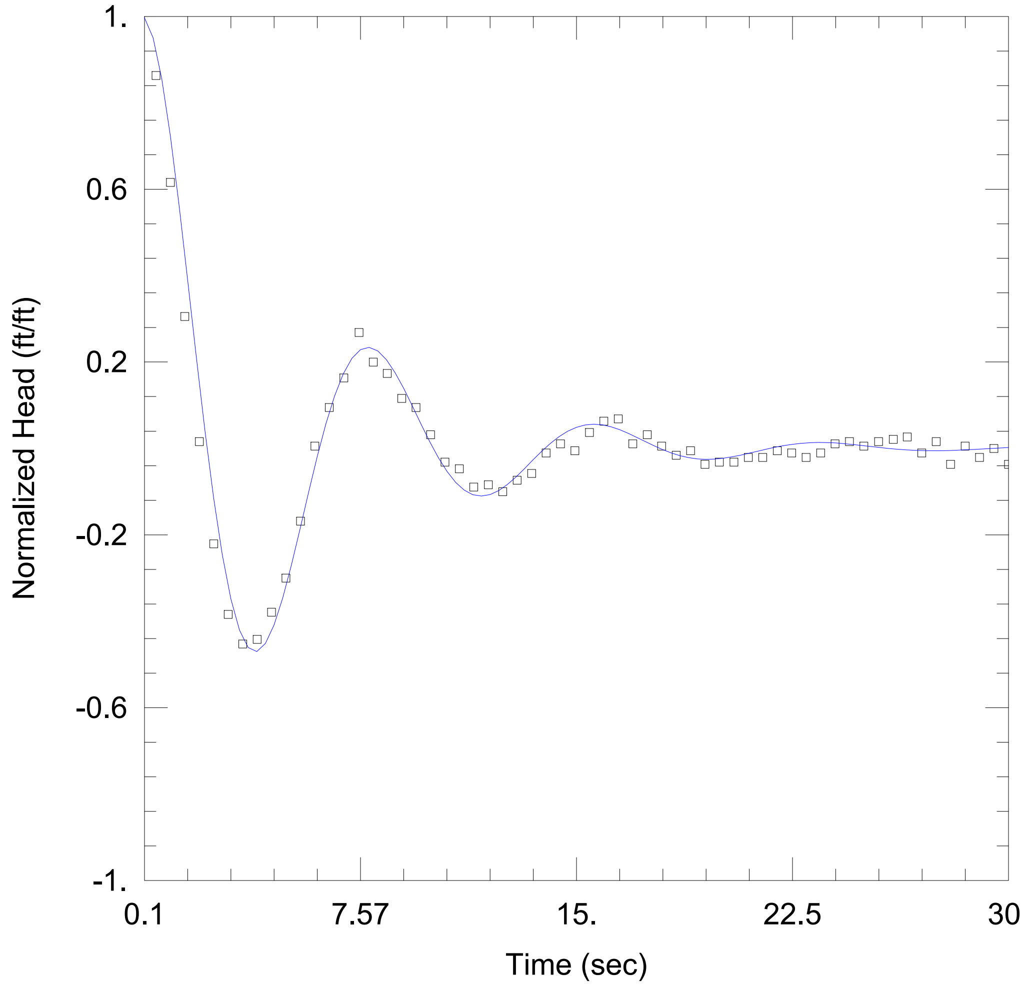
WELL DATA (APW-16)

Initial Displacement: 0.24 ft
Total Well Penetration Depth: 16.3 ft
Casing Radius: 0.086 ft
Static Water Column Height: 64.37 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.124 cm/sec
Kz/Kr = 1.
Ss = 8.12E-7 ft^{-1}
Le = 56.01 ft



APW-16 FH02

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-16
Test Date: 3/11/2021

AQUIFER DATA

Saturated Thickness: 16.4 ft
Anisotropy Ratio (Kz/Kr): 1.

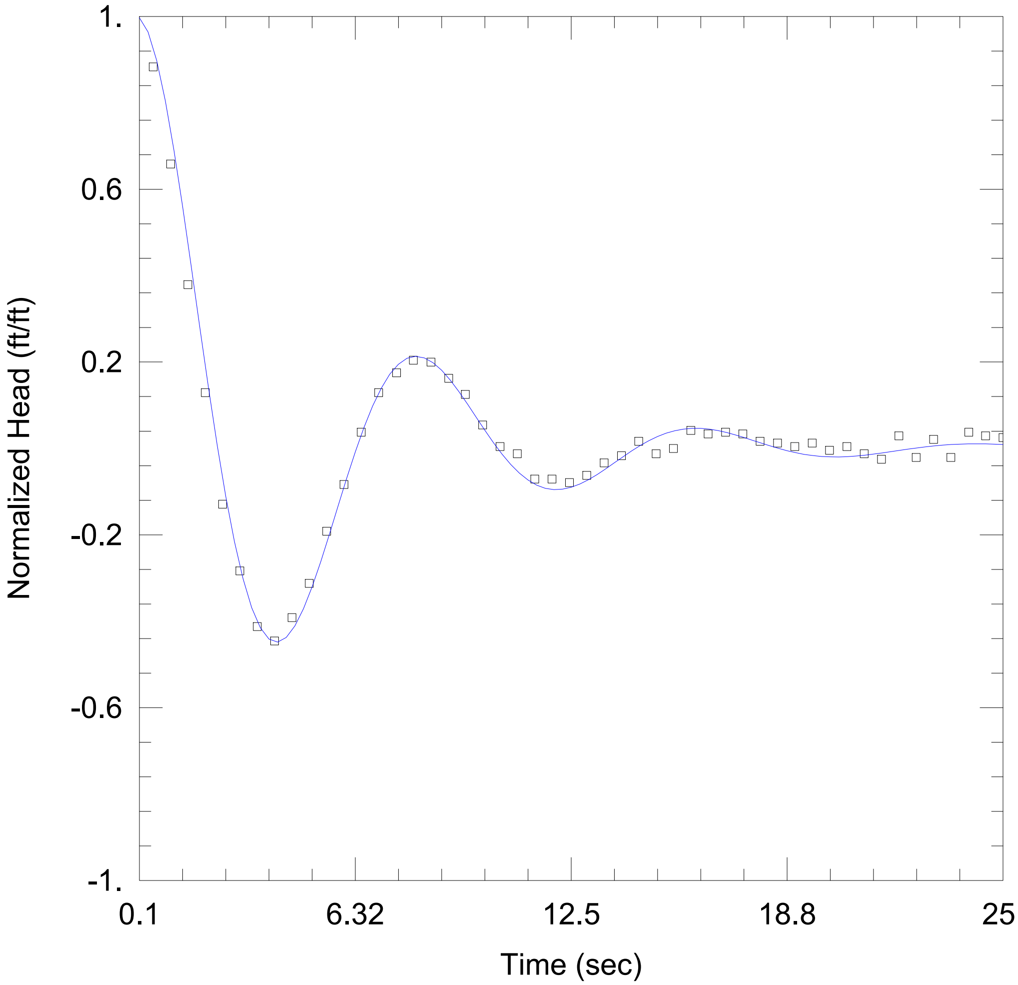
WELL DATA (APW-16)

Initial Displacement: 0.19 ft
Total Well Penetration Depth: 16.3 ft
Casing Radius: 0.08625 ft
Static Water Column Height: 64.22 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.141 cm/sec
Kz/Kr = 1.
Ss = 6.55E-7 ft^{-1}
Le = 48.91 ft



APW-16 FH03

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-16
Test Date: 3/11/2021

AQUIFER DATA

Saturated Thickness: 16.4 ft
Anisotropy Ratio (Kz/Kr): 1.

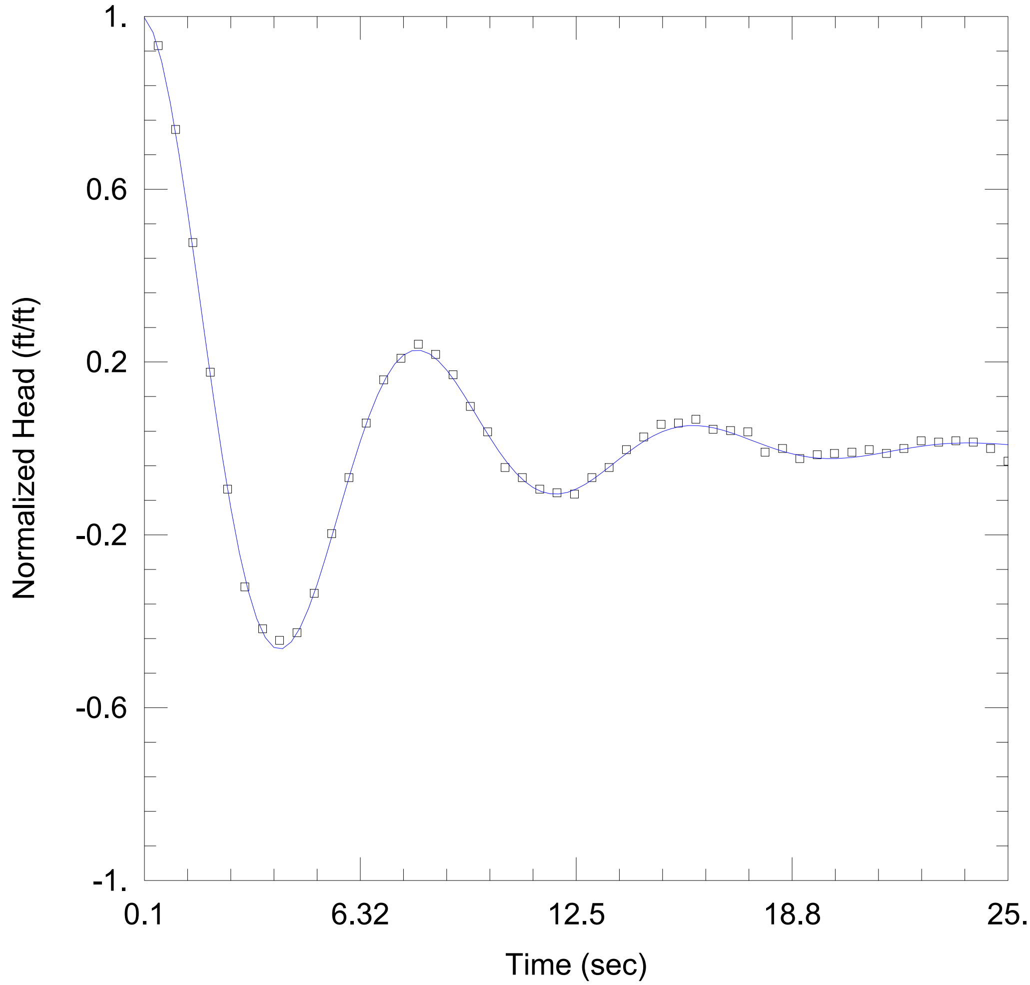
WELL DATA (APW-16)

Initial Displacement: 0.24 ft
Total Well Penetration Depth: 16.3 ft
Casing Radius: 0.086 ft
Static Water Column Height: 64.49 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.135 cm/sec
Kz/Kr = 1.
Ss = 1.65E-7 ft^{-1}
Le = 51.68 ft



APW-16 RH01

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-16
Test Date: 3/11/2021

AQUIFER DATA

Saturated Thickness: 16.4 ft
Anisotropy Ratio (Kz/Kr): 1.

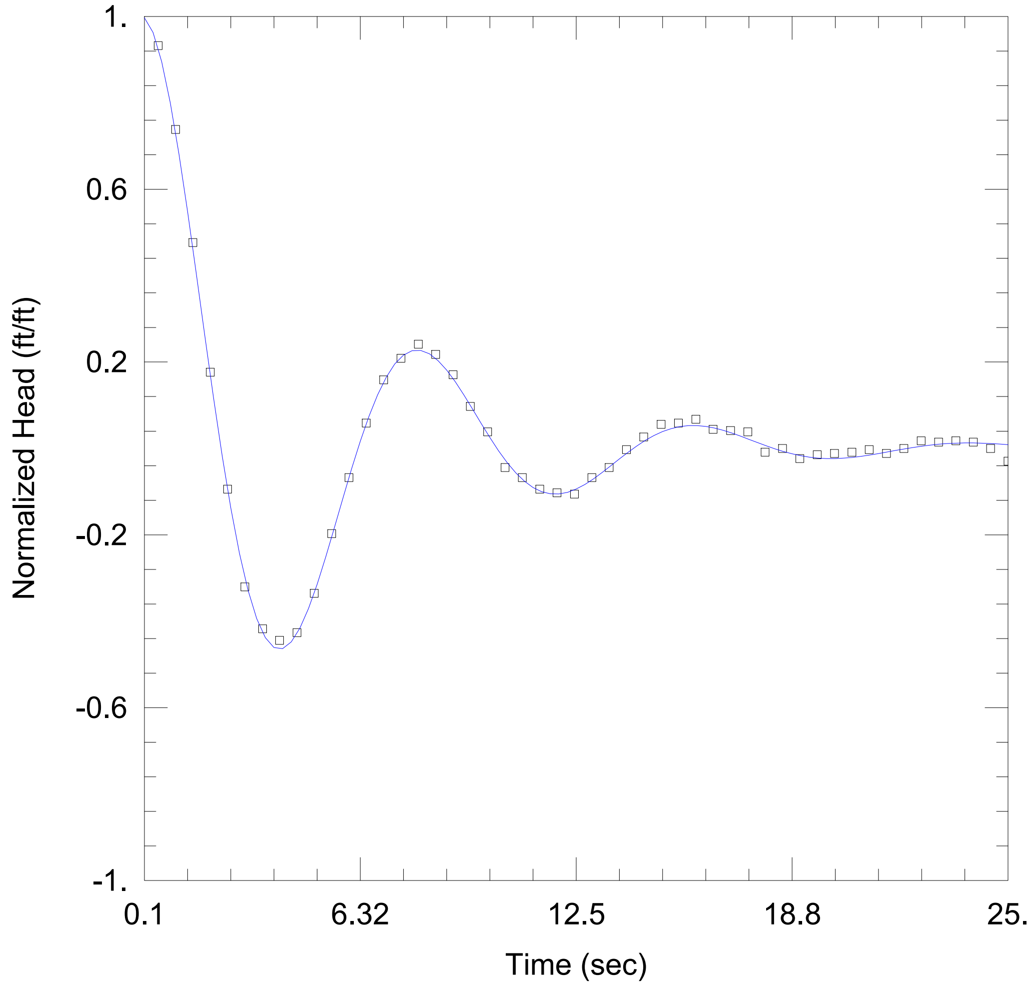
WELL DATA (APW-16)

Initial Displacement: 0.34 ft
Total Well Penetration Depth: 16.3 ft
Casing Radius: 0.086 ft
Static Water Column Height: 64.49 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.145 cm/sec
Kz/Kr = 1.
Ss = 1.21E-7 ft^{-1}
Le = 50.37 ft



APW-16 RH01

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-16
Test Date: 3/11/2021

AQUIFER DATA

Saturated Thickness: 16.4 ft
Anisotropy Ratio (Kz/Kr): 1.

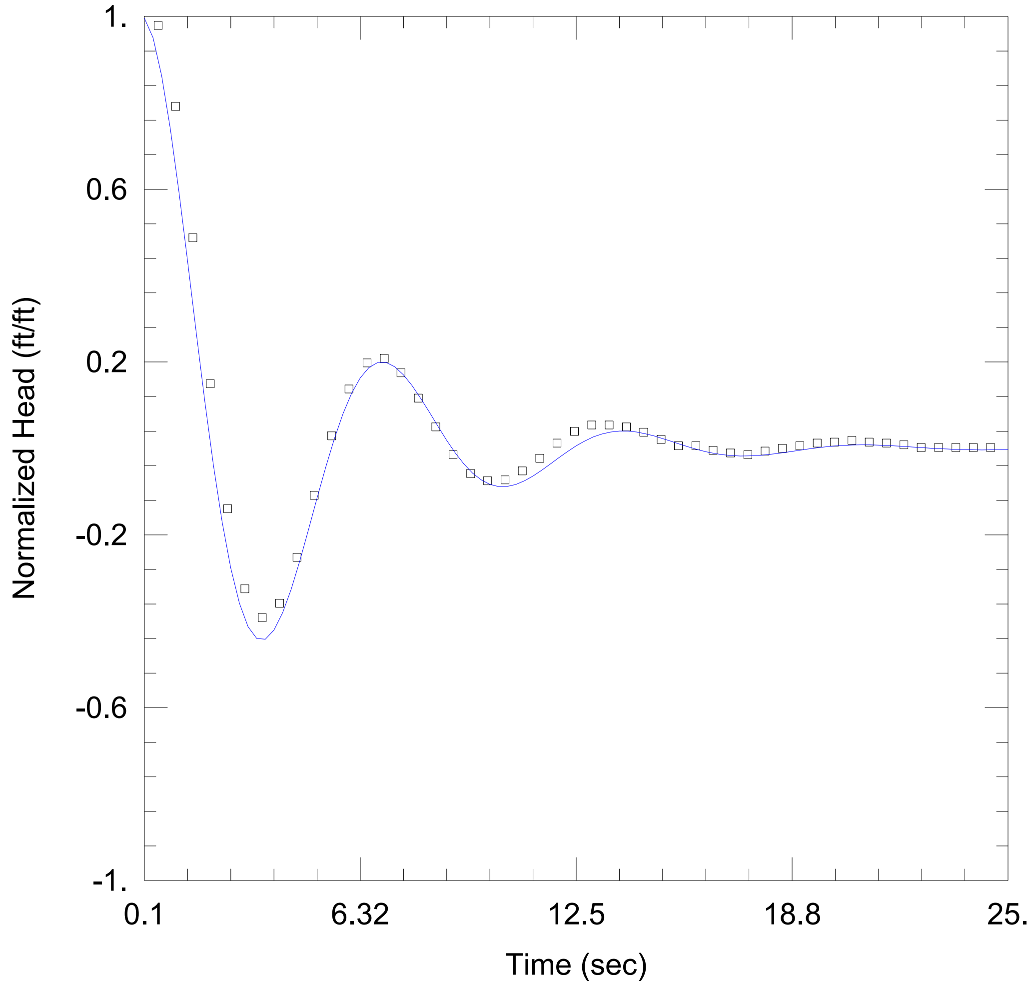
WELL DATA (APW-16)

Initial Displacement: 0.34 ft
Total Well Penetration Depth: 16.3 ft
Casing Radius: 0.086 ft
Static Water Column Height: 64.49 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.145 cm/sec
Kz/Kr = 1.
Ss = 1.21E-7 ft^{-1}
Le = 50.37 ft



APW-17 FH01

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-17
Test Date: 02/16/2021

AQUIFER DATA

Saturated Thickness: 84.7 ft
Anisotropy Ratio (Kz/Kr): 1.

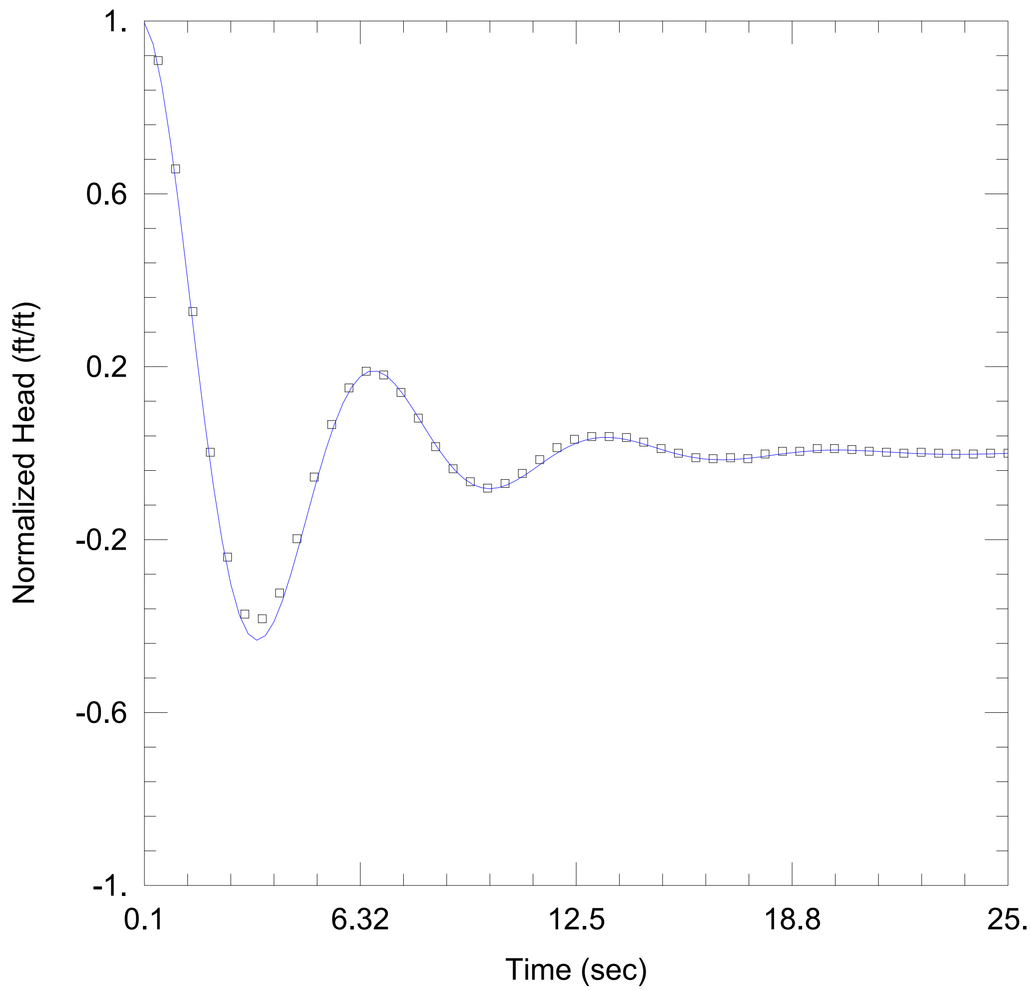
WELL DATA (APW-17)

Initial Displacement: 0.48 ft
Total Well Penetration Depth: 79.7 ft
Casing Radius: 0.086 ft
Static Water Column Height: 53.93 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.113 cm/sec
Kz/Kr = 1.
Ss = 5.88E-7 ft^{-1}
Le = 37.31 ft



APW-17 FH02

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-17
Test Date: 02/16/2021

AQUIFER DATA

Saturated Thickness: 84.7 ft
Anisotropy Ratio (Kz/Kr): 1.

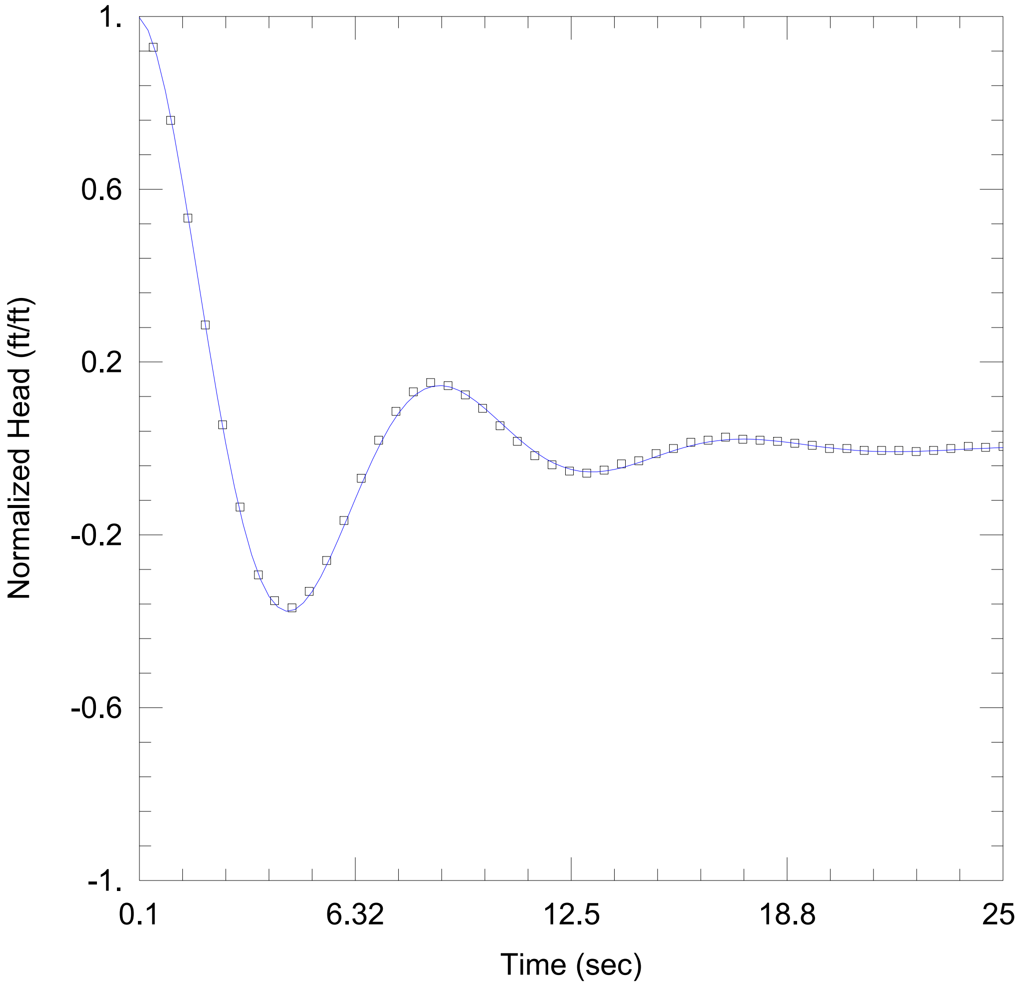
WELL DATA (APW-17)

Initial Displacement: 0.47 ft
Total Well Penetration Depth: 79.7 ft
Casing Radius: 0.086 ft
Static Water Column Height: 53.93 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.115 cm/sec
Kz/Kr = 1.
Ss = 2.88E-7 ft^{-1}
Le = 34.54 ft



APW-17 RH01

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-17
Test Date: 02/16/2021

AQUIFER DATA

Saturated Thickness: 84.7 ft
Anisotropy Ratio (Kz/Kr): 1.

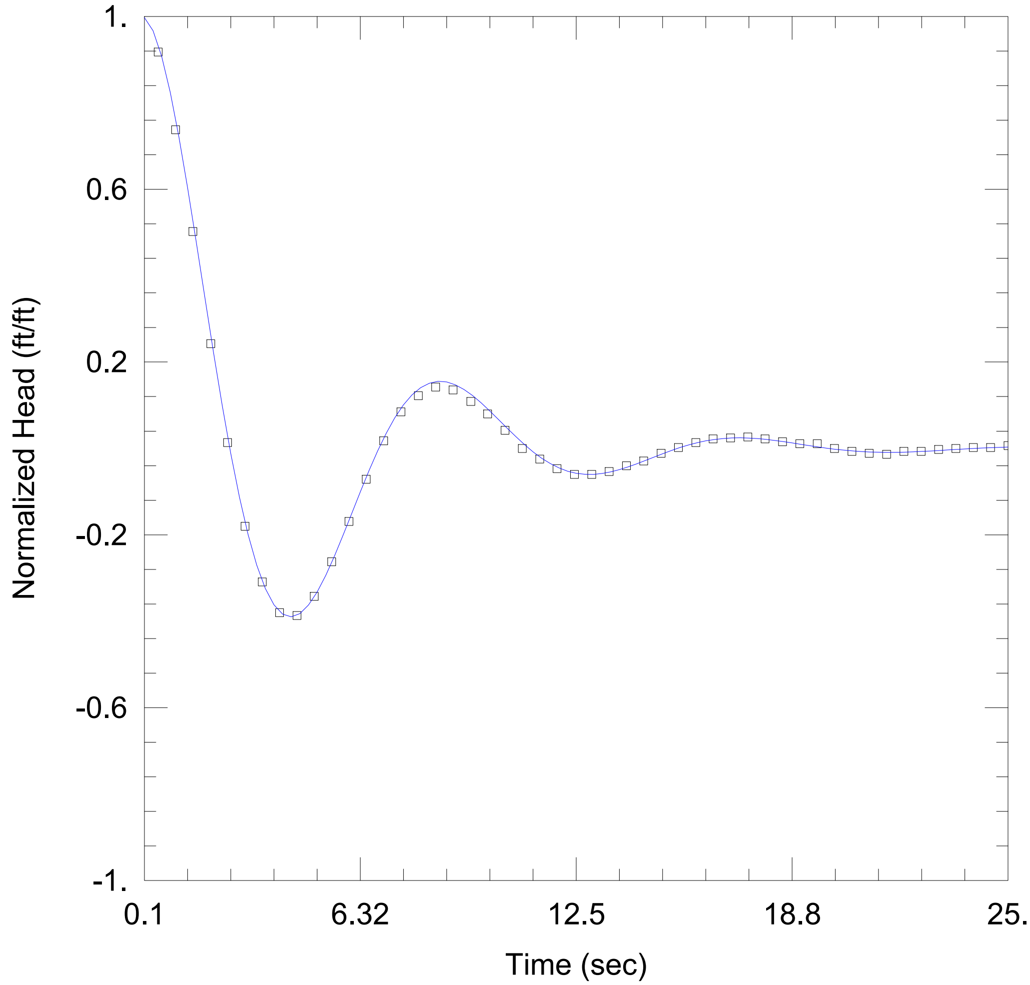
WELL DATA (APW-17)

Initial Displacement: 0.42 ft
Total Well Penetration Depth: 79.7 ft
Casing Radius: 0.086 ft
Static Water Column Height: 53.93 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.076 cm/sec
Kz/Kr = 1.
Ss = 2.88E-7 ft^{-1}
Le = 57.77 ft



APW-17 RH02

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-17
Test Date: 02/16/2021

AQUIFER DATA

Saturated Thickness: 84.7 ft
Anisotropy Ratio (Kz/Kr): 1.

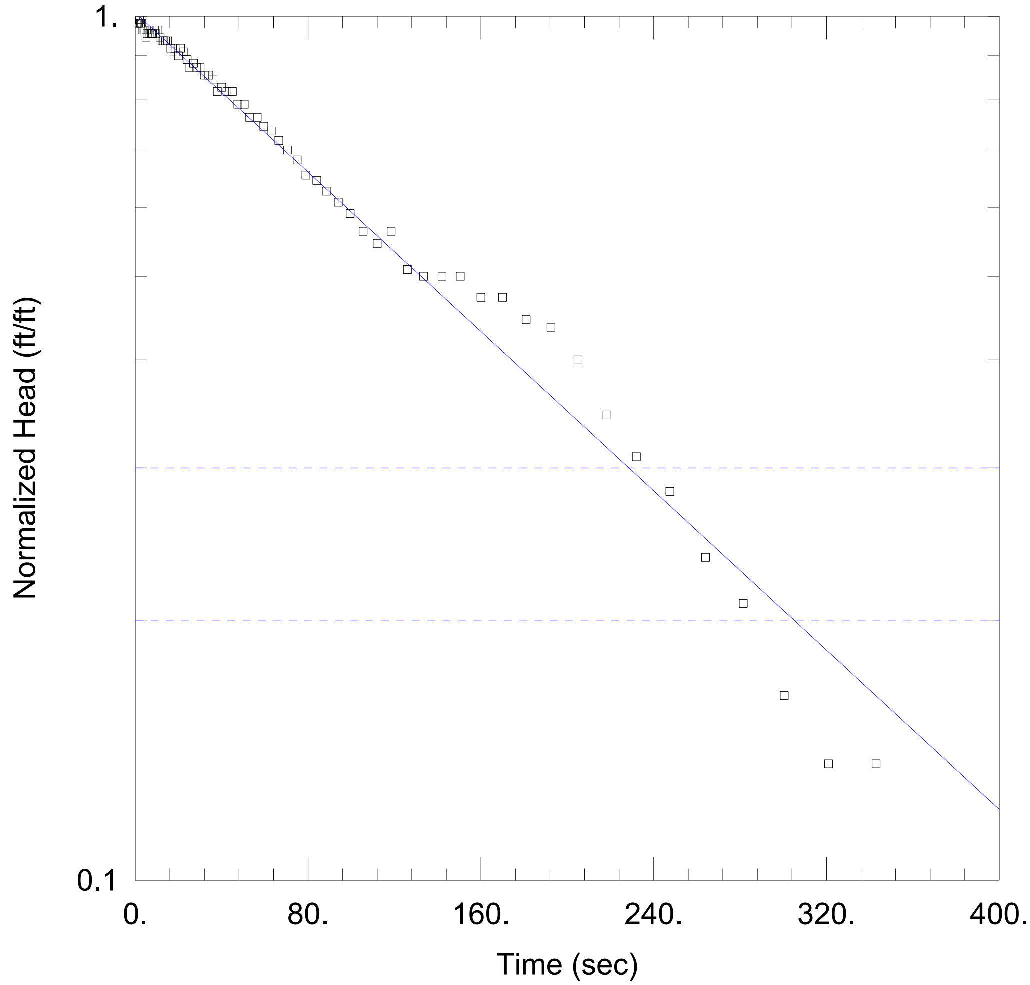
WELL DATA (APW-17)

Initial Displacement: 0.45 ft
Total Well Penetration Depth: 79.7 ft
Casing Radius: 0.086 ft
Static Water Column Height: 53.93 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.0796 cm/sec
Kz/Kr = 1.
Ss = 2.88E-7 ft^{-1}
Le = 56.31 ft



APW-18 FH01

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: APW-18
Test Date: 2/16/21

AQUIFER DATA

Saturated Thickness: 78.8 ft
Anisotropy Ratio (Kz/Kr): 1.

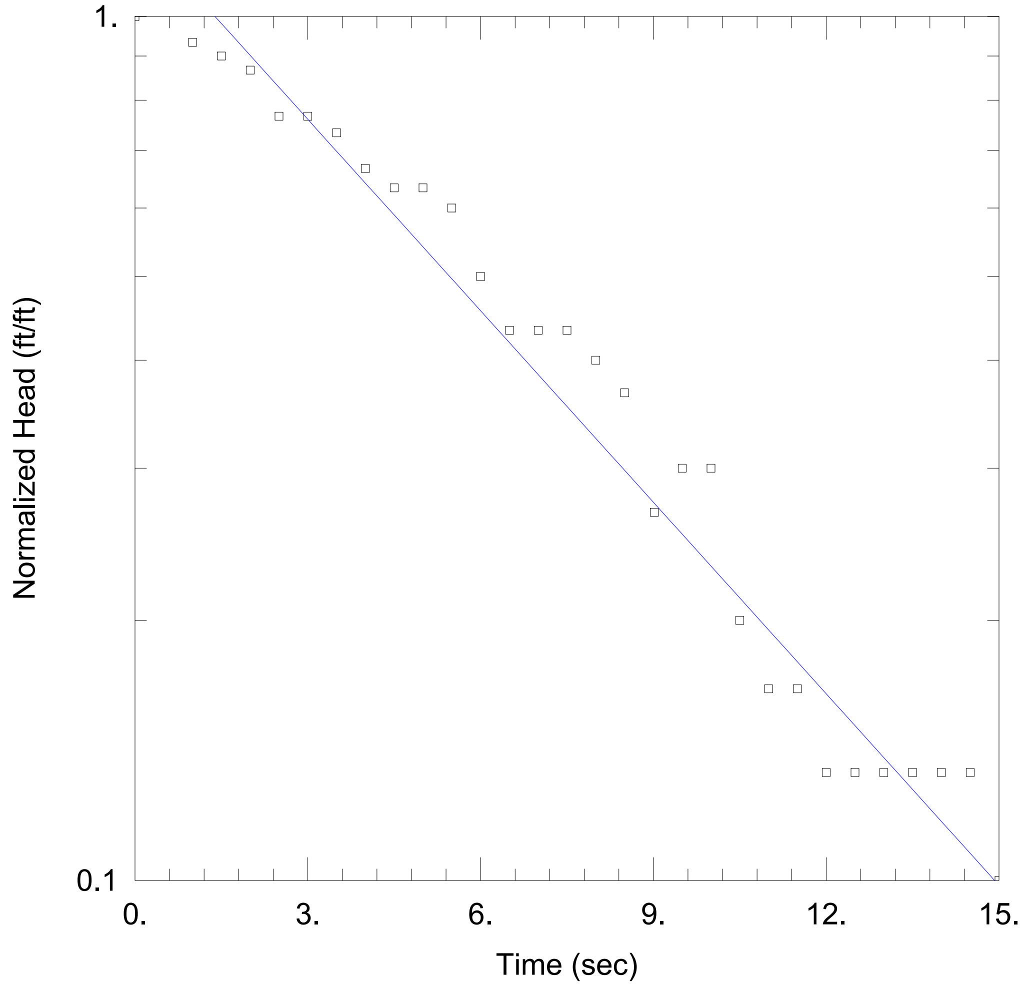
WELL DATA (APW-18)

Initial Displacement: 0.11 ft
Total Well Penetration Depth: 51.1 ft
Casing Radius: 0.086 ft
Static Water Column Height: 31.38 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.000267 cm/sec
y0 = 0.111 ft



XPW-01 FH01

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: XPW-01
Test Date: 3/11/21

AQUIFER DATA

Saturated Thickness: 8. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (XPW-01)

Initial Displacement: 0.03 ft
Total Well Penetration Depth: 8.033 ft
Casing Radius: 0.086 ft

Static Water Column Height: 8.033 ft
Screen Length: 8.033 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.25

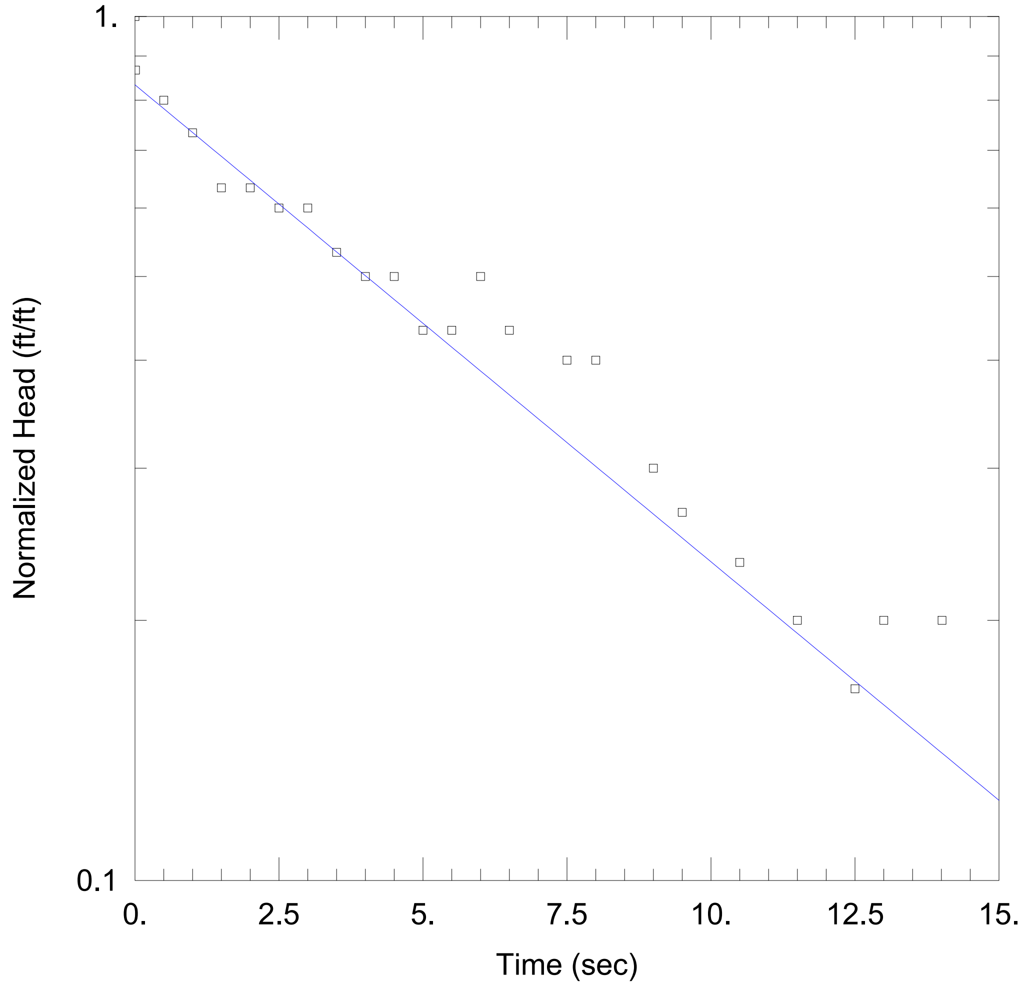
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 0.183 cm/sec

y0 = 0.038 ft



XPW-01 FH-02

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: XPW-01
Test Date: 3/11/21

AQUIFER DATA

Saturated Thickness: 8. ft
Anisotropy Ratio (Kz/Kr): 1.

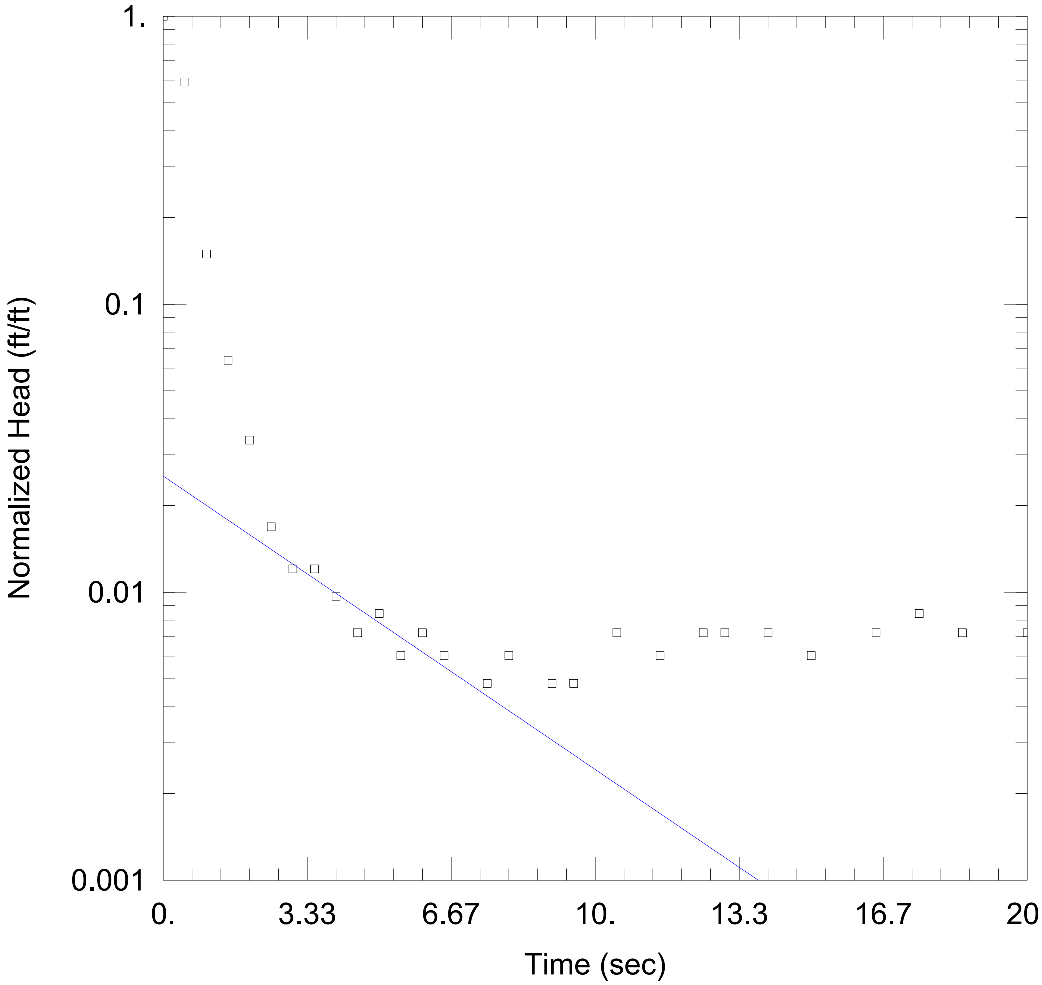
WELL DATA (XPW-01)

Initial Displacement: 0.03 ft
Total Well Penetration Depth: 8.033 ft
Casing Radius: 0.086 ft
Static Water Column Height: 8.033 ft
Screen Length: 8.033 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0129 cm/sec
y0 = 0.025 ft



XPW-01 RH1

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: XPW-01
Test Date: 3/11/21

AQUIFER DATA

Saturated Thickness: 8. ft
Anisotropy Ratio (Kz/Kr): 1.

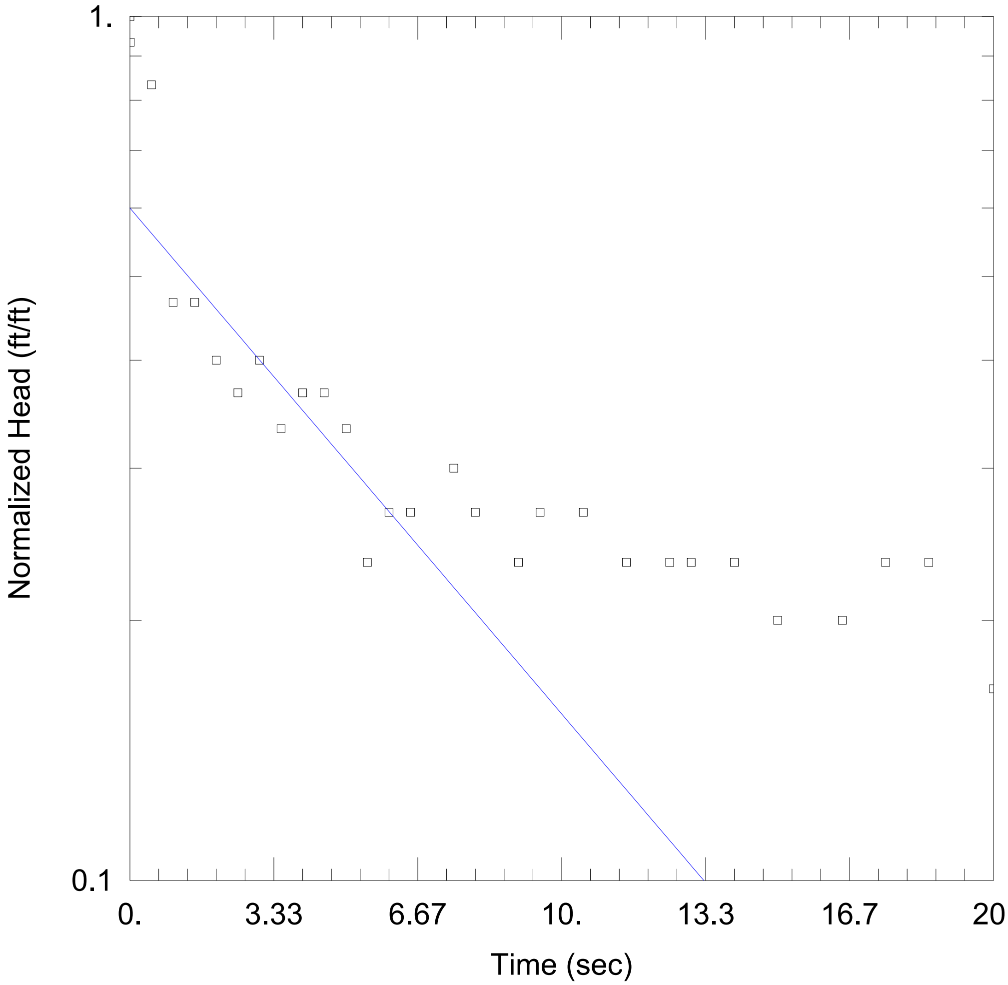
WELL DATA (XPW-01)

Initial Displacement: 0.83 ft
Total Well Penetration Depth: 8.033 ft
Casing Radius: 0.086 ft
Static Water Column Height: 8.033 ft
Screen Length: 8.033 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0238 cm/sec
y0 = 0.021 ft



XPW-01 RH2

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: XPW-01
Test Date: 3/11/21

AQUIFER DATA

Saturated Thickness: 8. ft
Anisotropy Ratio (Kz/Kr): 1.

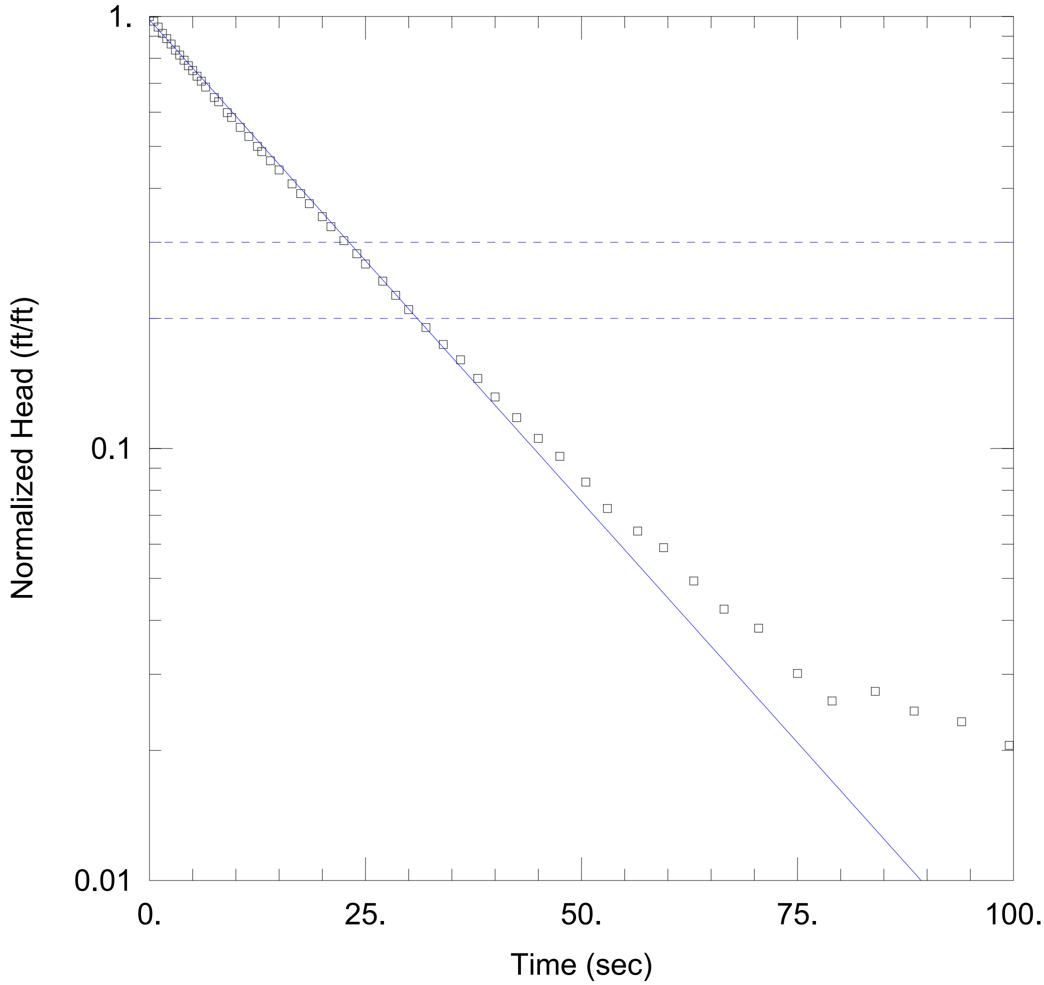
WELL DATA (XPW-01)

Initial Displacement: 0.03 ft
Total Well Penetration Depth: 8.033 ft
Casing Radius: 0.08625 ft
Static Water Column Height: 8.033 ft
Screen Length: 8.033 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0137 cm/sec
y0 = 0.018 ft



XPW02 FH1

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: XPW02
Test Date: 3/11/21

AQUIFER DATA

Saturated Thickness: 7.259 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (XPW02)

Initial Displacement: 0.73 ft
Total Well Penetration Depth: 7.259 ft
Casing Radius: 0.086 ft

Static Water Column Height: 9.759 ft
Screen Length: 7.259 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.

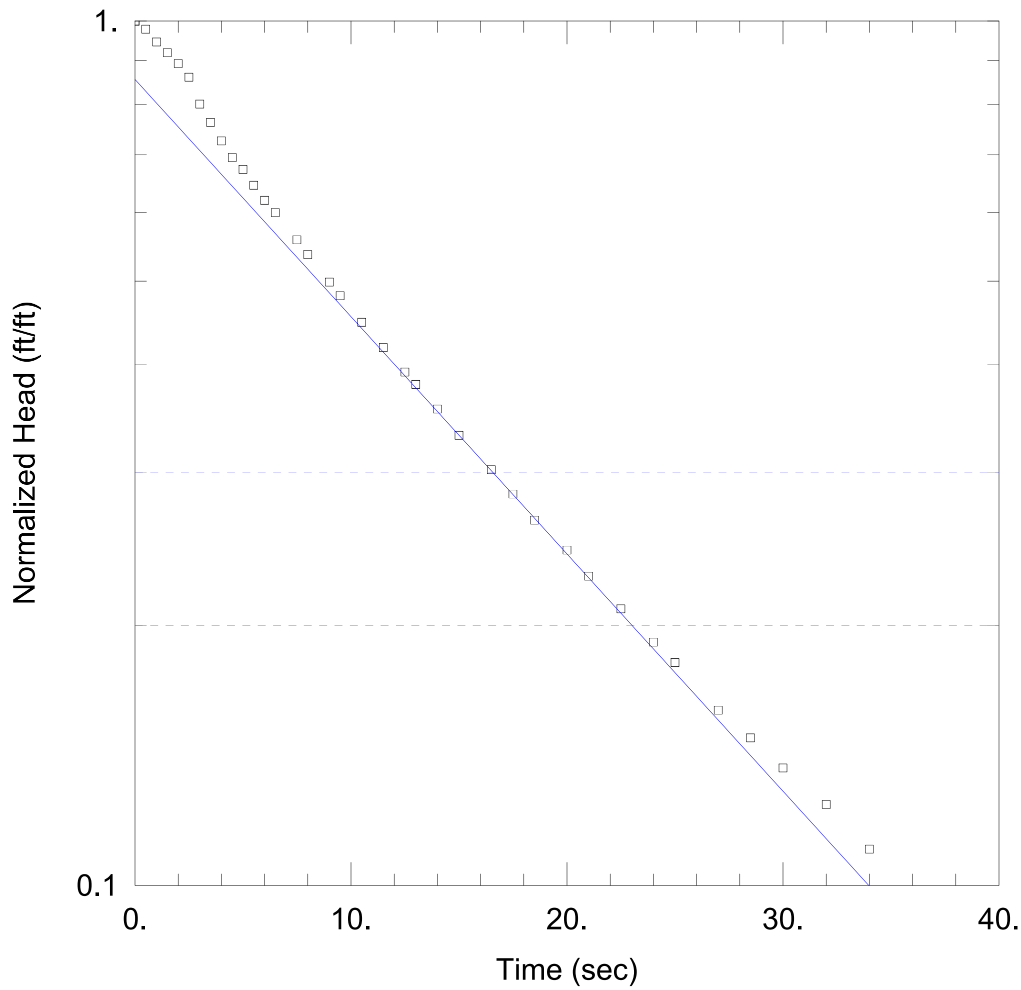
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 0.00197 cm/sec

y0 = 0.717 ft



XPW02 FH2

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: XPW02
Test Date: 3/11/21

AQUIFER DATA

Saturated Thickness: 7.259 ft
Anisotropy Ratio (Kz/Kr): 1.

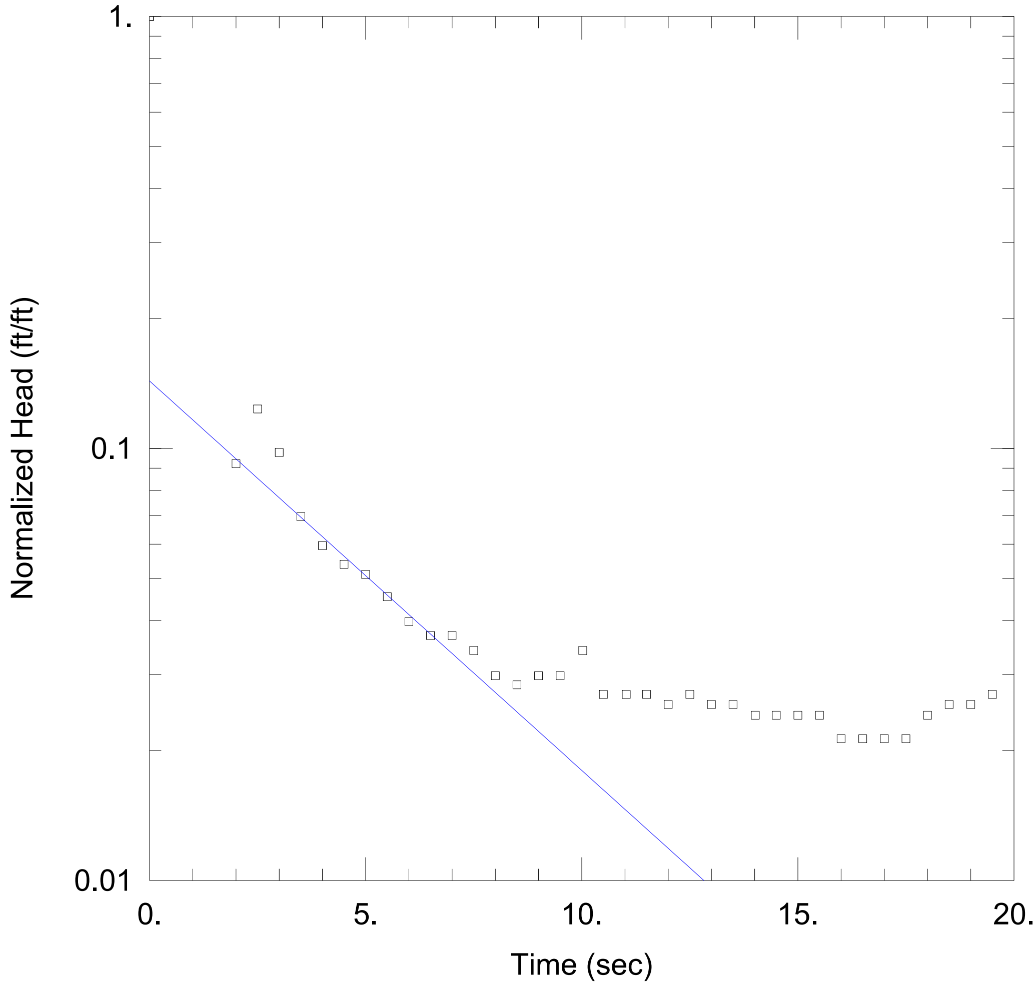
WELL DATA (XPW02)

Initial Displacement: 0.79 ft
Total Well Penetration Depth: 7.259 ft
Casing Radius: 0.086 ft
Static Water Column Height: 9.759 ft
Screen Length: 7.259 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.00257 cm/sec
y0 = 0.676 ft



XPW03 FH1

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: XPW03
Test Date: 3/31/21

AQUIFER DATA

Saturated Thickness: 7.958 ft
Anisotropy Ratio (Kz/Kr): 1.

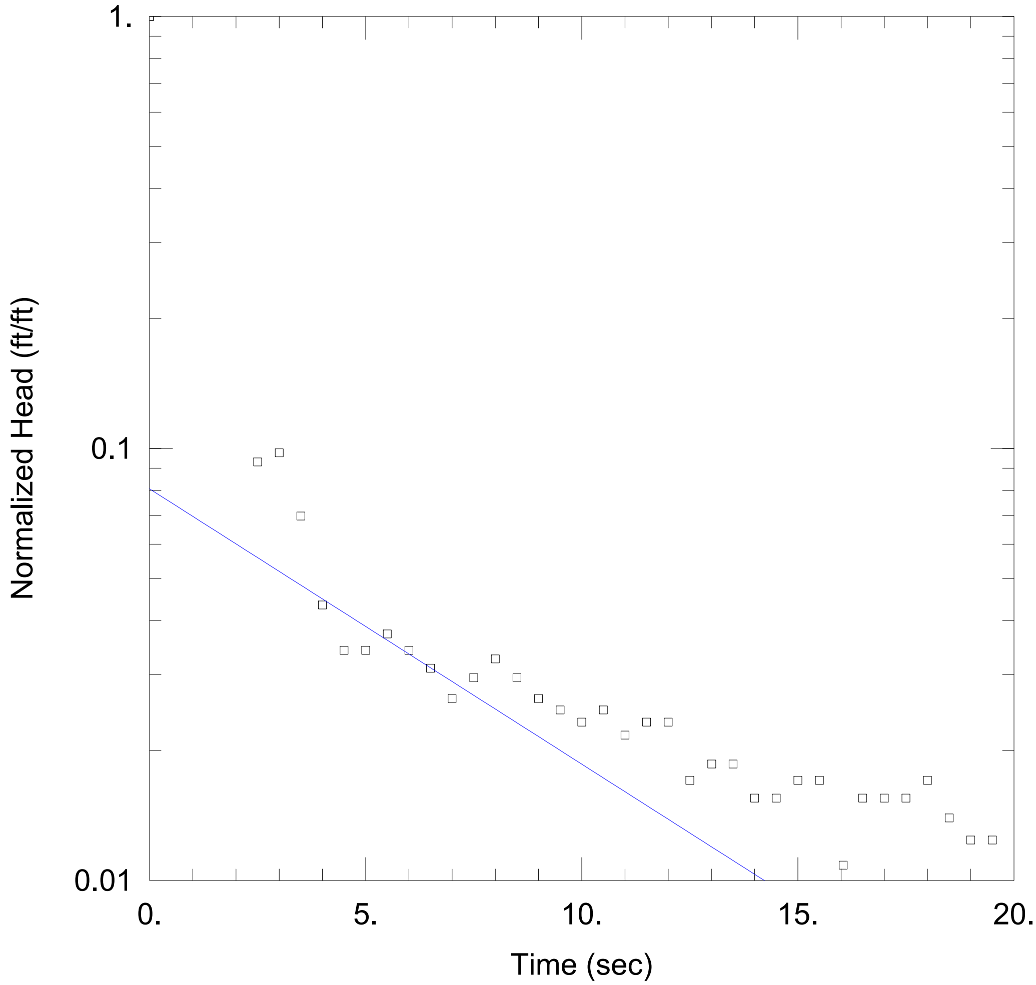
WELL DATA (XPW03)

Initial Displacement: 0.705 ft
Total Well Penetration Depth: 4.7 ft
Casing Radius: 0.086 ft
Static Water Column Height: 13.26 ft
Screen Length: 4.7 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0573 cm/sec
y0 = 0.101 ft



XPW03 FH2

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: XPW03
Test Date: 3/31/21

AQUIFER DATA

Saturated Thickness: 7.938 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (XPW03)

Initial Displacement: 0.645 ft
Total Well Penetration Depth: 4.7 ft
Casing Radius: 0.086 ft

Static Water Column Height: 13.24 ft
Screen Length: 4.7 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.

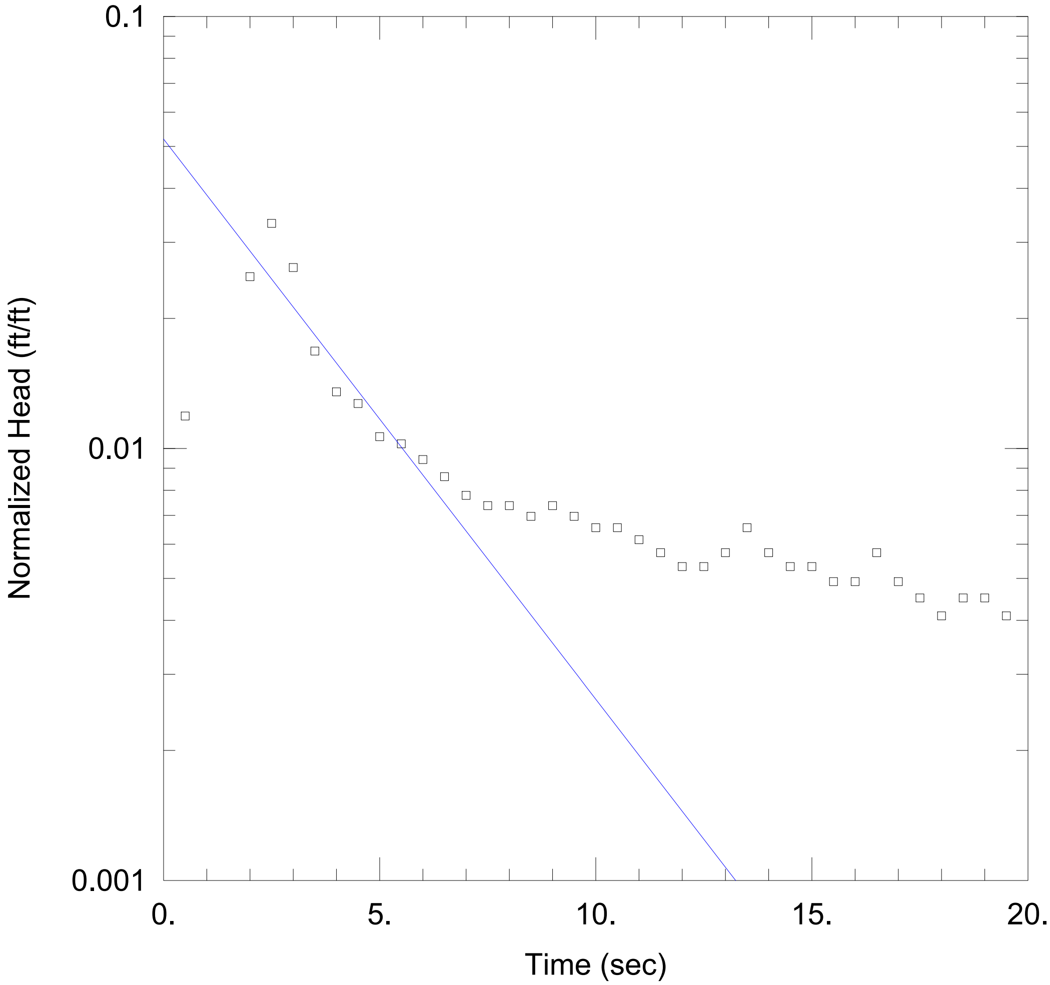
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 0.072 cm/sec

y0 = 0.052 ft



XPW03 FH3

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: XPW03
Test Date: 3/31/21

AQUIFER DATA

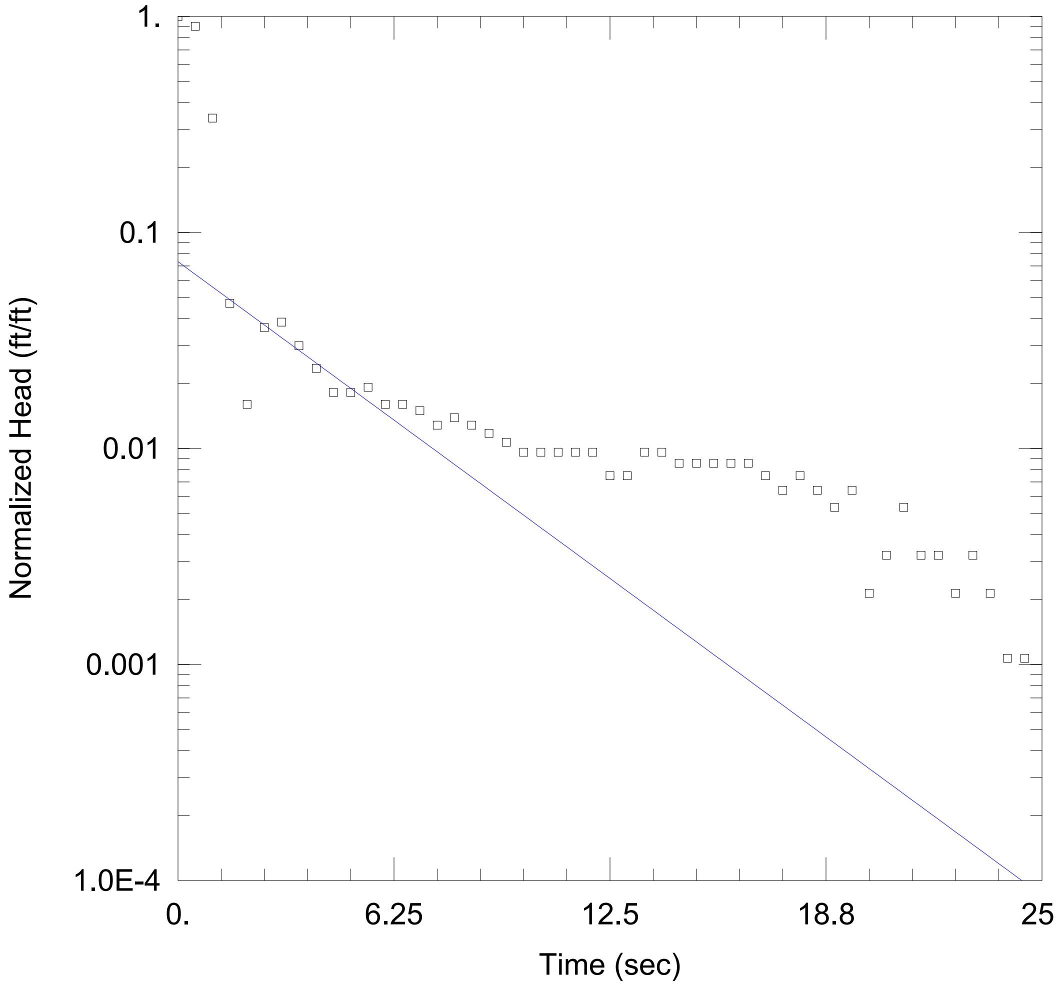
Saturated Thickness: 7.948 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (XPW03)

Initial Displacement: 2.441 ft
Total Well Penetration Depth: 4.7 ft
Casing Radius: 0.086 ft
Static Water Column Height: 13.25 ft
Screen Length: 4.7 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.227 cm/sec
y0 = 0.127 ft



XPW03 RH01

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: XPW03
Test Date: 3/31/21

AQUIFER DATA

Saturated Thickness: 7.948 ft
Anisotropy Ratio (Kz/Kr): 1.

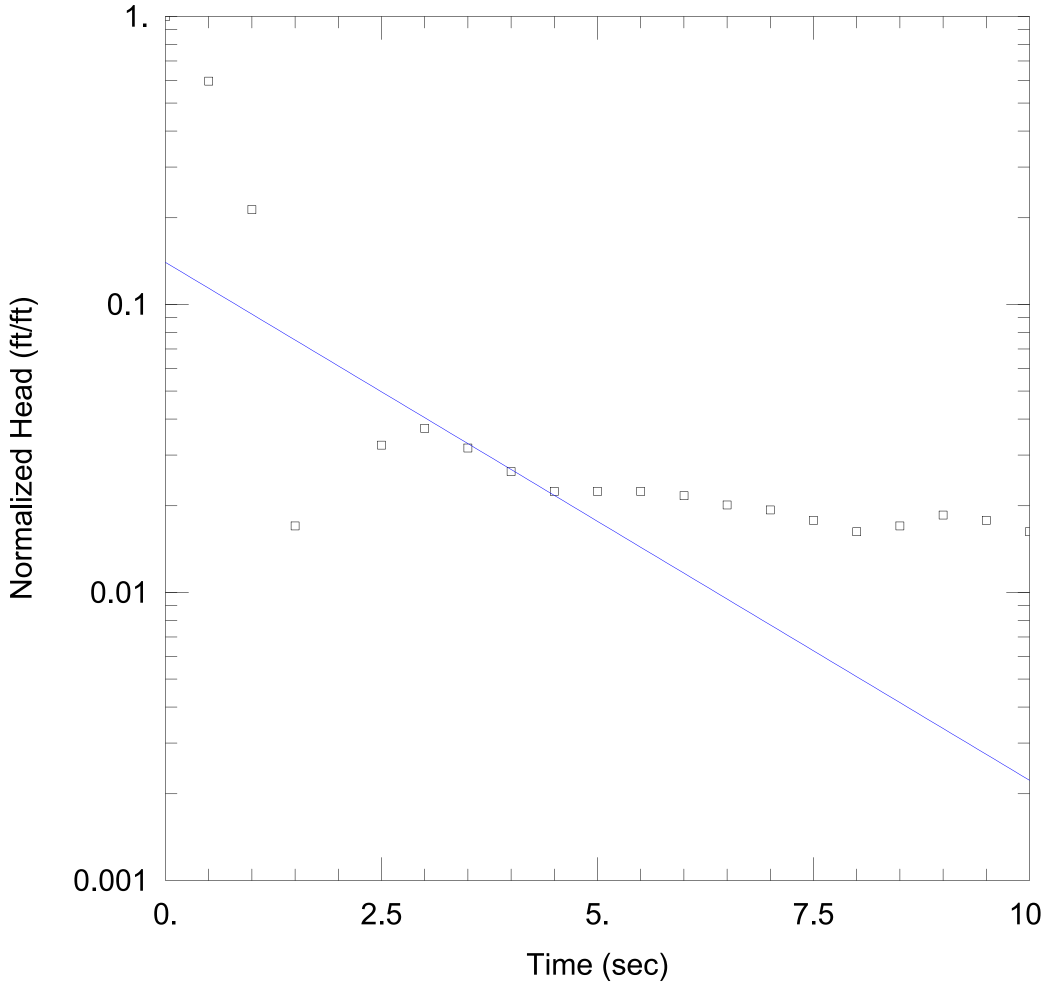
WELL DATA (XPW03)

Initial Displacement: -0.937 ft
Total Well Penetration Depth: 4.7 ft
Casing Radius: 0.086 ft
Static Water Column Height: 13.25 ft
Screen Length: 4.7 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.146 cm/sec
y0 = -0.0686 ft



XPW03 RH2

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: XPW03
Test Date: 3/31/21

AQUIFER DATA

Saturated Thickness: 7.948 ft
Anisotropy Ratio (Kz/Kr): 1.

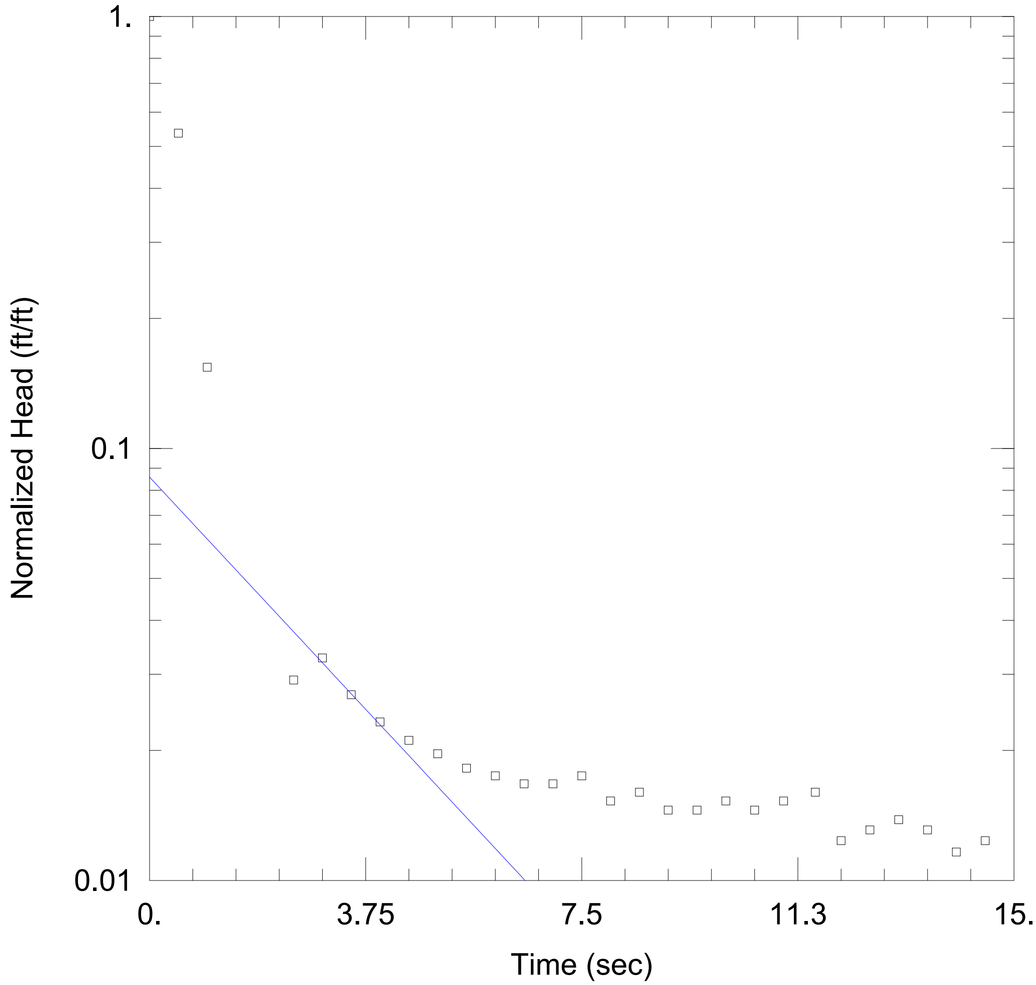
WELL DATA (XPW03)

Initial Displacement: -1.293 ft
Total Well Penetration Depth: 4.7 ft
Casing Radius: 0.086 ft
Static Water Column Height: 13.25 ft
Screen Length: 4.7 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.117 cm/sec
y0 = -0.181 ft



XPW03 RH3

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: XPW03
Test Date: 3/31/21

AQUIFER DATA

Saturated Thickness: 7.948 ft
Anisotropy Ratio (Kz/Kr): 1.

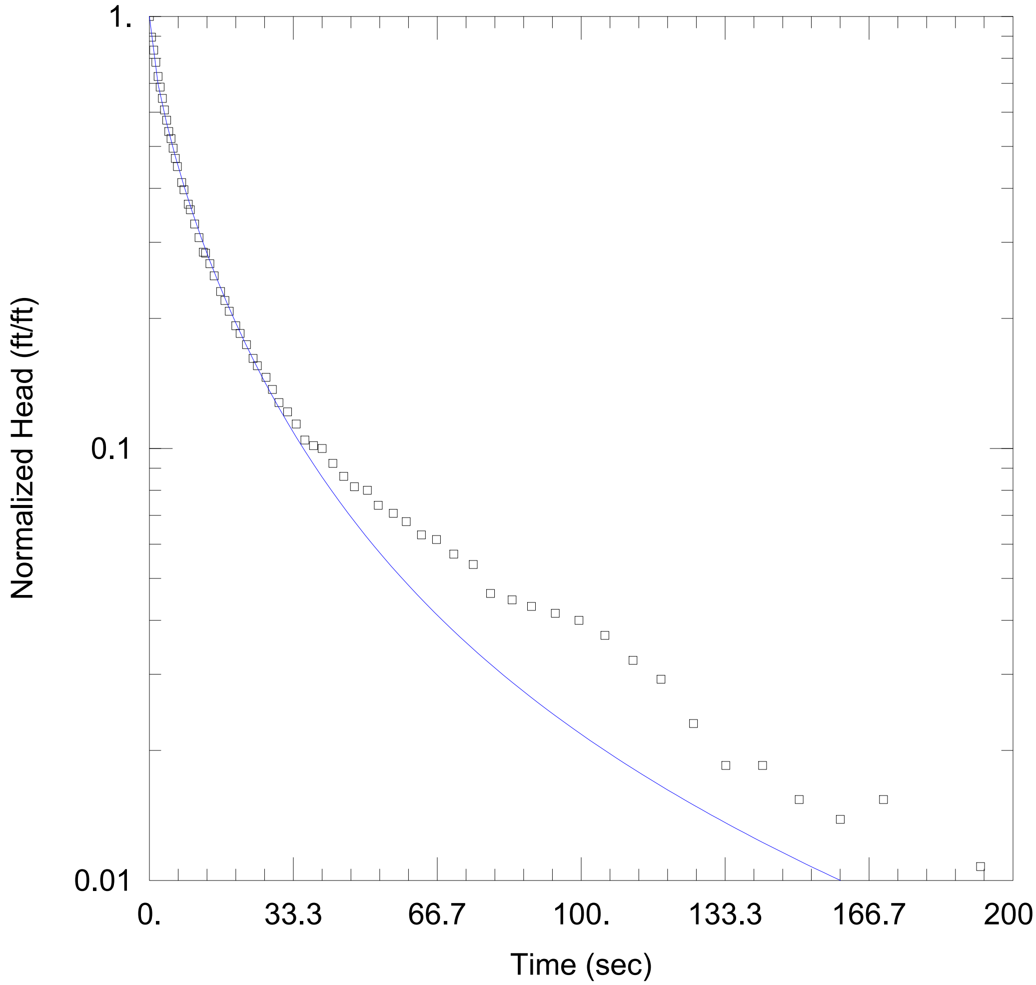
WELL DATA (XPW03)

Initial Displacement: -1.375 ft
Total Well Penetration Depth: 4.7 ft
Casing Radius: 0.086 ft
Static Water Column Height: 13.25 ft
Screen Length: 4.7 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.143 cm/sec
y0 = -0.118 ft



XPW04 FH2

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: XPW04
Test Date: 3/11/21

AQUIFER DATA

Saturated Thickness: 9.9 ft

WELL DATA (XPW04)

Initial Displacement: 0.65 ft
Total Well Penetration Depth: 9.9 ft
Casing Radius: 0.086 ft

Static Water Column Height: 10.4 ft
Screen Length: 9.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.

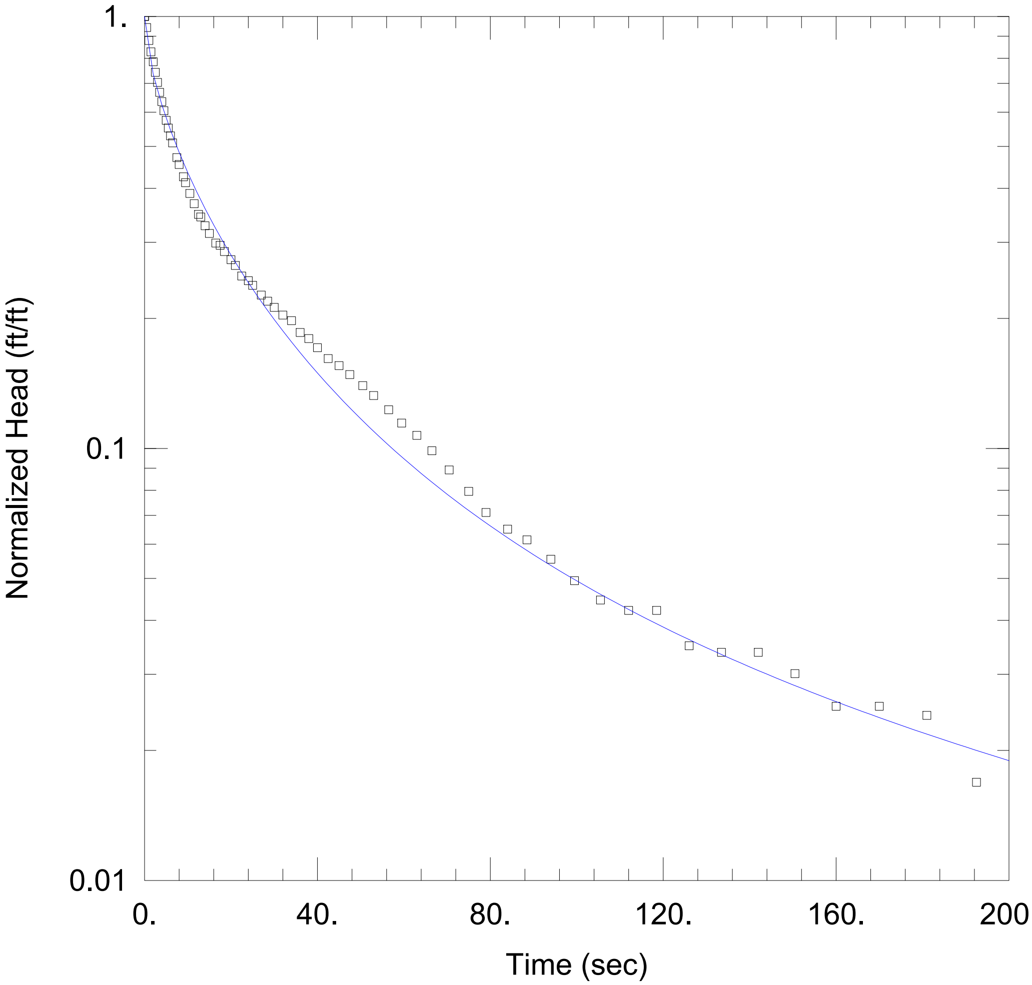
SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 0.0021 cm/sec
Kz/Kr = 1.

Ss = 0.00051 ft^{-1}



XPW04 RH1

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: XPW04
Test Date: 3/11/21

AQUIFER DATA

Saturated Thickness: 9.9 ft

WELL DATA (XPW04)

Initial Displacement: 0.83 ft
Total Well Penetration Depth: 9.9 ft
Casing Radius: 0.086 ft

Static Water Column Height: 10.4 ft
Screen Length: 9.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.

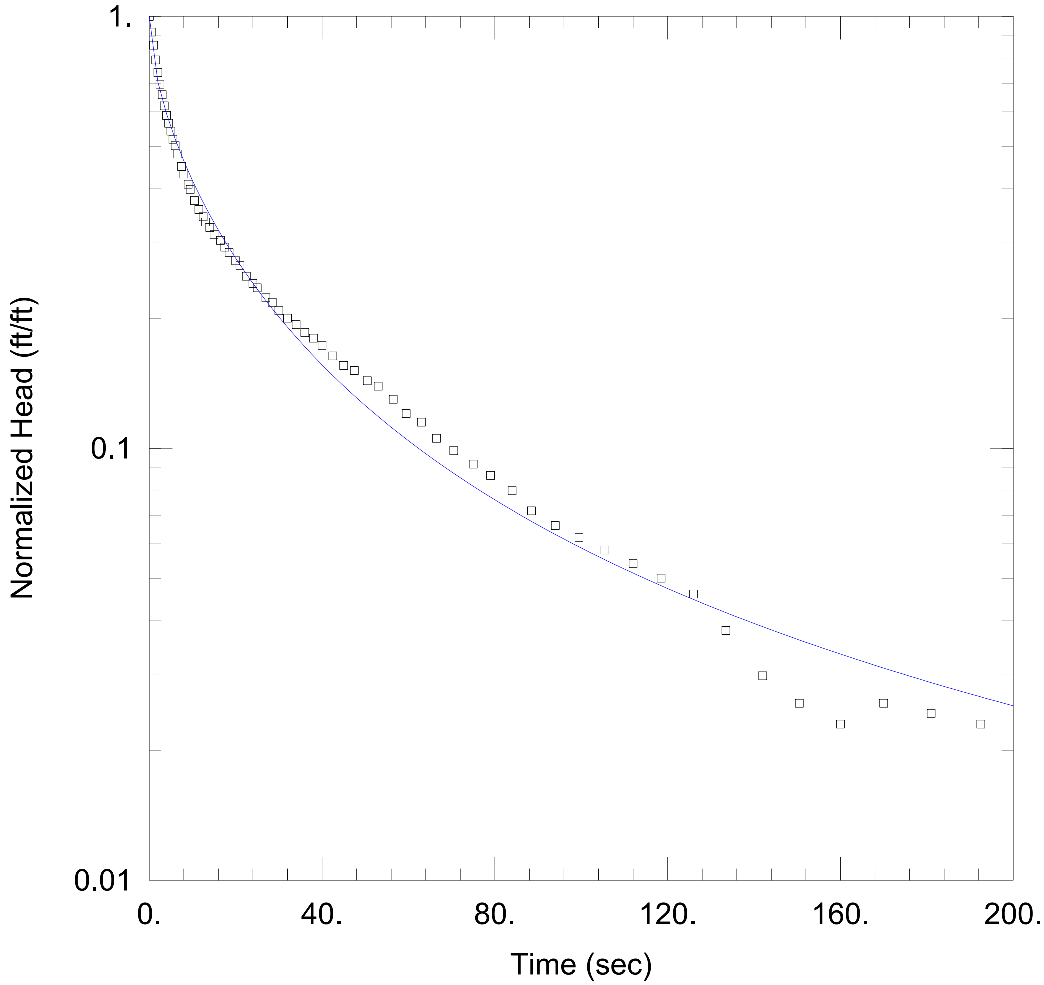
SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 0.00122 cm/sec
Kz/Kr = 1.

Ss = 0.00094 ft^{-1}



XPW04 RH2

PROJECT INFORMATION

Company: Ramboll
Client: IPGC
Project: 1940100499-001
Location: Newton
Test Well: XPW04
Test Date: 3/11/21

AQUIFER DATA

Saturated Thickness: 9.9 ft

WELL DATA (XPW04)

Initial Displacement: 0.74 ft
Total Well Penetration Depth: 9.9 ft
Casing Radius: 0.086 ft

Static Water Column Height: 10.4 ft
Screen Length: 9.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 0.00101 cm/sec
Kz/Kr = 1.

Ss = 0.0019 ft^{-1}

2017 HYDRAULIC CONDUCTIVITY TEST DATA

Appendix C - Table 1
Newton Power Station
Slug Test Results - Primary Ash Pond Wells (ID 501)
Hydrogeologic Monitoring Plan

Well ID	Slug In 1	Slug In 2	Slug In 3	Slug Out 1	Slug Out 2	Slug Out 3	Slug Out 4	MIN	MAX	GEOMEAN	Solution
APW2		4.41E-05		4.52E-05		3.45E-05		3.45E-05	4.52E-05	4.1E-05	Bouwer-Rice
APW3	8.44E-06			8.61E-06				8.44E-06	8.61E-06	8.5E-06	Bouwer-Rice
APW4	6.66E-06			5.14E-06				5.14E-06	6.66E-06	5.8E-06	Bouwer-Rice
APW5	5.66E-04	1.42E-03		1.54E-04	2.74E-04	2.56E-04		1.54E-04	1.42E-03	3.9E-04	Bouwer-Rice
APW6	1.64E-03	2.18E-03			2.09E-03	1.98E-03		1.64E-03	2.18E-03	2.0E-03	Bouwer-Rice
APW7	2.25E-03				3.24E-03	2.99E-03	2.75E-03	2.25E-03	3.24E-03	2.8E-03	Bouwer-Rice
APW8	6.60E-04	1.31E-03			1.06E-03	7.89E-04		6.60E-04	1.31E-03	9.2E-04	Bouwer-Rice
APW9	3.21E-03	3.28E-03		3.40E-03	3.00E-03			3.00E-03	3.40E-03	3.2E-03	Bouwer-Rice
APW10	5.27E-04	5.49E-04			5.73E-04	5.60E-04		5.27E-04	5.73E-04	5.5E-04	Bouwer-Rice

All slug test (i.e. hydraulic conductivity) results are in centimeters per second

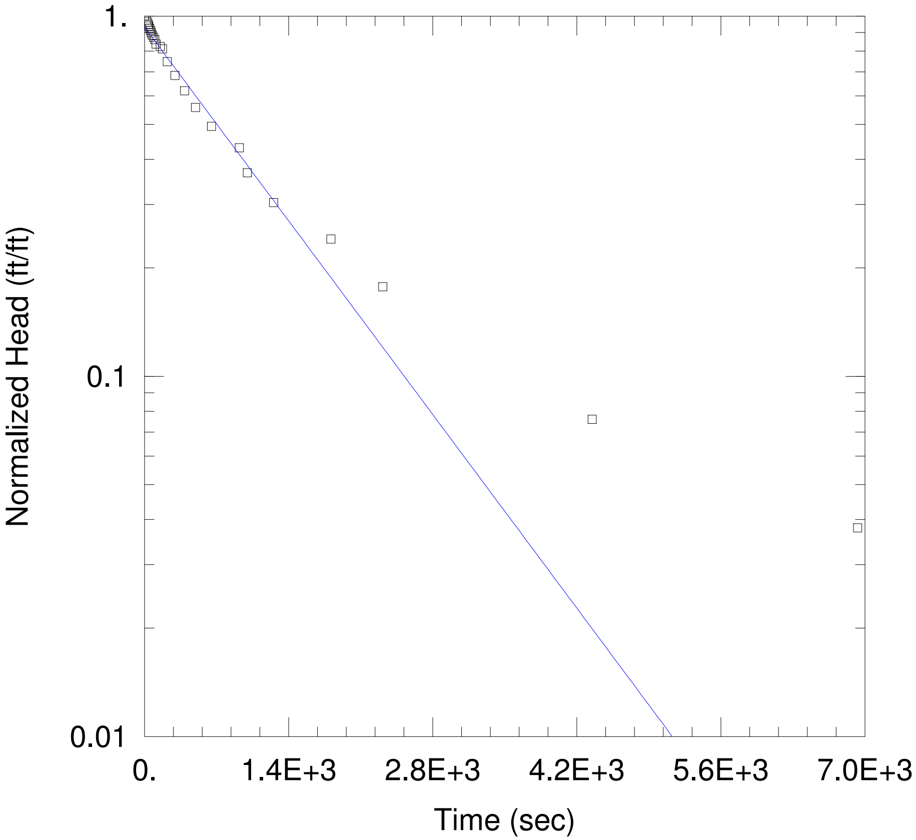
(grey box) Not Applicable

Appendix C - Table 2
Newton Power Station
Slug Test Results - Landfill 2 CCR Wells (ID 502)
Hydrogeologic Monitoring Plan

Well ID	Slug In 1	Slug In 2	Slug In 3	Slug Out 1	Slug Out 2	Slug Out 3	MIN	MAX	GEOMEAN	Solution
G06D				3.92E-08			3.92E-08	3.92E-08	3.9E-08	Bouwer-Rice
G202	1.70E-02	1.43E-02			2.87E-02	2.33E-02	1.43E-02	2.87E-02	2.0E-02	Bouwer-Rice
G203	2.53E-02			2.42E-02	3.47E-02		2.42E-02	3.47E-02	2.8E-02	Bouwer-Rice
G208				1.32E-08			1.32E-08	1.32E-08	1.3E-08	Bouwer-Rice
G217D	2.27E-04	2.92E-04				3.03E-04	2.27E-04	3.03E-04	2.7E-04	Bouwer-Rice
G220				3.51E-07			3.51E-07	3.51E-07	3.5E-07	Bouwer-Rice
G222				1.54E-06			1.54E-06	1.54E-06	1.5E-06	Bouwer-Rice
G223	5.19E-05	2.50E-05		1.37E-05	1.79E-05		1.37E-05	5.19E-05	2.4E-05	Bouwer-Rice
G224	5.15E-02	1.90E-02	4.64E-02	4.31E-02		2.97E-02	1.90E-02	5.15E-02	3.6E-02	Bouwer-Rice

All slug test (i.e. hydraulic conductivity) results are in centimeters per second

[grey box] Not Applicable



WELL TEST ANALYSIS

Data Set: P:\...\APW2 SI2.aqt
Date: 10/09/17 Time: 15:04:26

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW2
Test Date: 4/6/17

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

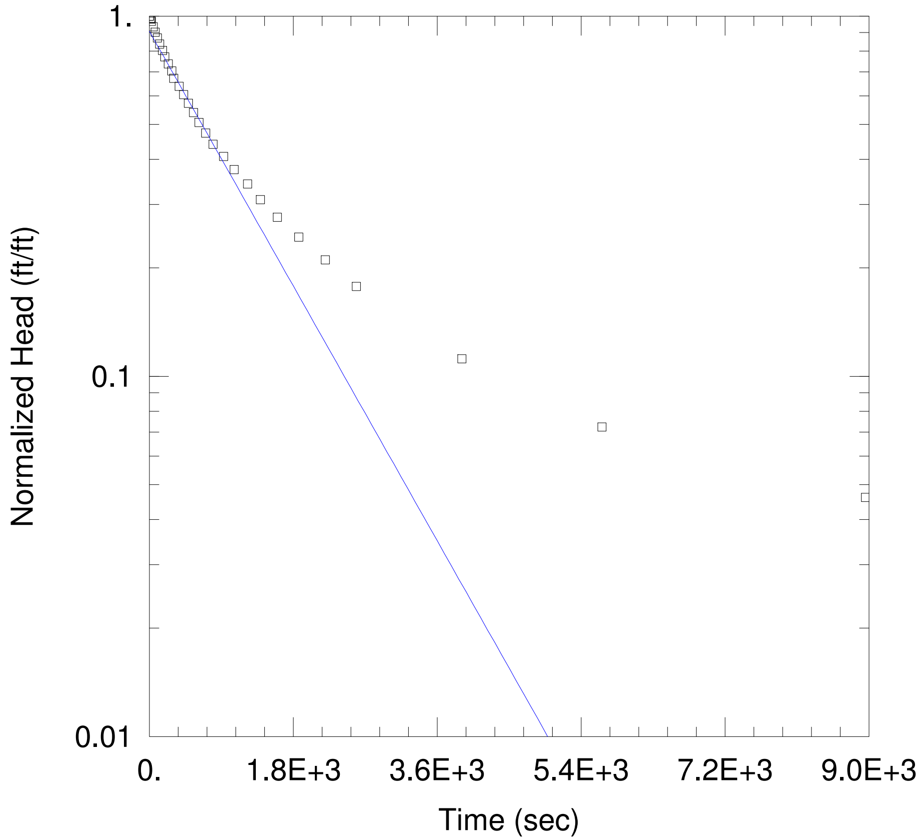
K = 4.414E-5 cm/sec
y0 = 0.7361 ft

AQUIFER DATA

Saturated Thickness: 9. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW2 SI2)

Initial Displacement: 0.79 ft
Total Well Penetration Depth: 6.4 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 9. ft
Screen Length: 3.4 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW2 SO1.aqt
Date: 10/09/17 Time: 15:05:33

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW2
Test Date: 4/6/17

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

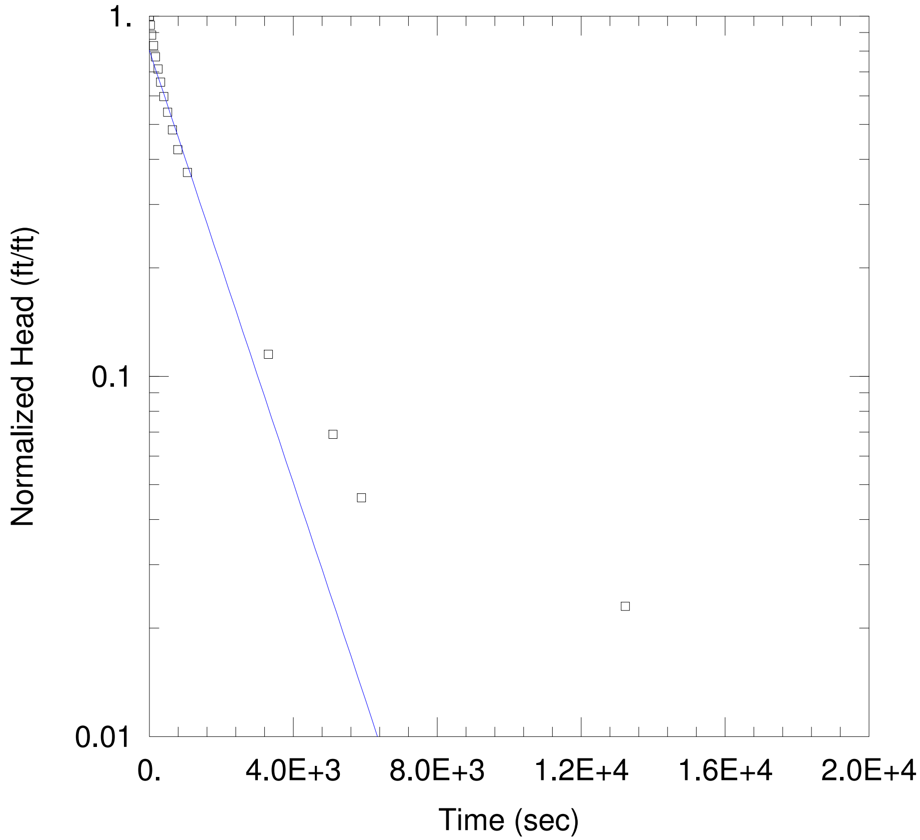
K = 4.517E-5 cm/sec
y0 = 1.38 ft

AQUIFER DATA

Saturated Thickness: 9. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW2 SO1)

Initial Displacement: 1.52 ft
Total Well Penetration Depth: 6.4 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 9. ft
Screen Length: 3.4 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW2 SO3.aqt
Date: 10/09/17 Time: 15:06:23

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW2
Test Date: 4/6/17

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

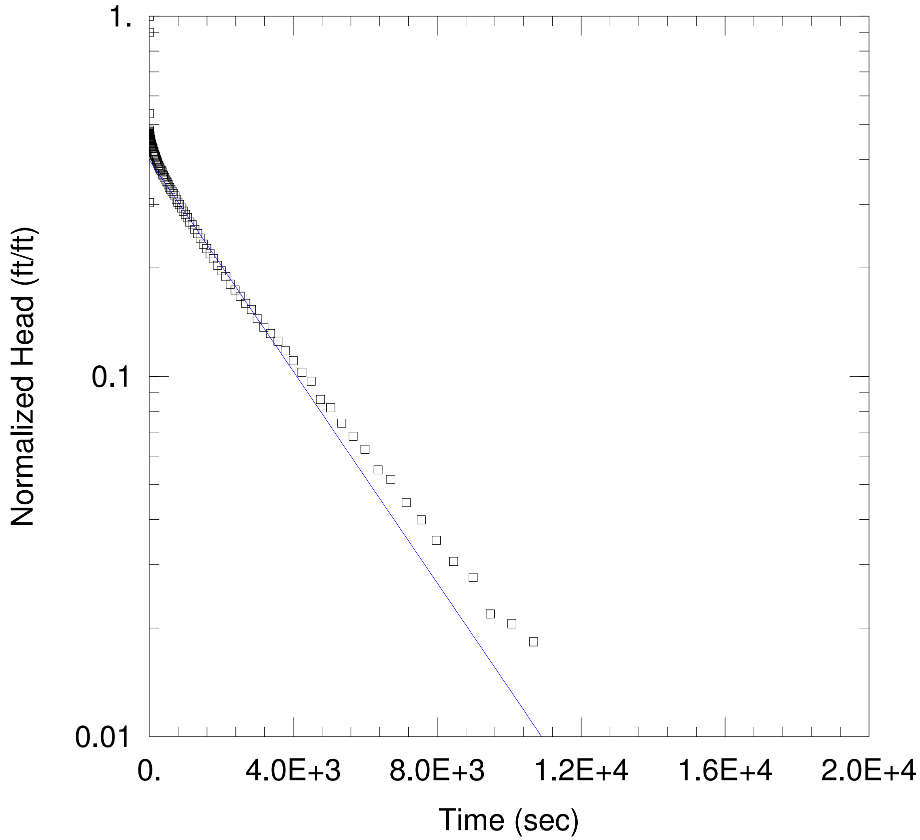
K = 3.449E-5 cm/sec
y0 = 0.698 ft

AQUIFER DATA

Saturated Thickness: 9. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW2 SO3)

Initial Displacement: 0.87 ft
Total Well Penetration Depth: 6.4 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 9. ft
Screen Length: 3.4 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW 3 SI1.aqt
Date: 10/09/17 Time: 15:13:21

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW3
Test Date: 4/6/17

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

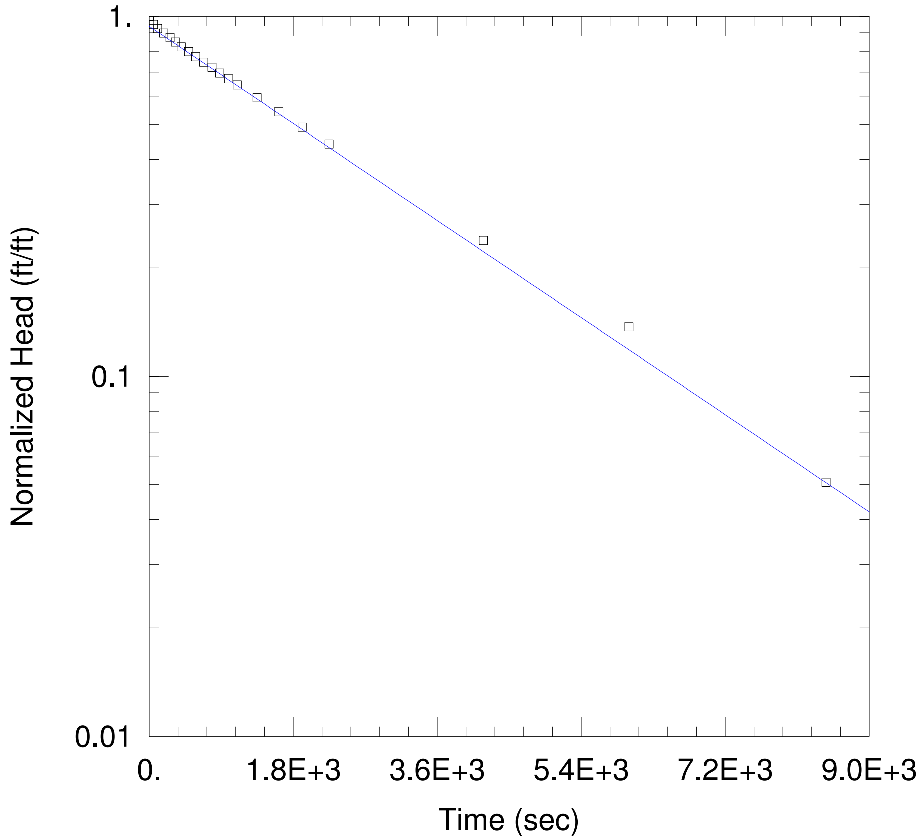
K = 8.437E-6 cm/sec
y0 = 1.458 ft

AQUIFER DATA

Saturated Thickness: 14. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW3 SI1)

Initial Displacement: 3.656 ft
Total Well Penetration Depth: 11.5 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 14. ft
Screen Length: 10. ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW 3 SO1.aqt
Date: 10/09/17 Time: 15:08:16

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW3
Test Date: 4/6/17

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

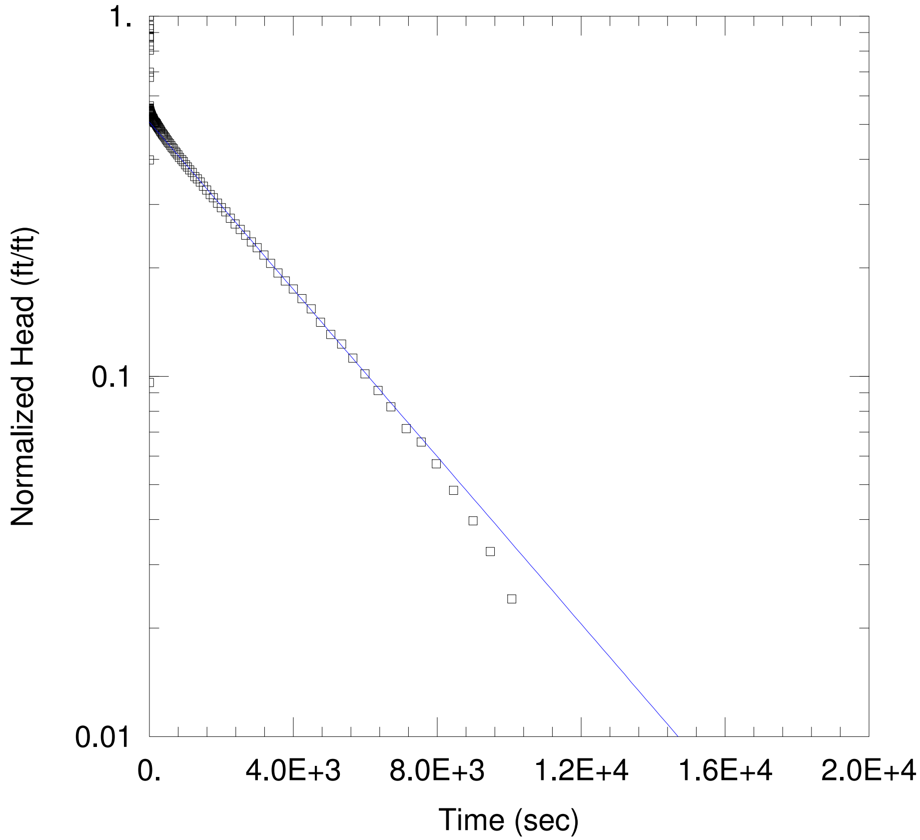
K = 8.611E-6 cm/sec
y0 = 1.848 ft

AQUIFER DATA

Saturated Thickness: 14. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW3 SO1)

Initial Displacement: 1.97 ft
Total Well Penetration Depth: 11.5 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 14. ft
Screen Length: 10. ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW 4 SI1.aqt
Date: 10/09/17 Time: 15:15:09

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW4
Test Date: 4/6/17

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

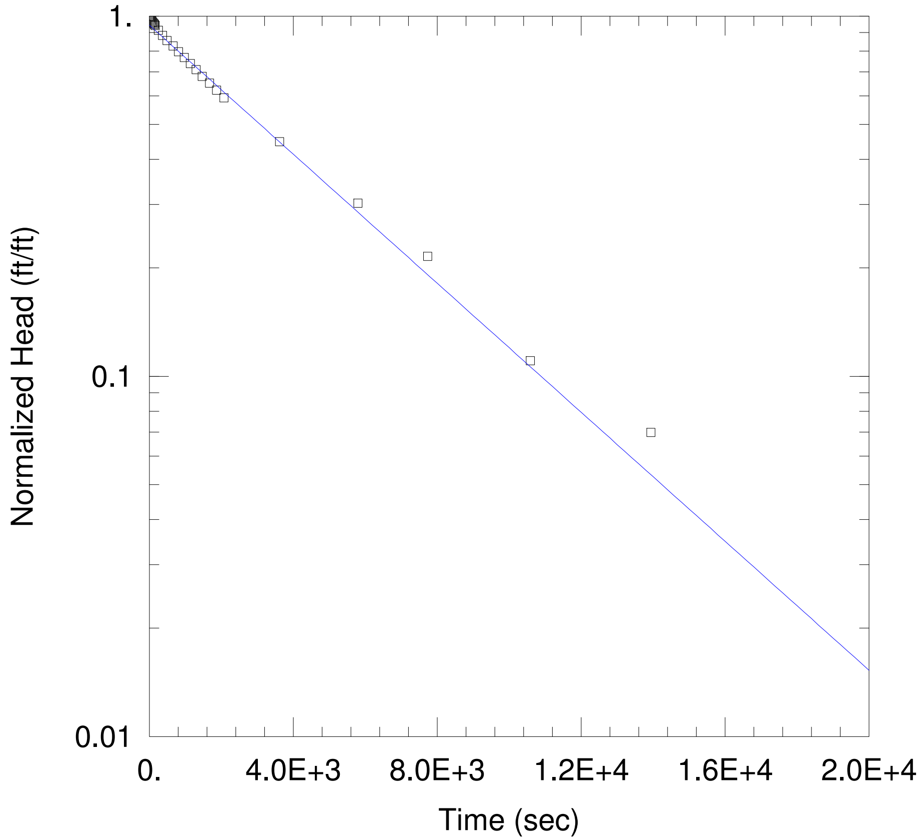
K = 6.66E-6 cm/sec
y0 = 1.37 ft

AQUIFER DATA

Saturated Thickness: 11. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW4 S11)

Initial Displacement: 2.697 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.08333 ft
Static Water Column Height: 11. ft
Screen Length: 10. ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW 4 SO1.aqt
Date: 10/09/17 Time: 15:15:46

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW4
Test Date: 4/6/17

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

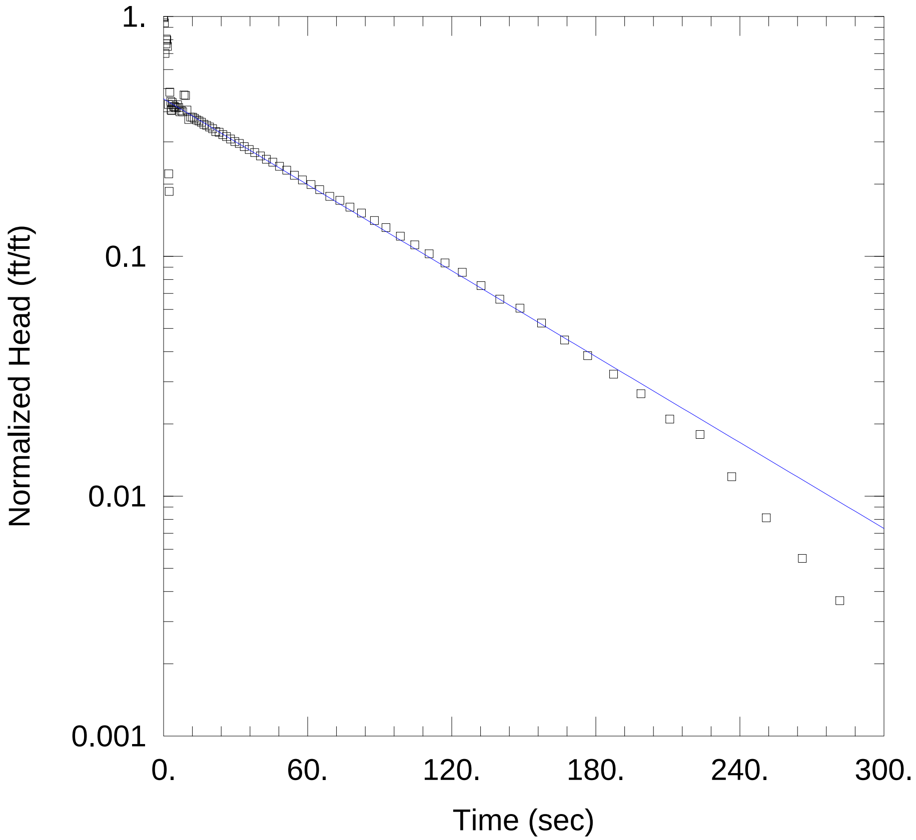
K = 5.137E-6 cm/sec
y0 = 1.622 ft

AQUIFER DATA

Saturated Thickness: 11. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW4 SO1)

Initial Displacement: 1.72 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.08333 ft
Static Water Column Height: 11. ft
Screen Length: 10. ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW5 SI1.aqt
Date: 06/15/17 Time: 11:53:01

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW5
Test Date: 4/6/17

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0005655 cm/sec
y0 = 1.731 ft

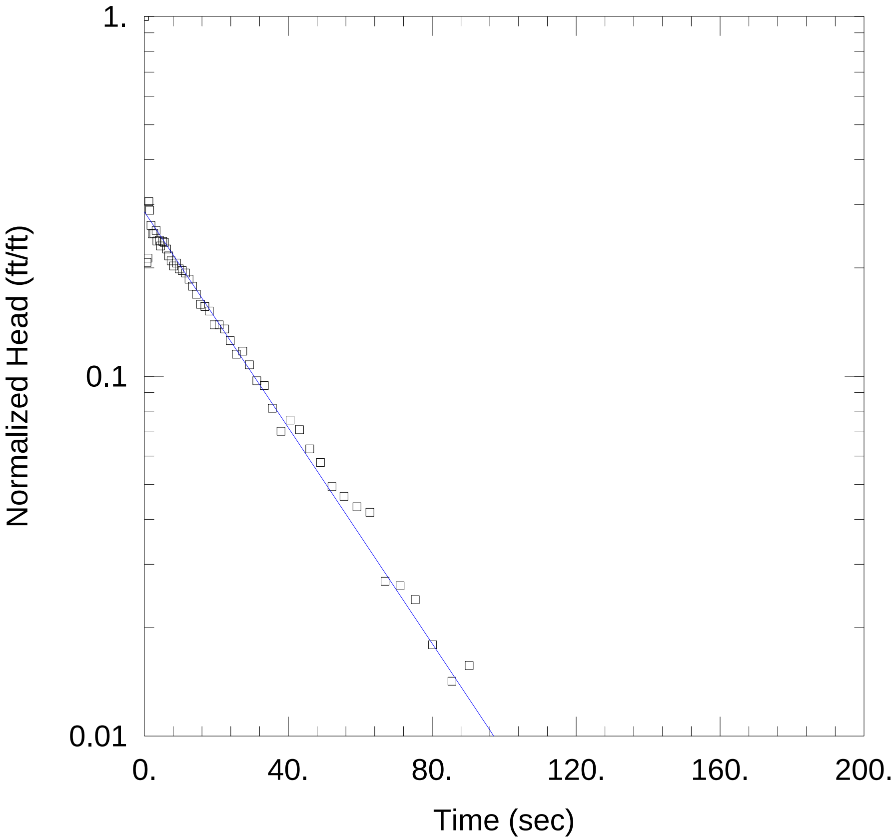
AQUIFER DATA

Saturated Thickness: 8.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW5 SI1)

Initial Displacement: 3.818 ft
Total Well Penetration Depth: 6.81 ft
Casing Radius: 0.08333 ft

Static Water Column Height: 8.5 ft
Screen Length: 4.68 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW5 SI2.aqt
Date: 05/12/17 Time: 17:23:52

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW5
Test Date: 4/6/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

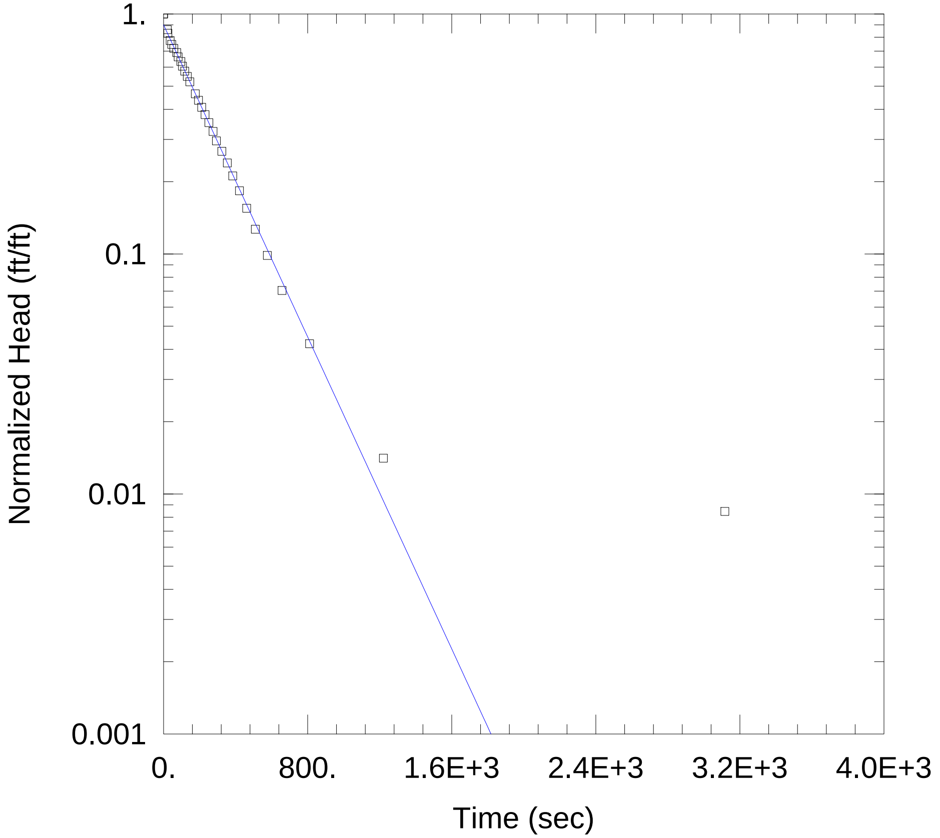
K = 0.001421 cm/sec
y0 = 0.383 ft

AQUIFER DATA

Saturated Thickness: 8.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW5 SI2)

Initial Displacement: 1.338 ft
Total Well Penetration Depth: 6.81 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 8.5 ft
Screen Length: 4.68 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW5 SO1.aqt
Date: 05/12/17 Time: 17:30:12

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW5
Test Date: 4/6/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

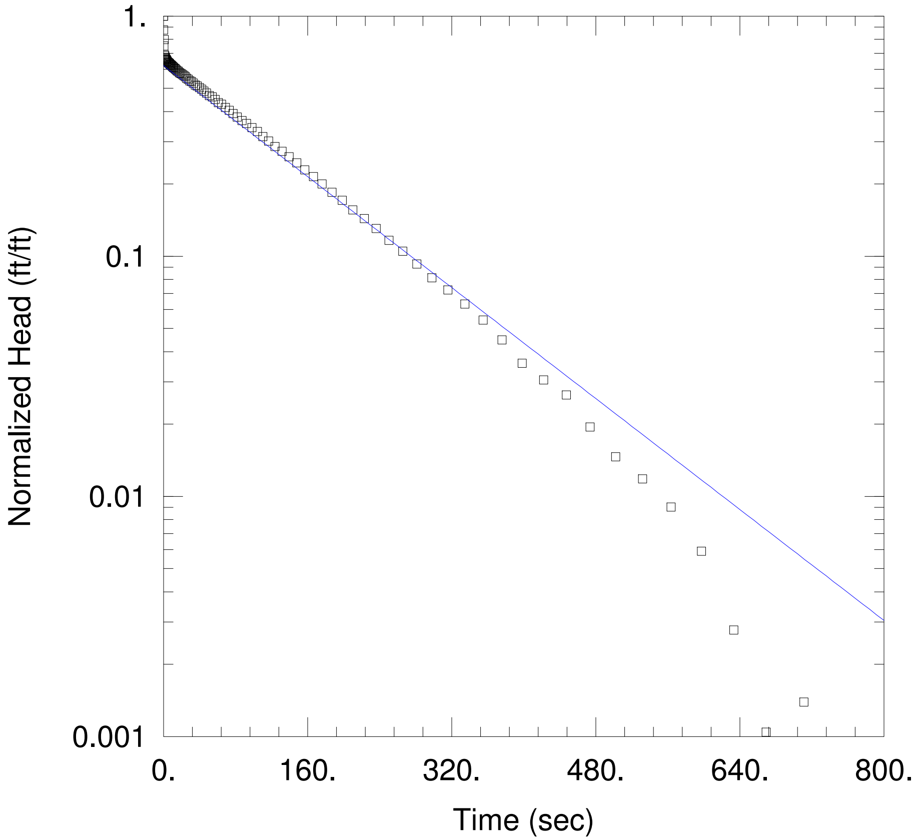
K = 0.0001539 cm/sec
y0 = 3.197 ft

AQUIFER DATA

Saturated Thickness: 8.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW5 SO1)

Initial Displacement: 3.55 ft
Total Well Penetration Depth: 6.81 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 8.5 ft
Screen Length: 4.68 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW5 SO2.aqt
Date: 10/09/17 Time: 14:59:07

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW5
Test Date: 4/6/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

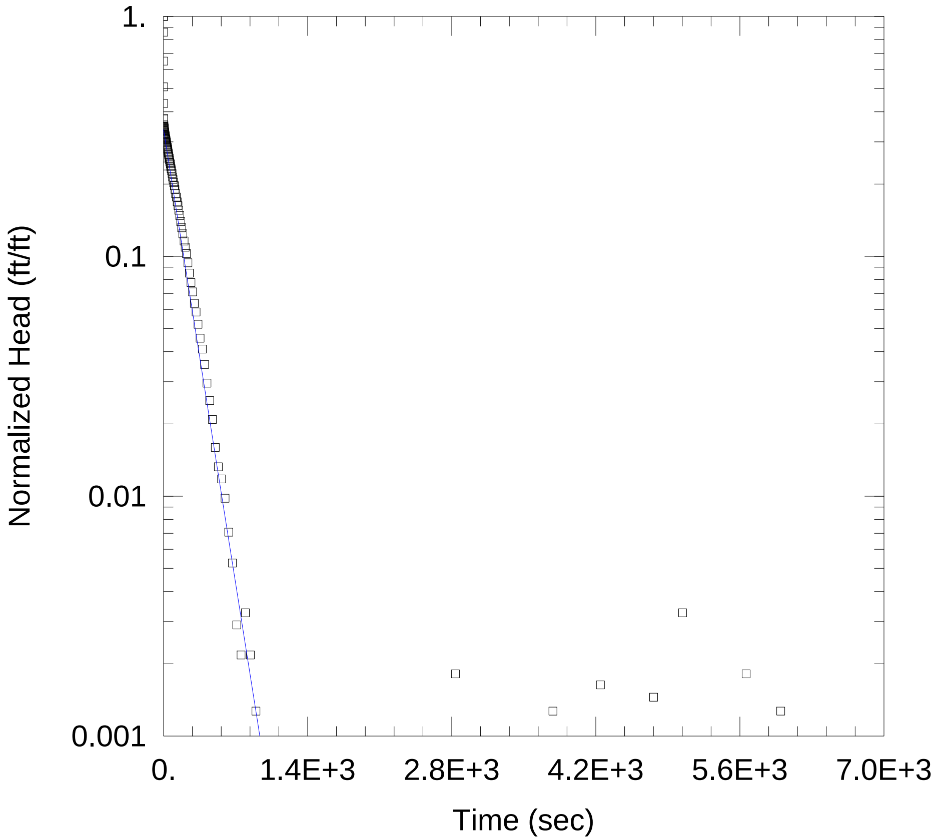
K = 0.0002735 cm/sec
y0 = 1.789 ft

AQUIFER DATA

Saturated Thickness: 8.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW5 SO2)

Initial Displacement: 2.879 ft
Total Well Penetration Depth: 6.81 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 8.5 ft
Screen Length: 4.68 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW5 SO3.aqt
Date: 06/15/17 Time: 11:57:15

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW5
Test Date: 4/6/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

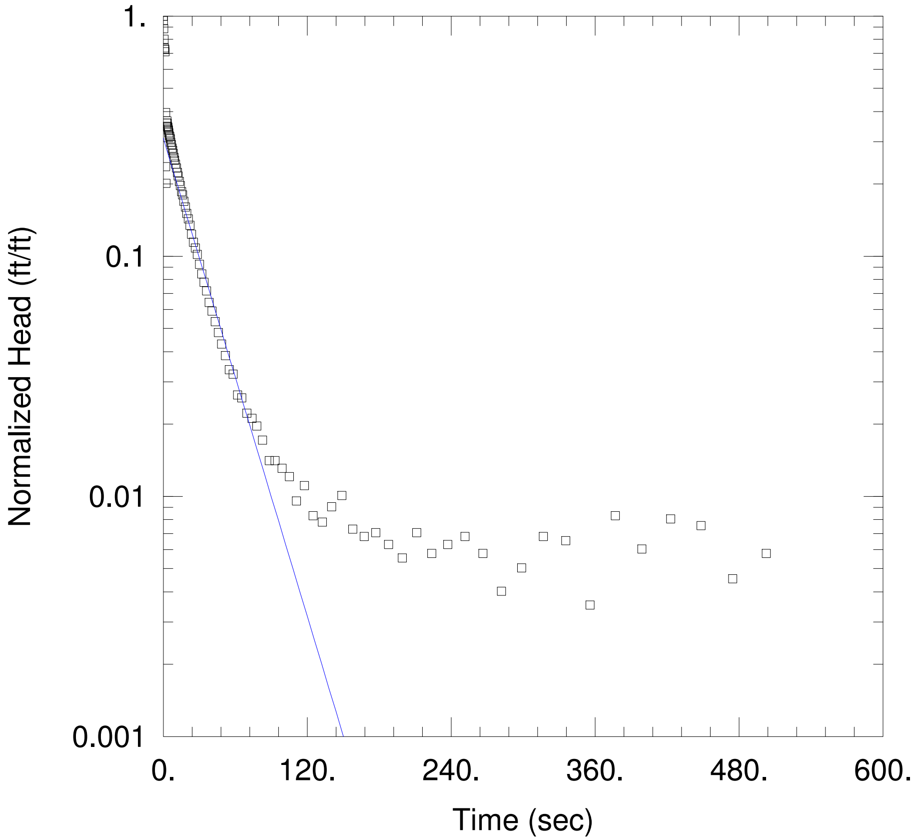
K = 0.0002559 cm/sec
y0 = 1.858 ft

AQUIFER DATA

Saturated Thickness: 8.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW5 SO3)

Initial Displacement: 5.512 ft
Total Well Penetration Depth: 6.81 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 8.5 ft
Screen Length: 4.68 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW6 SI1.aqt
Date: 10/10/17 Time: 08:43:51

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW6
Test Date: 4/6/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.001642 cm/sec
y0 = 1.231 ft

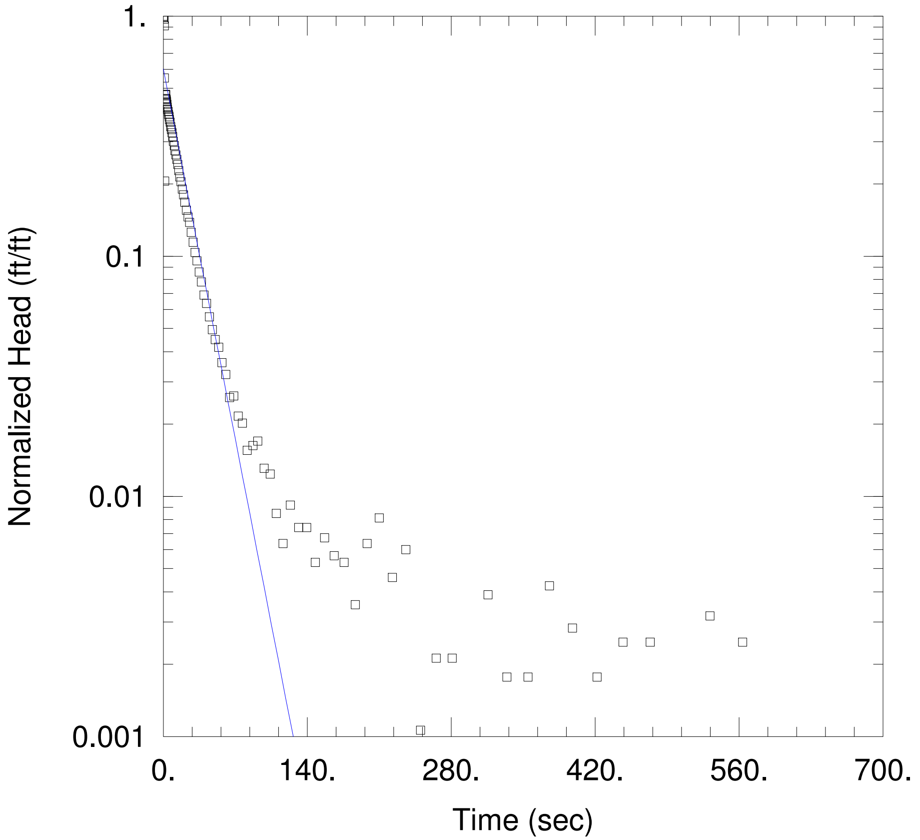
AQUIFER DATA

Saturated Thickness: 6.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW6 SI1)

Initial Displacement: 3.973 ft
Total Well Penetration Depth: 3.3 ft
Casing Radius: 0.08333 ft

Static Water Column Height: 6.5 ft
Screen Length: 3.3 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW6 SI2.aqt
Date: 10/10/17 Time: 08:45:57

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW6
Test Date: 4/6/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

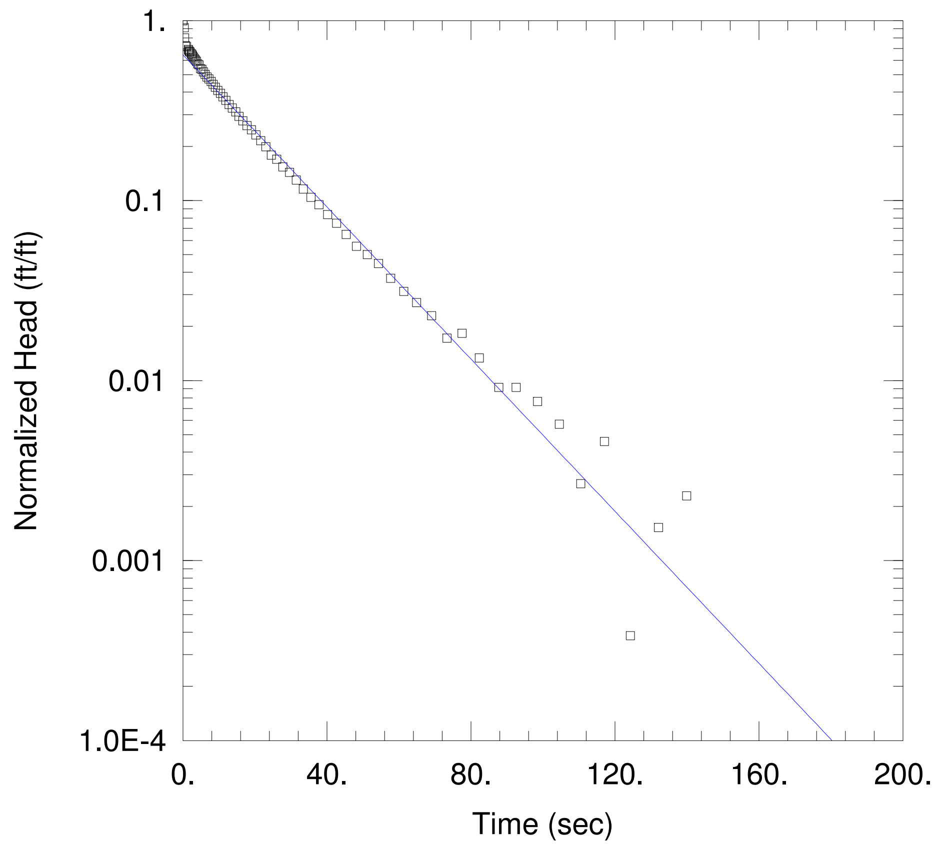
K = 0.002177 cm/sec
y0 = 1.702 ft

AQUIFER DATA

Saturated Thickness: 6.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW6 SI2)

Initial Displacement: 2.83 ft
Total Well Penetration Depth: 3.3 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.5 ft
Screen Length: 3.3 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW6 SO2.aqt
Date: 10/10/17 Time: 08:48:43

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW6
Test Date: 4/6/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

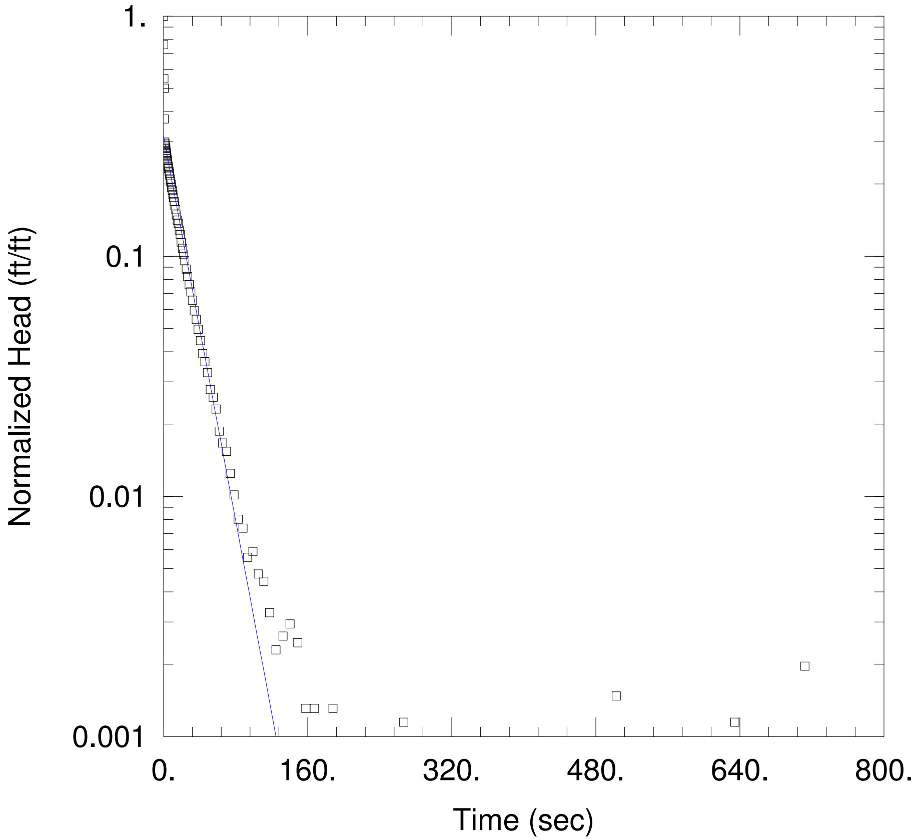
K = 0.002091 cm/sec
y0 = 1.689 ft

AQUIFER DATA

Saturated Thickness: 6.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW6 SO2)

Initial Displacement: 2.62 ft
Total Well Penetration Depth: 3.3 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.5 ft
Screen Length: 3.3 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW6 SO3.aqt
Date: 10/10/17 Time: 08:51:05

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW6
Test Date: 4/6/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

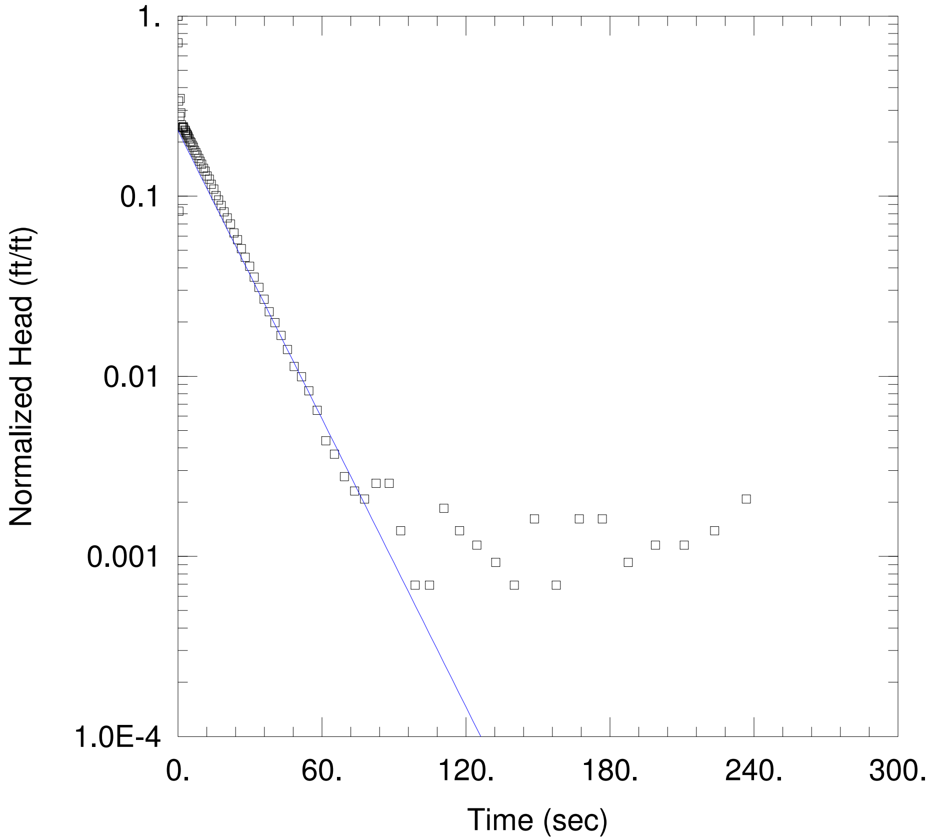
K = 0.001979 cm/sec
y0 = 1.936 ft

AQUIFER DATA

Saturated Thickness: 6.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW6 SO3)

Initial Displacement: 6.109 ft
Total Well Penetration Depth: 3.3 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.5 ft
Screen Length: 3.3 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW7 SI1.aqt
Date: 10/10/17 Time: 09:03:20

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW7
Test Date: 4/6/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

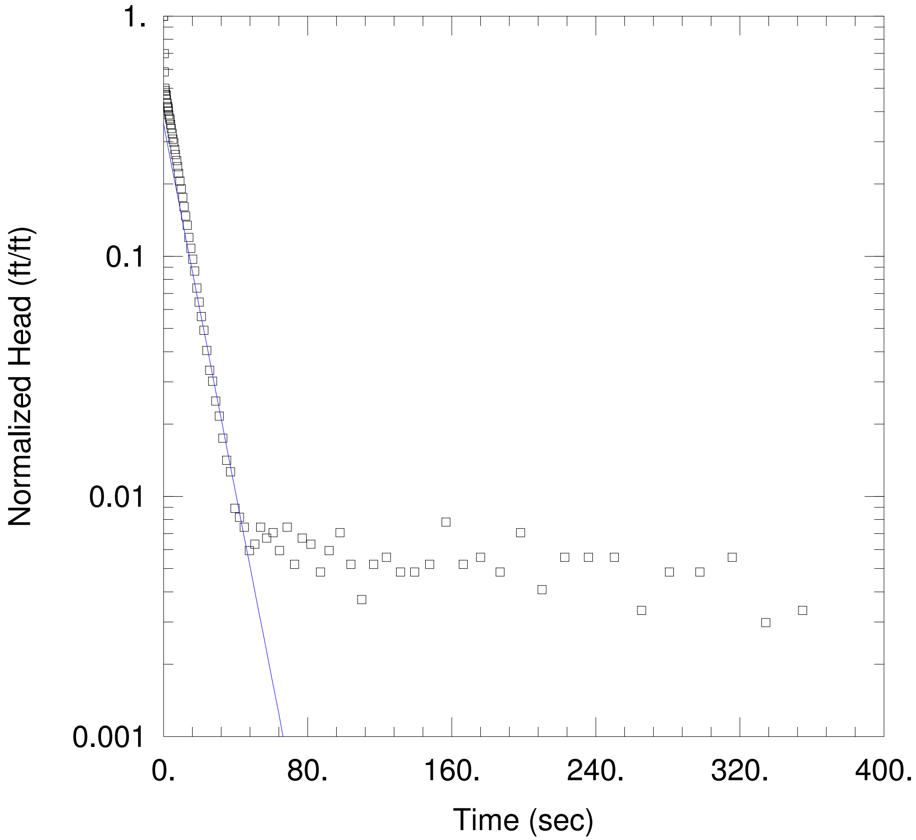
K = 0.00225 cm/sec
y0 = 1.004 ft

AQUIFER DATA

Saturated Thickness: 7.1 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW7 SI1)

Initial Displacement: 4.331 ft
Total Well Penetration Depth: 4.8 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 7.1 ft
Screen Length: 4.8 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW7 SO2.aqt
Date: 10/10/17 Time: 09:05:47

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW7
Test Date: 4/6/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

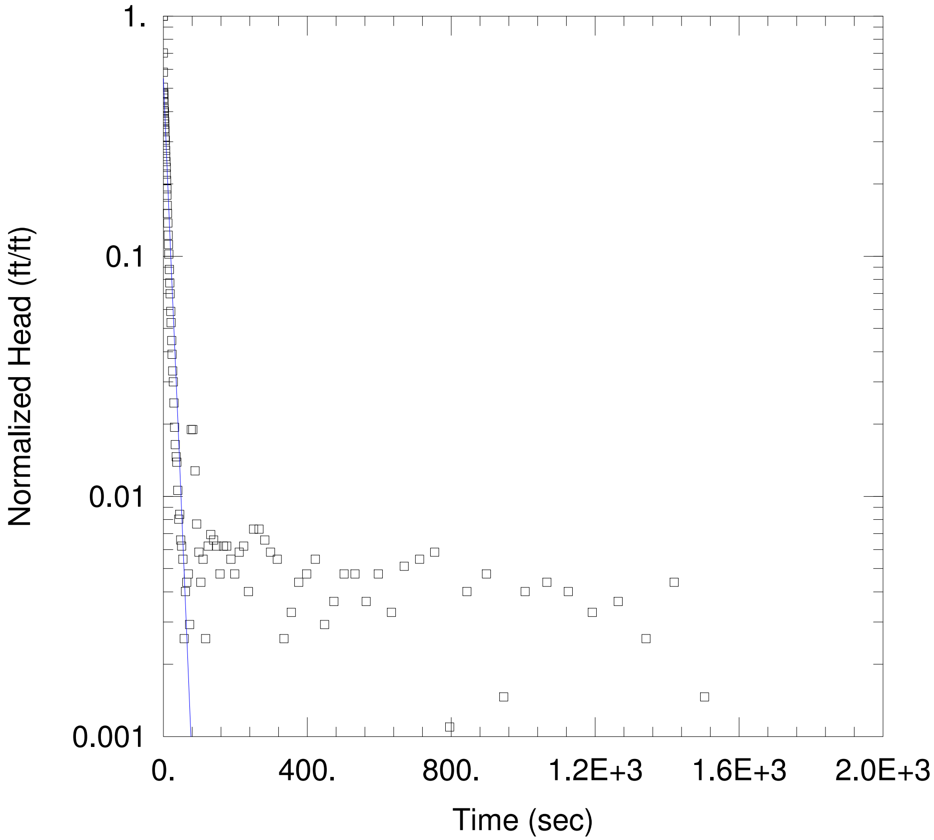
K = 0.003237 cm/sec
y0 = 0.9561 ft

AQUIFER DATA

Saturated Thickness: 7.1 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW7 S02)

Initial Displacement: 2.69 ft
Total Well Penetration Depth: 4.8 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 7.1 ft
Screen Length: 4.8 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW7 SO3.aqt
Date: 10/10/17 Time: 09:07:38

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW7
Test Date: 4/6/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

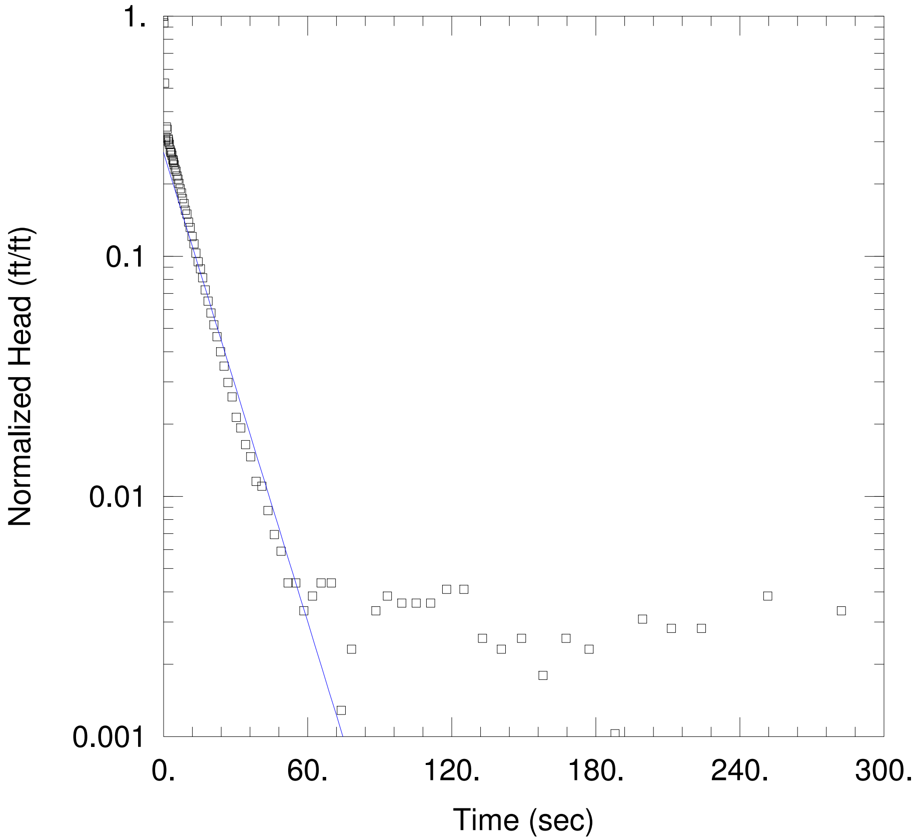
K = 0.002989 cm/sec
y0 = 1.503 ft

AQUIFER DATA

Saturated Thickness: 7.1 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW7 S03)

Initial Displacement: 2.738 ft
Total Well Penetration Depth: 4.8 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 7.1 ft
Screen Length: 4.8 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW7 SO4.aqt
Date: 10/10/17 Time: 09:09:26

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW7
Test Date: 4/6/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

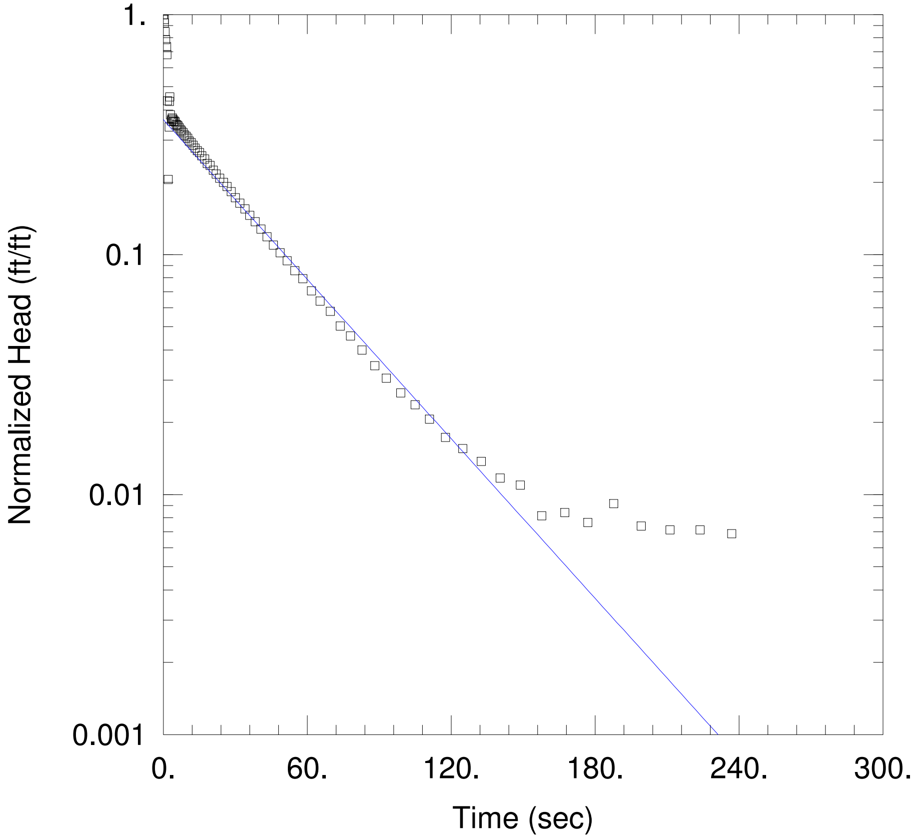
K = 0.002745 cm/sec
y0 = 1.052 ft

AQUIFER DATA

Saturated Thickness: 7.1 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW7 SO4)

Initial Displacement: 3.899 ft
Total Well Penetration Depth: 4.8 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 7.1 ft
Screen Length: 4.8 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW8 SI1.aqt
Date: 10/10/17 Time: 09:12:16

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW8
Test Date: 4/6/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

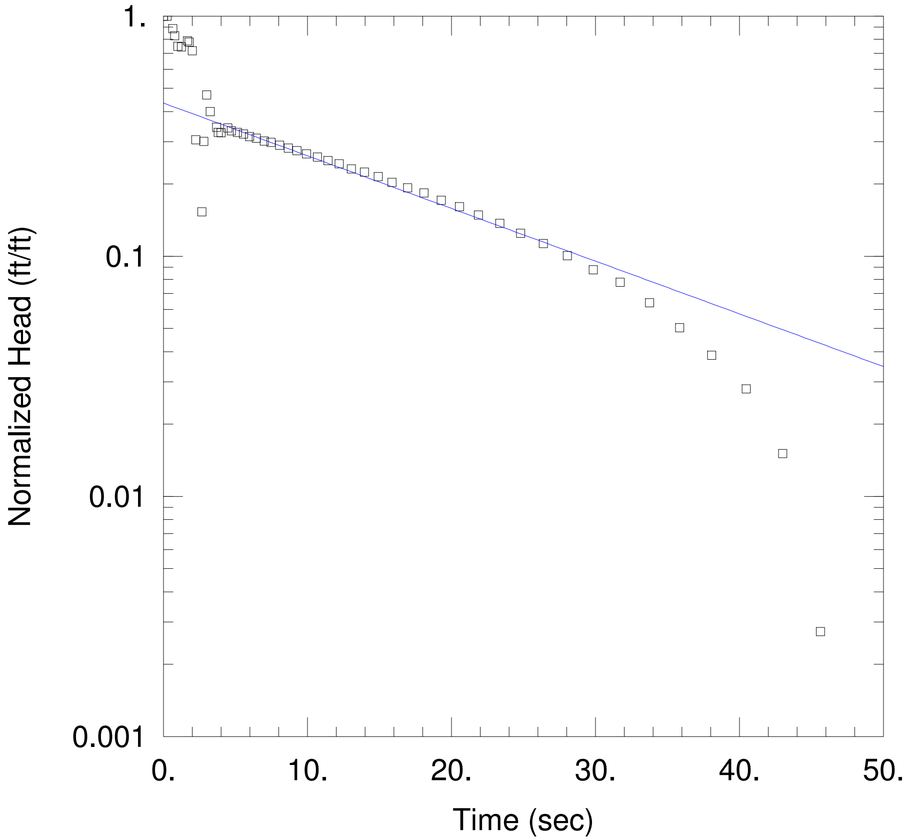
K = 0.0006602 cm/sec
y0 = 1.431 ft

AQUIFER DATA

Saturated Thickness: 16.3 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW8 SI1)

Initial Displacement: 3.929 ft
Total Well Penetration Depth: 12.8 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 16.3 ft
Screen Length: 9.7 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW8 SI2.aqt
Date: 10/10/17 Time: 09:39:50

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW8
Test Date: 4/6/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

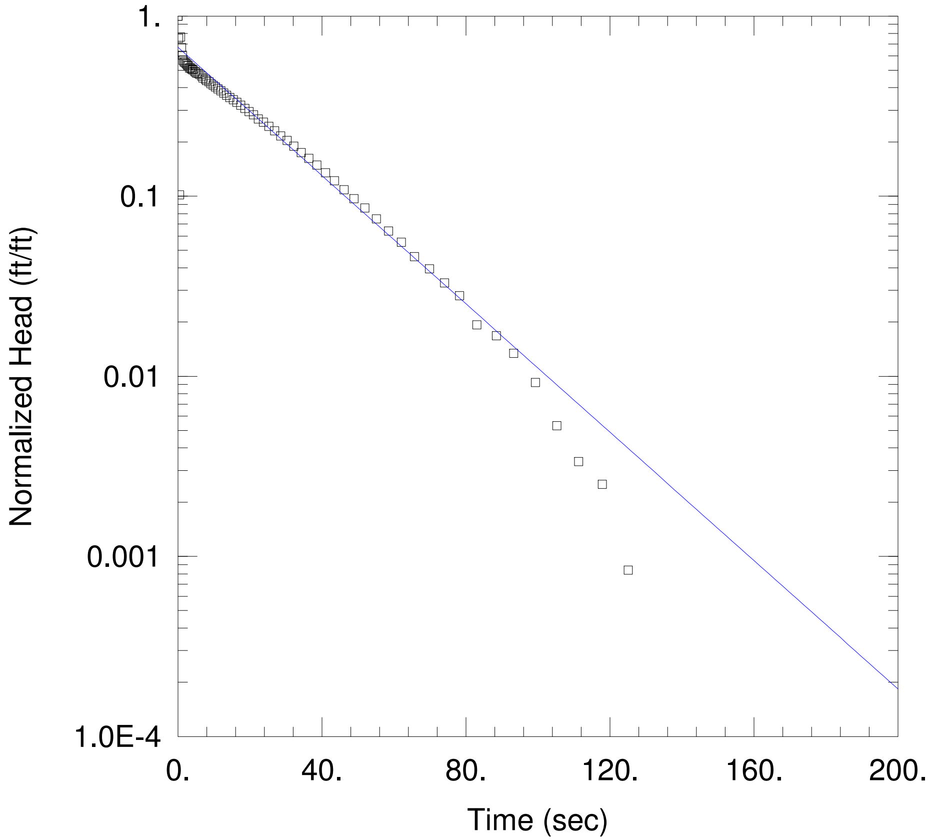
K = 0.001308 cm/sec
y0 = 1.269 ft

AQUIFER DATA

Saturated Thickness: 16.3 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW8 SI2)

Initial Displacement: 2.924 ft
Total Well Penetration Depth: 12.8 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 16.3 ft
Screen Length: 9.7 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW8 SO2.aqt
Date: 10/10/17 Time: 09:41:42

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW8
Test Date: 4/6/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

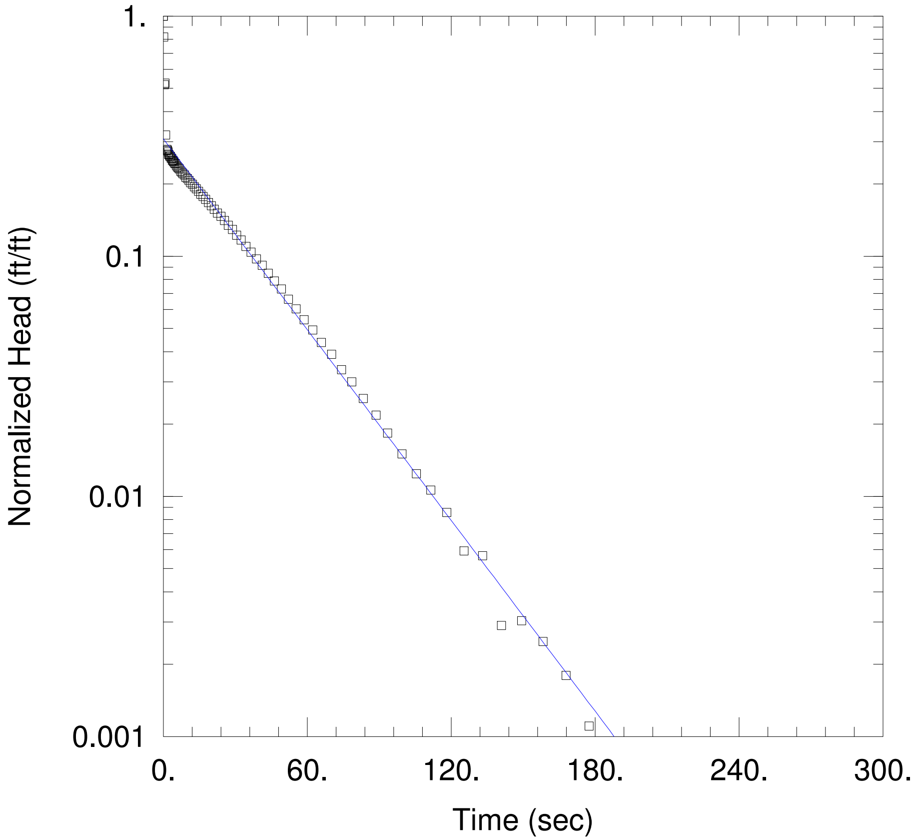
K = 0.001062 cm/sec
y0 = 2.403 ft

AQUIFER DATA

Saturated Thickness: 16.3 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW8 SO2)

Initial Displacement: 3.577 ft
Total Well Penetration Depth: 12.8 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 16.3 ft
Screen Length: 9.7 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW8 SO3.aqt
Date: 10/10/17 Time: 09:43:26

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW8
Test Date: 4/6/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

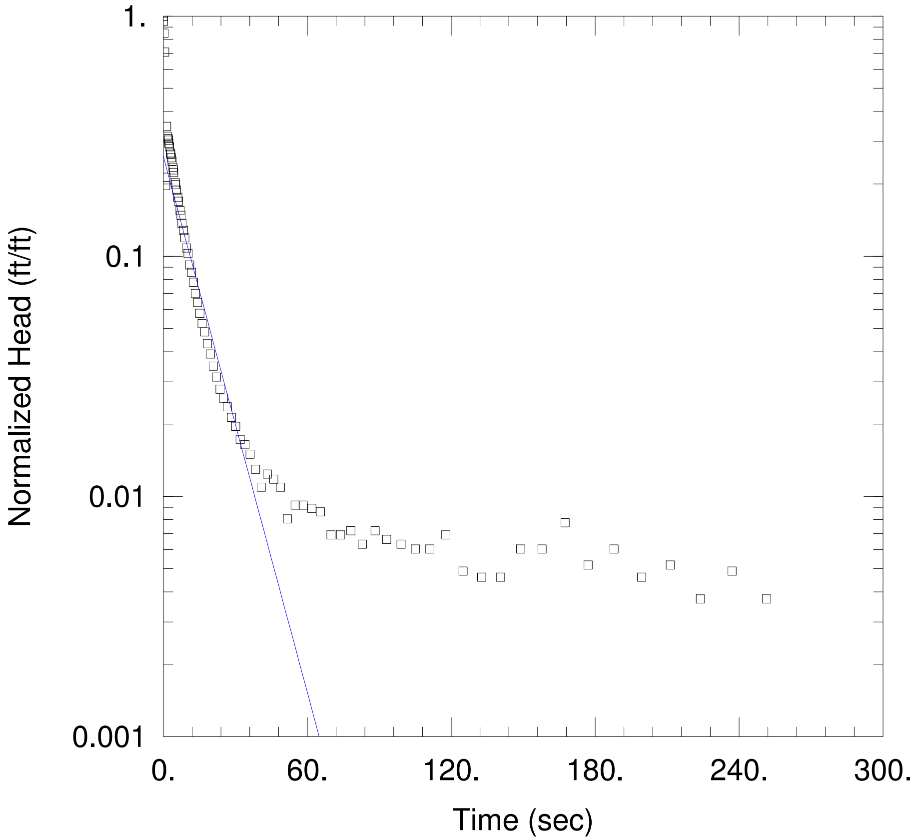
K = 0.0007891 cm/sec
y0 = 2.233 ft

AQUIFER DATA

Saturated Thickness: 16.3 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW8 SO3)

Initial Displacement: 7.249 ft
Total Well Penetration Depth: 12.8 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 16.3 ft
Screen Length: 9.7 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW9 SI1.aqt
Date: 10/10/17 Time: 09:48:54

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW9
Test Date: 4/7/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

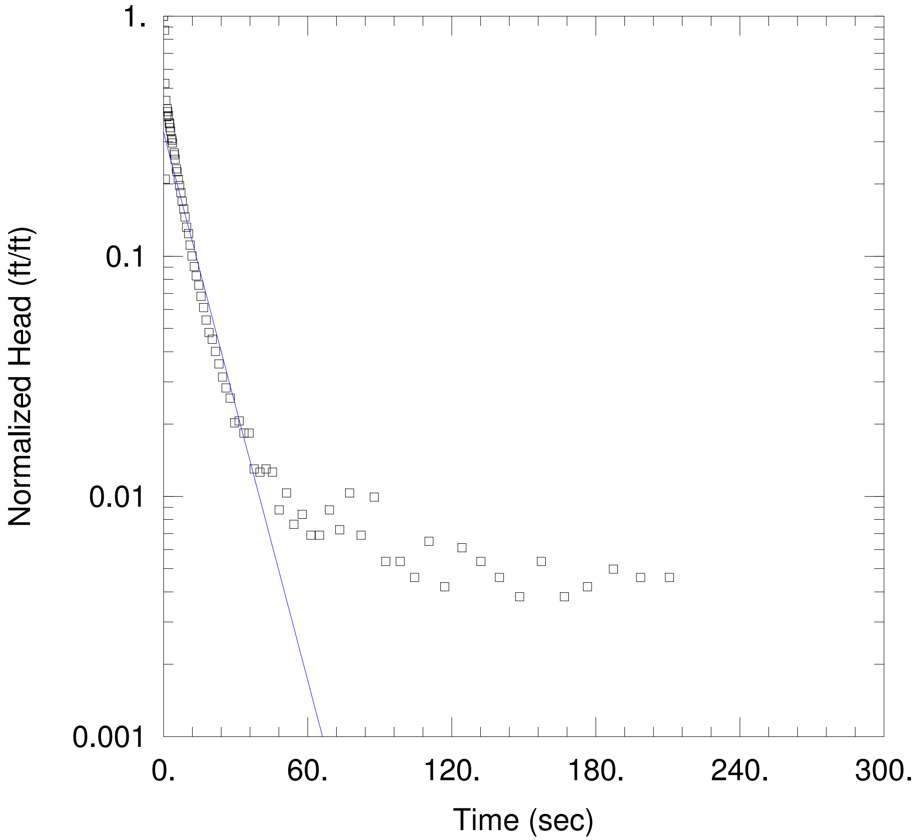
K = 0.00321 cm/sec
y0 = 0.9059 ft

AQUIFER DATA

Saturated Thickness: 6.3 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW9 SI1)

Initial Displacement: 3.477 ft
Total Well Penetration Depth: 4.7 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.3 ft
Screen Length: 4.7 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW9 SI2.aqt
Date: 10/10/17 Time: 09:50:42

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW9
Test Date: 4/7/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

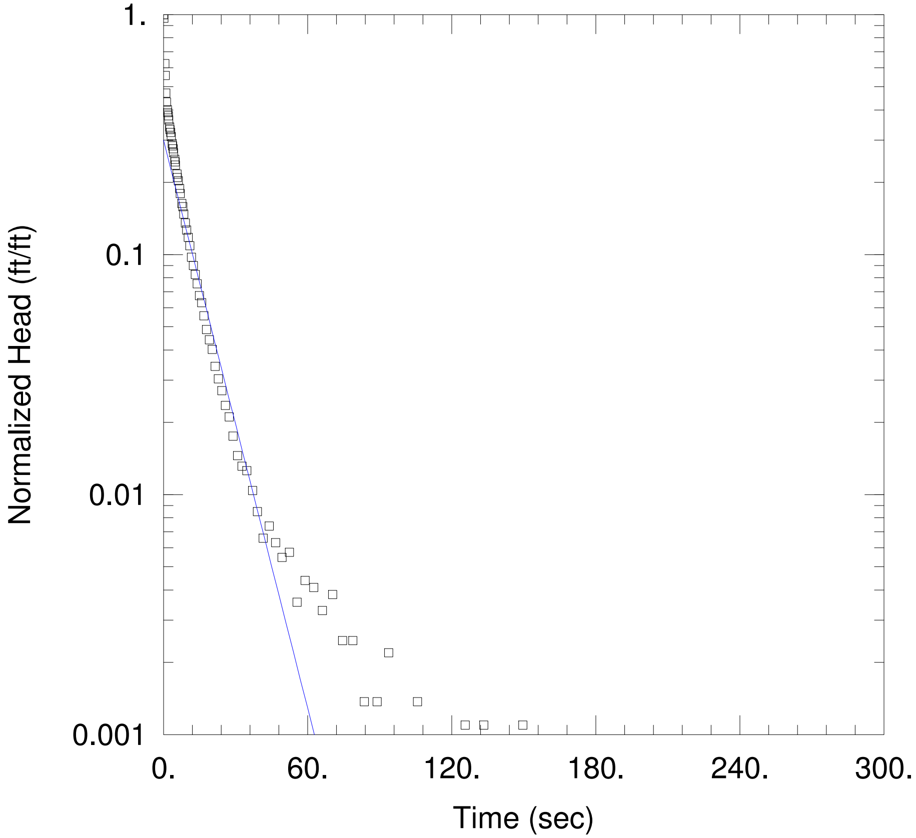
K = 0.003282 cm/sec
y0 = 0.8588 ft

AQUIFER DATA

Saturated Thickness: 6.3 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW9 SI2)

Initial Displacement: 2.617 ft
Total Well Penetration Depth: 4.7 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.3 ft
Screen Length: 4.7 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW9 SO1.aqt
Date: 10/10/17 Time: 09:52:04

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW9
Test Date: 4/7/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.003404 cm/sec
y0 = 1.094 ft

AQUIFER DATA

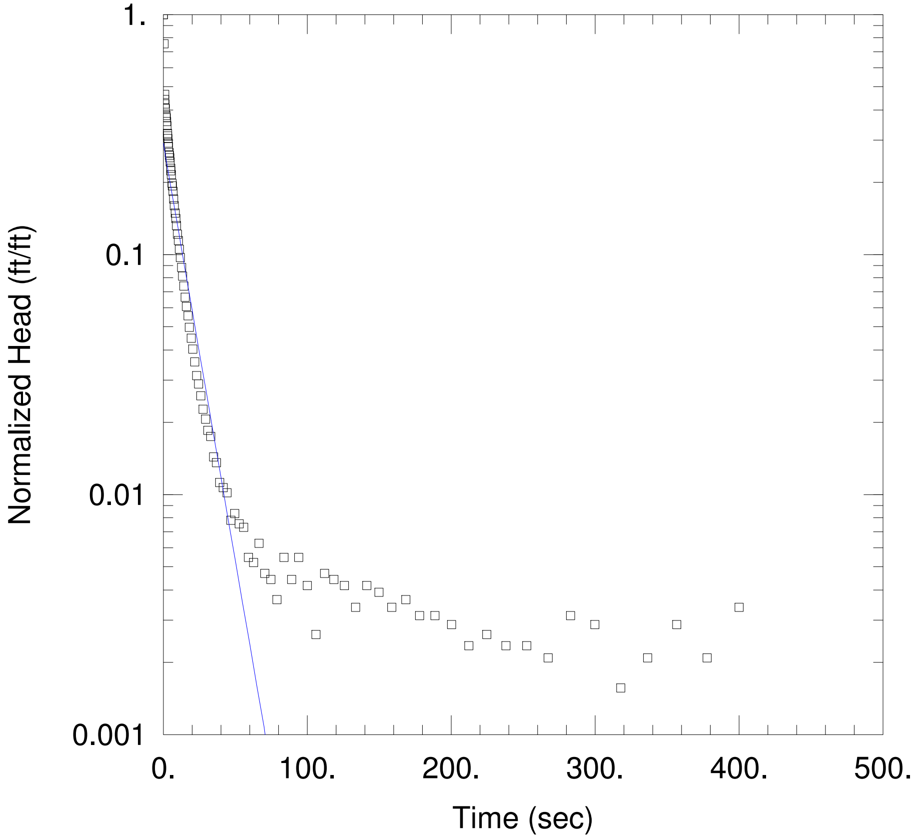
Saturated Thickness: 6.3 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW9 SO1)

Initial Displacement: 3.654 ft
Total Well Penetration Depth: 4.7 ft
Casing Radius: 0.08333 ft

Static Water Column Height: 6.3 ft
Screen Length: 4.7 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW9 SO2.aqt
Date: 10/10/17 Time: 09:53:49

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW9
Test Date: 4/7/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

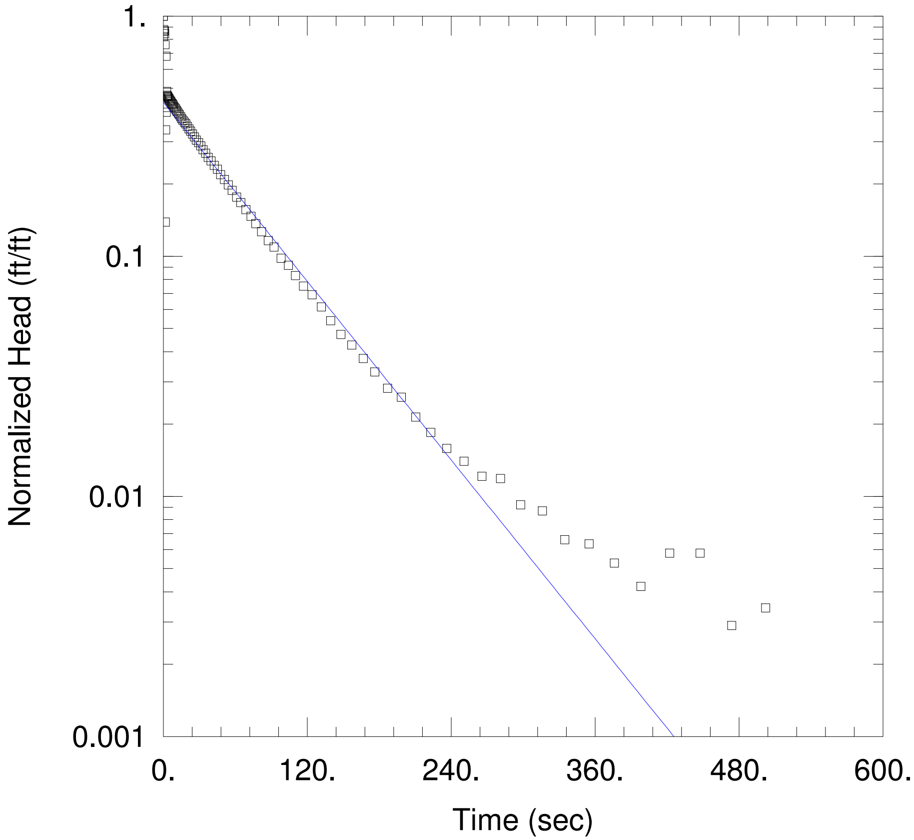
K = 0.003003 cm/sec
y0 = 1.117 ft

AQUIFER DATA

Saturated Thickness: 6.3 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW9 SO2)

Initial Displacement: 3.837 ft
Total Well Penetration Depth: 4.7 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.3 ft
Screen Length: 4.7 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW10 SI1.aqt
Date: 10/10/17 Time: 09:56:32

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW10
Test Date: 4/7/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

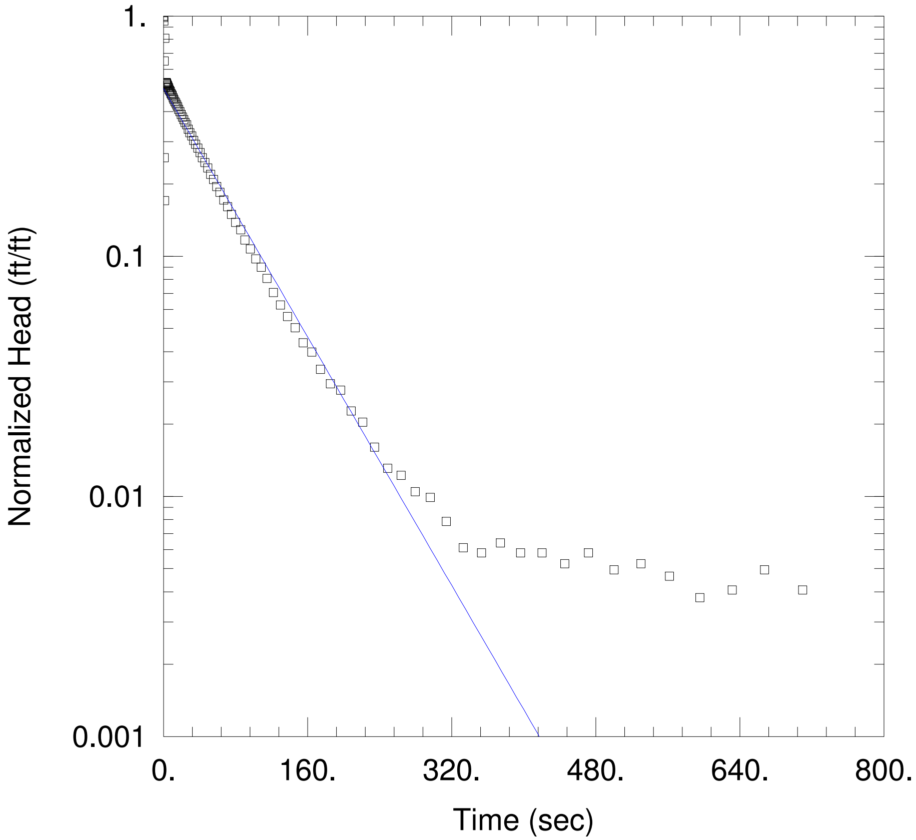
K = 0.0005269 cm/sec
y0 = 1.656 ft

AQUIFER DATA

Saturated Thickness: 6.7 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW10 SI1)

Initial Displacement: 3.792 ft
Total Well Penetration Depth: 4.8 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.7 ft
Screen Length: 4.8 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW10 SI2.aqt
Date: 10/10/17 Time: 09:59:35

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW10
Test Date: 4/7/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

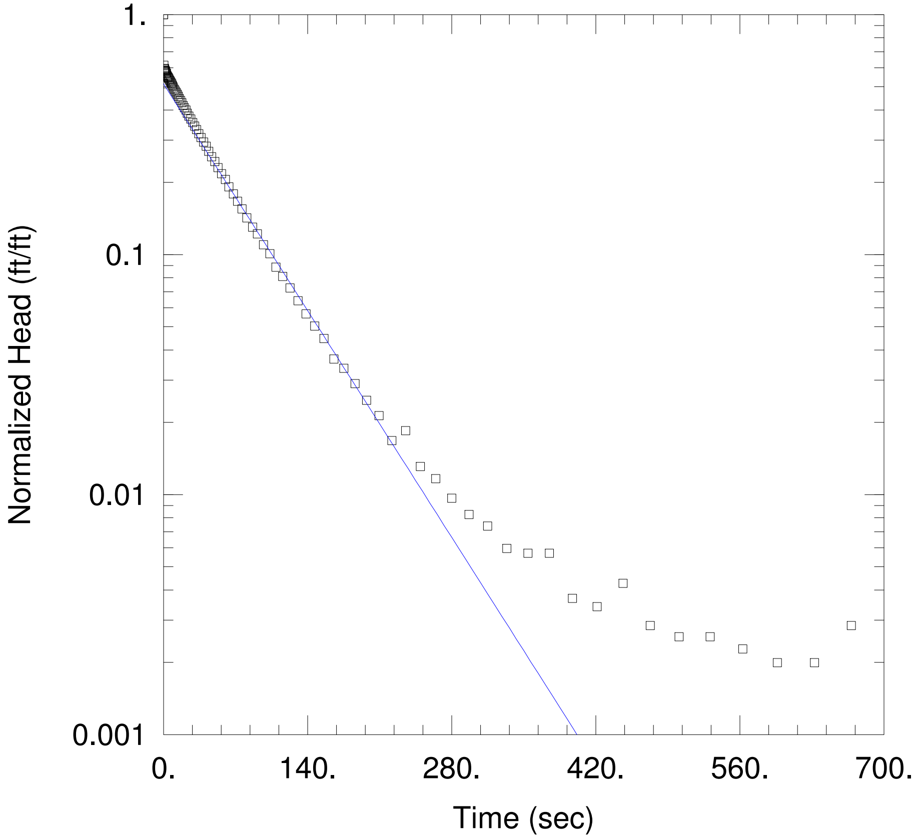
K = 0.0005491 cm/sec
y0 = 1.716 ft

AQUIFER DATA

Saturated Thickness: 6.7 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW10 SI2)

Initial Displacement: 3.438 ft
Total Well Penetration Depth: 4.8 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.7 ft
Screen Length: 4.8 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW10 SO2.aqt
Date: 10/10/17 Time: 10:01:28

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW10
Test Date: 4/7/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

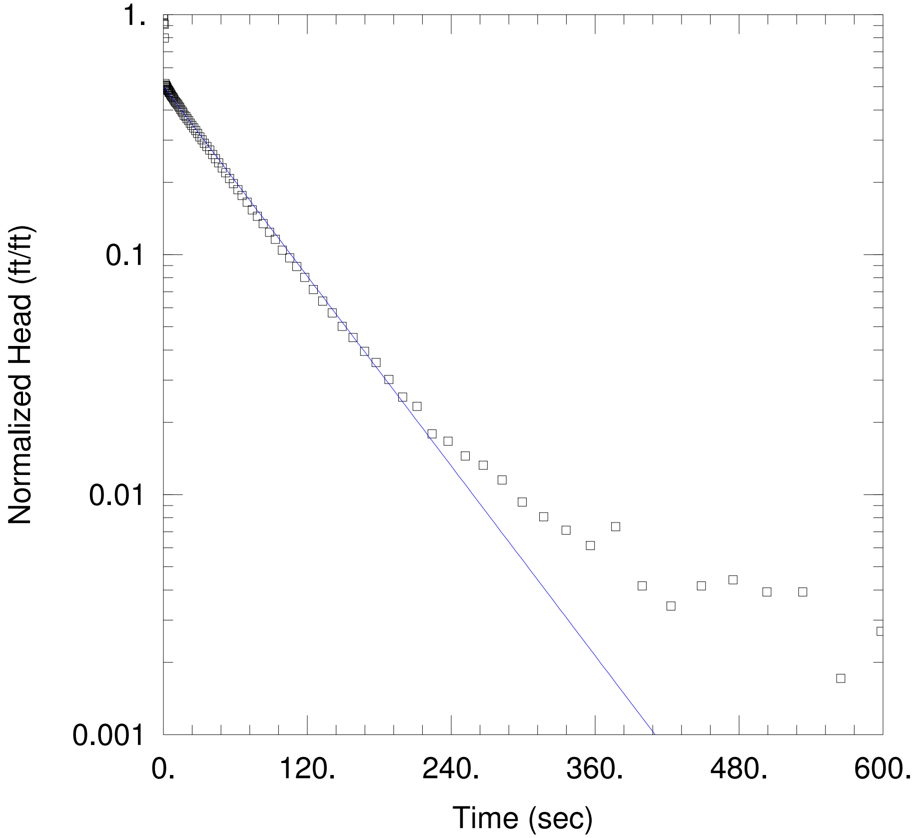
K = 0.0005731 cm/sec
y0 = 1.809 ft

AQUIFER DATA

Saturated Thickness: 6.7 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW10 SO2)

Initial Displacement: 3.518 ft
Total Well Penetration Depth: 4.8 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.7 ft
Screen Length: 4.8 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\APW10 SO3.aqt
Date: 10/10/17 Time: 10:09:04

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Primary Ash Pond
Test Well: APW10
Test Date: 4/7/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

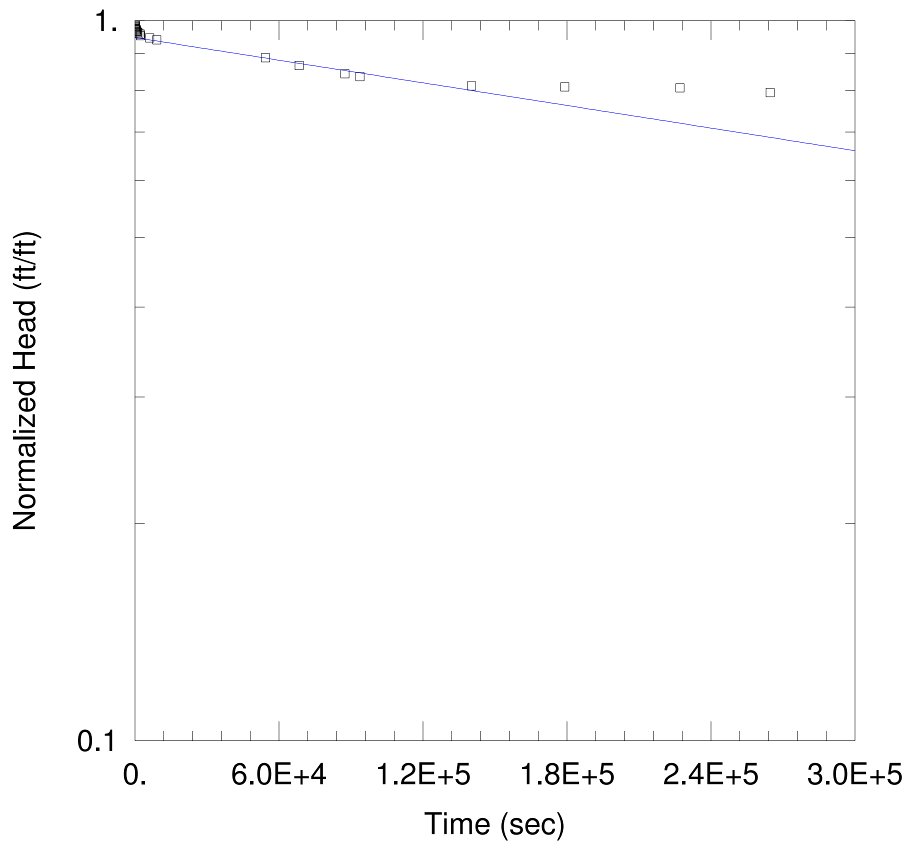
K = 0.0005595 cm/sec
y0 = 2.048 ft

AQUIFER DATA

Saturated Thickness: 6.7 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW10 SO2)

Initial Displacement: 4.081 ft
Total Well Penetration Depth: 4.8 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.7 ft
Screen Length: 4.8 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G06D SO1.aqt
Date: 10/10/17 Time: 10:15:04

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G06D
Test Date: 4/4/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

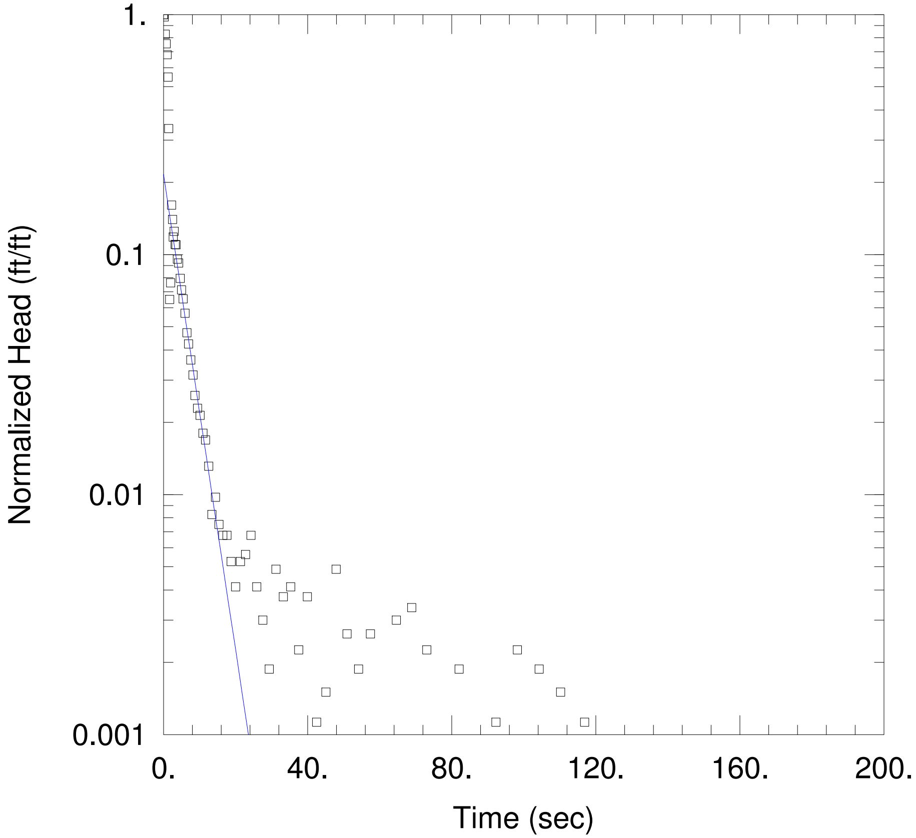
K = 3.917E-8 cm/sec
y0 = 3.807 ft

AQUIFER DATA

Saturated Thickness: 0.4 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G06D)

Initial Displacement: 4.02 ft
Total Well Penetration Depth: 0.4 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 0.4 ft
Screen Length: 0.4 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G202 SI1.aqt
Date: 10/10/17 Time: 10:19:06

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G202
Test Date: 4/5/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

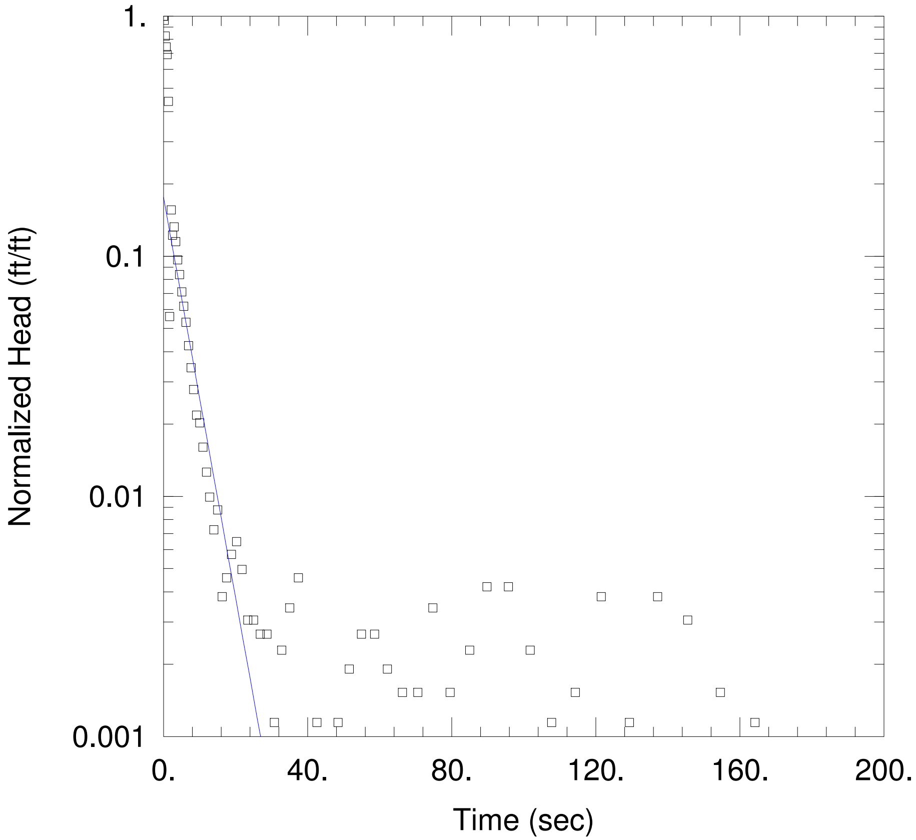
K = 0.01698 cm/sec
y0 = 0.5744 ft

AQUIFER DATA

Saturated Thickness: 0.6 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G202 SI1)

Initial Displacement: 2.666 ft
Total Well Penetration Depth: 0.6 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 0.6 ft
Screen Length: 0.6 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G202 SI2.aqt
Date: 10/10/17 Time: 10:20:26

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G202
Test Date: 4/5/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

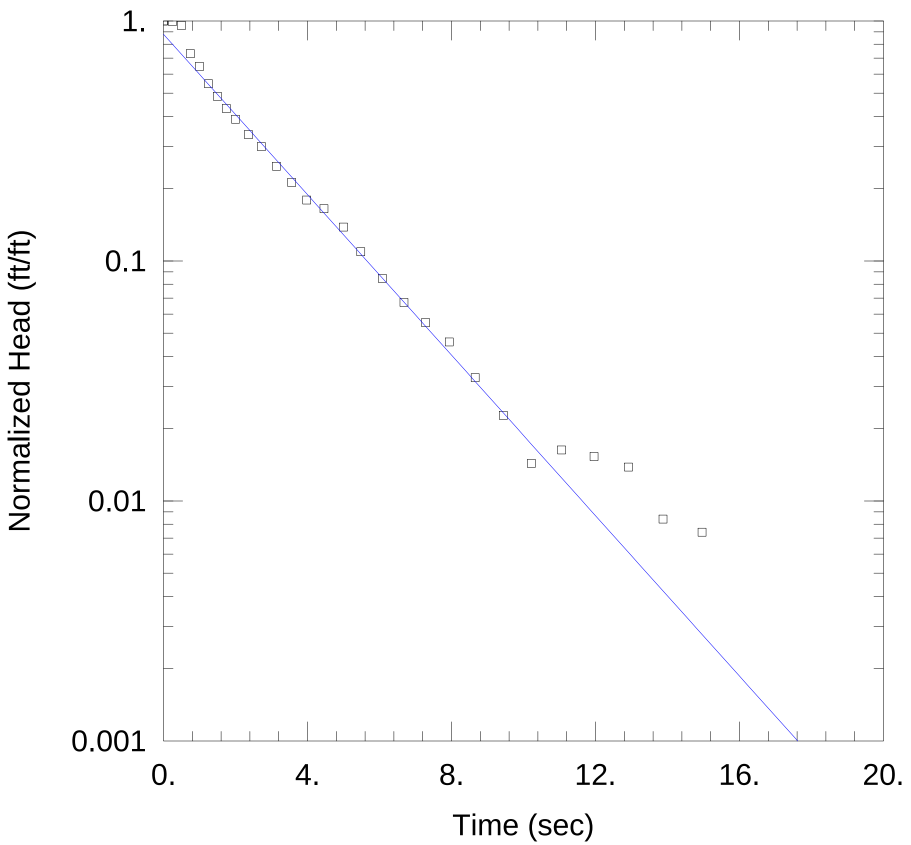
K = 0.0143 cm/sec
y0 = 0.4599 ft

AQUIFER DATA

Saturated Thickness: 0.6 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G202 SI2)

Initial Displacement: 2.621 ft
Total Well Penetration Depth: 0.6 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 0.6 ft
Screen Length: 0.6 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G202 SO2.aqt
Date: 06/15/17 Time: 10:21:12

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G202
Test Date: 4/5/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.02868 cm/sec
y0 = 1.781 ft

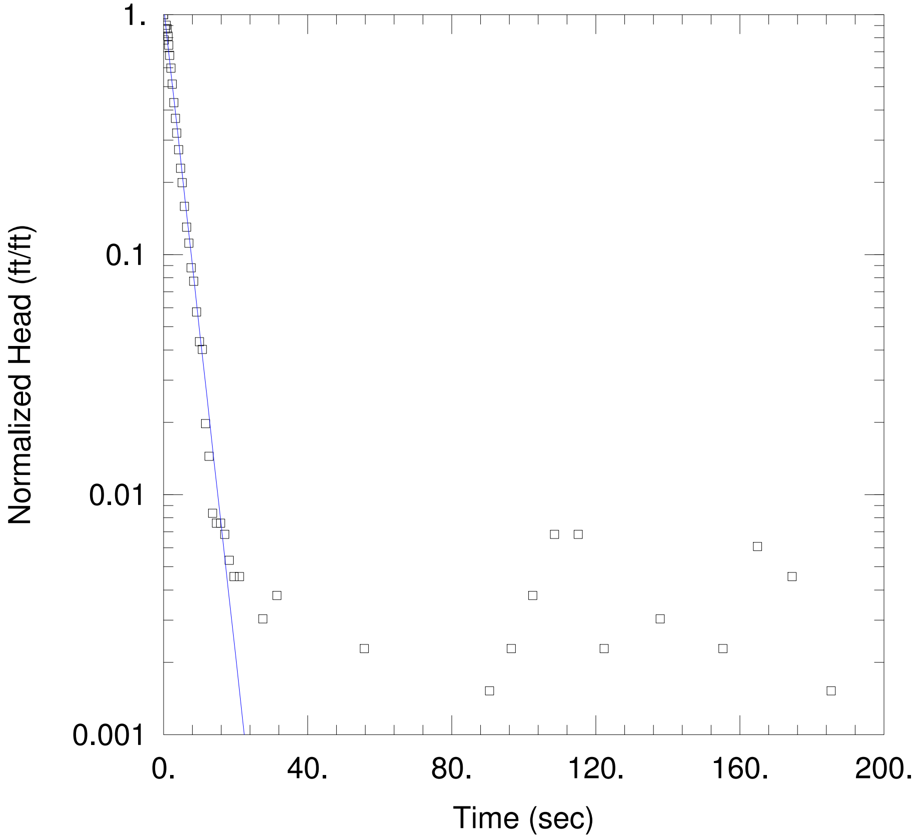
AQUIFER DATA

Saturated Thickness: 0.6 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G202 SO2)

Initial Displacement: 2.024 ft
Total Well Penetration Depth: 0.6 ft
Casing Radius: 0.08333 ft

Static Water Column Height: 0.6 ft
Screen Length: 0.6 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G202 SO3.aqt
Date: 10/10/17 Time: 10:21:38

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G202
Test Date: 4/5/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

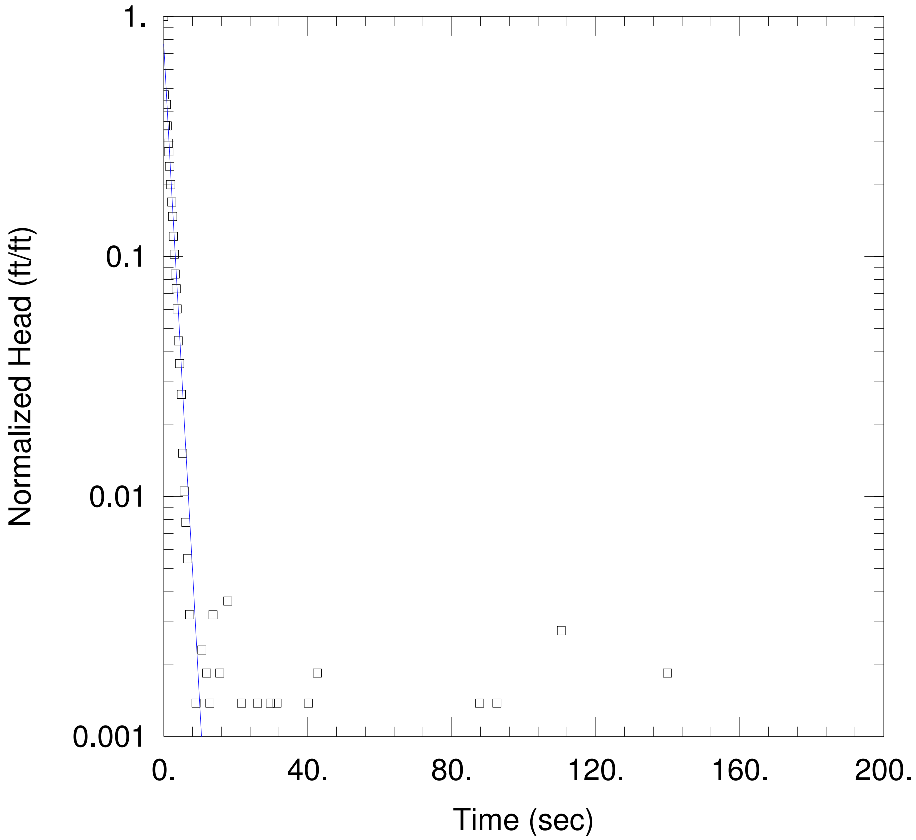
K = 0.02325 cm/sec
y0 = 1.444 ft

AQUIFER DATA

Saturated Thickness: 0.6 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G202 SO3)

Initial Displacement: 1.317 ft
Total Well Penetration Depth: 0.6 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 0.6 ft
Screen Length: 0.6 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G203 SI1.aqt
Date: 10/10/17 Time: 10:24:55

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G203
Test Date: 4/4/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

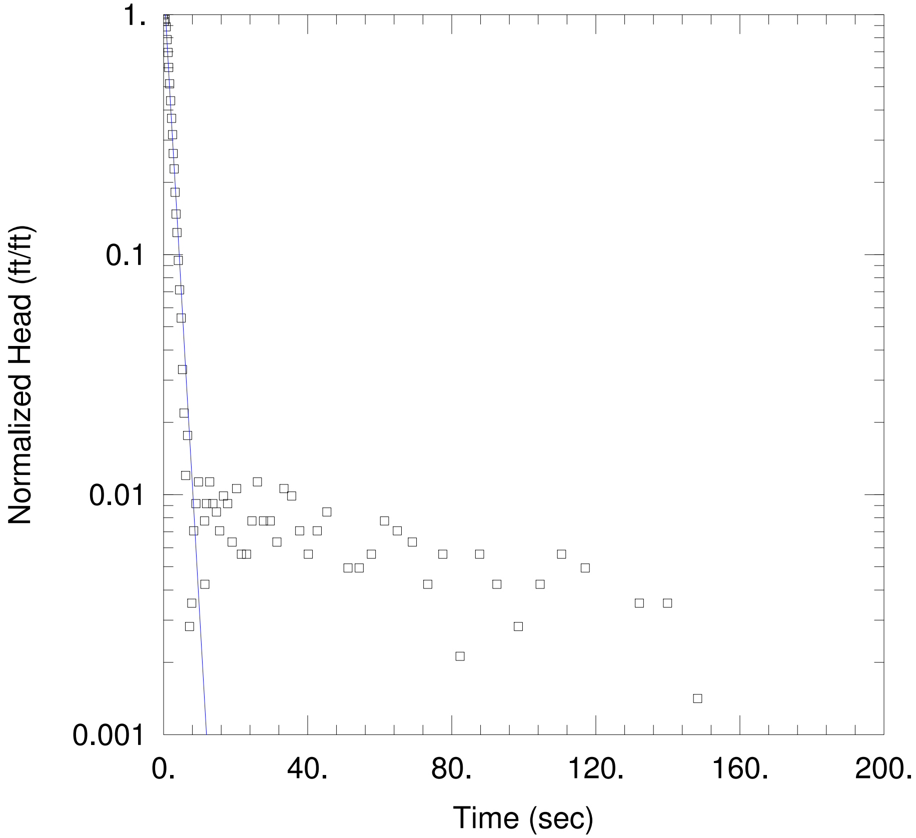
K = 0.02529 cm/sec
y0 = 1.676 ft

AQUIFER DATA

Saturated Thickness: 6.9 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G203 SI1)

Initial Displacement: 2.184 ft
Total Well Penetration Depth: 3.9 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.9 ft
Screen Length: 3.9 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G203 SO1.aqt
Date: 10/10/17 Time: 10:28:31

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G203
Test Date: 4/4/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

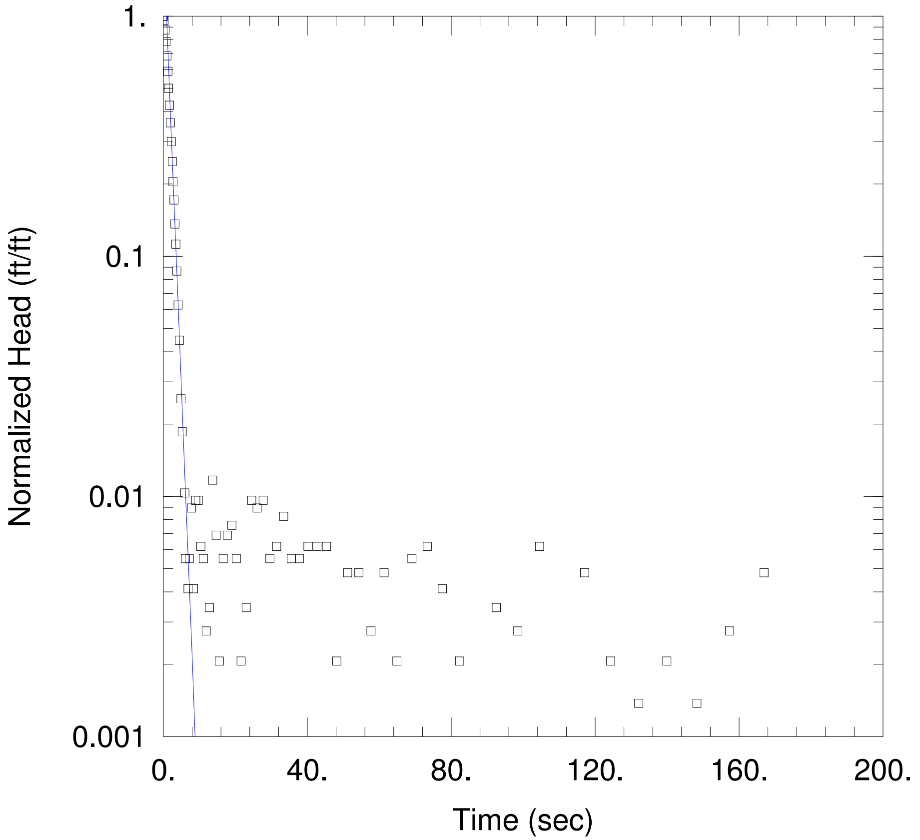
K = 0.02421 cm/sec
y0 = 1.958 ft

AQUIFER DATA

Saturated Thickness: 6.9 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G203 SO1)

Initial Displacement: 1.418 ft
Total Well Penetration Depth: 3.9 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.9 ft
Screen Length: 3.9 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G203 SO2.aqt
Date: 10/10/17 Time: 10:30:34

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G203
Test Date: 4/4/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

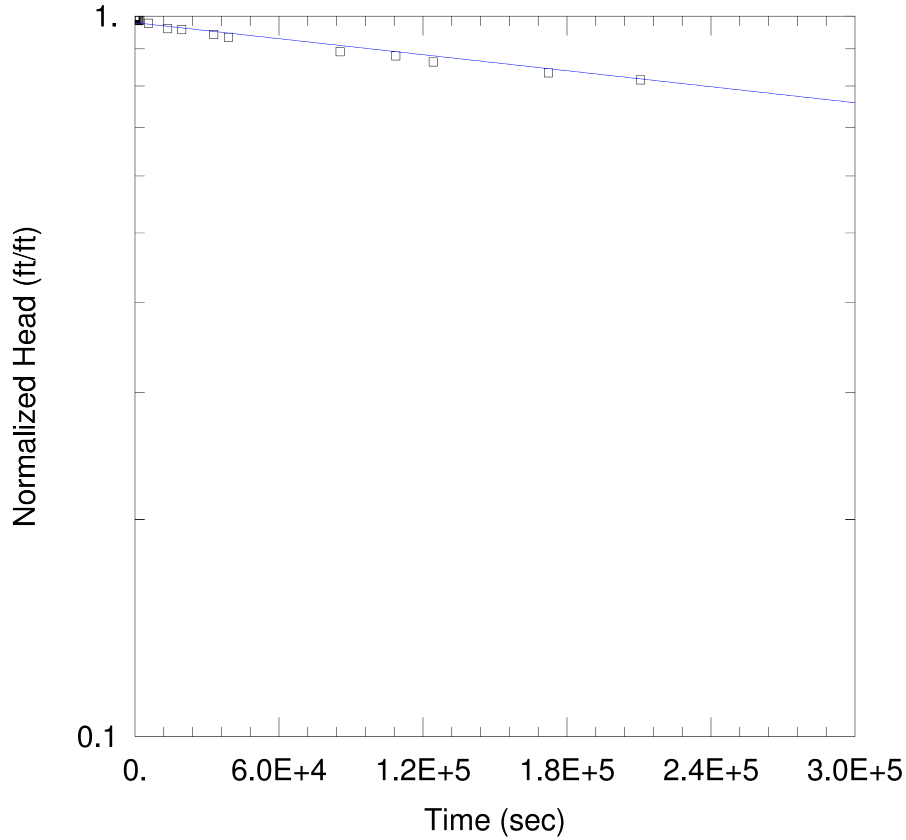
K = 0.03469 cm/sec
y0 = 3.185 ft

AQUIFER DATA

Saturated Thickness: 6.9 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G203 SO2)

Initial Displacement: 1.454 ft
Total Well Penetration Depth: 3.9 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.9 ft
Screen Length: 3.9 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G208 SO1.aqt
Date: 10/10/17 Time: 10:33:25

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G208
Test Date: 4/4/17

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

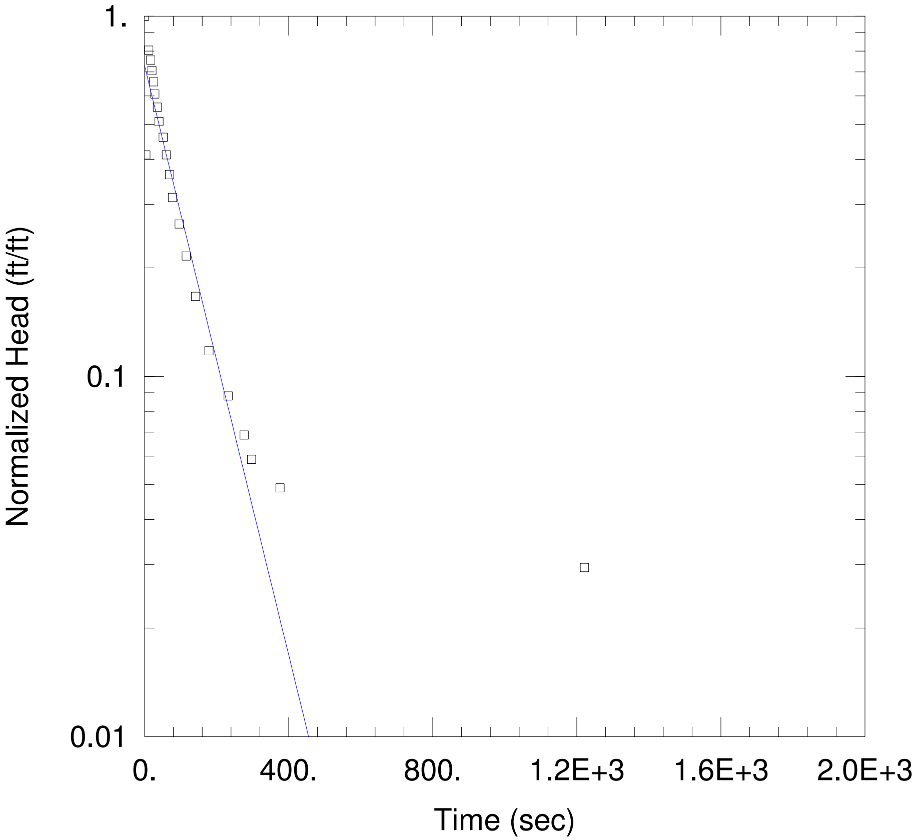
K = 1.315E-8 cm/sec
y0 = 10.16 ft

AQUIFER DATA

Saturated Thickness: 22.1 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G208 SO1)

Initial Displacement: 10.38 ft
Total Well Penetration Depth: 19.8 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 22.1 ft
Screen Length: 19.8 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G217D SI1.aqt
Date: 10/10/17 Time: 10:35:45

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G217D
Test Date: 4/4/17

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

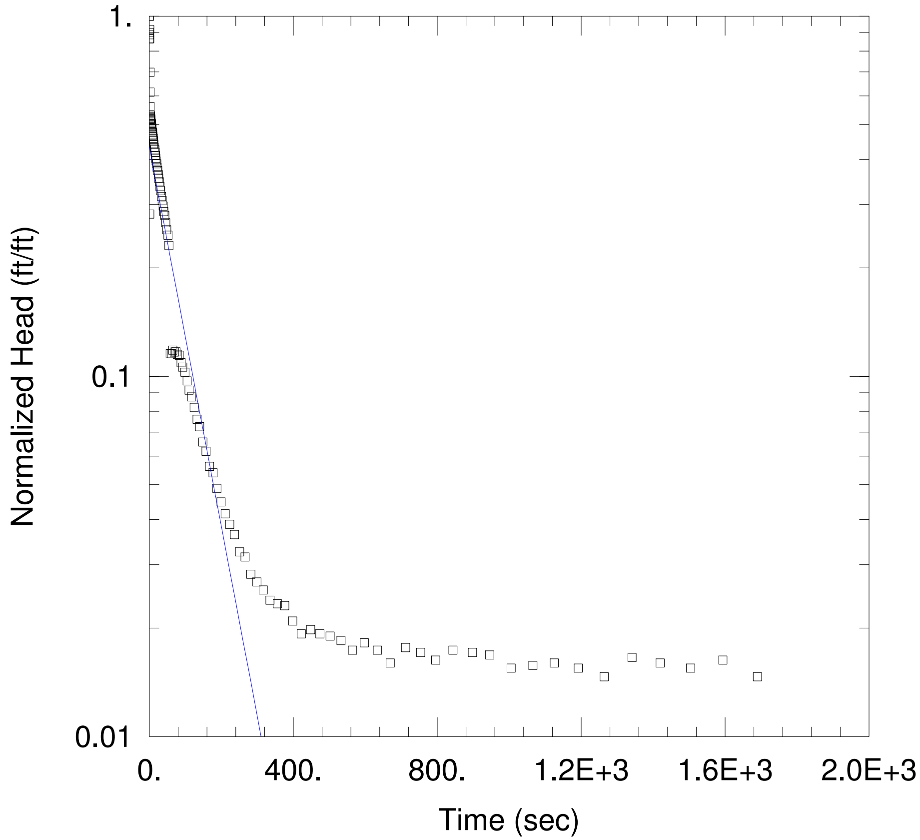
K = 0.0002266 cm/sec
y0 = 0.743 ft

AQUIFER DATA

Saturated Thickness: 13. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G217D SI1)

Initial Displacement: 1.02 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.08333 ft
Static Water Column Height: 13. ft
Screen Length: 10. ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G217D SI2.aqt
Date: 10/10/17 Time: 10:38:05

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G217D
Test Date: 4/4/17

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

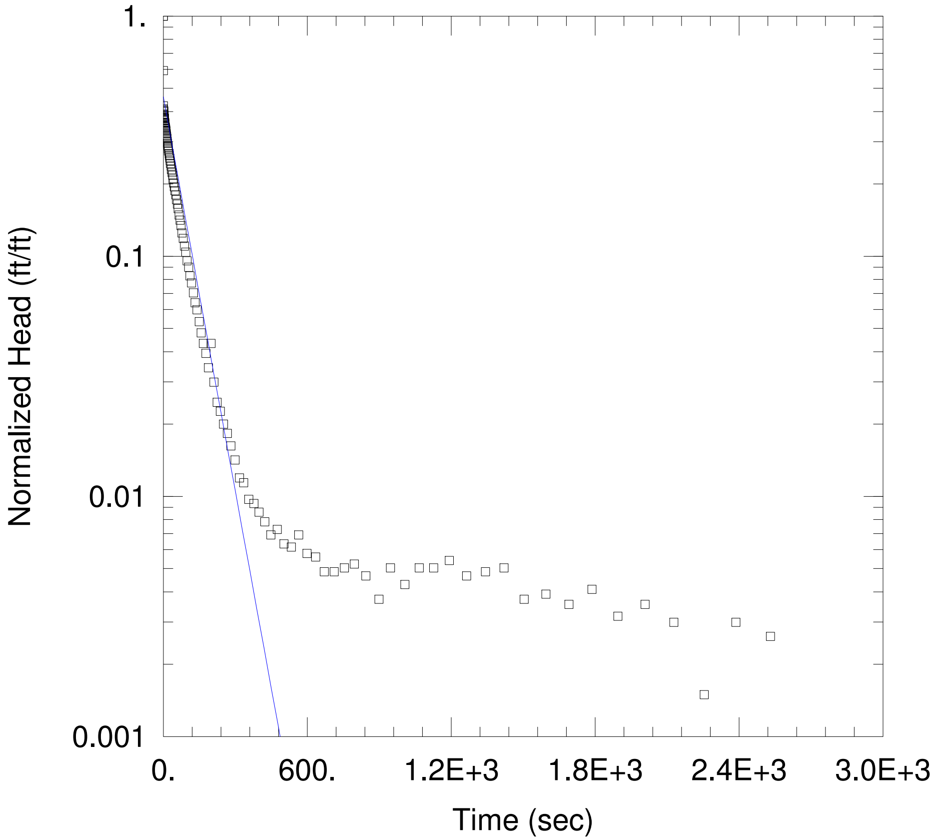
K = 0.0002919 cm/sec
y0 = 1.598 ft

AQUIFER DATA

Saturated Thickness: 13. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G217D SI2)

Initial Displacement: 3.685 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.08333 ft
Static Water Column Height: 13. ft
Screen Length: 10. ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G217D SO3.aqt
Date: 10/10/17 Time: 10:40:18

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G217D
Test Date: 4/4/17

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

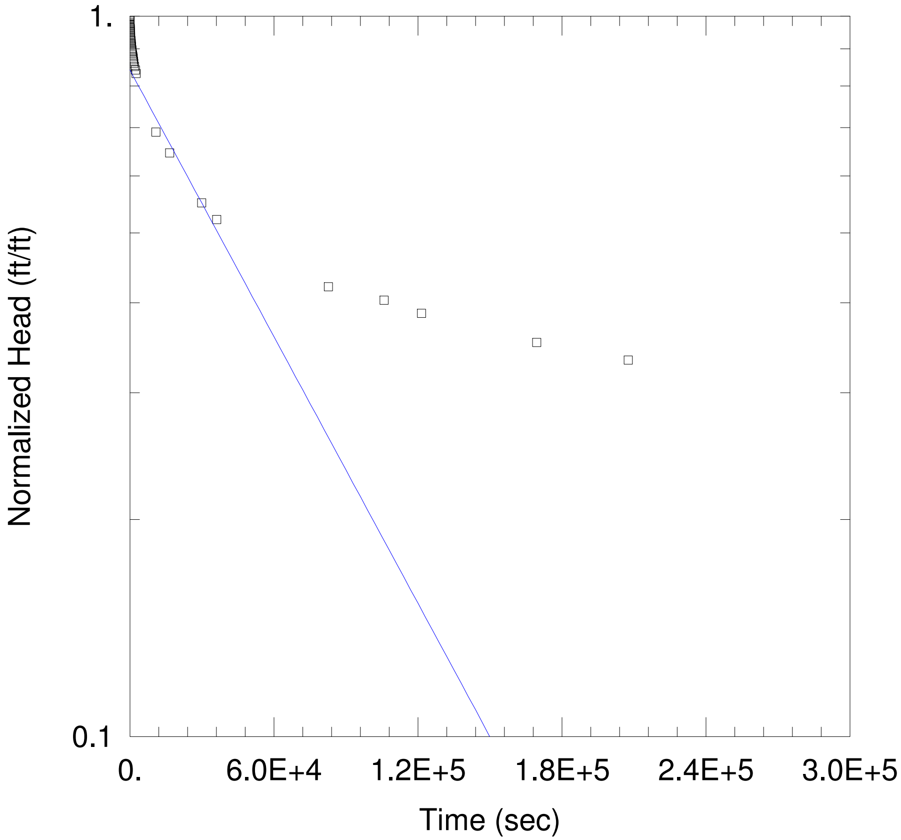
K = 0.0003032 cm/sec
y0 = 2.469 ft

AQUIFER DATA

Saturated Thickness: 13. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G217D SO3)

Initial Displacement: 5.362 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.08333 ft
Static Water Column Height: 13. ft
Screen Length: 10. ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G220 SO1.aqt
Date: 10/10/17 Time: 10:42:50

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G220
Test Date: 4/4/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

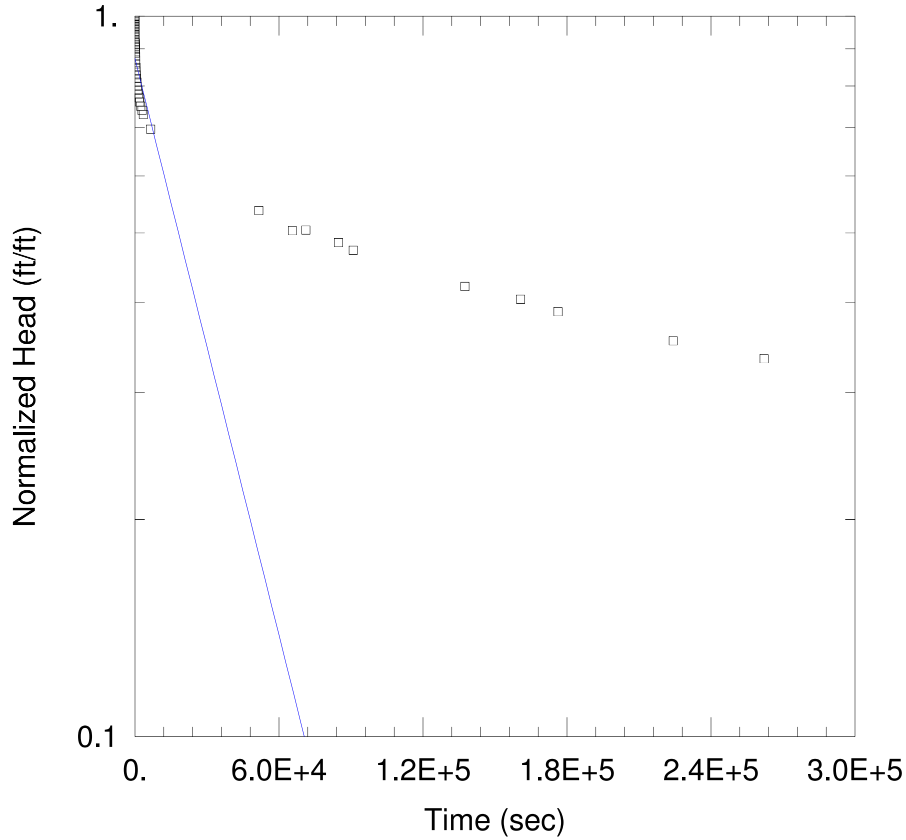
K = 3.513E-7 cm/sec
y0 = 9.098 ft

AQUIFER DATA

Saturated Thickness: 12. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G220 SO1)

Initial Displacement: 10.81 ft
Total Well Penetration Depth: 9.7 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 12. ft
Screen Length: 9.7 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G222 SO1.aqt
Date: 10/10/17 Time: 10:49:55

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G222
Test Date: 4/4/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

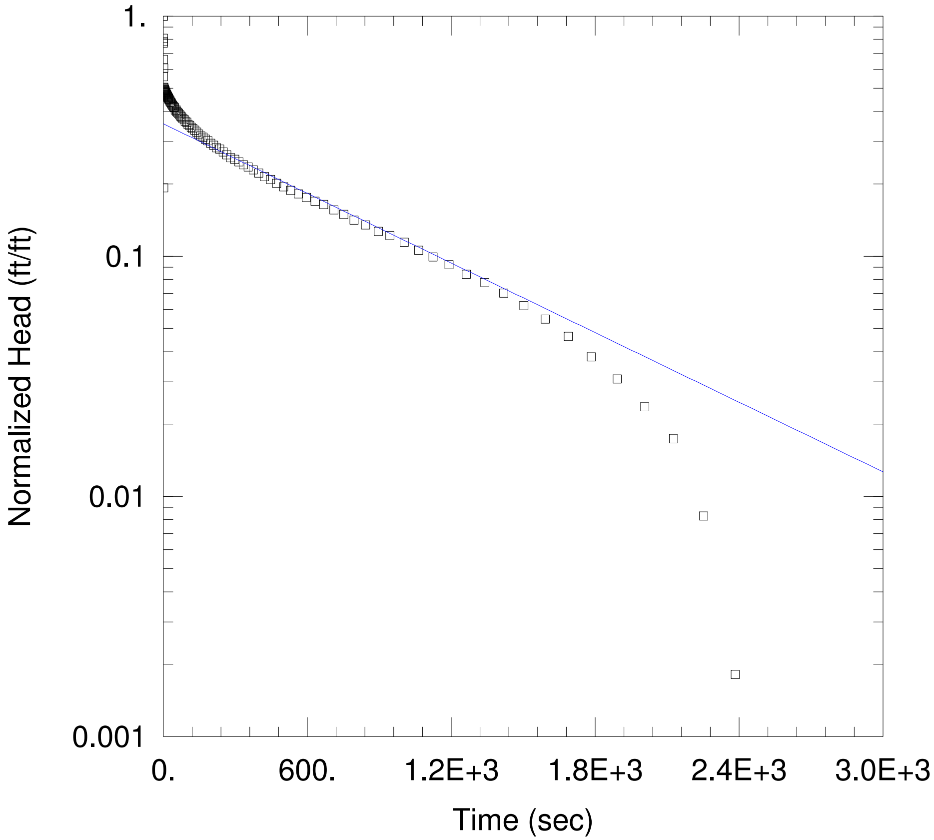
K = 1.541E-6 cm/sec
y0 = 8.832 ft

AQUIFER DATA

Saturated Thickness: 3.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G222 SO1)

Initial Displacement: 10.11 ft
Total Well Penetration Depth: 3.5 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 3.5 ft
Screen Length: 3.5 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G223 SI1.aqt
Date: 10/10/17 Time: 10:55:09

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G223
Test Date: 4/5/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

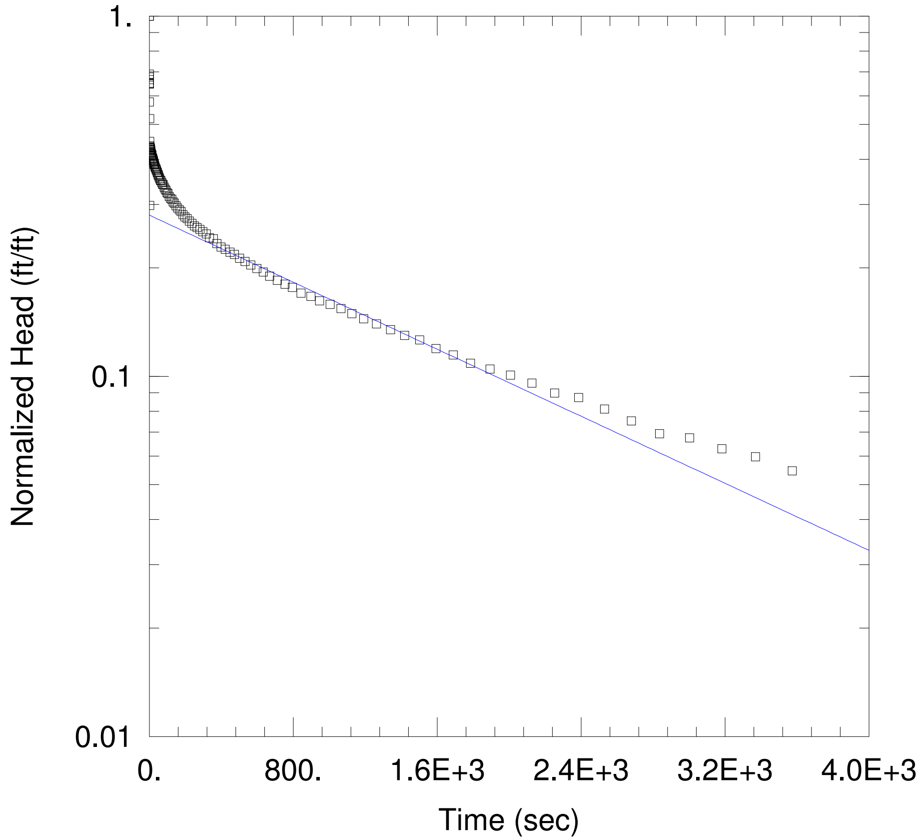
K = 5.19E-5 cm/sec
y0 = 1.374 ft

AQUIFER DATA

Saturated Thickness: 4. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G223 SI1)

Initial Displacement: 3.86 ft
Total Well Penetration Depth: 4. ft
Casing Radius: 0.08333 ft
Static Water Column Height: 4. ft
Screen Length: 4. ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G223 SI2.aqt
Date: 10/10/17 Time: 10:57:35

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G223
Test Date: 4/5/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

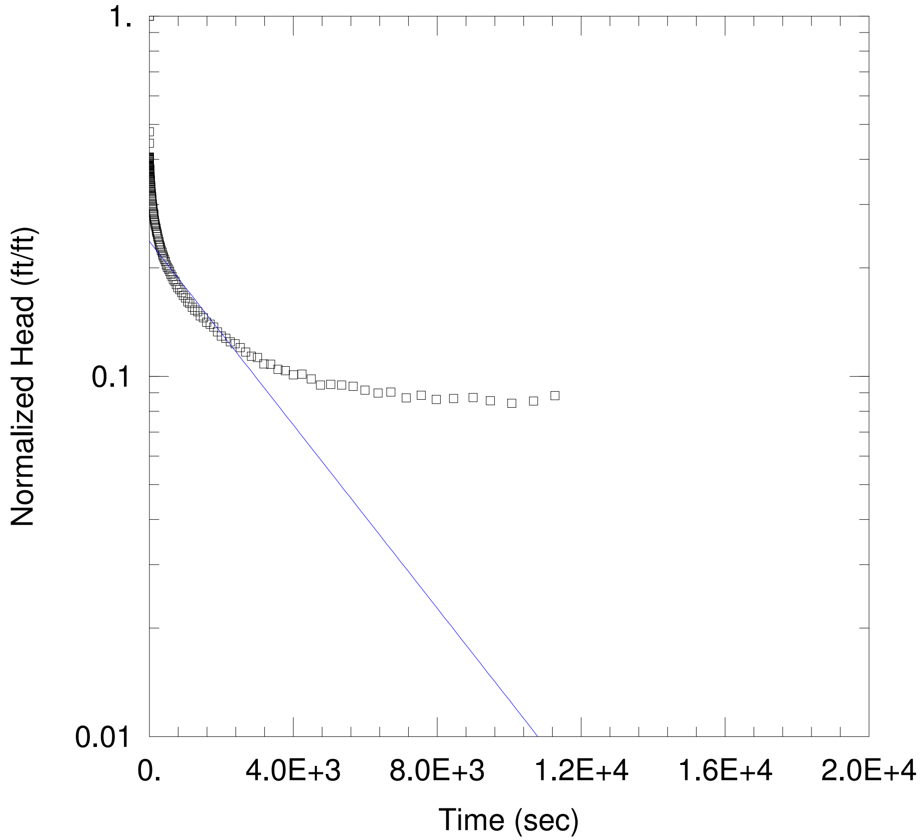
K = 2.5E-5 cm/sec
y0 = 1.251 ft

AQUIFER DATA

Saturated Thickness: 4. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G223 SI2)

Initial Displacement: 4.466 ft
Total Well Penetration Depth: 4. ft
Casing Radius: 0.08333 ft
Static Water Column Height: 4. ft
Screen Length: 4. ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G223 SO1.aqt
Date: 10/10/17 Time: 11:00:37

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G223
Test Date: 4/5/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 1.368E-5 cm/sec
y0 = 1.281 ft

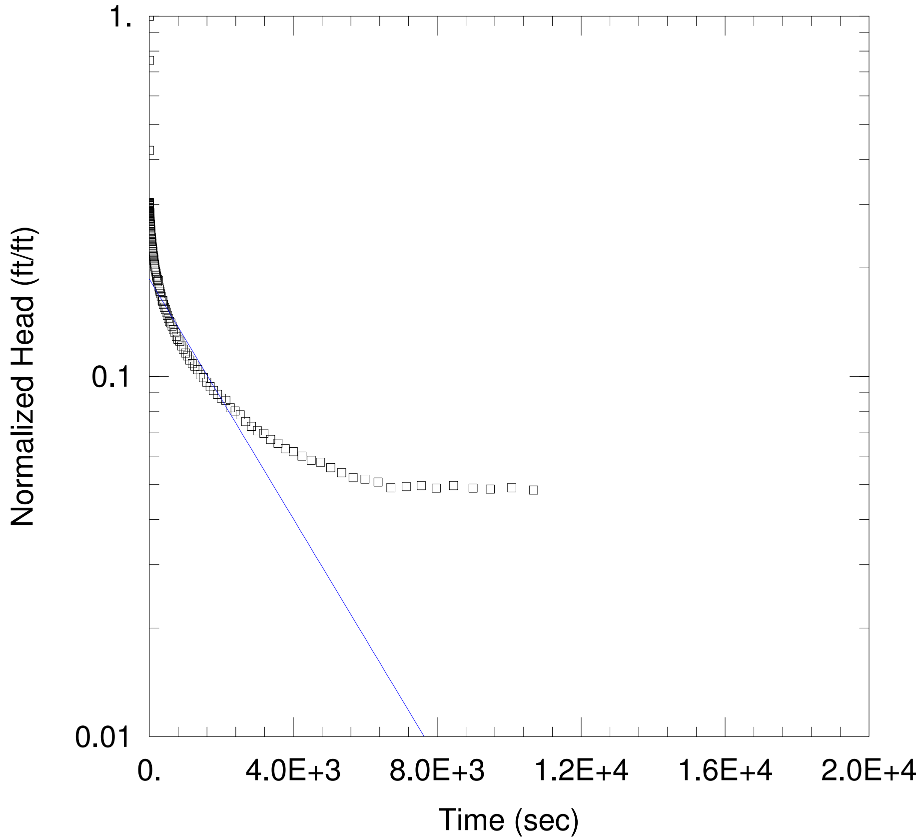
AQUIFER DATA

Saturated Thickness: 4. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G223 SO1)

Initial Displacement: 5.412 ft
Total Well Penetration Depth: 4. ft
Casing Radius: 0.08333 ft

Static Water Column Height: 4. ft
Screen Length: 4. ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G223 SO2.aqt
Date: 10/10/17 Time: 11:01:58

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G223
Test Date: 4/5/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

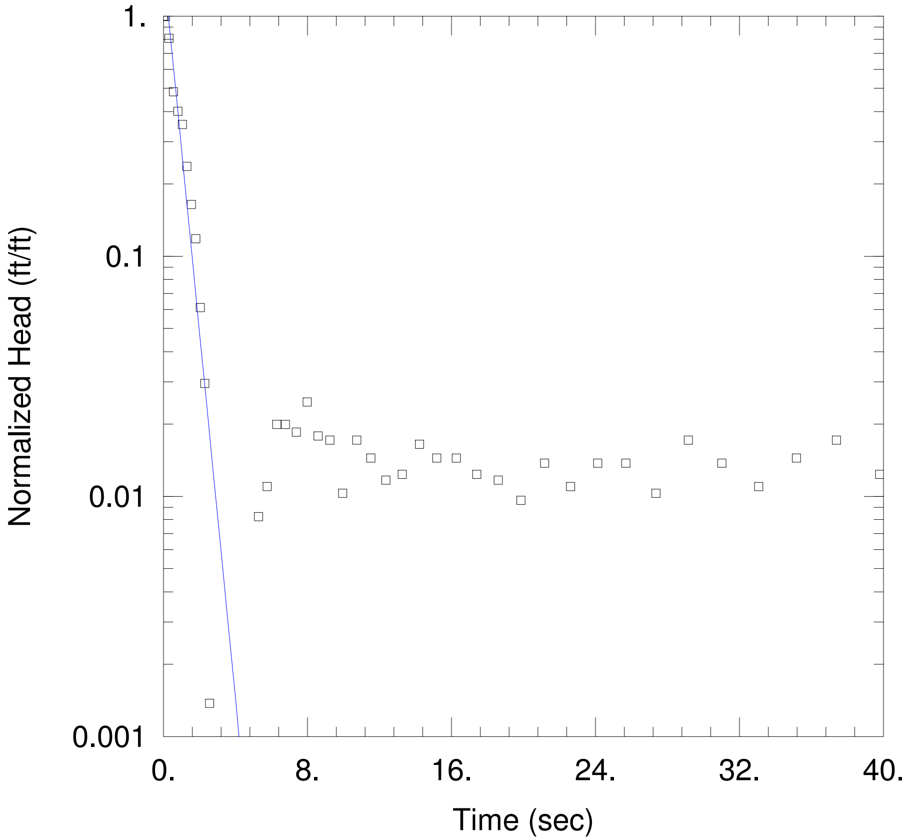
K = 1.786E-5 cm/sec
y0 = 1.359 ft

AQUIFER DATA

Saturated Thickness: 4. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G223 SO2)

Initial Displacement: 7.304 ft
Total Well Penetration Depth: 4. ft
Casing Radius: 0.08333 ft
Static Water Column Height: 4. ft
Screen Length: 4. ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G224 SI1.aqt
Date: 10/10/17 Time: 11:04:28

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G224
Test Date: 4/5/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

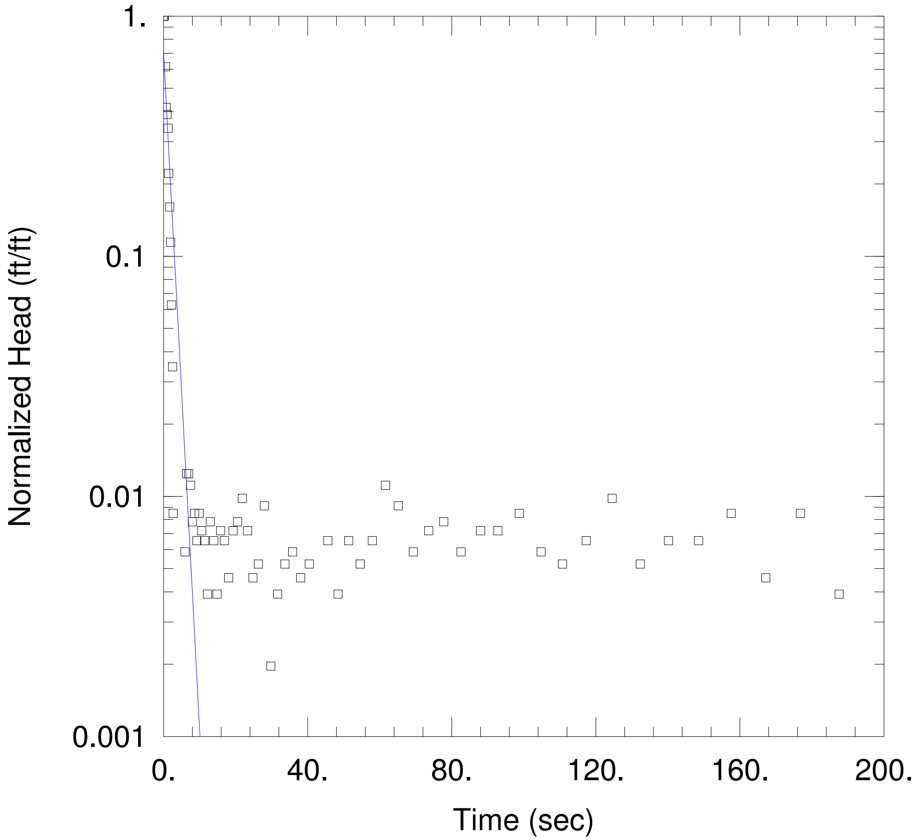
K = 0.05146 cm/sec
y0 = 2.38 ft

AQUIFER DATA

Saturated Thickness: 8.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G224 SI1)

Initial Displacement: 1.457 ft
Total Well Penetration Depth: 8.2 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 8.5 ft
Screen Length: 8.2 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G224 SI2.aqt
Date: 10/10/17 Time: 11:06:55

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G224
Test Date: 4/5/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

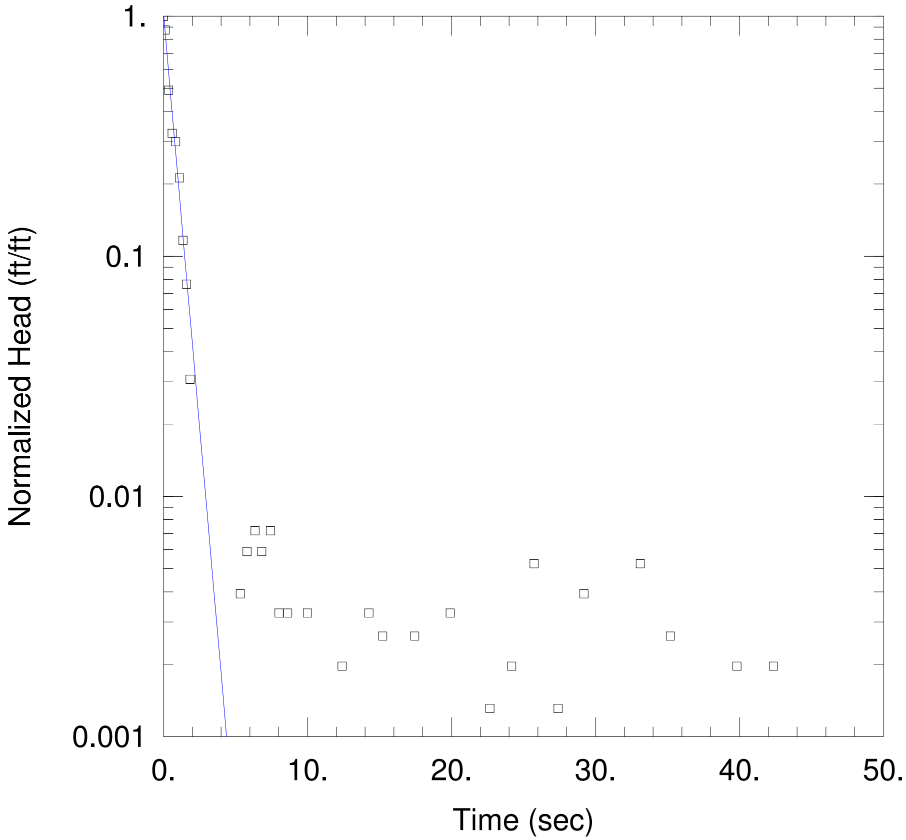
K = 0.01897 cm/sec
y0 = 1.081 ft

AQUIFER DATA

Saturated Thickness: 8.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G224 SI2)

Initial Displacement: 1.531 ft
Total Well Penetration Depth: 8.2 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 8.5 ft
Screen Length: 8.2 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G224 SI3.aqt
Date: 10/10/17 Time: 11:08:48

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G224
Test Date: 4/5/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

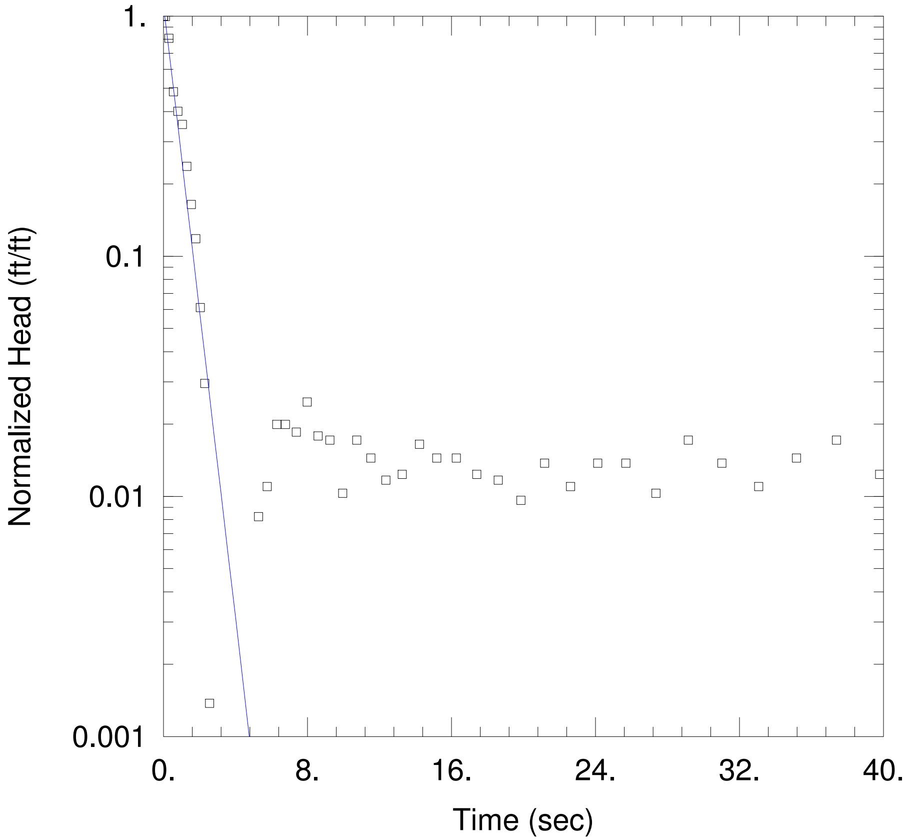
K = 0.04637 cm/sec
y0 = 1.586 ft

AQUIFER DATA

Saturated Thickness: 8.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G224 SI3)

Initial Displacement: 1.529 ft
Total Well Penetration Depth: 8.2 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 8.5 ft
Screen Length: 8.2 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G224 SO1.aqt
Date: 10/10/17 Time: 11:10:44

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G224
Test Date: 4/5/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

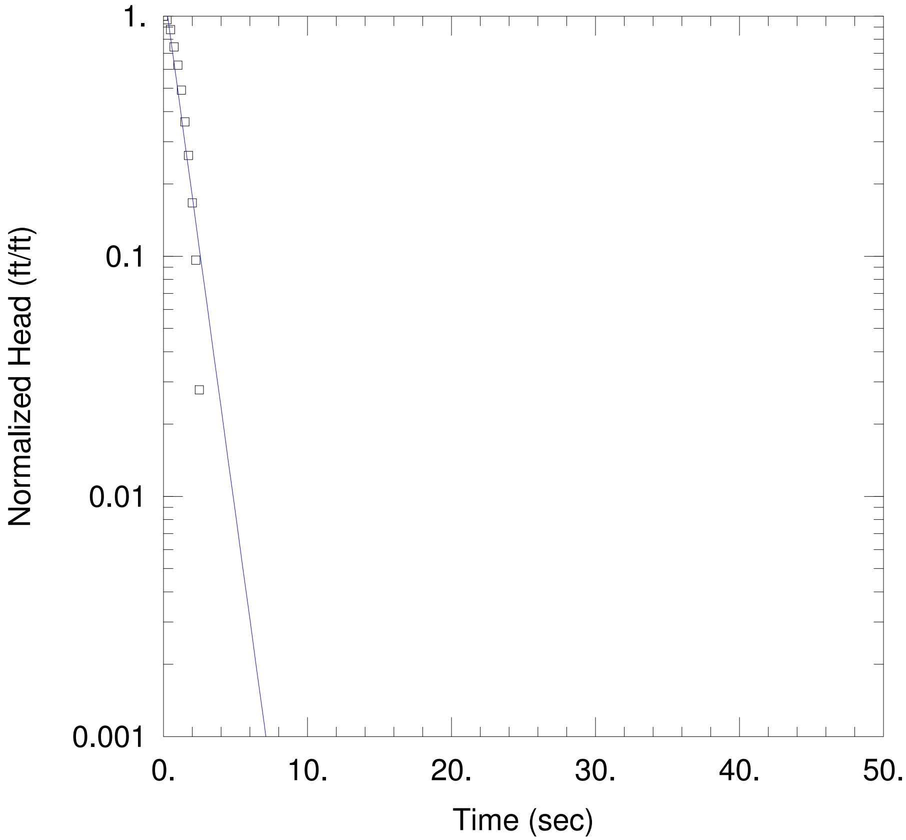
K = 0.04312 cm/sec
y0 = 1.657 ft

AQUIFER DATA

Saturated Thickness: 8.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G224 SI1)

Initial Displacement: 1.457 ft
Total Well Penetration Depth: 8.2 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 8.5 ft
Screen Length: 8.2 ft
Well Radius: 0.3458 ft



WELL TEST ANALYSIS

Data Set: P:\...\G224 SO3.aqt
Date: 10/10/17 Time: 11:12:56

PROJECT INFORMATION

Company: Natural Resource Technology
Client: Dynegy
Project: 2285
Location: Newton Landfill
Test Well: G224
Test Date: 4/5/17

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0297 cm/sec
y0 = 1.264 ft

AQUIFER DATA

Saturated Thickness: 8.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G224 SO2)

Initial Displacement: 0.936 ft
Total Well Penetration Depth: 8.2 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 8.5 ft
Screen Length: 8.2 ft
Well Radius: 0.3458 ft

APPENDIX G
FEMA FLOOD HAZARD MAP

KEY TO MAP

- 500-Year Flood Boundary → ZONE B
- 100-Year Flood Boundary →
- Zone Designations* — ZONE A1 / ZONE A5
- 100-Year Flood Boundary →
- 500-Year Flood Boundary → ZONE B
- Base Flood Elevation Line With Elevation In Feet** — 513
- Base Flood Elevation in Feet Where Uniform Within Zone** — (EL 987)
- Elevation Reference Mark — RM7×
- Zone D Boundary —
- River Mile — •M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Map Index.

INITIAL IDENTIFICATION:
JULY 27, 1979

FLOOD HAZARD BOUNDARY MAP REVISIONS:

FLOOD INSURANCE RATE MAP EFFECTIVE:
JANUARY 17, 1985

FLOOD INSURANCE RATE MAP REVISIONS:

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program, at (800) 638-6620.

APPROXIMATE SCALE

2000 0 2000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

JASPER COUNTY,
ILLINOIS
(UNINCORPORATED AREAS)

PANEL 125 OF 150
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
170990 0125 B

EFFECTIVE DATE:
JANUARY 17, 1985

Federal Emergency Management Agency

Intended for
Illinois Power Generating Company

Date
October 25, 2021

Project No.
1940100806-008

GROUNDWATER MONITORING PLAN

PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

Bright ideas. Sustainable change.

GROUNDWATER MONITORING PLAN
NEWTON POWER PLANT PRIMARY ASH POND

Project Name	**Newton Power Plant Primary Ash Pond**
Project No.	**1940100806-008**
Recipient	**Illinois Power Generating Company**
Document type	**Groundwater Monitoring Plan**
Revision	**FINAL**
Date	**October 25, 2021**

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Senior Hydrogeologist

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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, Newton Power Plant Primary Ash Pond), has been designed and constructed to meet the requirements of 35 I.A.C. § 845.630. The monitoring system was developed based on information included in the Hydrogeologic Site Characterization Report (Ramboll 2021; included in the Operating Permit to which this Groundwater Monitoring Plan is attached).

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. § 845.630 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, Newton Power Plant Primary Ash Pond), has been designed and constructed to meet the requirements of 35 I.A.C. § 845.630. The monitoring system was developed based on information included in the Hydrogeologic Site Characterization Report (Ramboll 2021; included in the Operating Permit to which this Groundwater Monitoring Plan is attached).

Brian G. Hennings
Professional Geologist
196.001482
Illinois
Date: October 25, 2021

LICENSED PROFESSIONAL GEOLOGIST
BRIAN G. HENNINGS
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ILLINOIS

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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
bgs	below ground surface
CCR	coal combustion residuals
cm/s	centimeters per second
GMP	Groundwater Monitoring Plan
GWPS	Groundwater Protection Standard
HCR	Hydrogeologic Site Characterization Report
ID	identification
IEPA	Illinois Environmental Protection Agency
IPGC	Illinois Power Generating Company
LCU	lower confining unit
LF 1	Phase 1 Landfill
LF 2	Phase 2 Landfill
LVW	low-volume wastewater
NAVD88	North American Vertical Datum of 1988
NID	National Inventory of Dams
No.	Number
NPDES	National Pollutant Discharge Elimination System
NPP	Newton Power Plant
NRT	Natural Resource Technology, Inc.
PAP	Primary Ash Pond
Part 845	Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845
PMP	potential migration pathway
QA/QC	quality assurance/quality control
Ramboll	Ramboll Americas Engineering Solutions, Inc.
RL	Reporting Limit
SI	Surface Impoundment
TDS	total dissolved solids
UA	uppermost aquifer
UCU	upper confining unit
UD	upper drift
USEPA	United States Environmental Protection Agency
WLO	water level only

1. INTRODUCTION

1.1 Overview

In accordance with requirements of the Standards for the Disposal of Coal Combustion Residuals (CCR) in Surface Impoundments (SIs): Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845 (Part 845) (Illinois Environmental Protection Agency [IEPA], April 15, 2021), Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this Groundwater Monitoring Plan (GMP) on behalf of Newton Power Plant (NPP) (**Figure 1-1**), operated by Illinois Power Generating Company (IPGC). This report will apply specifically to the CCR Unit referred to as the Primary Ash Pond (PAP), Vistra identification (ID) number (No.) 501, IEPA ID No. W0798070001-01, and National Inventory of Dams (NID) No. IL50719. This GMP includes Part 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 PAP at the NPP.

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 NPP is located in Jasper County in the southeastern part of central Illinois, approximately seven miles southwest of the town of Newton (**Figure 1-1**). The NPP operates as a coal-fired power plant with three CCR units present, including the PAP which is the subject of this GMP and two landfills: the Phase 1 Landfill (LF 1) located northwest and west of the PAP, and the Phase 2 Landfill (LF 2) located to the west of the PAP. The PAP is located within Section 26 and the west half of Section 25, Township 6 North, Range 8 East. The PAP is located south of the NPP and surrounded by Newton Lake to the south, east, and west (**Figure 1-2**).

The PAP is an unlined CCR SI used to manage CCR and non-CCR waste streams at the NPP. The PAP was constructed in 1977 and has a design capacity of approximately 9,715 acre-feet. There is also a non-CCR 83.6 acre-feet Secondary Pond located immediately south of the PAP. The PAP has a surface area of 404 acres and the Secondary Pond has an area of 9.3 acres. The PAP currently receives stormwater runoff, bottom ash, fly ash, and low-volume wastewater (LVW) from the plant’s two coal-fired boilers. The SI is operated per National Pollutant Discharge Elimination System (NPDES) Permit No. IL0049191, Outfall 001 (located at the Secondary Pond). Areas within the impoundment were excavated during construction for native materials used to build the containment berms.

1.3 Conceptual Model

Significant site investigation has been completed at the NPP to characterize the geology, hydrogeology, and groundwater quality. Based on extensive investigation and monitoring, the PAP has been well characterized and detailed in the Hydrogeologic Site Characterization Report (HCR; included in the Operating Permit to which this Plan is attached). A site conceptual model has been developed and is discussed below.

In addition to the CCR present in the PAP, there are six layers of unlithified material present above the bedrock, which are categorized into the four hydrostratigraphic units below based on stratigraphic relationships and common hydrogeologic characteristics:

- **Upper Drift (UD)/Potential Migration Pathway (PMP):** The UD is composed of the low permeability silts and clays of the Peoria Silt and Sangamon Soil and the sandier soils of the Hagarstown Member(*i.e.,* PMP).
  - **Hagarstown Member/PMP:** The Hagarstown Member consists of discontinuous sandier deposits of the UD, where present, and overlies the Vandalia Till.
- **Upper Confining Unit (UCU):** This unit consists of the low permeability clay and silt of the Vandalia Till Member (Vandalia Till).
- **Uppermost Aquifer:** This unit is composed of the Mulberry Grove Formation, which onsite has been classified as poorly graded sand, silty sand, clayey sand, and gravel.
- **Lower Confining Unit (LCU):** This unit is comprised of low permeability silt and clay of the Smithboro Till Member (Smithboro Till) and the Banner Formation.

Groundwater migrates downward through the UD and UCU into the uppermost aquifer. Groundwater in the uppermost aquifer flows from north to south/southwest and converges near a former drainage feature located west of the PAP (**Figure 1-3**). Groundwater elevations vary seasonally, although generally less than one foot per year. The surface water elevation at Newton Lake (at location SG02) measured between February 15 and March 9, 2021 ranged from 504.42 to 504.84 feet North American Vertical Datum of 1988 (NAVD88). Groundwater elevations in the uppermost aquifer at downgradient wells were observed around 491 feet NAVD88 (approximately 15 feet lower than the Lake elevation). The separation between measured groundwater elevations and Lake elevations (and observed downward vertical gradients) indicates groundwater does not flow into Newton Lake from the uppermost aquifer.

Part 845 parameters were monitored in uppermost aquifer and PMP monitoring wells as part of groundwater quality evaluations performed between 2015 and present. These data were supplemented with installation and sampling of additional locations in 2021. The results indicate that the following parameters were detected at concentrations greater than the applicable 35 I.A.C. § 845.600 groundwater protection standards (GWPSs) and are considered potential exceedances:

- Arsenic at six uppermost aquifer wells, including downgradient wells APW08, APW09, APW15, and APW16 and background wells APW05 and APW06.
- Chloride at upgradient UD well APW05S and downgradient uppermost aquifer well APW15.
- Cobalt at PMP well APW12.
- Fluoride at downgradient uppermost aquifer well APW15 and APW18.
- Lead at downgradient uppermost aquifer wells APW08, APW11, and APW18.
- Lithium at three PMP wells APW02, APW04, and APW12; one upgradient UD well APW05S; and two downgradient uppermost aquifer wells APW13 and APW14.
- pH values below the lower range of the GWPS were observed at four PMP wells APW02, APW03, APW04, APW12; one background UA well APW06; and two downgradient uppermost aquifer wells APW11 and APW13.

- Radium 226 and 228 combined at downgradient uppermost aquifer well APW16.
- Sulfate at three PMP wells APW02, APW04, and APW12; one upgradient UD well APW05S; and one downgradient uppermost aquifer well APW10.
- Thallium at one background well APW06, and two downgradient uppermost aquifer wells APW11 and APW18.
- Total dissolved solids (TDS) at four PMP wells APW02, APW03, APW04, and APW12; and one Upgradient UD well APW05S.

Concentration results for the above parameters were compared directly to 35 I.A.C. § 845.600(a)(1) GWPS, without an evaluation of background concentrations. Evaluation of background groundwater quality has been completed as part of this GMP, and compliance with Part 845 will be determined following the first round of groundwater sampling. The first round of groundwater sampling for compliance will be completed the quarter following issuance of the Operating Permit and in accordance with this GMP.

2. GROUNDWATER MONITORING SYSTEMS

2.1 Existing Monitoring Well Network and Analysis

This GMP is being provided to propose a groundwater monitoring network and monitoring program specific to the PAP that will comply with Part 845. The remaining discussion in this document will include only these networks and monitoring programs that are applicable and specific to the PAP, specifically the IEPA monitoring program, the Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257 network, and the proposed Part 845 monitoring network.

2.1.1 IEPA Monitoring Program

The current IEPA-required groundwater monitoring program associated with the PAP consists of four groundwater monitoring wells, including two background monitoring wells (G116 and APW02) and two compliance monitoring wells (APW03 and APW04) in accordance with the Special Condition No. 19 of the plant’s NPDES Permit IL0049191. Groundwater samples are collected quarterly and analyzed for dissolved manganese, dissolved sulfate, dissolved zinc, TDS, and pH. Upon approval of the Operating Permit application (and by extension the GMP), the NPDES monitoring program Special Condition No. 19 will be discontinued following approval of a future NPDES permit modification submittal. The boring logs, well construction forms, and other related monitoring well forms for the well network are included in Appendix C of the HCR (included in the Operating Permit to which this Plan is attached). The well locations are shown on **Figure 2-1**.

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

The 40 C.F.R. § 257 well network for the PAP consists of six monitoring wells screened in the uppermost aquifer, including two background monitoring wells (APW05 and APW06) and four compliance monitoring wells (APW07, APW08, APW09, and APW10). 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 Operating Permit to which this Plan is attached). The well locations are shown on **Figure 2-1**.

Groundwater is being monitored at the PAP in accordance with the Detection Monitoring Program requirements specified in 40 C.F.R. § 257.94. Details of the procedures and techniques used to fulfill the groundwater sampling and analysis program requirements are found in the Sampling and Analysis Plan for the PAP (Natural Resource Technology, Inc. [NRT], 2017).

Groundwater samples are collected semi-annually and analyzed for the field and laboratory parameters from Appendix III of 40 C.F.R. § 257, summarized in **Table A** below.

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

[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 of the following year and made available on the CCR public website as required by 40 C.F.R. § 257.

2.1.3 Part 845 Well Installation and Monitoring

In 2021, nine additional monitoring wells (APW11, APW12, APW13, APW14, APW15, APW16, APW17, APW18, and APW5S) were installed along the perimeter of the PAP to assess the vertical and horizontal lithology, stratigraphy, chemical properties, and physical properties of geologic layers to a minimum of 100 feet below ground surface (bgs) as specified in 35 I.A.C. § 845.620(b). Additionally, four leachate monitoring wells (XPW01, XPW02, XPW03, and XPW04) were installed within the PAP to characterize CCR materials and leachate.

Prospective Part 845 monitoring wells were sampled for eight rounds between February and August 2021 and the results were used for selection of the PAP Part 845 monitoring well network. Groundwater samples were collected and analyzed for 35 I.A.C. § 845.600 parameters as summarized in **Table B** below.

Table B. Part 845 Groundwater Monitoring Program Parameters

Field Parameters[1]			
pH	Turbidity	Groundwater Elevation	
Metals (Total)			
Antimony	Boron	Cobalt	Molybdenum
Arsenic	Cadmium	Lead	Selenium
Barium	Calcium	Lithium	Thallium
Beryllium	Chromium	Mercury	
Inorganics (Total)			
Fluoride	Sulfate	Chloride	TDS
Other (Total)			
Radium 226 and 228 combined			

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

Data and results from the Part 845 background monitoring were included in the water quality discussion included in the HCR (included in the Operating Permit to which this Plan is attached). The data collected from background locations during the Part 845 monitoring were used to evaluate and calculate background concentrations for the PAP. The evaluation and discussion are included in **Section 3.2** of this report.

Data collected from the 40 C.F.R. § 257 monitoring network from 2015 to 2020, and from the Part 845 background monitoring were used for selection of the Part 845 monitoring well network proposed in **Section 2.2**.

2.2 Proposed Part 845 Monitoring Well Network

The groundwater monitoring network proposed in this plan will include five monitoring wells screened in the UD (APW02[1], APW03[1], APW04[1], APW05S[1], and APW12[1]), 13 monitoring wells screened in the uppermost aquifer (APW05, APW06, APW07, APW08, APW09, APW10, APW11, APW13, APW14, APW15, APW16, APW17, and APW18), and two temporary water level only surface water staff gages (XSG01 and SG02). The proposed network is summarized in **Table C** on the following page and displayed on **Figure 2-1.** Eighteen wells (two background and 16 compliance) will be used to monitor groundwater concentrations within the hydrostratigraphic units.

The groundwater samples collected from the 18 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.

[1] Monitoring wells APW02, APW03, APW04, APW05S, and APW12 are wells screened in the UD that have been identified to monitor the PMP.

Table C. Proposed Part 845 Monitoring Well Network

Well ID	Monitored Unit	Well Screen Interval (feet bgs)	Well Type[3]
APW02*	UD	9.7 - 19.7	Compliance
APW03*	UD	9.7 - 19.7	Compliance
APW04*	UD	7.7 - 17.7	Compliance
APW05	UA	62.6 - 67.4	Background
APW05S*	UD	10.0 – 20.0	Compliance
APW06	UA	67.7 - 72.5	Background
APW07	UA	77.9 - 82.7	Compliance
APW08	UA	71.4 - 81.1	Compliance
APW09	UA	56.7 - 61.5	Compliance
APW10	UA	40.7 - 45.5	Compliance
APW11	UA	60.0 - 65.0	Compliance
APW12*	UD	20.0 - 30.0	Compliance
APW13	UA	58.5 - 63.5	Compliance
APW14	UA	50.0 - 55.0	Compliance
APW15	UA	98.0 - 103.0	Compliance
APW16	UA	80.5 - 85.5	Compliance
APW17	UA	87.0 - 92.0	Compliance
APW18	UA	75.0 - 80.0	Compliance
XSG01[1,2]	CCR	NA	WLO
SG02[1,2]	Surface Water	NA	WLO

[1] Surface water level measuring points.
[2] Location is temporary pending implementation of impoundment closure per an approved Construction Permit Application.
[3] Well type refers to the role of the well in the monitoring network.
* Well in the UD that has been identified to monitor the PMP
NA = not applicable
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

Per 35 I.A.C. § 620.210, groundwater within the uppermost aquifer at the PAP meets the definition of a Class I - Potable Resource Groundwater based on the following criteria:

- Groundwater is located more than 10 feet bgs and within an unconsolidated silty sand and gravel unit which is five feet or more in thickness.
- Field hydraulic conductivity testing identified a geometric mean horizontal hydraulic conductivity of 6.8 x 10^{-3} centimeters per second (cm/s), which exceeds the 1 x 10^{-4} cm/s criterion.
- Groundwater is not downgradient of or underlying previously mined out areas.

Testing of the unconsolidated materials of the Mulberry Grove member averaged 21 percent fines which is greater than the 12 percent fines criterion; however, this was not deemed prohibitive of the Class I Classification.

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 United States Environmental Protection Agency's (USEPA) *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 was 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 GWPS 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 UD and uppermost aquifer 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 include arsenic, pH, and radium 226 and 228 combined where the background concentration/measurement is greater (or lower for pH lower limit) than the 35 I.A.C. § 845.600(a)(1) standard. In these instances, the GWPS will be the background concentration/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 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 groundwater monitoring plan 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). 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 compliance wells as required by 35 I.A.C. § 845.630. As discussed in **Section 2,** three monitoring programs specific to the PAP exist: the IEPA-required monitoring program, the 40 C.F.R. § 257 monitoring program, and the proposed Part 845 monitoring program. These networks will continue to be monitored until USEPA approves Part 845. It is expected that upon USEPA approval of Part 845, the 40 C.F.R. § 257 monitoring program and reporting will be eliminated, and the proposed Part 845 monitoring and reporting included in this GMP will replace the current IEPA monitoring program. The Part 845 monitoring and reporting will continue until requirements of Part 845 have been achieved.

4.1 Monitoring Networks and Parameters

4.1.1 IEPA Groundwater Monitoring

The existing IEPA-required monitoring program was discussed in detail in **Section 2.1.1**. Four groundwater monitoring wells, including two background monitoring wells (G116 and APW02) and two compliance monitoring wells (APW03 and APW04), are sampled on a quarterly frequency for the parameters listed Special Condition No. 19 of NPDES Permit No. IL0049191.

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**. Six wells (two background and four compliance) are sampled for Appendix III parameters on a semi-annual frequency. No changes are proposed to this monitoring network. Well locations and parameters will continue to be monitored and reported as required by 40 C.F.R. § 257 until USEPA approves Part 845.

4.1.3 Part 845 Groundwater Monitoring

The proposed Part 845 Monitoring Network will consist of two background monitoring wells (APW05, and APW06), 16 compliance monitoring wells (APW02, APW03, APW04, APW05S, APW07, APW08, APW09, APW10, APW11, APW12, APW13, APW14, APW15, APW16, APW17, and APW18) and two temporary water level only surface water staff gages (XSG01 and SG02) to monitor potential impacts from the PAP (**Figure 2-1**). These monitoring wells are screened within the UD (APW02[2], APW03[2], APW04[2], APW05S[2], and APW12[2]) and the uppermost aquifer (APW05, APW06, APW07, APW08, APW09, APW10, APW11, APW13, APW14, APW15, APW16, APW17, APW18) along the perimeter of the PAP. Groundwater samples will be collected and analyzed for the laboratory and field parameters in **Table D** below.

[2] Monitoring wells APW02, APW03, APW04, APW05S, and APW12 are wells screened in the UD that have been identified to monitor the PMP.

Table D. Part 845 Groundwater Monitoring Program Parameters

Field Parameters[1]			
pH	Turbidity	Groundwater Elevation	
Metals (Total)			
Antimony	Boron	Cobalt	Molybdenum
Arsenic	Cadmium	Lead	Selenium
Barium	Calcium	Lithium	Thallium
Beryllium	Chromium	Mercury	
Inorganics (Total)			
Fluoride	Sulfate	Chloride	TDS
Other (Total)			
Radium 226 and 228 combined			

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

All parameters listed above were sampled a minimum of eight times by October 18, 2021 to establish background groundwater quality in accordance with 35 I.A.C. § 845.650 (b)(1)(A). Discussion of background groundwater quality is included in **Section 3.2**.

4.2 Sampling Schedule

Groundwater sampling for the Part 845 monitoring well network will initially be performed quarterly according to the following schedule:

Table E. Part 845 Sampling Schedule

Frequency	Duration
Monthly (groundwater elevations only)	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).
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 **Section 4.5** (**Table 4-1**).

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.

4.5 Quality Assurance Program

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

- Field duplicates will be collected at a frequency of one per group of ten or fewer investigative water samples.
- One equipment blank sample will be collected and analyzed for each day of sampling. If dedicated sampling equipment is used, then equipment blank samples will not be collected.
- The duplicate and equipment blank quality assurance samples will be supplemented by the laboratory QA/QC program, which typically includes:
  - Regular generation of instrument calibration curves to assure instrument reliability
  - Laboratory control samples and/or quality control check standards that have been spiked, and analyses to monitor the performance of the analytical method
  - Matrix spike/matrix spike duplicate analyses to determine percent recoveries and relative percent differences for each of the parameters detected
  - Analysis of replicate samples to check the precision of the instrumentation and/or methodology employed for all analytical methods
  - Analysis of method blanks to assure that the system is free of contamination

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

4.6 Groundwater Monitoring System Maintenance Plan

Consistent with the requirements of 35 I.A.C. § 845.630(e)(2), maintenance will be performed as needed to assure that the monitoring wells provide representative groundwater samples. Monitoring wells will be inspected during each groundwater sampling event; inspections will consist of the following:

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

If maintenance of a monitoring well cannot address an identified deficiency, a replacement well will be installed.

4.7 Statistical Analysis

Statistical analysis will be consistent with 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 recordkeeping, 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 Part 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 any required corrective action plan for the PAP 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 groundwater protection standard 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(a)(1); 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.

Following detection of an exceedance of the GWPS, 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 PAP caused the contamination and the PAP 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 Part 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 Addendum will continue as specified until the post closure care period has expired and IEPA has approved termination of post-closure care.

5. REFERENCES

Illinois Environmental Protection Agency, 2021. Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845, April 15, 2021.

Natural Resource Technology, Inc. (NRT), 2017. Sampling and Analysis Plan, Newton Primary Ash Pond, Newton Power Station, Newton, Illinois, Project No. 2285, Revision 0, October 17, 2017.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021. Hydrogeologic Site Characterization Report, Newton Primary Ash Pond, Newton Power Plant, 6725 North 500th St., Newton, Illinois.

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.

United States Environmental Protection Agency (USEPA), 2015. Title 40 of the Code of Federal Regulations, Part 257.

TABLES

TABLE 1-1. PART 845 REQUIREMENTS CHECKLIST
GROUNDWATER MONITORING PLAN
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Part 845 Reference	Part 845 Components	Location of Information in GMP
845.630	**Groundwater Monitoring Systems**	
845.630(a)(2)	Potential contaminant pathways must be monitored.	Sections 2.2 & 4.1.3
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	Section 4.1.3
845.640(j)	Analyze groundwater samples using a certified laboratory	Section 4.4

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TABLE 1-1. PART 845 REQUIREMENTS CHECKLIST

GROUNDWATER MONITORING PLAN

NEWTON POWER PLANT

PRIMARY ASH POND

NEWTON, ILLINOIS

Part 845 Reference	Part 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) 845.650(b)(3)	Staff gauge/ piezometer to monitor head in impoundment	Sections 2.2 & 4.1.3 Figure 2-1 (XSG01)
NA	Staff gauge/ piezometer to monitor head of neighboring surface water body	Sections 2.2 & 4.1.3 Figure 2-1 (SG02)

[O: CJC 08/25/21; C: LDC 09/09/21]

Notes:

GMP = Groundwater Monitoring Plan

NA = Not Applicable

TABLE 2-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
GROUNDWATER MONITORING PLAN
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, 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)
APW02	C	UD	06/19/2010	533.61	533.61	Top of Riser	529.90	9.70	19.70	520.20	510.20	20.00	509.90	10	2	38.925918	-88.293907
APW03	C	UD	06/18/2010	532.41	532.41	Top of Riser	528.37	9.70	19.70	518.67	508.67	20.00	508.40	10	2	38.922322	-88.281567
APW04	C	UD	06/19/2010	525.06	525.06	Top of Riser	521.45	7.70	17.70	513.75	503.75	18.00	503.50	10	2	38.927444	-88.273113
APW05	B	UA	10/22/2015	544.07	544.07	Top of Riser	541.08	62.64	67.44	478.44	473.64	67.84	473.10	4.8	2	38.933958	-88.280983
APW05S	C	UD	01/19/2021	543.94	543.94	Top of PVC	541.05	10.00	20.00	531.05	521.05	20.00	518.10	10	2	38.933958	-88.281033
APW06	B	UA	10/21/2015	546.07	546.07	Top of Riser	542.89	67.67	72.48	475.22	470.41	72.88	468.90	4.8	2	38.933746	-88.286276
APW07	C	UA	11/05/2015	538.37	538.37	Top of Riser	535.72	77.89	82.70	457.83	453.02	83.10	452.60	4.8	2	38.928233	-88.292076
APW08	C	UA	10/28/2015	528.97	528.97	Top of Riser	526.26	71.40	81.06	454.86	445.20	81.53	444.30	9.7	2	38.923154	-88.292286
APW09	C	UA	11/03/2015	531.52	531.52	Top of Riser	528.33	56.66	61.46	471.67	466.87	61.85	466.30	4.8	2	38.922319	-88.281585
APW10	C	UA	11/06/2015	524.25	524.25	Top of Riser	521.49	40.74	45.54	480.75	475.95	45.94	475.60	4.8	2	38.927435	-88.273127
APW11	C	UA	01/23/2021	538.63	538.63	Top of PVC	536.05	60.00	65.00	476.05	471.05	65.00	436.10	5	2	38.932811	-88.27545
APW12	C	UD	02/21/2021	546.29	546.29	Top of PVC	543.33	20.00	30.00	523.33	513.33	30.00	456.30	10	2	38.92975	-88.272058
APW13	C	UA	01/22/2021	537.99	537.99	Top of PVC	535.16	58.50	63.50	476.66	471.66	63.50	445.20	5	2	38.92566	-88.274416
APW14	C	UA	01/23/2021	526.29	526.29	Top of PVC	523.85	50.00	55.00	473.85	468.85	55.00	428.90	5	2	38.924057	-88.277994
APW15	C	UA	01/22/2021	524.69	524.69	Top of PVC	522.06	98.00	103.00	424.06	419.06	103.00	412.10	5	2	38.921593	-88.285226
APW16	C	UA	01/20/2021	531.18	531.18	Top of PVC	529.16	80.50	85.50	448.66	443.66	85.50	419.20	5	2	38.920317	-88.291291
APW17	C	UA	01/22/2021	532.52	532.52	Top of PVC	529.84	87.00	92.00	442.84	437.84	92.00	429.80	5	2	38.925916	-88.293928
APW18	C	UA	01/21/2021	543.27	543.27	Top of PVC	540.55	75.00	80.00	465.55	460.55	80.00	433.60	5	2	38.930979	-88.290122
XSG01	WLO	CCR	--	--	536.17	Staff gauge	--	--	--	--	--	--	--	--	--	38.923218	-88.29067
SG02	WLO	SW	--	--	506.89	Staff gauge	--	--	--	--	--	--	--	--	--	38.921234	-88.292057

TABLE 2-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
GROUNDWATER MONITORING PLAN
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, 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)

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
-- = data not available
BGS = below ground surface
CCR = Coal Combustion Residual
ft = foot or feet
HSU = Hydrostratigraphic Unit
PVC = polyvinyl chloride
SW = surface water
UA = uppermost aquifer
UD = upper drift
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TABLE 3-1. BACKGROUND GROUNDWATER QUALITY AND STANDARDS
GROUNDWATER MONITORING PLAN
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Parameter	Background Concentration	845 Limit	Groundwater Protection Standard	Unit
Antimony, total	0.003	0.006	0.006	mg/L
Arsenic, total	0.059	0.010	0.059	mg/L
Barium, total	0.3	2.0	2.0	mg/L
Beryllium, total	0.001	0.004	0.004	mg/L
Boron, total	0.26	2	2	mg/L
Cadmium, total	0.001	0.005	0.005	mg/L
Chloride, total	52	200	200	mg/L
Chromium, total	0.011	0.1	0.1	mg/L
Cobalt, total	0.0043	0.006	0.006	mg/L
Fluoride, total	0.633	4.0	4.0	mg/L
Lead, total	0.0074	0.0075	0.0075	mg/L
Lithium, total	0.03	0.04	0.04	mg/L
Mercury, total	0.0002	0.002	0.002	mg/L
Molybdenum, total	0.018	0.1	0.1	mg/L
pH (field)	7.8 / 6.4	9.0 / 6.5	9.0 / 6.4	SU
Radium 226 and 228 combined	6.9	5	6.9	pCi/L
Selenium, total	0.001	0.05	0.05	mg/L
Sulfate, total	36	400	400	mg/L
Thallium, total	0.001	0.002	0.002	mg/L
Total Dissolved Solids	628	1200	1200	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

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TABLE 4-1. SAMPLING AND ANALYSIS SUMMARY
GROUNDWATER MONITORING PLAN
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, 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	18	2	0	0	1	21	plastic	600 mL	HNO_3 to pH<2	6 months
Mercury	7470A or 6020	18	2	0	0	1	21	plastic	400 mL	HNO_3 to pH<2	28 days
Inorganic Parameters											
Fluoride	9214 or EPA 300	18	2	0	0	1	21	plastic	300 mL	Cool to 4 °C	28 days
Chloride	9251 or EPA 300	18	2	0	0	1	21	plastic	100 mL	Cool to 4 °C	28 days
Sulfate	9036 or EPA 300	18	2	0	0	1	21	plastic	50 mL	Cool to 4 °C	28 days
Total Dissolved Solids	SM 2540 C	18	2	0	0	1	21	plastic	200 mL	Cool to 4 °C	7 days
Radium											
Radium 226	9315 or EPA 903	18	0	0	0	0	18	plastic	1000 mL	HNO_3 to pH<2	6 months
Radium 228	9320 or EPA 904	18	0	0	0	0	18	plastic	1000 mL	HNO_3 to pH<2	6 months
Field Parameters											
pH	SM 4500-H+ B	18	NA	NA	NA	NA	18	flow-through cell	NA	none	immediately
Dissolved Oxygen [8]	SM 4500-O/405.1	18	NA	NA	NA	NA	18	flow-through cell	NA	none	immediately
Temperature [8]	SM 2550	18	NA	NA	NA	NA	18	flow-through cell	NA	none	immediately
Oxidation/Reduction Potential [8]	SM 2580 B	18	NA	NA	NA	NA	18	flow-through cell	NA	none	immediately
Specific Conductance [8]	SM 2510 B	18	NA	NA	NA	NA	18	flow-through cell	NA	none	immediately
Turbidity [7]	SM 2130 B	18	NA	NA	NA	NA	18	flow-through cell or hand-held turbidity meter	NA	none	immediately

[O: CJC 08/25/21; C: LDC 09/09/21]

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 PART 845 PARAMETERS
GROUNDWATER MONITORING PLAN
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, 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 228 combined	7440-14-4	pCi/L	9315/9320 or EPA 903/904	5	5	-- [6]	-- [7]
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 Conductivity	NA	µS/cm	SM 2510 B	NS	NS	NA	NA
Turbidity	NA	NTU	SM 2130 B	NS	NS	NA	NA

[O: CJC 08/25/21; C: LDC 09/09/21]

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TABLE 4-2. DETECTION AND REPORTING LIMITS FOR PART 845 PARAMETERS
GROUNDWATER MONITORING PLAN
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

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.

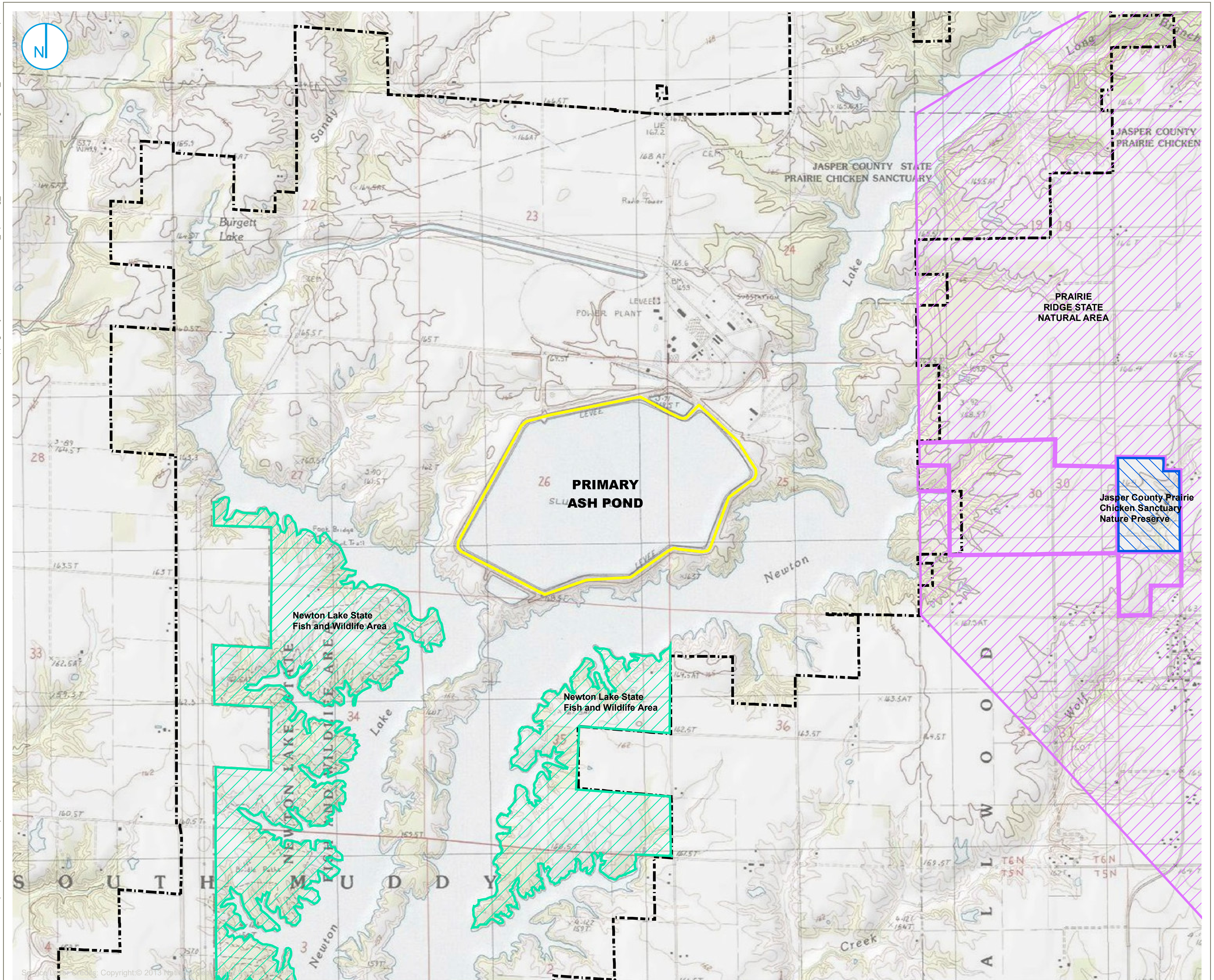
[5] RLs and method detection limits (MDL) will vary depending on the laboratory performing the work.

[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
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



PART 845 REGULATED UNIT FACILITY BOUNDARY
JASPER COUNTY PRAIRIE CHICKEN SANCTUARY NATURE PRESERVE
NEWTON LAKE STATE FISH AND WILDLIFE AREA
PRAIRIE RIDGE STATE NATURAL AREA
PROPERTY BOUNDARY

0 1,000 2,000 Feet

SITE LOCATION MAP

GROUNDWATER MONITORING PLAN
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 1-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 10/20/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\GMP\Figure 1-1_Site Location Map.mxd

PART 845 REGULATED UNIT FACILITY BOUNDARY
SITE FEATURE
PROPERTY BOUNDARY

0 500 1,000 Feet

SITE MAP

GROUNDWATER MONITORING PLAN
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 1-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\GMP\Figure 1-2_Site Map.mxd

PROJECT: 169000XXXX | DATED: 10/19/2021 | DESIGNER: STOLZSD

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE

NOTES:

1. ELEVATIONS IN PARENTHESIS WERE NOT USED FOR CONTOURING.
2. NM = NOT MEASURED
3. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988

0 400 800 Feet

UPPERMOST AQUIFER GROUNDWATER ELEVATION CONTOURS APRIL 27, 2021

GROUNDWATER MONITORING PLAN
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 1-3

RAMBOLL AMERICAS
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Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\GMP\Figure 1-3_GWE_Contours_20210427.mxd

PROJECT: 169000XXXX | DATED: 10/20/2021 | DESIGNER: STOLZSD

COMPLIANCE WELL
BACKGROUND WELL
STAFF GAUGE
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
PROPERTY BOUNDARY

0 500 1,000 Feet

PROPOSED MONITORING WELL NETWORK

GROUNDWATER MONITORING PLAN
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\GMP\Figure 2-1_Proposed Monitoring Well Network.mxd

PROJECT: 169000XXXX | DATED: 10/20/2021 | DESIGNER: STOLZSD

APPENDIX A
STATISTICAL ANALYSIS PLAN

Prepared for
Illinois Power Generating Company

Date
October 25, 2021

Project No.
1940100806-008

STATISTICAL ANALYSIS PLAN

PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL Bright ideas. Sustainable change.

STATISTICAL ANALYSIS PLAN
NEWTON POWER PLANT PRIMARY ASH POND

Project Name	**Newton Power Plant Primary Ash Pond**
Project No.	**1940100806-008**
Recipient	**Illinois Power Generating Company**
Document Type	**Statistical Analysis Plan**
Version	**FINAL**
Date	**October 25, 2021**

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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; Newton Power Plant Primary 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; Newton Power Plant Primary 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; Newton Power Plant Primary 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; Newton Power Plant Primary 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

The background and 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 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 sampling events were completed within 180 days of April 21, 2021. As outlined, groundwater sampling procedures included sampling of the 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 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. Compliance Monitoring will begin the 1st quarter following approval of this Groundwater Monitoring Plan and issuance of the Operating Permit. 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:

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

$\overline{y}$ = 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 100^{th} percentile is (1–*P*). The number of sample values falling below the *P* x 100^{th} 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 100^{th} 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:

$$1 - \alpha = Bin(L^* - 1; n, 0.50) = \sum_{x=L^*}^{n} \binom{n}{x} \left(\frac{1}{2}\right)^n$$

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:

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

x_i = i^{th} concentration value and

t_i = 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:

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

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

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

$F_{1-2\alpha,2,\mathrm{n}-2}$ = 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 (x_i, x_j) for j > i will be considered and the simple pairwise slope estimate will be computed for each pair as follows:

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

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

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

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

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

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

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

To construct a confidence band around the Thiel-Sen line, sample pairs (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

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Intended for
Illinois Power Generating Company

Date
July 28, 2022

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GROUNDWATER MODELING REPORT

PRIMARY ASH POND

NEWTON POWER PLANT

NEWTON, ILLINOIS

GROUNDWATER MODELING REPORT
NEWTON POWER PLANT PRIMARY ASH POND

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APPENDICES

ACRONYMS AND ABBREVIATIONS

§	Section
±	plus or minus
35 I.A.C.	Title 35 of the Illinois Administrative Code
BCU	bedrock confining unit
bgs	below ground surface
CBR	closure by removal
CBR-Offsite	Closure-by-Removal with Off-Site CCR Disposal
CBR-Onsite	Closure-by-Removal with On-Site CCR Disposal
CCR	coal combustion residuals
CIP	closure in place
cm/s	centimeters per second
CSM	conceptual site model
DEM	Digital Elevation Model
ft/ft	feet per foot
ft^2	square feet
ft/d	feet per day
GHB	general head boundary conditions
GMP	Groundwater Monitoring Plan
GMR	Groundwater Modeling Report
Golder	Golder Associates USA Inc.
GWL	groundwater elevation
GWPS	groundwater protection standard
HCR	Hydrogeologic Site Characterization Report
HDPE	high-density polyethylene
HDR	HDR, Inc.
HELP	Hydrologic Evaluation of Landfill Performance
HUC	Hydrologic Unit Code
ID	identification
IEPA	Illinois Environmental Protection Agency
IPGC	Illinois Power Generating Company
ISGS	Illinois State Geological Survey
K	hydraulic conductivity
Kd	distribution coefficient
Kh/Kv	anisotropy ratio
LCU	lower confining unit
LF1	Phase 1 Landfill
LF2	Phase 2 Landfill
LVW	low volume wastewater
m	meter
mg/L	milligrams per liter
mL/g	milliliters per gram
NAVD88	North American Vertical Datum of 1988

NID	National Inventory of Dams
No.	Number
NPDES	National Pollutant Discharge Elimination System
NPP	Newton Power Plant
NRT/OBG	Natural Resource Technology, an OBG Company
Part 845	Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: 35 I.A.C. § 845
PAP	Primary Ash Pond
PMP	potential migration pathway
Ramboll	Ramboll Americas Engineering Solutions, Inc
Rapps	Rapps Engineering and Applied Science
RMSE	root mean squared error
SI	surface impoundment
std	standard deviation
TDS	total dissolved solids
TVD	total-variation-diminishing
UA	uppermost aquifer
UCU	upper confining unit
UD	upper drift
USEPA	United States Environmental Protection Agency
USDA/NRCS	United States Department of Agriculture/Natural Resources Conservation Service
USGS	United States Geological Survey

EXECUTIVE SUMMARY

Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this Groundwater Modeling Report (GMR) on behalf of the Newton Power Plant (NPP), operated by Illinois Power Generating Company (IPGC), in accordance with requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) Section (§) 845: Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845) (Illinois Environmental Protection Agency [IEPA], April 15, 2021). This document presents the results of predictive groundwater modeling simulations for proposed closure scenarios for the Primary Ash Pond (PAP), Vistra identification (ID) number (No.) 501, IEPA ID No. W0798070001-01, and National Inventory of Dams (NID) No. IL50719.

The NPP is located in Jasper County in the southeastern part of central Illinois, approximately seven miles southwest of the town of Newton (**Figure 1-1**). The PAP is located south of the NPP and situated in a predominantly agricultural area. The PAP is surrounded by Newton Lake on the west, south, and east. Beyond the lake is additional agricultural land.

A detailed summary of site conditions was provided in the Hydrogeologic Site Characterization Report (HCR; Ramboll, 2021a). This report integrates existing site data and information with the latest hydrogeology and groundwater quality data to generate a conceptual and numerical model of the PAP. The conceptual site model (CSM) includes hydrogeologic and groundwater quality data specific to the PAP, which has been collected between 2015 and 2021. The PAP is a 9,715 acre-feet earthen berm coal combustion residuals (CCR) surface impoundment (SI) located south of the power plant. In addition to the CCR within the PAP, there are six layers of unlithified material present above the Pennsylvanian-Age bedrock. These materials have been categorized into five hydrostratigraphic units presented below in descending order:

- **Upper Drift (UD)/Potential Migration Pathway (PMP):** The UD is composed of the low permeability silts and clays of the Peoria Silt and Sangamon Soil and the sandier soils of the Hagarstown Member (*i.e.,* PMP).
  - **Hagarstown Member/PMP**: The Hagarstown Member consists of the discontinuous, sandier deposits of the UD where present and overlies the Vandalia Till.
- **Upper Confining Unit (UCU):** The UCU consists of a thick package of low permeability clays and silts of the Vandalia Till. This unit is a laterally continuous layer between the base of the CCR unit and the top of the uppermost aquifer (UA).
- **Uppermost Aquifer (UA)**: The UA is composed of the Mulberry Grove Member, which has been classified as poorly graded sand, silty sand, clayey sand, and gravel.
- **Lower Confining Unit (LCU)**: The LCU is comprised of low permeability silt and clay of the Smithboro Till Member and the Banner Formation.
- **Bedrock Confining Unit (BCU):** The low permeability bedrock underlying the PAP is the Pennsylvanian-Age Mattoon Formation, which consists of a complex sequence of thin limestones, coals, black fissile shales, underclay, thick gray shales, and several well-developed sandstones. The Mattoon Formation has a maximum thickness of more than 600 feet in the central part of the Illinois Basin in Jasper County.

The Cahokia Formation, described in the regional geology of the HCR, occurs in modern river valleys and floodplains. These deposits (which may contain sand, silt, or clay with wood and shell fragments) are expected to occur along the southeastern boundary of the PAP associated with the east branch of Newton Lake and may be difficult to distinguish from the deposits of the UD and the top of the UCU given the observed heterogeneity in the Cahokia, UD, and UCU.

Groundwater migrates downward through the UD and UCU into the UA. Groundwater in the UA flows from north to south/southwest and converges near a former drainage feature located west of the PAP. Groundwater elevations vary seasonally, although generally less than one foot per year. The surface water elevation at Newton Lake (at location SG02) measured between February 15 and March 9, 2021 ranged from 504.42 to 504.84 feet North American Vertical Datum of 1988 (NAVD88). Groundwater elevations in the UA at downgradient wells were observed around 491 feet NAVD88 (approximately 15 feet lower than the lake elevation). The separation between measured groundwater elevations and lake elevations (and observed downward vertical gradients in wells) indicates groundwater does not flow into Newton Lake from the UA. As indicated by the observed heads and groundwater flow directions in the UA, surface water from Newton Lake is entering the UA. The UA also approaches the former land surface east of the PAP, now beneath Newton Lake, as illustrated in geologic cross section B'-B" (Figure 2-7 of the HCR). The CSM for modeling the PAP is as follows:

- Most hydrostratigraphic layers are laterally continuous across the area. The flat to gently rolling uplands are dissected by deeply incised streams (into the materials of the UD, UCU, and UA) that are tributaries to river systems in the area. Cahokia formation deposits are also located within the incised streams. Newton Lake was created by damming one of these tributary streams for use by the NPP. Increased water levels within Newton Lake induced flow of surface water into the UA through discrete and limited areas north and east of the PAP, creating the potentiometric surface observed beneath the PAP.
- The UA is separated from the bottom of the PAP by a minimum of 14 feet of low-permeability glacial till that comprises the UCU. This laterally continuous confining unit is a barrier to vertical migration of groundwater from the PAP to the UA. Erosion caused by incised streams and deposition of Cahokia formation deposits has occurred along the southeast corner of the PAP.
- Groundwater in the UA flows from north to south/southwest and converges near a former drainage feature located west of the PAP.
- Surface recharge and groundwater migrate vertically through the low permeability sediments of the UD and Cahokia deposits. Groundwater migrates horizontally through the higher permeability sediments of the PMP and the UA.
- The UA is heterogenous, with materials ranging from clayey sand to coarse gravels. The highly transmissive sands and gravel are prominent in close proximity to the PAP.
- The separation between measured groundwater elevations and lake elevations (and observed downward vertical gradients) indicates groundwater does not flow into Newton Lake from the UA. The connection between the UA and Newton Lake is spatially discrete and limited to areas northeast of the PAP.
- The PAP is constructed such that the earthen berm and base are in contact with the UCU.
- The stage within the PAP is managed with minimal (less than 3 feet) variability throughout the year.

Groundwater quality parameters were monitored in the shallow sands of the PMP and UA monitoring wells at the PAP as part of the groundwater quality investigations performed between

2015 and 2021. A review and summary of data collected from 2015 through 2021 for parameters with groundwater protection standards (GWPS) listed in 35 I.A.C. § 845.600 is provided in the HCR (Ramboll, 2021a). Groundwater concentrations presented in Table 4-1 of the HCR and summarized in the History of Potential Exceedances (Ramboll, 2021b) are considered potential exceedances because the methodology used to determine them is proposed in the Groundwater Monitoring Plan (GMP) (Ramboll, 2021c) and has not been reviewed or approved by IEPA at the time of this submittal. The following constituents with potential exceedances of the GWPS listed in 35 I.A.C. § 845.600 were identified: lithium, pH, sulfate, and total dissolved solids (TDS) (Ramboll, 2021b).

Multiple lines of evidence that limited potential GWPS exceedances of pH in the PMP are not related to the PAP are provided in the technical memorandum (**Appendix A**), *Evaluation of Potential GWPS Exceedances* (Golder Associates USA Inc. [Golder], 2022a). Statistically significant correlations between sulfate concentrations and concentrations of lithium and TDS indicate sulfate is an acceptable surrogate for lithium and TDS in the groundwater model. Concentrations of these parameters are expected to change along with model predicted sulfate concentrations.

It was assumed that sulfate 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 in the model. Lithium, sulfate, and TDS transport is likely to be affected by both chemical and physical attenuation mechanisms (i.e., adsorption and/or precipitation reactions as well as dilution and dispersion).

All available hydrological information were used to construct a CSM and numerical model of the PAP. A steady state, 7-layer numerical model was constructed to characterize the long-term groundwater flow conditions at the site. The hydrostratigraphic units included in the model were the UD, PMP, UCU, UA, and LCU. The BCU was not included in the model. Calibration of the model focused on simulating mean groundwater elevations for 30 wells at the site by modifying hydraulic parameters for the different hydrostratigraphic units, alongside river and general head boundary conductance. The calibrated model represents a reasonable match to the observed head and sulfate concentration data.

The calibrated model was used to predict the sulfate concentration for two closure scenarios described in the *Primary Ash Pond Final Closure Plan* (HDR, 2022), including:

- **Scenario 1:** closure in place (CIP) including removal of CCR from the southern portion of the PAP, consolidation into the northern portion of the PAP, and construction of a cover system over the remaining CCR, and;
- **Scenario 2:** closure by removal (CBR) including removal of all CCR and regrading of the removal area.
- Prior to the simulation of these scenarios, a dewatering simulation was included which simulated the removal of free liquids from the PAP prior to the implementation of the two scenarios.

Scenario 1 (CIP) was predicted to reduce total flux in and out of the Fill Unit (CCR) by approximately 94%, when simulated post-construction heads in the groundwater monitoring wells are predicted to stabilize.

Predictive simulations of pond closure indicate simulated groundwater concentrations in the monitoring wells within the two transport zones, namely the UD/PMP and UA, will achieve the GWPS in 20 years and 16 years for the CIP and CBR closure scenarios, respectively. This indicates that both scenarios are predicted to reach the GWPS for the monitoring wells after approximately 20 years. The model predicted four-year time difference when GWPSs are achieved for CIP (20 years post-closure) and CBR (16 years post-closure) is not significant because the estimated duration of construction activities indicates that CBR will take longer to implement than CIP (3.2-4.3 years for CIP compared to 7.8-9.2 years for Closure-by-Removal with On-Site CCR Disposal [CBR-Onsite] and 22 years for Closure-by-Removal with Off-Site CCR Disposal [CBR-Offsite]; Section 2.1 of the Closure Alternative Analysis [Gradient, 2022]).

The prediction simulations indicate that although the groundwater wells reach the GWPS, sulfate remains within the model beyond 100 years. This is due to the sulfate mass retained within the thick UCU which underlies the PAP. The low vertical hydraulic conductivity of this thick unit leads to low flow rates through the unit which will require time to release the sulfate mass. However, in both the CIP and CBR scenarios, the plume footprint continues to recede with time and remains within the property boundaries, indicating these closure options are equally protective.

Results of groundwater fate and transport modeling conservatively estimate that groundwater concentrations will attain the GWPS for all constituents identified as potential exceedances of the GWPS in the UD/PMP and UA monitoring wells within 20 years of closure implementation for both CIP and CBR. Within the property boundary, residual sulfate will be present within the clay confining unit above the GWPS due to the slow release of sulfate from the UCU.

1. INTRODUCTION

1.1 Overview

In accordance with the requirements of Part 845 (IEPA, 2021), Ramboll has prepared this GMR on behalf of the NPP, operated by IPGC. This report applies specifically to the CCR unit referred to as the PAP. However, information gathered to evaluate other CCR units in the vicinity regarding geology, hydrogeology, and groundwater quality is included, where appropriate. This GMR presents and evaluates the results of predictive groundwater modeling simulations for two proposed closure scenarios: 1) CIP and 2) CBR.

1.2 Previous Groundwater Reports

Numerous hydrogeologic investigations have been performed at the NPP. The information presented in this GMR includes data collected as part of a 2021 field investigation and previous investigations summarized and presented in the HCR (Ramboll, 2021a) which was provided as an attachment to the initial operating permit application required by 35 I.A.C. § 845.230.

1.3 Site Location and Background

The NPP is located in Jasper County, Illinois approximately 7.5 miles southwest of the town of Newton. The PAP is located in Section 26 and the western half of Section 25, Township 6 North, Range 8 East (**Figure 1-1**). The PAP is located south of the power plant and situated in a predominantly agricultural area. The PAP is surrounded by Newton Lake on the west, south, and east. Beyond the lake is additional agricultural land. The region is characterized by relatively flat to gently rolling topography.

1.4 Site History and CCR Units

Three CCR units are present on the NPP property, including the PAP and two landfills: the Phase 1 Landfill (LF1) is located northwest and west of the PAP, and the Phase 2 Landfill (LF2) is located west of the PAP (**Figure 1-2**). The PAP was constructed in 1977 and has a design capacity of approximately 9,715 acre-feet. There is also a non-CCR 83.6 acre-feet Secondary Pond located immediately south of the PAP. The PAP has a surface area of 404 acres and the Secondary Pond has an area of 9.3 acres. The PAP currently receives stormwater runoff, bottom ash, fly ash, and low-volume wastewater (LVW) from the plant's two coal-fired boilers. The PAP is operated per National Pollutant Discharge Elimination System (NPDES) Permit No. IL0049191, Outfall 001 (located at the Secondary Pond).

Prior to PAP construction, an incised stream gully existed at the site of the PAP. Areas within the impoundment were excavated during construction for native materials used to build the containment berms (AECOM, 2016).

2. SITE GEOLOGY AND HYDROGEOLOGY

The geology and hydrogeology of the PAP is described in detail in the HCR (Ramboll, 2021a). A short summary is provided below.

2.1 Stratigraphy

The unlithified stratigraphy within and immediately surrounding the PAP consists of the following in descending order: fill material and CCR; silt and clayey silt loess (Peoria Loess); weathered till of the Sangamon Soil; discontinuous gravel and sand (Hagarstown Member), sandy/silty till with discontinuous lenses of sand and gravel (Vandalia Till); sands of the UA (Mulberry Grove Member); and clay till (Smithboro Till and Banner Formation) (Rapps Engineering and Applied Science [Rapps], 1997). The Cahokia Formation, described in the regional geology of the HCR, occurs in modern river valleys and floodplains. These deposits (which may contain sand, silt, or clay with wood and shell fragments) are expected to occur along the southeastern boundary of the PAP associated with the east branch of Newton Lake and may be difficult to distinguish from the deposits of the UD and the top of the UCU given the observed heterogeneity in the Cahokia, UD, and UCU. Unlithified units overlay Pennsylvanian-age shaley bedrock (Mattoon Formation).

CCR is present within most of the PAP at thicknesses between 17 to 19.5 feet thick as observed in porewater wells XPW01 through XPW04. The lowest bottom of ash elevation observed is approximately 486 feet in the center of a former drainage feature oriented north-south through the center of the PAP, whereas ash is potentially highest in elevation at approximately 550 feet along the outer edges of the PAP. The bottom of ash surface appears to mirror the former drainage feature. Comparison of the bottom of ash contours and topographic contours indicate CCR fill may be 40 feet or greater within the former drainage feature.

The Peoria Silt and Sangamon Soils extends from beneath the topsoil to depths ranging from 3 to 46 feet. The Peoria Silt and Sangamon Soils consist predominantly of low permeability lean clay.

The Hagarstown Member of the Pearl Formation underlies the Peoria Silt and Sangamon Soils. This is a discontinuous sandy unit composed of poorly graded sand with silt, with thicknesses up to approximately 7 feet but generally the thickness is less than 2 feet.

The Hagarstown Member is generally underlain by a relatively thick till sequence consisting of the Vandalia Till. The till sequence is encountered at thicknesses up to 59 feet in the area of the PAP, while the average thickness is 26 feet. This thick glacial deposit is laterally continuous beneath the NPP. The Vandalia Till primarily consists of lean clay and silty clay. Alluvial deposits belonging to the Cahokia Formation, which is a Holocene stage deposit in floodplains and channels of modern rivers and streams are expected to occur along the southeastern corner of the PAP. Generally, the Cahokia Formation consists of poorly sorted sand, silt, and clay with wood and shell fragments with local deposits of sandy gravel which is similar in composition to the deposits that comprise the UD and UCU.

The Mulberry Grove Member is a thin to moderately thick (3 to 17 feet) unit composed of silty sand, poorly graded sand with silt and well graded sand with silt. The Mulberry Member generally slopes from approximately 483 feet NAVD88 in the northeast portion of the PAP to 462 feet NAVD88 in the southwest portion of PAP. The maximum observed thickness of this member was 30 feet, while the average thickness is approximately 10 feet.

Till sequences underlying the Mulberry Grove Member consist of clay and silt of the Smithboro Till Member and Banner Formation. These laterally continuous till units are encountered at thicknesses up to 36 feet, while the average thickness is 32 feet. The till sequences are typically composed of lean clay and silty clay.

The Pennsylvanian Age Mattoon Formation consists of a complex sequence of thin limestones, coals, black fissile shales, underclays, thick gray shales, and several well-developed sandstones. The bedrock is dipping to the southwest at the site.

2.2 Hydrogeology

Five distinct hydrostratigraphic units have been identified at the site based on stratigraphic relationships and common hydrogeologic characteristics, which are summarized below:

- **UD/PMP:** this unit includes the lower permeability silts and clays of the Peoria Silt and Sangamon Soil, and the sandier soils of the Hagarstown Member (*i.e.,* PMP). These units are hydraulically connected and underlain by a thick till sequence of Vandalia Till.
- **UCU:** underlying the UD till sequence, the laterally continuous low permeability silts and clays of the Vandalia Till and Cahokia Formation are 26 feet thick on average.
- **UA:** this unit consisting of sands and gravels of the Mulberry Grove Formation is on average 10 feet thick and can be up to 30 feet thick. These sandy deposits are the first laterally continuous sands observed beneath the PAP.
- **LCU:** underlying the UA are the low permeability silts and clays of the Smithboro Till and the Banner Formation. This unit is approximately 5 to 36 feet thick.
- **BCU:** The low permeability bedrock underlying the PAP is the Pennsylvanian Age Mattoon Formation, which consists of a complex sequence of thin limestones, coals, black fissile shales, underclays, thick gray shales, and several well-developed sandstones. The Mattoon Formation has a maximum thickness of more than 600 feet in the central part of the Illinois Basin in Jasper County.
- Holocene alluvial deposits of the Cahokia formation are expected to replace UD and UCU deposits along the southeastern boundary of the PAP.

2.2.1 Groundwater Flow

Monitoring well locations are illustrated in **Figure 2-1**. The elevations of water within the PAP (as observed in XPW01 through XPW04 and XSG01) are greater than the surrounding areas (**Figures 2-2** and **2-3**). The phreatic surface within the PAP between February and August 2021 averaged 542 feet NAVD88, ranging from 546.69 feet NAVD88 in XPW02 (located along the northern portion of the PAP) to 535.40 feet NAVD88 in XSG01 (located along the southern portion of the PAP). Groundwater elevations in PMP wells are above those in the UA and range from approximately 518 feet NAVD88 (APW05S) to 535 feet NAVD88 (APW05S).

Groundwater flow in the UA is generally from north to south. However, the UA wells also display flow converging towards a former surface drainage feature located west of the PAP (**Figure 2-2** and **Figure 2-3**) and an area where the UA has the greatest thickness. Groundwater elevations vary seasonally, generally less than one foot per year, while across the PAP they range from approximately 490 to 530 feet NAVD88, although flow directions are generally consistent.

2.2.2 Hydraulic Properties

Hydraulic field tests were conducted on multiple wells within the CCR, UD, PMP, and UA at NPP and are summarized below:

- Hydraulic properties for the CCR ranged from 1.0 x 10^{-3} to 2.3 x 10^{-1} centimeters per second (cm/s) (2.8 to 652 feet per day [ft/d]), with a geometric mean hydraulic conductivity of 2.0 x 10^{-2} cm/s (56.7 ft/d), based on hydraulic tests on four wells.
- Hydraulic field tests conducted on three wells provided hydraulic properties of the UD unit, which ranged from 5.14 x 10^{-6} to 4.53 x 10^{-5} cm/s (0.01 to 128.4 ft/d) with a geometric mean of 1.5 x 10^{-5} cm/s (0.04 ft/d).
- Hydraulic properties for the PMP ranged from 6.1 x 10^{-4} to 1.5 x 10^{-2} cm/s (1.7 to 42.5 ft/d) with a geometric mean hydraulic conductivity of 3.1 x 10^{-3} cm/s (8.8 ft/d), based on hydraulic tests on two wells.
- Hydraulic properties for the UA ranged from 2.0 x 10^{-4} to 1.5 x 10^{-1} cm/s (0.57 to 425.0 ft/d) with a geometric mean of 6.8 x 10^{-3} cm/s (19.3 ft/d), based on field tests conducted on seven wells.

The absence of wells screened within the UCU, LCU, and BCU at the NPP means that no field based hydraulic data are available for these units.

Additional laboratory analysis of samples from the CCR, UD, PMP, UCU, UA, and LCU provided vertical hydraulic conductivities summarized below:

- Laboratory falling head permeability test results for the six CCR samples indicated a geometric mean vertical hydraulic conductivity of 3.1 x 10^{-4} cm/s (0.88 ft/d) with a range of 1.6 x 10^{-5} to 1.3 x 10^{-3} cm/s (0.05 to 3.7 ft/d).
- Laboratory falling head permeability test results in the UD indicated a geometric mean vertical hydraulic conductivity of 5.9 x 10^{-8} cm/s (0.0002 ft/d) and ranged from 3.1 x 10^{-8} to 8.6 x 10^{-8} cm/s (0.0001 to 0.00024 ft/d). These values are less than previous samples collected in 2017, with a geometric mean hydraulic conductivity of 1.3 x 10^{-5} cm/s (0.04 ft/d) (Natural Resource Technology, an OBG Company [NRT/OBG], 2017).
- Laboratory falling head permeability test results from three samples collected from the Hagarstown Member (i.e., PMP) within the UD, indicated a geometric mean vertical hydraulic conductivity of 3.5 x 10^{-5} cm/s (0.1 ft/d) and ranged from 1.1 x 10^{-7} to 9.6 x 10^{-5} cm/s (0.0003 to 0.27 ft/d).
- Laboratory falling head permeability test results from four samples collected from the Vandalia Till indicated that the UCU has a geometric mean vertical hydraulic conductivity of 6.7 x 10^{-8} cm/s (0.0002 ft/d) and ranged from 3.3 x 10^{-8} to 9.7 x 10^{-8} cm/s (0.0001 to 0.0003 ft/d).
- Laboratory falling head permeability test results from five samples collected from the Mulberry Grove Formation indicated that the UA has a geometric mean vertical hydraulic conductivity of 3.2 x 10^{-4} cm/s (0.9 ft/d) and ranged from 3.5 x 10^{-6} to 7.2 x 10^{-4} cm/s (0.01 to 2.04 ft/d) (NRT/OBG, 2017).
- Laboratory falling head permeability test results from eight samples collected from the glacial tills of the Smithboro Till indicated a geometric mean vertical hydraulic conductivity of 9.3 x 10^{-8} cm/s (0.0003 ft/d) and ranged from 2.4 x 10^{-8} to 2.7 x 10^{-7} cm/s (0.0001 to 0.0008 ft/d).

2.2.3 Groundwater Elevation Data

There are 30 wells located around the PAP with most wells located adjacent to the perimeter of the PAP. In most of these wells, water level measurements are available from 2015 to 2021. The well construction details are summarized in **Table 2-1** and groundwater elevation readings are summarized in **Table 2-2**. The observed range in groundwater elevation (GWL) within the PMP wells data set is 17.3 feet and 44.3 feet in the UA wells. For all wells, the mean variation in GWL within each well is 0.8 feet (mean GWL variation), with an observed minimum and maximum variation of 0.2 and 2.5 feet, respectively. The UA approaches the former land surface, now beneath Newton Lake, northeast of the PAP. The UA may intersect the base of Newton Lake allowing groundwater within the UA to mix with surface water from the lake, upgradient of the PAP. Groundwater flow in the UA generally flows southwest across the PAP with potentiometric surface elevations at downgradient wells around 491 feet NAVD88 (approximately 15 feet lower than the Newton Lake elevation). The elevation of water in Newton Lake ranges from 504.42 to 504.84 feet NAVD88. This separation in groundwater and lake elevations (and observed downward vertical gradients) indicates groundwater within the UA does not flow into Newton Lake.

2.2.4 Mining Activity

The areas immediately surrounding the facility have never been mined. Based on the directory of coal mines for Jasper County (Illinois State Geological Survey [ISGS], 2021), the nearest coal mines in the vicinity of the PAP are located approximately 6.7 miles to the northeast.

3. GROUNDWATER QUALITY

3.1 Groundwater Classification

Per 35 I.A.C. § 620.210, groundwater within the UA at the PAP meets the definition of Class I – Potable Resource Groundwater based on the following criteria:

- Groundwater is located more than 10 feet below ground surface (bgs) and within an unconsolidated silty sand and gravel unit which is five feet or more in thickness.
- Hydraulic conductivity exceeds the 1 x 10^{-4} cm/s criterion.
- Groundwater is not downgradient of or underlying previously mined out areas.

Testing of the unconsolidated materials of the Mulberry Grove Member averaged 21 percent fines, which is greater than the 12 percent fines criterion; however, this was not deemed prohibitive of the Class I Classification (Ramboll, 2021a).

3.2 Potential Groundwater Exceedances

There are potential groundwater exceedances of applicable GWPS attributable to the PAP as described below. Groundwater concentrations from 2015 to 2021 are presented in the HCR Table 4-1 (Ramboll, 2021a), were evaluated and summarized in the History of Potential Exceedance tables (Ramboll, 2021b), and are considered potential exceedances because the methodology used to determine them is proposed in the Statistical Analysis Plan (Appendix A to GMP; Ramboll, 2021c), which has not been reviewed or approved by IEPA at the time of submittal of 35 I.A.C. § 845 operating permit application.

The History of Potential Exceedances attached to the operating permit application summarizes all potential groundwater exceedances following the proposed Statistical Analysis Plan. The following potential exceedances were identified:

- Lithium – UD well APW02;
- pH – UD wells APW04 and APW12;
- Sulfate – UA well APW10 and UD wells APW02 and APW04; and
- TDS – UD wells APW02, APW04, and AP05S

Multiple lines of evidence that limited potential GWPS exceedances of pH are not related to the GMF Pond is provided in the *Evaluation of potential GWPS Exceedances* (**Appendix A**, Golder, 2022a) and summarized below:

- The pH of CCR porewater is significantly higher than the pH in monitoring wells APW04 and APW12.
- The pH ranges recorded in the PMP are likely naturally occurring.

Since potential GWPS exceedances for pH are not related to the Ash Pond, these parameters will not be discussed further in this GMR.

4. GROUNDWATER MODEL

4.1 Overview

Data collected at the Site from 2004 to the recent 2021 field investigation were used to construct a groundwater model of the PAP. The model was then used to evaluate how the proposed closure options (CIP and CBR) would achieve compliance with the applicable groundwater standards following the closure construction. The modeling results are summarized and evaluated in this GMR. The associated model files are included as **Appendix B**.

4.2 Conceptual Model

The HCR (Ramboll, 2021a) forms the foundation of the PAP hydrogeological setting. The PAP overlies the recharge area for the underlying transmissive geologic media, which are composed of unlithified deposits.

4.2.1 Hydrogeology

As discussed in **Section 2.2**, groundwater flow around the PAP is generally in a southwest direction. The silts of the UD and sands of the PMP are hydraulically connected. The groundwater flow in the silts and clays of the UD and confining units of the UCU, LCU, and BCU are expected to be primarily vertical. The Hagarstown member PMP and sands of the UA are where the majority of the horizontal migration is expected to occur. The geological conceptual model for the site consists of the following layers:

- Silts and Clays (UD) – silt and clayey silt of the Peoria Silt and Sangamon Soil which extends beneath the topsoil.
- Discontinuous sands (PMP) - sandier soils of the Hagarstown Member.
- Vandalia Till (UCU) – a thick layer of low permeability till consisting of the Vandalia Till.
- Sands (UA) – sands and gravels of the Mulberry Grove Formation, laterally continuous sand and gravel deposit identified beneath the site.
- Smithboro Till (LCU) – composed of lean clay Smithboro Till and Banner Formation.
- BCU – lowermost unit identified at the site and underlies all unlithified deposits. This unit, composed of low permeability shale of the Mattoon Formation.
- Alluvial deposits of the Cahokia formation may replace UD and UCU deposits along the southeastern boundary of the PAP.

Surfaces for each of the six major geological units (Silts/Clays, discontinuous sand, Vandalia Till, shallow sand, Smithboro Till and Bedrock) were made by interpolating contacts between the units interpreted from boring logs. Alluvial deposits of the Cahokia formation were represented by zones within the horizontal layers of the major geologic units. Boring log information is centered around the pond and CCR units; the surfaces were extended to the full model domain by extrapolation and verified with off-site well logs, where available.

4.2.2 Extent and Boundaries

The United States Geological Survey (USGS) National Map places the NPP within the upper Illinois-Little Wabash watershed subbasin (Hydrologic Unit Code [HUC] 05120114).

The PAP CSM extent is bounded by a hydrological catchment (watershed) divide to the east based on watershed data from USGS. Along the north, south, and east the model boundary has been placed along known waterbodies as much as possible. As such, it is assumed groundwater inflow from adjacent watersheds is negligible through both the UA and LCU.

The Newton Lake water levels are managed such that they remain at an elevation between 504.23 and 504.82 feet NAVD88. Newton Lake is the receiving body of water for surface water in the area encompassed by the CSM.

Infiltration of precipitation to the groundwater table is applied as recharge at the site. Groundwater in the UD migrates downward into the discontinuous sands of the Hagarstown Formation. As discussed in **Section 2.2.1**, the Hagarstown Formation is considered a PMP for groundwater adjacent to the PAP. The sands of the UA are separated from the Hagarstown Formation PMP and the base of ash in the PAP by the laterally continuous UCU. The UA receives water from connection with Newton Lake.

4.2.3 Primary Ash Pond

The PAP is constructed with an earthen berm which acts as a low permeability interface between the CCR contained within the PAP and the ambient groundwater system. Findings from the HCR (Ramboll, 2021a) indicate that the PAP does not appear to impact groundwater flow directions in the UA via recharge to groundwater. The PAP does influence the shallower UD/PMP flow system, where there is a component of radial flow from the pond to the thin Hagarstown Formation.

Sulfate was selected for transport modeling. Sulfate is commonly used as an indicator parameter for contaminant transport modeling for CCR because: (i) it is commonly present in coal ash leachate; and (ii) it is mobile and typically not very reactive but conservative (*i.e.*, low rates of sorption or degradation) in groundwater.

4.3 Model Approach

Comparisons of observed lithium and TDS concentrations to sulfate (Figure A and Figure B, respectively, below) indicate statistically significant correlations between these parameters in UD wells where these potential exceedances were observed. Observed concentrations were transformed into Log10 concentrations for evaluation. The correlation coefficient (R2) and p values (indicator of statistical significance) are also provided on Figure A and Figure B. Higher R2 values (i.e., closer to 1) indicate stronger correlation between parameters. A correlation is considered statistically significant when the p value is lower than 0.05. Both correlations have p values less than the target of 0.05, indicating correlations are statistically significant. The correlations are strongest between sulfate and TDS. The statistically significant correlations associated with sulfate concentrations indicate sulfate is an acceptable surrogate for lithium and TDS in the groundwater model, and concentrations of these parameters are expected to change along with model predicted sulfate concentrations.

Figure A. Sulfate Correlation with Lithium in UD Wells

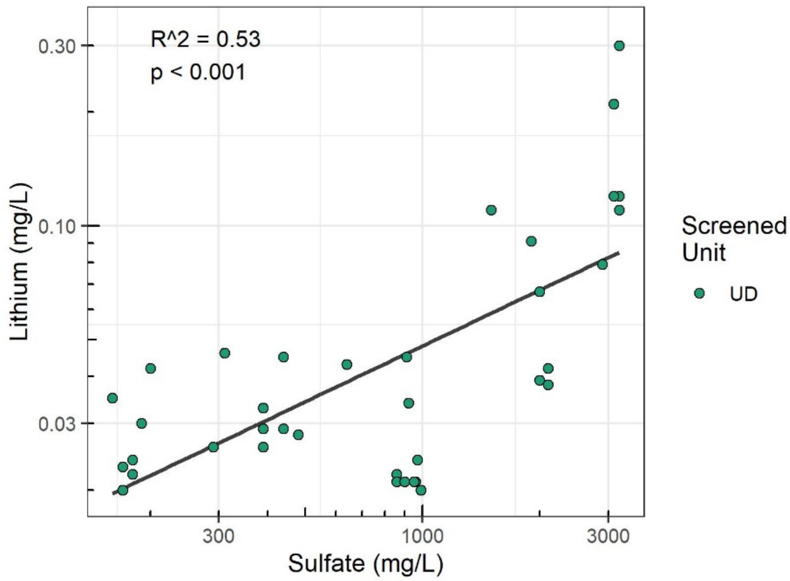
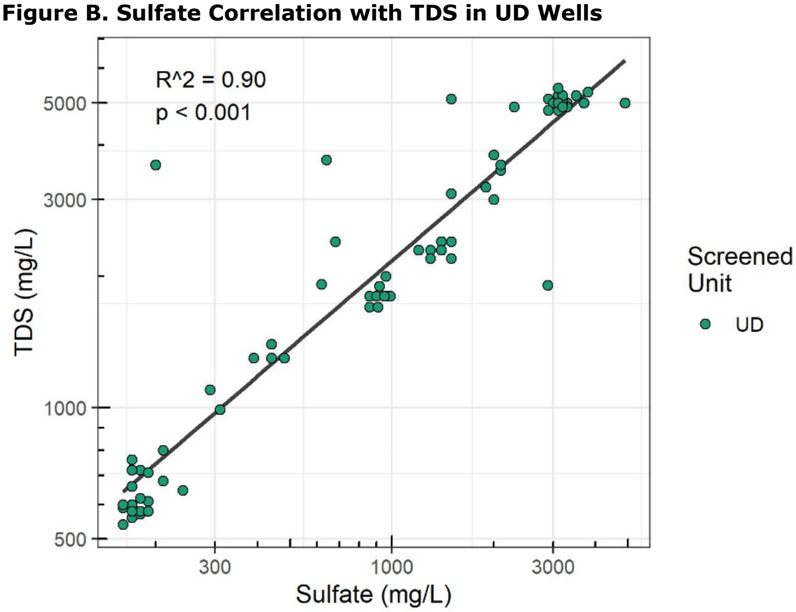


Figure B. Sulfate Correlation with TDS in UD Wells



A three-dimensional groundwater flow model was calibrated to represent the conceptual flow system described above. A steady state model was used to simulate the mean groundwater flow conditions at the site. The model was calibrated to match mean groundwater elevations observed between 2015 to 2021 (**Table 2-2**). Prediction simulations were then performed to evaluate the potential impacts to groundwater from CIP as presented in the *Primary Ash Pond Final Closure Plan* (HDR, 2022) which is an appendix to the Construction Permit Application to which this report is also attached. **Figure 4-1** shows the calibration and predictive modeling timeline.

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) 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 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.

MODFLOW was developed by USGS (McDonald and Harbaugh, 1988) and has been updated several times since. Major assumptions of the code are: (i) groundwater flow is governed by Darcy's law; (ii) the formation behaves as a continuous porous medium; (iii) flow is not affected by chemical, temperature, or density gradients; and (iv) hydraulic properties are constant within a grid cell. Other assumptions concerning the finite difference equation can be found in McDonald and Harbaugh (1988). MODFLOW 2005 was used for these simulations with Groundwater Vistas 7 software for model pre- and post- processing tasks (Environmental Simulations, Inc., 2017).

MT3DMS (Zheng and Wang, 1998) is an update of MT3D. It calculates concentration distribution for a single dissolved solute as a function of time and space. Concentration is distributed over a three-dimensional, non-uniform, transient flow field. Solute mass may be input at discrete points (wells, drains, river nodes, constant head cells), or distributed evenly or unevenly over the land surface (recharge).

MT3DMS accounts for advection, dispersion, diffusion, first-order decay, and sorption. Sorption can be calculated using linear, Freundlich, or Langmuir isotherms. First-order decay terms may be differentiated for the adsorbed and dissolved phases.

The program uses the standard finite difference method, the particle-tracking-based Eulerian-Lagrangian methods and the higher-order finite-volume total-variation-diminishing (TVD) method for the solution schemes. The finite difference solution has numerical dispersion for low-dispersivity transport scenarios but conserves good mass balance. The particle-tracking method avoids numerical dispersion but was not accurate in conserving mass. The TVD solution is not subject to significant numerical distribution and adequately conserves mass, but is numerically intensive, particularly for long-term models such as developed for the PAP. The finite difference solution was used for this simulation.

Major assumptions of MT3DMS are: (i) changes in the concentration field do not affect the flow field; (ii) changes in the concentration of one solute do not affect the concentration of another solute; (iii) chemical and hydraulic properties are constant within a grid cell; and (iv) sorption is instantaneous and fully reversible, while decay is not reversible.

The HELP model was developed by the United States Environmental Protection Agency (USEPA). HELP is a one-dimensional hydrologic model of water movement across, into, through and out of a landfill or soil column based on precipitation, evapotranspiration, runoff, and the geometry and hydrogeologic properties of a layered soil and waste profile. For this modeling, results of the HELP model, HELP Version 4.0 (Tolaymat and Krause, 2020) completed for the groundwater model were used to estimate the hydraulic flux from beneath the PAP.

5.2 Flow and Transport Model Setup

The modeled area was approximately 7,900 feet by 9,950 feet (382,955,000 square feet [ft^2]) with the PAP located in the southern quadrant (**Figure 5-1**). The model boundaries along the northern, southern and eastern edges of the model were selected to maintain sufficient distance from the PAP to reduce boundary interference with model calculations, while not extending too far past the extent of available calibration data. The east and west edges of the model also approximate topographic highs, surface water divides, watershed boundaries.

The MODFLOW model was calibrated to mean groundwater elevation collected from 2015 to 2021 presented in **Table 2-2**. MT3DMS was run on the calibrated flow model and model-simulated concentrations were calibrated to observed sulfate concentration values at the monitoring wells from March to July 2021 presented in **Table 2-2**. Multiple iterations of MODFLOW and MT3DMS calibration were performed to achieve an acceptable match to observed flow and transport data. For the PAP, the calibrated flow and transport models were used in predictive modeling to evaluate the CIP and CBR closure scenarios. Prior to simulation of CIP and CBR, a dewatering phase, which simulated the removal of free liquid from the CCR material in the PAP was completed. Closure scenarios were simulated by removing saturated ash cells and using HELP modeled recharge values to simulate changes proposed in the closure scenarios.

5.2.1 Grid and Boundary Conditions

A seven-layer, 451 x 508 node grid was established with a variable grid spacing of between 25 and 100 feet (**Figure 5-2 through Figure 5-8**), with a total number of 1,546,703 active cells. The grid is rotated 25 degrees to the east to align the model boundary with the orientation of Newton Lake and Sandy Creek.

The northern boundaries for layers 1, 2, 3, and 4 are general head boundaries placed to simulate flow in the Peoria Silt, Sangamon Soil, and sandier soils of the Hagarstown Member composing the UD, PMP, and UCU. The general head boundaries along the northern and southern model boundaries for layer 6 represents the regional flow conditions within this unit. The eastern and western edges are no flow boundaries in all model layers.

Newton Lake is represented as a constant head boundary based on a reasonably constant surface water elevation measured from February 15 to March 9, 2021 of between 504.42 to 504.84 feet NAVD88. The constant head boundary was simulated with an elevation equal to 504.6 feet. The lake is in hydraulic connection with multiple layers within the model.

The bottom of the model was also a no-flow boundary. The top of the model was a time-dependent specified flux boundary, with specified flux rates equal to the recharge rate. A specified mass flux boundary was used to simulate downward percolation of solute mass from the PAP. This boundary condition assigns a specified concentration to recharge water entering the cells within the PAP, and the resulting concentration in the PAP cells is a function of the relative rate and concentration of recharge water (water percolating from the impoundments) compared to the rate and concentration of other water entering the node.

Natural (streams) drainage features are present in the modeled area; these are represented as rivers and drains depending on available information in the model.

5.2.2 Flow Model Input Values and Sensitivity

Evaluation of monitoring well data for the PAP has not identified statistically significant seasonal trends in groundwater flow or quality which could affect model applicability for prediction of transport. The MODFLOW model was calibrated to mean groundwater elevations from 2015 to 2021. Multiple iterations of MODFLOW calibration were performed to achieve an acceptable match to observed flow data.

Sensitivity analysis was conducted by changing input values and observing changes in the sum of squared residuals (SSR). Horizontal conductivity, vertical conductivity, and river and general head conductance terms were all varied by one order of magnitude (*i.e.*, between one-tenth and ten times) of the calibrated values. Recharge terms were varied between one-half and two times calibrated values. River stage and drain bottom elevations were obtained from the 10 meter (m) Digital Elevation Model (DEM) from the United States Department of Agriculture/Natural Resources Conservation Service National Geospatial Center of Excellence (USDA/NRCS, 2022). The vertical error of the 10 m DEM is 0.82 m (2.7 feet); therefore, the stream stage and drain bases were varied by adding and subtracting 2.7 feet. General head boundary head terms were varied between 90 and 110 percent of calibrated values. When the calibrated model was tested, the SSR was 794. Sensitivity test results were categorized into negligible, low, moderate, moderately high, and high sensitivity based on the change in the SSR as summarized in the notes in **Table 5-1**.

5.2.2.1 Layer Top/Bottom

A digital elevation model of the area was used to assign the top of layer one. The elevations for the base of each hydrostratigraphic layer were interpolated from boring log data primarily from logs provided in the HCR (Ramboll, 2021a) utilizing Surfer® software for each of the six distinct water-bearing units described in **Section 2** (excluding the BCU). The resulting surfaces were imported into MODFLOW. The silts, clays, and sands of the UD unit (Peoria Silt, Sangamon Soil and Hagarstown Member) were divided into three layers to accommodate the explicit inclusion of the PAP ash deposits and the PMP. The thick UCU comprised of Vandalia Till was divided into two layers for contaminant transport; the Mulberry Grove Formation and Smithboro Till were represented as single layers within the model. **Figures 5-9** to **Figure 5-15** show the seven model layer elevations. 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. Flow model layer descriptions are summarized in **Table A** below.

Table A. Flow Model Layer Descriptions

Layer	Hydrostratigraphic unit name	Hydrostratigraphic unit used to determine layer thickness	Top Elevation [1]	Bottom Elevation [1]	Thickness (feet)
			Mean (Minimum – Maximum)		
1&2	UD	Silty clay and clay	535.6 (503.71-564.0)	511.1 (472.0-532.5)	24.5 (4.0-76.4)
3	PMP	Sand, silty clay, and clay	511.1 (472.0-532.5)	508.8 (470.0-530.1)	2.3 (2.0-25.56)
4&5	UCU	Silts and lean clays of the Vandalia member	508.8 (470.0-530.1)	472.0 (425.4-486.9)	36.8 (10.7-57.6)
6	UA	Sands and gravels within silty clay	472.0 (425.4-486.9)	465.3 (418.1-483.9)	6.7 (2.0-29.9)
7	LCU	lean clays of the Smithboro Till	465.3 (418.1-483.9)	438.3 (412.2-458.1)	26.9 (5.9-37.8)

Notes:
[1] Elevation is measured in feet, referenced to NAVD88.

5.2.2.2 Hydraulic Conductivity

Hydraulic conductivity values and sensitivity results are summarized in **Table 5-1.** The spatial distribution of the hydraulic conductivities within the UD, UCU, and LCU was considered homogenous. A zone representing the Cahokia deposits was included in UCE layers 4 and 5. The hydraulic properties of this zone is equivalent to those of the rest of the UCU, this zone is discussed further in **Section 5.2.3.5**. In both the PMP and UA layers (model layers 3 and 6, respectively), well log data indicated the presence of silt, sand, and gravel lenses. These were included in the model as zones within these two layers. The spatial extent of these zones was determined using well log data for areas of silt within the PMP, and silt/sand and gravel within the UA. Hydraulic properties within these zones do not vary. **Figures 5-16 through 5-22** show the spatial distribution of the hydrostratigraphic units, PAP and other units on site for each of the seven model layers.

Where available, hydraulic conductivity values were derived from field measured or laboratory tested values reported in the HCR (Ramboll, 2021a) (**Section 2.2.2**). No horizontal anisotropy was assumed. Vertical anisotropy was applied to conductivity zones to simulate preferential flow in the horizontal direction in these materials, and are presented as anisotropy ratio (Kh/Kv) in **Table 5-1**.

The model was highly sensitive to changes in horizontal conductivity in UD (zone 1), UD-PMP sand (zone 5), UA (zone 7), UA-gravel (zone 9), and moderately high sensitivity to the sand deposit in the UA (zone 8). The calibrated model has low to moderate sensitivity to horizontal conductivity in the remaining hydrostratigraphic units. The model was highly sensitive to changes in the vertical conductivity in the UD (zone 1), and the UCU and UCU-Cahokia (zone 6 and 11, respectively). The model had a moderately high sensitivity to changes in vertical conductivity in the UA (zone 7) and the sand deposit in the UA (zone 8), and moderate sensitivity to changes in vertical conductivity in UD-PMP sand (zone 5) and UA-gravel (zone 9). The UD fill (zone 2), CCR (zone 3), UD-PMP (zone 4), and LCU (zone 10) exhibited low sensitivity.

5.2.2.3 Recharge

Recharge rates were determined through calibration of the model to observed groundwater elevations. For the calibration model, recharge was applied to the upper most active layer and the rates varied based on different units, namely the PAP, LF1, LF2, Secondary Pond, NPP, and Cooling Pond. Model inputs are summarized in **Table 5-1**. The distribution of recharge is show in **Figure 5-23**.

The calibrated flow model is highly sensitive to recharge to the PAP, moderately sensitive to recharge to the UD, and has negligible sensitivity to all other zones within the model (**Table 5-1**).

5.2.2.4 Storage and Specific Yield

The flow calibration model did not use these terms because it was run at steady state. For the transport model, which was run as a transient simulation, no field data defining these terms were available so published values were used consistent with Fetter (1988). Specific yield was set to equal effective porosity values described in **Section 5.2.3.3**. The spatial distribution of the storage and specific yield zones were consistent with those of the hydraulic conductivity zones. The sensitivity of these parameters was tested by evaluating their effect on the transport model as described in **Section 5.2.3.4**.

5.2.2.5 General Head Boundary Parameters

General head boundary conditions (GHB) were used along the northern boundary of the model for layer 1 through 4 and layer 6. GHB were also used along the southern boundary for layer 6 only (**Figures 5-2** to **5-7**). The GHB at the northern limit of the model in layers 1 through 4 was used to simulate groundwater flow into the model via the UD, PMP, and UCU. The UCU was included in the GHB due to its hydraulic connection to Newton Lake even though it has a low hydraulic conductivity. The groundwater levels used for the northern boundary of the model in layers 1 through 4 were estimated using the Dupuit equation for steady state flow in an unconfined aquifer with recharge.

The DEM of the site provided estimates of the surface water levels for Newton Lake on the east of the model domain (504.6 feet) and the Sandy Creek (525 feet) located 6,500 feet west of Newton Lake. The calibrated ambient recharge to the UD was used in the calculation of the groundwater level distribution at the northern boundary. The hydraulic conductivity value K used in the Dupuit equation was estimated during model calibration.

This GHB was only applied to cells along the northern boundary where the base of the cell was below the calculated groundwater head for a given distance from the constant head boundaries, the head was determined by the Dupuit equation. Cell conductance was then calculated using the calibrated hydraulic conductivity and the cells’ saturated thickness and cell width.

The CSM for NPP (layer 6) describes a potential hydraulic connection between the UA and either Big Muddy Creek or Newton Lake dam, both of which are located approximately 14,000 feet southwest of the model domain. The elevation of both Big Muddy Creek and Newton Lake dam at this distance is approximately 460 feet. Therefore, the GHB elevation and distance at the southern limits of the model in the UA was set to 460 feet and 14,000 feet. The conductance was determined using the cells calibrated hydraulic conductivity, cell width and thickness (cells were assumed to be fully saturated).

The GHB elevation for northern boundary in the UA was established during calibration (**Table 5-1**). The distance to the GHB head was set to 1, and the GHB conductivity was calculated using the cell width, cell thickness, and calibrated hydraulic conductivity from the model.

The sensitivity to changes in specified head was negligible to moderate for both the northern GHB in layer 1-4, and in the UA (layer 6), and high for the southern GHB in the UA. The flow calibration model had low sensitivity to changes in the conductance for both the northern GHBs (layer 1-4 and layer 6), and high sensitivity in the southern GHB in layer 6 (UA).

5.2.2.6 River Parameters

The Cooling Flume transports water from the Cooling Pond north of the PAP to Newton Lake. The flume consists of three sections, where the surface water elevation is controlled via weirs with decreasing elevation as the flume approaches Newton Lake. The most upstream section is maintained at 530.98 feet, the intermediate section has a surface water elevation of 515.66 feet, and the surface water elevation in the final section is maintained at 499.0 feet. Sandy Creek is the primary natural surface water feature which discharges into Newton Lake west of the PAP.

Both the Cooling Flume and Sandy Creek are included in the model as head dependent flux boundaries that required inputs for elevation of the surface water, bottom of the stream, width, bed thickness, and bed hydraulic conductivity (**Table 5-1**). A total of three river reaches are included in the model; in the absence of river geometry information the DEM was used to estimate stream stage at the upstream and downstream limits of each reach. For Sandy Creek the slope of the river was then linearly interpolated along the reach, providing an estimation of stream stage along the length of each reach for each model grid cell though which the river flows. Bed thickness was set at 1 foot and river width was set at 10 feet.

The width of the Cooling Flume (approximately 32 feet) is larger than the grid cell dimensions (25 feet by 25 feet), therefore the conductance term for the Cooling Flume was based on the area of the cells which coincide with the flume. The DEM provided surface water elevation estimations of the three sections of the Cooling Flume, and the bed thickness was set to 1 foot.

River width, bed thickness, and bed hydraulic conductivity parameters were used to calculate a conductance term for the river cells. This conductance term was determined by adjusting hydraulic conductivity during model calibration.

The river boundaries were placed in layers 1 through 4, corresponding with simulated river elevation and base of the river (**Figure 5-2 through Figure 5-5**).

The calibrated flow model has negligible sensitivity to changes in either river stage or conductance.

Table B. River and Drain Information

Name	Boundary Type	Length (feet)	Slope (ft/ft)
Cooling Flume	River	7891.0	-
Sandy Creek	River	13082.7	-0.0019
Sandy Creek Tributary 1	Drain	2420.5	-0.0076
Sandy Creek Tributary 2	Drain	6326.4	-0.0038
Sandy Creek Tributary 3A	Drain	4359.1	-0.0015
Sandy Creek Tributary 3B	Drain	4088.8	-0.0058
Landfill Stream	Drain	2706.7	-0.0057
PAP Stream	Drain	5658.5	-0.0038
PAP drain north	Drain	2055.2	-0.0102
Newton Lake Tributary 1	Drain	6854.6	-0.0057
Newton Lake Tributary 2	Drain	3414.8	-0.0083
Newton Lake Tributary 3	Drain	2369.0	-0.0090
Newton Lake Tributary 4	Drain	1603.0	-0.0029
Newton Lake Tributary 5	Drain	2448.4	-0.0078
Newton Lake Tributary 6	Drain	2556.7	-0.0107
Newton Lake Tributary 7	Drain	3002.7	-0.0061
Tributary South 1	Drain	1839.0	-0.0021
Tributary South 2	Drain	4364.0	-0.0041
Tributary South 3	Drain	1200.9	-0.0083
PAP drain north	Drain	2051.2	-0.0137

Notes:
ft/ft = feet per foot

5.2.2.7 Drains

The model contains numerous small tributaries which discharge into both Sandy Creek and Newton Lake. Limited hydrological data are available for these surface water features; therefore, it is uncertain how these interact with the groundwater levels. However, these features are all first-order streams (or headwater streams) and therefore it is highly likely that they are fed by a combination of groundwater discharge and surface runoff (Horton, 1945). Therefore, these streams are included in the model as head dependent flux boundaries (drain) that required inputs for elevation of the bottom on the stream, width, bed thickness, and bed hydraulic conductivity (**Table 5-1**). By using the drain head-dependent flux boundary it is assumed that these streams only act as groundwater discharge features and makes the fewest assumptions regarding stream geometry.

A total of 18 drain reaches are included in the model. In the absence of river geometry information the DEM was used to estimate stream stage at the upstream and downstream limits of each reach. The slope of the river was then linearly interpolated along the reach, which provided an estimate of stream stage along the length of each reach for each model grid cell though which the stream flows.

The drain boundaries were placed in layers 1 through 4 corresponding with simulated drain depth (**Figure 5-2 through Figure 5-5**).

The calibrated flow model has negligible to low sensitivity to both drain elevation and conductance for most drains. Only the Landfill drain (reach 6) had moderate sensitivity to drain elevation.

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 sulfate concentration ranges at each well as measured from the monitoring wells between 2015 (where available) and 2021. The transport model calibration targets are summarized in **Table 2-2**.

Sensitivity analysis was conducted by changing input values and observing percent change in sulfate concentration at each well from the calibrated model sulfate concentration. Effective porosity was varied by decreasing and increasing calibrated model values by 0.05. Storage values were multiplied and divided by a factor of 10, and specific yield by a factor of 2. Dispersivity in the Cahokia Alluvium was varied by decreasing and increasing calibrated model dispersivity by 50 percent. The transport model had a negligible sensitivity to changes in storage and specific yield (**Table 5-3**). The transport model ranged from negligible to high sensitivity to effective porosity and negligible to moderately high sensitivity to dispersivity as discussed in **Sections 5.2.3.3** and **5.2.3.5**.

5.2.3.1 Initial Concentrations

No initial concentrations were placed in the steady state flow calibration model. The flow model was run as transient and concentration was added to the model through recharge starting at the same time as flow simulation. Modeling was performed for a sufficient period (45 years) to allow modeled concentrations in the primary transport layer (*i.e.,* UD/PMP and UA) to reach recently observed levels.

5.2.3.2 Source Concentrations

Based on review of CCR placement, initial source concentrations for the pond were set to observed concentrations from porewater samples collected from earlier placement areas (XPW02 and XPW03) with a sulfate concentration of 130 milligrams per liter (mg/L) (**Figure 5-24**). This was applied throughout the pond until 1985, after which discoloration becomes apparent in the CCR deposits and source areas were added using porewater results from XPW01 and XPW04. Three concentration sources in the form of vertical percolation (recharge) through CCR were simulated within the PAP for calibration (**Table 5-2**): (i) percolation through CCR in the northeastern portion of the PAP, (ii) percolation through CCR in the northwestern portion of the PAP, and (iii) percolation through CCR in the remaining area of the PAP (**Figure 5-24**).

Porewater chemistry from within the PAP indicated that the distribution of sulfate concentrations is spatially variable, ranging on average between 19,000 mg/L (XPW01) and 99 mg/L (XPW03). Therefore, zonation of the PAP concentration sources was used to delineate areas with differing sulfate source inputs. The zonation was based on evidence provided by Ramboll (2020) and AECOM’s (2016) History of Construction of the PAP. The CCR materials within the PAP shows zones of discoloration, suggestive of additional chemical processes occurring within the CCR and/or the presence of deposits other than CCR (Burns & McDonnell Engineering Company, Inc., 2020). Analysis of aerial imagery of the PAP indicates that the zones of discoloration around XWP01 and XPW04 are present from 1998 onwards. The CCR around XWP02 and XWP03 shows no discoloration and are located within the oldest CCR deposits. The sulfate concentration in these wells are similar and possibly more indicative of the sulfate concentrations within the CCR in general. Therefore, the CCR sulfate concentration (excluding the 2 zones) was set to the average concentration from XWP02 and XPW03 (130 mg/L).

All three source areas were simulated by assigning concentration to the recharge input. All source concentrations in the transport model were based on sulfate concentration data collected in 2021. The source concentrations applied to the recharge zones and saturated ash cells immediately below the recharge zones have the same concentration values. Because these are the sources of concentration in the model, the model will be highly sensitive to changes in the input values. For that reason, sensitivity testing was not completed for the source values.

5.2.3.3 Effective Porosity

Effective porosity for each modeled hydrostratigraphic unit were obtained from the HCR (Ramboll, 2021a) and based on the porosity and are presented in **Table 5-2**.

The model had a negligible to high sensitivity to changes in porosity values, not including monitoring locations where the calibration concentration was less than 10.0 mg/L (*i.e.*, AWP05, APW06, APW08, APW11, APW15, and APW16) (**Table 5-3**). For wells with calibration concentrations greater than 10.0 mg/L, the greatest sensitivity for porosity was high for the low porosity sensitivity test at monitoring locations APW07, AWP09, APW17, and APW18.

5.2.3.4 Storage and Specific Yield Sensitivity

Estimates of storage and specific yield for each modeled hydrostratigraphic unit were obtained from the HCR (Ramboll, 2021a) and based on the porosity and are presented in **Table 5-2**.

The model had a negligible sensitivity to changes in storage and specific yield values (**Table 5-3**).

5.2.3.5 Dispersivity

Physical attenuation (dilution and dispersion) of contaminants is simulated in MT3DMS. Dispersion in porous media refers to the spreading of contaminants over a greater region than would be predicted solely from the average groundwater velocity vectors (Anderson, 1979 and 1984). Dispersion is caused by both mechanical dispersion, a result of deviations of actual velocity at a microscale from the average groundwater velocity, and molecular diffusion driven by concentration gradients. Molecular diffusion is generally secondary and negligible compared to the effects of mechanical dispersion and only becomes important when groundwater velocity is very low. The sum of mechanical dispersion and molecular diffusion is termed hydrodynamic dispersion, or simply dispersion (Zheng and Wang, 1998).

Dispersivity values were applied to the entire model domain and determined during calibration. Longitudinal dispersivity was set at 1 foot. The transverse and vertical dispersivity were set at 1/10 and 1/100 of longitudinal dispersivity. The Cahokia Alluvial deposits are represented in layer 4 a distinct zone within the UCU, there is no evidence to indicate that the hydraulic properties of this unit differ from those of the UCU; however, there is evidence that there is preferred transport through this unit. Therefore, this unit (**Figure 5-19** and **5-20**) has been included as an area of increased dispersivity. The calibrated longitudinal dispersivity for the Cahokia Alluvium was 20 feet, with the transverse and vertical dispersivity set at 1/10 and 1/100 of longitudinal dispersivity. Changes in hydraulic conductivity within this zone have negative impacts on the flow calibration in the UA. The increased dispersivity allows for migration of mass to wells where elevated sulfate concentrations have been observed and are coincident with the Cahokia deposits illustrated on Figure 2 of the HCR (Ramboll, 2021a) while preserving flow calibration.

The model had a negligible to moderately high sensitivity to changes in the Cahokia Alluvium dispersivity in wells, not including monitoring locations where the calibrated concentration was less than 10 mg/L. For wells with calibration concentrations greater than 10.0 mg/L, the greatest sensitivity for dispersivity was moderately high for the low dispersivity sensitivity test at monitoring locations APW07, APW09, APW17, and APW18.

5.2.3.6 Retardation

It was assumed that sulfate 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. Lithium, sulfate, and TDS transport is likely to be affected by both chemical and physical attenuation mechanisms (i.e., adsorption and/or precipitation reactions as well as dilution and dispersion). Batch adsorption testing was conducted to generate site specific partition coefficient results for lithium and sulfate (Golder, 2022b, **Appendix C**) for locations APW-04 and APW-14. Results of the testing are summarized below:

- Lithium: Calculated linear partition coefficient (K_D) values for APW-04 and APW-14 were 4.49 and 5.58 liters per kilogram (L/kg) respectively, Langmuir partition coefficient (K_L) values were 6.2 x 10^7 and 1.6 x 10^8 L/kg, respectively, and Freundlich partition coefficients (K_F) values were 135 and 230 L/kg, respectively. In Strenge and Peterson (1989), partition coefficients for lithium range from 0 to 0.8 L/kg, depending on pH conditions and the amount of sorbent present.
- Sulfate: Calculated K_D values for APW-04 and APW-14 were 3.58 and -25.6 L/kg, respectively, K_L values were -626 and -2,200 L/kg, respectively, and K_F values were 4.11 and 2.14 x 10^{11} L/kg, respectively. In Strenge and Peterson (1989), partition coefficients for sulfate are 0.0 L/kg, regardless of pH conditions and the amount of sorbent present.

The results from site samples have a high degree of variation and little correlation with the literature values provided for comparison. The potential exceedances identified in groundwater (lithium, sulfate and TDS) are affected by natural attenuation processes in multiple ways and to varying degrees. Further assessment of these processes and how they may be applied as a potential groundwater remedy will be completed as part of future remedy selection evaluations as necessary. For the purposes of this modeling report, and as mentioned at the beginning of this section, no retardation was applied to sulfate 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:

- Natural recharge is constant over the long term.
- Fluctuations in lake stage do not affect groundwater flow and transport over the long term.

- Hydraulic conductivity is consistent within hydrostratigraphic units and delineated zones.
- The approximate base of ash surface in the PAP was developed with HDR using soil borings and bathymetric survey results.
- Source concentrations are assumed to remain constant over time.
- Sulfate is not adsorbed and does not decay and mixing and dispersion are the only attenuation mechanisms.

The model is limited by the data used for calibration, which adequately define the local groundwater flow system and the source and extent of the plume. Since data used for calibration are near the PAP, 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 in 2021.

5.4 Calibration Flow Model

The groundwater model was manually calibrated to best approximate the mean groundwater elevations in 30 wells at the site. The mean elevations used for calibration and locations of wells within the flow model are summarized in **Table 2-2**. Well locations are shown in **Figure 2-1**. This involved modifying the hydraulic conductivities of the different hydrostratigraphic units, recharge rate, and conductance of the drains, rivers, and general head boundaries within the model to minimize the difference between the mean observed groundwater elevation and simulated groundwater elevation. Where possible, the range of the parameter values used during calibration were based on observed values (*i.e.,* for the range in hydraulic conductivity estimates from the HCR). Where this was not possible, such as for the drain and general head boundary conductance, the range of parameter values were based on other site information or inferred from knowledge from similar sites. Where data were limited, the parameter values were less constrained during calibration (*e.g.,* parameter values had wider ranges). The RMSE was used as a metric to identify the optimal values for the different parameters.

5.5 Calibration Flow Model Results

Results of the MODFLOW modeling are presented below. The model files accompany this report (**Attachment A**). **Table 5-1** shows the calibrated hydraulic conductivity for the different units shown in **Figures 5-16** to **5-22**.

Groundwater model calibration results are presented in **Figure 5-25** and **Figure 5-26**, which shows the observed GWL and simulated groundwater elevations and the observed GWL versus residuals. The near-linear relationship between observed and simulated values presented on **Figure 5-25** indicates that the model adequately represents the calibration dataset. The RMSE of the GWL across all wells was 5.14 feet. The mass balance error for the flow model was 0.00 percent and the ratio of the residual std to the range of heads was 9.2 percent, which is just below the desired target value of 10 percent. Another flow model calibration goal is that residuals are evenly distributed such that there is no bias affecting modeled flow. The observed heads are plotted versus the simulated heads in Figure **5-26** and simulated values are evenly distributed above and below observed values. The residual mean was also near zero with a value of 1.12 feet, indicating a small bias towards overestimating the GWL in the calibrated model; this is also illustrated in the observed versus residuals plot in **Figure 5-26**. The simulated groundwater elevations within the UD/PMP (layer 3) and the UA (layer 6) are shown in **Figure 5-27** and **Figure 5-28**.

In general, the model is able to simulate the groundwater flow patterns the UA (**Figure 2-2** and **Figure 2-3**) interpreted from the site well data for May and July 2021 respectively. The notable exceptions are 1) those wells located to the north of the PAP, close to the boundary between the UA and UA- sand, and 2) those wells to the east of the PAP close to the boundary between the UA, UA-sand and UA-gravel. The groundwater level is underestimated in both of these areas. The underestimation in groundwater heads suggests that the subsurface heterogeneity (the uppermost aquifer is located in glacial deposits that grade from sand to silt with gravel deposits) is not optimally represented by the zoned layers used in the model. The interpretation of both the UA-sand and UA-gravel areas were based on well log data available near the PAP. These sand and gravel deposits may or may not be present beyond the available well information. Based on the objective of the model to estimate potential impacts from the PAP, and the model's ability to simulate flow within the UA, the zoned representation in hydraulic properties within the UA is suitable.

5.6 Transport Model Results

The range of observed sulfate concentrations for transport calibration locations are summarized in **Table 2-2**. The goals of the transport model calibration were to have predicted concentrations fall within the range of observed concentrations; and, to have predicted concentrations above and below the GWPS for sulfate (400 mg/L) match observed concentrations above or below the standard at each well.

Both these goals were achieved in three of the transport calibration location wells (**Figure 5-29**), and all but two wells achieved the second goal of matching observed concentrations above or below 2 mg/L. Deviations from the observed ranges are discussed below.

- The model over predicts concentration in wells APW02, APW04, and APW12, which are screened in the UD/PMP. The modeled and observed concentration are both above 400 mg/L, so one of the two calibration goals was satisfied.
- The model under predicts concentrations in APW05S, which is screened in the UD/PMP; however, the difference between the lower limit of the range of observed concentrations (200 mg/L) and the predicted concentration of 116.3 mg/L is small. APW05S is located upgradient of the pond and may also be influenced by other factors, notwithstanding the PAP. The modeled and minimum observed concentration are both below 400 mg/L, so one of the two calibration goals was satisfied.
- The model under predicts concentrations in APW03, which is screened in the UD/PMP; however, the difference between the lower limit of the range of observed concentrations (160 mg/L) and the predicted concentration of 128.9.3 mg/L is small. Both the observed and predicted concentrations are below the GWPS, so one of the two calibration goals was satisfied.
- The model slightly under predicts the concentration in APW10, which is screened in the UA. The minimum observed concentration at APW10 is 390 mg/L and simulated sulfate concentration is 340 mg/L. The modeled and minimum observed concentration are both below 400 mg/L, so one of the two calibration goals was satisfied.
- The model under predicts concentrations in APW05, APW06, APW11, APW13, APW14, APW15 and APW17 which are screened in the UA. The range in observed sulfate concentrations in these wells is very small, with an average range of 35 mg/L. The maximum observed

concentrations in these wells are 15 mg/L, 9.9 mg/L, 300 mg/L, 230 mg/L, 340 mg/L, 1 mg/L and 41 mg/L, respectively. The predicted concentrations are 0.3 mg/L, 0 mg/L, 2.5 mg/L, 85.2 mg/L, 96.8 mg/L, 9 mg/L and 87.6 mg/L for APW05, APW06, APW11, APW13, APW14, APW15 and APW17, respectively. However, observed and predicted concentrations did not exceed the GWPS, satisfying one of the calibration goals.

- The model over predicts the concentration at APW18, which is screened in the UA. The maximum observed sulfate concentration at APW18 is 26 mg/L and the simulated concentration is 87.6 mg/L, which is an overprediction of 61.6 mg/L. However, observed and predicted concentrations did not exceed the GWPS, satisfying one of the calibration goals.

The remaining calibration locations (APW07, APW09, APW16) have predicted concentrations that were within range of the observed sulfate concentration and simulated GWPS exceedances. The UD/PMP well APW02, where the highest concentrations were observed (3,200 mg/L), was also calibrated to the median concentration of the observed values in 2021, indicating the transport calibration model was able to simulate the highest observed concentrations (**Figure 5-29**). The sulfate plume at the end of the transient model simulation of 500 years for the UD/PMP is shown in **Figure 5-30.** There are no simulated exceedances in the UA at the end of the transient model; however, sulfate is approaching the GWPS of 400 mg/L near APW-10 where exceedances of the GWPS have been observed.

6. SIMULATION OF CLOSURE SCENARIOS

6.1 Overview and Prediction Model Development

Prediction simulations were performed to evaluate the effects of Closure (source control measures) for the PAP on groundwater quality. The prediction simulations evaluated changes in groundwater sulfate concentrations from Scenario 1: CIP (removal of CCR from the southern portion of the PAP and consolidation into the northern portion of the PAP and Scenario 2: CBR (removal of all CCR material from the PAP). As discussed in **Section 5.2.3.5** physical attenuation (dilution and dispersion) of contaminants in groundwater is simulated in MT3DMS, which captures the physical process of natural attenuation as part of corrective actions for both closure scenarios simulated. No retardation was applied to boron transport in the model (i.e., Kd was set to 0) as discussed in **Section 5.2.3.6**.

Closure scenarios were simulated by initially removing free liquid from the CCR material over the course of 1 year by placing constant head cells with an elevation of 520 feet above the base of the CCR material and applying zero recharge to simulate dewatering of the PAP.

HELP-calculated percolation rates, based on removal and final soil backfill grading designs also provided in the *Primary Ash Pond Final Closure Plan* (HDR, 2022), were applied for the different closure scenarios. HELP modeling input and output values are summarized in **Table 6-1** and described in detail below.

The CIP and CBR scenarios were simulated for a 500-year period. The following simplifying assumptions were made during the simulations:

- Removal of free liquids from CCR takes place prior to the CIP and CBR closure scenarios. Constant head cells were placed within the PAP to simulate the target water elevation within the ponds; and recharge was set to zero.
- In the CIP and CBR closure scenarios, HELP-calculated average annual percolation rates were developed from a 30-year HELP model run. This 30-year HELP-calculated percolation rate remained constant over duration of the closure scenario prediction model runs following CCR dewatering period.
- Changes in recharge resulting from removal of free liquids (decrease calibration model recharge rates to zero) and CCR fill removal/ final soil backfill grading (recharge rates are based on HELP-calculated average annual percolation rates) have an instantaneous effect on recharge and percolation through surface materials.
- Sulfate source concentrations were assumed to be negligible (0 mg/L) in CCR removal areas in both the CIP and CBR scenarios. The spatial distribution of CCR concentrations within the consolidation area for the CIP scenario were maintained from the initial transport simulation.
- Cap construction in CIP scenario was assumed to be completed with a cover system consisting of the following (listed from ground surface down): a vegetative cover (6 inches thick), rooting zone (18 inches thick), a 200-mil geocomposite drainage layer and a 40-mil linear low-density polyethylene (LLDPE) geomembrane.
- The start of each closure prediction simulation was initiated at the end of the calibration model period of 45 years plus 1 year to complete removal of free liquid. For example, the

simulation of Scenario 1: CIP begins at 46 years (45 years for calibration plus 1 year). The prediction modeling timeline for each scenario is illustrated in Figure 4-1.

- CCR removal areas were assumed to be graded following placement of soil backfill based on the design drawings provided in the *Primary Ash Pond Final Closure Plan* (HDR, 2022).
- CCR consolidation/removal areas were assumed to be graded and include proper storm water controls to remove excess water from the surface using the design drawings provided (HDR, 2022).
- The CIP scenario includes the placement of a stormwater drain within the removal area. The outflow elevation of this stormwater pond is 525 feet, which will discharge into Newton Lake adjacent to the PAP. This is represented as a drain in the model whose elevation is equal to the stormwater pond outflow elevation.
- All saturated CCR (constant concentration cells) in the transport calibration model were removed instantaneously in all CCR removal areas for all prediction models.
- Local fill materials applied to the prediction models have similar hydraulic properties as the UD materials used in the transport calibration models. However, the local fill materials were assumed to have reduced vertical anisotropy ratios, approaching isotropic, due to reworking of the material as it is placed as backfill (Kh/Kv decreased from measured values of 100 to 1 for reworked material).

6.2 HELP Model Setup and Results

HELP (Version 4.0; Tolaymat and Krause, 2020) was used to estimate percolation through the PAP in areas of CCR removal with soil backfill, and areas of CCR consolidation with final cover system. HELP input and output files are included electronically and attached to this report.

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 Terra Haute, Indiana (the closest weather station included in the HELP database). Precipitation, temperature, and solar radiation was simulated based on the latitude of the PAP. Thickness of soil backfill and soil runoff input parameters were developed for the ash fill removal scenarios using data provided the *Primary Ash Pond Final Closure Plan* (HDR, 2022).

HELP model results (**Table 6-1**) indicated 4.29 inches of percolation per year for the PAP CCR removal and soil backfill area in the CIP scenario, 0.042 inches of percolation per year through the CCR and final cover system for the CIP scenario, 4.38 inches of percolation per year for the PAP CCR removal and soil backfill area in the CBR scenario. HELP model simulations were also completed to estimate the percolation for the proposed closure of LF2. Model results indicated 0.000003 inches of percolation per year for LF1 and LF2 through the cover system. The differences in HELP model runs for each area included the following parameters: area, soil backfill thickness, slopes, and soil runoff slope length; all other HELP model input parameters were the same for each simulated area. HELP input data and results are provided in **Appendix B.**

Two additional HELP model simulations were completed to support the *Proposed Alternative Final Protective Layer Equivalency Demonstration*, (Geosyntec, 2022) which is an appendix to the Construction Permit Application to which this report is also attached. Results of these two HELP simulations were not incorporated in the MODFLOW simulations for closure. Simulation inputs and output results are presented in **Appendix D**.

6.3 Simulation of Closure Scenarios

The calibrated model was used to evaluate the effectiveness of the two closure scenarios by adding constant head cells within the PAP, decreasing recharge to simulate removal of free liquid within the ash fill prior to removal, and changing recharge rates to simulate ash fill removal areas at the PAP. Removal of source inputs from the ash removal areas was simulated by reducing the sulfate concentrations associated with recharge in the areas to 0 mg/L. Constant concentration cells that represent areas with potentially saturated CCR were also removed from the ash removal areas.

Each prediction scenario was simulated as a continuation of the PAP dewatering simulation which followed the transient calibrated model. The prediction model input values are summarized in **Table 6-2,** and the modifications to the recharge zones and drain placement for the CIP scenario are illustrated in **Figure 6-1**. **Figure 6-2** illustrates the CCR removal area for the CBR at the PAP. The two closure scenarios are discussed in this report based on predicted changes in sulfate concentrations as described below.

6.3.1 Closure in Place Model Results

In the CIP scenario, the predicted concentrations in the UD/PMP start to decline once the closure actions are implemented within the prediction model. The reduced recharge rate in the northern area of the PAP leads to an increasing number of saturated ash cells (constant concentration cells) becoming inactive. These inactive cells are no longer contributing sulfate source concentration to the model domain. Sulfate concentration continues to be introduced in the CIP consolidation area via recharge, although only at a low rate. In addition, as a result of removal of free liquid and low recharge rate, downward percolation of solute mass from the PAP is reduced.

As previously discussed, the calibrated model over predicts sulfate concentrations in monitoring wells APW02, APW04, and APW12, which are screened in the UD/PMP. The predictive model indicates that these wells will reach the GWPS (400 mg/L) in 15 years, 20 years, and 4 years respectively, after the corrective measures are in place. All UD/PMP groundwater monitoring wells are below the GWPS within 20 years (**Figure 6-3**). The predicted footprint of the sulfate plume within the UD/PMP (Layer 3) shown in **Figure 6-3** is considerably reduced from that at the end of the transient model simulation (**Figure 5-30**).

The predicted concentrations in UA groundwater monitoring wells increase for various periods of time after corrective measures are implemented (**Figure 6-4**). However, only APW10 exceeds the GWPS following closure. The predicted concentration in APW10 rises for approximately 10 years after closure is completed, after which it declines such that the concentrations fall below the GWPS after 20 years.

Most of the UA wells show a delayed response to the implementation of closure, with the concentrations continuing to rise for up to 200 years in the case of APW17 while remaining below the GWPS. This delay can be attributed to the thick layer of UCU materials present between the UA and the CCR. Due to its low vertical hydraulic conductivity (0.0001 ft/d), sulfate will very slowly percolate through the UCU into the UA. The reduced recharge rate in the CIP scenario further reduces the vertical gradient across this unit, thereby slowing the movement of the sulfate within it. This results in the slow rise and fall of sulfate in many of the UA wells.

The predicted footprint of the sulfate plume within the UA (Layer 6) is shown in **Figure 6-4.** Only a small area to the east of the pond (in close proximity to APW10) shows sulfate concentrations above the GWPS.

Evaluations of post-construction water flux through the consolidated and covered Fill Unit (CCR) were completed using data obtained from the Scenario 1 (CIP) prediction model when simulated post-construction heads in the groundwater monitoring wells are predicted to stabilize (once heads stabilized in the model, the post-construction movement of water in and out of the Fill Unit [CCR] were compared to pre-construction conditions). The pre-construction (calibration model) and post-construction Scenario 1 (CIP) prediction model simulated water flux values are summarized in **Appendix E** and discussed below. Data export files used for flux evaluations are found along with model files in **Appendix B**.

Scenario 1 (CIP) was predicted to reduce total flux in and out of the Fill Unit (CCR) by approximately 94%, when simulated post-construction heads in the groundwater monitoring wells are predicted to stabilize (approximate hydraulic steady state) as illustrated in **Figure 6-5**. **Figure 6-6** is a plot showing the changes in flux reduction (shown as negative percentage) over time starting from implementation of Scenario 1 (CIP) through approximate hydraulic steady state conditions. Both flux in and flux out are reduced greater than 75% after one year of closure. Following implementation of Scenario 1 (CIP), influx into the CCR unit decreases rapidly as illustrated in **Figure 6-6**. Concurrently, outflux from the CCR unit behaves similarly, decreasing rapidly and stabilizing 6 years post-construction, after which a reduction of outflux of at least 94% is maintained as heads approach hydraulic stabilization (**Figure 6-6**).

6.3.2 Closure by Removal Model Results

In the CBR scenario, predicted concentrations in the UD/PMP start to decline once the closure actions are implemented within the prediction model. These declines are due to removal of the CCR and a small reduction in recharge within the PAP. Predicted sulfate concentrations for APW02, APW03, APW04, APW05S, and APW12 are below the GWPS within 14 years (**Figure 6-3**).

As previously discussed, the model over predicts sulfate concentrations in monitoring wells APW02, APW04, and APW12, which are screened in the UD/PMP. The predictive model indicates that these wells will reach the GWPS 14 years, 10 years, and 13 years respectively, after closure.

Similar to the CIP scenario, the predicted footprint of the sulfate plume for the CBR within the UD/PMP (Layer 3) shown in **Figure 6-3** is considerately reduced from that of the transient model simulation (**Figure 5-30**). In comparison to the CIP scenario, the CBR simulation has a smaller plume at both the eastern boundary and western boundary of the PAP.

The simulated sulfate concentrations in the UA wells display a similar lagged response to closure as observed in the CIP scenario. Only APW10 exceeds the GWPS following closure. The predicted concentrations in APW10 continue to rise approximately 9 years after closure is completed, after which it declines such the concentrations fall below the GWPS after 16 years.

Like the CIP scenario, most of the UA wells show a delayed response to the implementation of closure, the concentrations continue to rise for up to 50 years in the case of APW18 while remaining below the GWPS.

The predicted footprint of the sulfate plume within the UA (Layer 6) is shown in **Figure 6-4**. Only a small area to the east of the pond (in close proximity to APW10) shows sulfate concentrations above the GWPS and is not significantly different from the CIP simulated plume footprint.

6.3.3 Sulfate Composite Plume for CIP and CBR

The maximum footprint of the plume, based on the simulated sulfate concentrations in all model layers 20 years after corrective measures, is shown in **Figure 6-7**. The footprint of the plume includes the sulfate concentrations retained within the UCU and is therefore greater in area than those plumes in either the UD/PMP or UA. As mentioned above, the sulfate within the thick UCU will slowly percolate through the unit, the rate of which is governed by the hydraulic gradient across the unit. **Figure 6-8** shows the maximum plume extent after 100 years for both the CIP and CBR scenarios. The reduced recharge rate in the CIP scenario leads to a slightly larger plume for the CIP scenario than for the CBR scenario.

The maximum plume footprint in both the CIP and CBR scenarios continues to reduce through time and remains within the property boundaries.

7. CONCLUSIONS

This GMR has been prepared to evaluate how proposed CIP and CBR scenarios will achieve compliance with the applicable groundwater standards at the NPP. Data collected from the recent 2021 field investigations were used to develop a groundwater model to predict the impacts of the closure scenarios on groundwater quality at the NPP. The MODFLOW and MT3DMS models were used to evaluate two scenarios using information provided in the *Primary Ash Pond Final Closure Plan* (HDR, 2022):

- Scenario 1: CIP (consolidation of CCR in the north of the unit with cover system)
- Scenario 2: CBR (CCR is removed)

Scenario 1 (CIP) was predicted to reduce total flux in and out of the Fill Unit (CCR) by approximately 94%, when simulated post-construction heads in the groundwater monitoring wells are predicted to stabilize.

Predictive simulations of pond closure indicate simulated groundwater concentrations in the monitoring well within the two transport zones, namely the UD/PMP and UA, will achieve the GWPS in 20 years and 16 years for the CIP and CBR closure scenarios, respectively. This indicates that both scenarios are predicted to reach the GWPS for the monitoring wells after approximately 20 years. The model predicted four-year time difference when GWPSs are achieved for CIP (20 years post-closure) and CBR (16 years post-closure) is not significant because the estimated duration of construction activities indicates that CBR will take longer to implement than CIP (3.2-4.3 years for CIP compared to 7.8-9.2 years for CBR-Onsite and 22 years for CBR-Offsite; Section 2.1 of the Closure Alternative Analysis [Gradient, 2022]).

The prediction simulations indicate that although the groundwater wells reach the GWPS, sulfate remains within the model beyond 100 years. This is due to the sulfate mass retained within the thick UCU which underlies the PAP. The low vertical hydraulic conductivity of this thick unit leads to low flow rates through the unit which will require time to release the sulfate mass. However, in both the CIP and CBR scenarios, the plume footprint continues to recede with time and remains within the property boundaries indicating these closure options are equally protective.

Results of groundwater fate and transport modeling conservatively estimate that groundwater concentrations will attain the GWPS for all constituents identified as potential exceedances of the GWPS in the UD/PMP and UA monitoring wells within 20 years of closure implementation for both CIP and CBR. Within the property boundary, residual sulfate will be present within the clay confining unit above the GWPS due to the slow release of sulfate from the UCU.

8. REFERENCES

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TABLES

TABLE 2-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
GROUNDWATER MODELING REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, 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)
APW02	UD	06/19/2010	533.61	533.61	Top of Riser	529.90	9.70	19.70	520.20	510.20	20.00	509.90	10	2	38.925918	-88.293907
APW03	UD	06/18/2010	532.41	532.41	Top of Riser	528.37	9.70	19.70	518.67	508.67	20.00	508.40	10	2	38.922322	-88.281567
APW04	UD	06/19/2010	525.06	525.06	Top of Riser	521.45	7.70	17.70	513.75	503.75	18.00	503.50	10	2	38.927444	-88.273113
APW05	UA	10/22/2015	544.07	544.07	Top of Riser	541.08	62.64	67.44	478.44	473.64	67.84	473.10	4.8	2	38.933958	-88.280983
APW05S	UD	01/19/2021	543.94	543.94	Top of PVC	541.05	10.00	20.00	531.05	521.05	20.00	518.10	10	2	38.933958	-88.281033
APW06	UA	10/21/2015	546.07	546.07	Top of Riser	542.89	67.67	72.48	475.22	470.41	72.88	468.90	4.8	2	38.933746	-88.286276
APW07	UA	11/05/2015	538.37	538.37	Top of Riser	535.72	77.89	82.70	457.83	453.02	83.10	452.60	4.8	2	38.928233	-88.292076
APW08	UA	10/28/2015	528.97	528.97	Top of Riser	526.26	71.40	81.06	454.86	445.20	81.53	444.30	9.7	2	38.923154	-88.292286
APW09	UA	11/03/2015	531.52	531.52	Top of Riser	528.33	56.66	61.46	471.67	466.87	61.85	466.30	4.8	2	38.922319	-88.281585
APW10	UA	11/06/2015	524.25	524.25	Top of Riser	521.49	40.74	45.54	480.75	475.95	45.94	475.60	4.8	2	38.927435	-88.273127
APW11	UA	01/23/2021	538.63	538.63	Top of PVC	536.05	60.00	65.00	476.05	471.05	65.00	436.10	5	2	38.932811	-88.27545
APW12	UD	02/21/2021	546.29	546.29	Top of PVC	543.33	20.00	30.00	523.33	513.33	30.00	456.30	10	2	38.92975	-88.272058
APW13	UA	01/22/2021	537.99	537.99	Top of PVC	535.16	58.50	63.50	476.66	471.66	63.50	445.20	5	2	38.92566	-88.274416
APW14	UA	01/23/2021	526.29	526.29	Top of PVC	523.85	50.00	55.00	473.85	468.85	55.00	428.90	5	2	38.924057	-88.277994
APW15	UA	01/22/2021	524.69	524.69	Top of PVC	522.06	98.00	103.00	424.06	419.06	103.00	412.10	5	2	38.921593	-88.285226
APW16	UA	01/20/2021	531.18	531.18	Top of PVC	529.16	80.50	85.50	448.66	443.66	85.50	419.20	5	2	38.920317	-88.291291
APW17	UA	01/22/2021	532.52	532.52	Top of PVC	529.84	87.00	92.00	442.84	437.84	92.00	429.80	5	2	38.925916	-88.293928
APW18	UA	01/21/2021	543.27	543.27	Top of PVC	540.55	75.00	80.00	465.55	460.55	80.00	433.60	5	2	38.930979	-88.290122
G48MG	UA	10/20/2015	545.53	545.53	Top of Riser	542.68	71.80	76.65	470.88	466.03	77.06	465.60	4.9	2	38.939248	-88.296012
G202	UA	10/16/1996	539.69	539.69	Top of Riser	536.85	64.00	74.00	472.85	462.85	74.00	462.90	10	2	38.930876	-88.290559
G203	UA	11/15/1996	533.13	533.13	Top of Riser	530.73	62.50	72.50	468.23	458.23	72.50	458.20	10	2	38.928597	-88.292217
G208	UA	10/13/2011	535.03	535.03	Top of Riser	533.19	74.93	94.71	458.26	438.48	94.80	438.20	19.8	2	38.929632	-88.298182
G217S	UD	08/26/1997	537.98	537.98	Top of Riser	535.54	9.00	19.00	526.54	516.54	19.00	510.50	10	2	38.932171	-88.290041

RAMBOLL

TABLE 2-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
GROUNDWATER MODELING REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, 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)
G217D	UA	12/09/2014	537.92	537.92	Top of Riser	535.51	--	--	--	--	69.30	--	--	--	38.932174	-88.29008
G222	UA	10/25/2011	534.32	534.32	Top of Riser	532.38	64.57	79.24	467.81	453.14	79.30	452.40	14.7	2	38.927194	-88.299669
G223	UA	10/11/2011	533.60	533.60	Top of Riser	531.68	79.09	88.75	452.59	442.93	89.10	442.60	9.7	2	38.93016	-88.293451
G224	UA	10/05/2011	534.31	534.31	Top of Riser	532.31	63.51	73.17	468.80	459.14	73.50	458.30	9.7	2	38.931767	-88.292396
R202	UA	--	--	--	--	--	--	--	--	--	--	--	--	--	38.930879	-88.290581
R217D	UA	09/26/2017	538.18	538.18	Top of Riser	535.60	60.10	65.03	475.50	470.57	65.24	470.40	4.9	2	38.932191	-88.290118
XPW01	CCR	01/20/2021	551.76	551.76	Top of PVC	548.62	7.00	17.00	541.62	531.62	17.00	528.60	10	2	38.932212	-88.285525
XPW02	CCR	01/19/2021	554.43	554.43	Top of PVC	551.97	6.00	16.00	545.97	535.97	16.00	532.00	10	2	38.932343	-88.28289
XPW03	CCR	01/19/2021	553.65	553.65	Top of PVC	550.81	10.00	20.00	540.81	530.81	20.00	530.80	10	2	38.931062	-88.27641
XPW04	CCR	01/19/2021	554.51	554.51	Top of PVC	551.90	10.00	20.00	541.90	531.90	20.00	531.90	10	2	38.929888	-88.274073
XSG01	CCR	--	--	536.17	Staff gauge	--	--	--	--	--	--	--	--	--	38.923218	-88.29067
SG02	SW	--	--	506.89	Staff gauge	--	--	--	--	--	--	--	--	--	38.921234	-88.292057

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
SW = surface water
UA = uppermost aquifer
UD = upper drift

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RAMBOLL

TABLE 2-2. FLOW AND TRANSPORT MODEL CALIBRATION TARGETS
GROUNDWATER MODELING REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

				Flow Targets								Transport Targets						
Well Name	Easting	Northing	HSU	Number of Samples	median GWL[1] (ft)	mean GWL[1] (ft)	std GWL[1] (ft)	min GWL[1] (ft)	max GWL[1] (ft)	Earliest Sample Date	Latest Sample Date	Number of Samples	mean Sulfate (mg/L)	std Sulfate (mg/L)	min Sulfate (mg/L)	max Sulfate (mg/L)	Earliest Sample Date	Latest Sample Date
APW02	995466.245	822683.473	UD	34	528.6	528.6	1.0	524.9	530.4	10/07/2015	08/02/2021	8	2913	579	1500	3200	01/13/2015	07/15/2021
APW03	998977.669	821375.539	UD	33	524.4	524.7	1.5	520.8	528.2	10/07/2015	08/02/2021	8	174	9	160	190	01/13/2015	07/15/2021
APW04	1001381.684	823242.504	UD	33	520.1	520.0	0.7	518.2	521.1	10/07/2015	08/02/2021	8	933	43	860	990	01/13/2015	07/15/2021
APW05	999141.384	825613.581	UA	37	529.5	529.5	0.5	528.0	530.8	12/14/2015	08/02/2021	25	3	4	1	15	12/15/2015	07/15/2021
APW05S	999127.161	825613.573	UD	15	533.6	533.1	0.8	531.7	534.4	02/04/2021	07/15/2021	7	1563	794	200	2100	02/17/2021	07/15/2021
APW06	997635.757	825535.544	UA	36	526.5	526.9	1.1	525.4	530.6	12/14/2015	08/02/2021	25	4	3	1	9.9	12/15/2015	07/15/2021
APW07	995986.774	823526.85	UA	29	492.5	492.8	1.4	491.3	497.6	12/14/2015	08/02/2021	17	12	20	1	66	12/15/2015	02/10/2021
APW08	995927.867	821677.002	UA	29	492.2	492.4	0.9	491.3	494.9	12/14/2015	08/02/2021	17	40	5	30	48	12/15/2015	02/10/2021
APW09	998972.548	821374.443	UA	29	505.1	505.7	1.9	503.4	510.9	12/14/2015	08/02/2021	17	19	22	1	62	12/15/2015	02/11/2021
APW10	1001377.703	823239.224	UA	32	506.6	506.8	0.9	505.1	509.4	12/14/2015	08/02/2021	19	422	34	390	540	12/16/2015	07/29/2021
APW11	1000715.588	825196.787	UA	13	514.1	514.2	0.3	513.9	514.7	02/04/2021	07/15/2021	8	266	52	140	300	02/18/2021	07/15/2021
APW12	1001681.255	824082.573	UD	14	532.0	532.0	0.6	531.3	533.1	02/04/2021	07/15/2021	8	391	65	290	480	02/17/2021	07/15/2021
APW13	1001011.414	822592.511	UA	17	505.8	505.8	0.3	505.2	506.5	02/04/2021	07/15/2021	8	216	7	210	230	02/22/2021	07/15/2021
APW14	999993.839	822008.042	UA	16	505.6	505.5	0.3	504.9	506.3	02/04/2021	07/15/2021	8	325	9	310	340	02/22/2021	07/15/2021
APW15	997936.787	821109.457	UA	15	502.4	501.9	0.9	500.5	502.8	02/04/2021	07/14/2021	8	1	0	1	1	02/23/2021	07/14/2021
APW16	996211.429	820643.869	UA	16	491.4	491.4	0.2	491.1	492.1	02/04/2021	07/15/2021	8	1	0	1	1.9	02/23/2021	07/15/2021
APW17	995460.271	822682.742	UA	16	491.7	491.8	0.3	491.4	492.6	02/04/2021	07/15/2021	8	35	6	25	41	02/23/2021	07/15/2021
APW18	996542.186	824527.23	UA	16	491.9	492.0	0.3	491.7	492.7	02/04/2021	07/15/2021	8	7	9	1	26	02/23/2021	07/15/2021
G48MG	994865.387	827538.141	UA	28	526.4	526.6	0.7	525.5	528.5	12/14/2015	08/02/2021	-	-	-	-	-	-	-
G202	996417.888	824489.657	UA	43	492.8	493.1	1.3	491.6	496.7	04/21/2015	07/14/2021	-	-	-	-	-	-	-
G203	995946.602	823659.404	UA	43	492.8	493.2	1.2	491.0	496.4	04/21/2015	08/02/2021	-	-	-	-	-	-	-
G208	994249.502	824035.648	UA	46	509.5	510.1	2.5	504.9	516.0	04/21/2015	08/02/2021	-	-	-	-	-	-	-
G217S	996565.022	824961.379	UD	30	531.5	531.8	1.4	528.6	535.4	04/21/2015	08/02/2021	-	-	-	-	-	-	-
G223	995595.297	824228.508	UA	47	500.4	500.4	1.2	495.6	504.2	04/21/2015	08/02/2021	-	-	-	-	-	-	-
G224	995895.159	824813.927	UA	47	492.7	492.4	1.4	486.5	495.0	04/21/2015	08/02/2021	-	-	-	-	-	-	-
R202	996411.629	824490.747	UA	2	493.1	493.1	0.2	492.9	493.3	05/21/2020	02/08/2021	-	-	-	-	-	-	-
XPW01	997849.684	824976.957	CCR	11	539.6	539.6	0.2	539.3	539.9	02/15/2021	07/14/2021	5	15000	3807.9	11000	19000	02/17/2021	07/14/2021
XPW02	998599.238	825025.074	CCR	12	545.9	545.9	0.6	544.9	546.7	02/04/2021	07/14/2021	5	164	15.2	150	190	02/17/2021	07/14/2021
XPW03	1000442.897	824559.611	CCR	12	544.1	543.9	0.4	543.3	544.4	02/04/2021	07/14/2021	5	99	11.8	92	120	02/17/2021	07/14/2021
XPW04	1001107.994	824132.454	CCR	11	542.2	542.1	0.2	541.8	542.5	02/04/2021	07/14/2021	5	1920	1196.7	600	3800	02/17/2021	07/14/2021

Notes:
[1] Groundwater Elevation (feet)
GWL = groundwater elevation
ft = feet
std = standard deviation from the mean
min = minimum
max = maximum

HSU: Hydrostratigraphic Unit
CCR = coal combustion residual
UD/PMP = upper drift/potential migration pathway
UA = uppermost aquifer

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

Zone	Hydrostratigraphic Unit	Materials	ft/d	cm/s	Kh/Kv	Value Source	Sensitivity[1]
Horizontal Hydraulic Conductivity			**Calibration Model**				
1	UD	clay and silt	0.41	1.45E-04	NA	Calibrated - Within Range of Field Test Results (Ramboll, 2021a)	High
2	UD -Fill (abover riv/drn)	NA	7	2.47E-03	NA	Calibrated - Conductivity Value to Allow Groundwater Flow from UD to Riverand Drain Boundary Conditions	Low
3	CCR	CCR	17.6	6.21E-03	NA	Calibrated - Within Range of Field Test Results (Ramboll, 2021a)	Moderate
4	UD-PMP	clay and silt	1.5	5.29E-04	NA	Calibrated - Within Range of Field Test Results (Ramboll, 2021a)	Low
5	UD-PMP Sand	mixed alluvial deposits in the vicinity of the PAP	28	9.88E-03	NA	Calibrated - Within Range of Field Test Results (Ramboll, 2021a)	High
6	UCU	lean clay/Cahokia alluvium	0.001	3.53E-07	NA	Calibrated - Within Range of Field Test Results (Ramboll, 2021a)	Low
7	UA	clay and silt	3	1.06E-03	NA	Calibrated - Within Range of Field Test Results (Ramboll, 2021a)	High
8	UA-Sand	sand	3	1.06E-03	NA	Calibrated - Within Range of Field Test Results (Ramboll, 2021a)	Moderately High
9	UA-Gravel	gravel	50	1.76E-02	NA	Calibrated - Within Range of Field Test Results (Ramboll, 2021a)	High
10	LCU	lean clay	0.001	3.53E-07	NA	Calibrated - Within Range of Field Test Results (Ramboll, 2021a)	Low
11	UCU-cahokia	alluvial deposits	0.001	3.53E-07	NA	Calibrated - Within Range of Field Test Results (Ramboll, 2021a)	Low
Vertical Hydraulic Conductivity			**Calibration Model**				
1	UD	clay and silt	0.0041	1.45E-06	100	Calibrated - Within Range Laboratory Test Results and near Geomean of Laboratory Test Results (Ramboll, 2021a)	High
2	UD -Fill (abover riv/drn)	NA	7	2.47E-03	1	Calibrated - Conductivity Value to Allow Groundwater Flow from UD to Riverand Drain Boundary Conditions	Low
3	CCR	CCR	0.2750	9.70E-05	64	Calibrated - Within Range Laboratory Test Results and near Geomean of Laboratory Test Results (Ramboll, 2021a)	Low
4	UD-PMP	clay and silt	0.0150	5.29E-06	100	Calibrated - Within Range Laboratory Test Results and near Geomean of Laboratory Test Results (Ramboll, 2021a)	Low
5	UD-PMP Sand	mixed alluvial deposits in the vicinity of the PAP	0.2800	9.88E-05	100	Calibrated - Within Range Laboratory Test Results and near Geomean of Laboratory Test Results (Ramboll, 2021a)	Moderate
6	UCU	lean clay/Cahokia alluvium	0.0001	3.53E-08	10	Calibrated - Within Range Laboratory Test Results and near Geomean of Laboratory Test Results (Ramboll, 2021a)	High
7	UA	clay and silt	0.0010	3.53E-07	10	Calibrated - Within Range Laboratory Test Results and near Geomean of Laboratory Test Results (Ramboll, 2021a)	Moderately High
8	UA-Sand	sand	0.1000	3.53E-05	21	Calibrated - Within Range Laboratory Test Results and near Geomean of Laboratory Test Results (Ramboll, 2021a)	Moderately High
9	UA-Gravel	gravel	0.1000	3.53E-05	208	Calibrated - Within Range Laboratory Test Results and near Geomean of Laboratory Test Results (Ramboll, 2021a)	Moderate
10	LCU	lean clay	0.0001	3.53E-08	10	Calibrated - Within Range Laboratory Test Results and near Geomean of Laboratory Test Results (Ramboll, 2021a)	Low
11	UCU-cahokia	alluvial deposits	0.0001	3.53E-08	10	Calibrated - Within Range Laboratory Test Results and near Geomean of Laboratory Test Results (Ramboll, 2021a)	High

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

Zone	Hydrostratigraphic Unit	Materials	ft/d	cm/s	Kh/Kv	Value Source	Sensitivity[1]
Recharge			**Calibration Model**				
1	UD	clay and silt	1.15E-04	0.50	NA	Calibrated	Moderate
2	Fill Unit - PAP	CCR	1.80E-03	7.88	NA	Calibrated	High
3	Fill Unit - Newton Phase II North Landfill	CCR	8.00E-05	0.35	NA	Calibrated	Negligible
4	Fill Unit - Newton Phase II West Landfill	CCR	8.00E-05	0.35	NA	Calibrated	Negligible
5	Fill Unit - Secondary Pond	CCR	8.00E-05	0.35	NA	Calibrated	Negligible
6	Fill Unit - PAP pond north	CCR	8.00E-05	0.35	NA	Calibrated	Negligible
7	Fill Unit - North Pond	CCR	8.00E-05	0.35	NA	Calibrated	Negligible
8	Fill Unit - South Pond	CCR	8.00E-05	0.35	NA	Calibrated	Negligible
9	Fill Unit - Cooling Pond	CCR	8.00E-05	0.35	NA	Calibrated	Negligible
10	NPP	Power Plant footprint	1.00E-05	0.04	NA	Calibrated	Negligible
Storage			**Calibration Model**				
1	UD	clay and silt	*Not used in steady-state calibration model*				
2	UD -Fill (abover riv/drn)	NA					
3	CCR	CCR					
4	UD-PMP	clay and silt					
5	UD-PMP Sand	mixed alluvial deposits in the vicinity of the PAP					
6	UCU	lean clay/Cahokia alluvium					
7	UA	clay and silt					
8	UA-Sand	sand					
9	UA-Gravel	gravel					
10	LCU	lean clay					
River Parameters	**Relative Location**	**River Width (feet)**	**River depth (feet)**	**Bed Thickness (feet)**	**Hydraulic Conductivity (ft/d)**	**Head (feet)**	**River Boundary Conductance (ft^2/d)**
Reach 0	Cooling Flume-0	varaible	5	1	0.9	535.98	5
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	Negligible	Negligible
Reach 1	Cooling Flume-1	varaible	5	1	0.9	520.66	5
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	Negligible	Negligible
Reach 2	Cooling Flume-2	varaible	5	1	0.9	504.60	5
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	Negligible	Negligible
Reach 3	Sandy Creek	10	6	1	7.5	530.0-504.6	2500
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	Negligible	Negligible
Value Source	NA	Calibrated	Calibrated	Calibrated	Calibrated	Estimated based on DEM	Calibrated

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

Drain Parameters	Name	Drain Width (feet)	Drain depth (feet)	Bed Thickness (feet)	Hydraulic Conductivity (ft/d)	Stage (feet)	Drain Conductance (ft^2/d)
Reach 1	Sandy Creek Trib 1	5	3	1	7.5	525.6-548.9	36.8-5161
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	Negligible	Negligible
Reach 2	Sandy Creek Trib 2	5	3	1	7.5	524.2-548	16.6-4541
Sensitivity[1]		- - -	- - -	- - -	- - -	Negligible	Negligible
Reach 3	Sandy Creek Trib 3A	5	3	1	7.5	521-544	129-3988
Sensitivity[1]		- - -	- - -	- - -	- - -	Negligible	Negligible
Reach 4	Sandy Creek Trib 3B	5	3	1	7.5	516-521	2.5-4037.2
Sensitivity[1]		- - -	- - -	- - -	- - -	Low	Negligible
Reach 5	Landfill Stream	5	3	1	7.5	508.6-511	8.7-1153.3
Sensitivity[1]		- - -	- - -	- - -	- - -	Low	Negligible
Reach 6	Landfill Drain	5	3	1	7.5	511-525.9	58.3-769.4
Sensitivity[1]		- - -	- - -	- - -	- - -	Moderate	Low
Reach 7	PAP Stream	5	3	1	7.5	508.6-530	3.3-1325.3
Sensitivity[1]		- - -	- - -	- - -	- - -	Low	Low
Reach 8	Newton Lake Trib 1	5	3	1	7.5	508.6-548	24.7-2282.3
Sensitivity[1]		- - -	- - -	- - -	- - -	Negligible	Negligible
Reach 9	Newton Lake Trib 2	5	3	1	7.5	508.6-537	5.1-1196.7
Sensitivity[1]		- - -	- - -	- - -	---	Negligible	Negligible
Reach 10	Newton Lake Trib 3	5	3	1	7.5	508.6-529.8	54.8-1982.7
Sensitivity[1]		- - -	- - -	- - -	- - -	Negligible	Negligible
Reach 11	Newton Lake Trib 4	5	3	1	7.5	508.6-518	101.98-2895
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	Negligible	Negligible
Reach 12	Newton Lake Trib 5	5	3	1	7.5	5086.-527.3	20.3-4147.1
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	Negligible	Negligible
Reach 13	Newton Lake Trib 6	5	3	1	7.5	508.6-535.5	212.5-5306.7
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	Negligible	Negligible
Reach 14	Newton Lake Trib 7	5	3	1	7.5	508.6-526.9	196.8-3828.5
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	Low	Low
Reach 15	Trib South 1	5	3	1	7.5	523-526.9	515.9-4076.7
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	Negligible	Negligible
Reach 16	Trib South 2	5	3	1	7.5	514-532	5.6-4441.4
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	Negligible	Negligible
Reach 17	Trib South 3	5	3	1	7.5	519-528.6	607.0-4191.6
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	Negligible	Negligible
Reach 18	PAP North drain	5	3	1	7.5	517-537.6	1.48-1998.7
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	Low	Negligible
Value Source	NA	Calibrated	Calibrated	Calibrated	Calibrated	Estimated based on DEM	Calibrated

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

General Head Parameters	Relative Location	Width of General Head Boundary Cell (feet)	Distance to General Head Boundary Head (feet)	Saturated Thickness of Cell (feet)	Hydraulic Conductivity (ft/d)	Head (feet)	General Head Boundary Conductance (ft^2/d)
Reach 0	Northern Model Boundary in UD & PMP	*variable*	1	variable	variable	variable	2.5-18325
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	Negligible	Low
Reach 1	Northern Model Boundary in UA	variable	1	variable	3	490	229-935
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	Moderate	Low
Reach 2	Southern Model Boundary in UA (silt,sand,gravel)	variable	14000	variable	3,3,50	460	0.033-3.4
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	High	High
Value Source	NA	Calibrated	Calibrated	Calibrated	Calibrated	Estimated based on Groundwater Elevation Targets in UD-PMP and UA around the PAP	Calibrated

Notes:
[1] Sensitivity Explanation:
Negligible - SSR changed by less than 1%
Low - SSR change between 1% and 10%
Moderate - SSR change between 10% and 50%
Moderately High - SSR change between 50% and 100%
High - SSR change greater than 100%
SSR = sum of squared residuals
- - - = not tested
CCR = coal combustion residuals
cm/s = centimeters per second
ft/d = feet per day
ft^2/day = feet squared per day
in/yr = inches per year
Kh/Kv = anisotropy ratio
NA = not applicable
PAP = Primary Ash Pond

Hydrostratigraphic Unit
UD = upper drift
LCU = lower confining unit
UA = uppermost aquifer
UCU = upper confining unit
PMP = potential migration pathway

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

Zone	Hydrostratigraphic Unit	Materials	Calibration Model				
			Sulfate Concentration (mg/L)			Value Source	Sensitivity
Initial Concentration							
Entire Domain	NA	NA	0			NA	- - -
Source Concentration (recharge)							
			pre-1985	**post 1985**			
1	UD	clay and silt	0	0		NA	- - -
2	Fill Unit - PAP	CCR	130	130		Sulfate concentration data from XWP02 and XWP03	- - -
3	Fill Unit - Newton Phase II North Landfill	CCR	0	0		NA	- - -
4	Fill Unit - Newton Phase II West Landfill	CCR	0	0		NA	- - -
5	Fill Unit - Secondary Pond	CCR	0	0		NA	- - -
6	Fill Unit - PAP pond north	CCR	0	0		NA	- - -
7	Fill Unit - North Pond	CCR	0	0		NA	- - -
8	Fill Unit - South Pond	CCR	0	0		NA	- - -
9	Fill Unit - Cooling Pond	CCR	0			NA	- - -
10	NPP	NPP	0	0		NA	- - -
11	Fill Unit - PAP	CCR	130	11,000		Sulfate concentration data from XWP01	- - -
12	Fill Unit - PAP	CCR	130	3,000		Sulfate concentration data from XWP04 - calibrated	- - -
Storage, Specific Yield and Effective Porosity			**Calibration Model**				
Zone	**Hydrostratigraphic Unit**	**Materials**	**Storage**	**Specific Yield**	**Effective Porosity**	**Value Source**	**Sensitivity**
1	UD	clay and silt	0.003	0.18	0.18	Ramboll (2021a) HCR	see Table 5-3
2	UD -Fill (abover riv/drn)	NA	0.003	0.5	0.5	Ramboll (2021a) HCR	see Table 5-3
3	CCR	CCR	0.003	0.21	0.21	Ramboll (2021a) HCR	see Table 5-3
4	UD-PMP	clay and silt	0.003	0.18	0.18	Ramboll (2021a) HCR	see Table 5-3
5	UD-PMP Sand	mixed alluvial deposits in the vicinity of the PAP	0.003	0.18	0.18	Ramboll (2021a) HCR	see Table 5-3
6	UCU	lean clay/Cahokia alluvium	0.003	0.15	0.15	Ramboll (2021a) HCR	see Table 5-3
7	UA	clay and silt	0.003	0.11	0.11	Ramboll (2021a) HCR	see Table 5-3
8	UA-Sand	sand	0.003	0.11	0.11	Ramboll (2021a) HCR	see Table 5-3
9	UA-Gravel	gravel	0.003	0.11	0.11	Ramboll (2021a) HCR	see Table 5-3
10	LCU	lean clay	0.003	0.155	0.155	Ramboll (2021a) HCR	see Table 5-3
Dispersivity							
Applicable Region	**Hydrostratigraphic Unit**	**Materials**	**Longitudinal (feet)**	**Transverse (feet)**	**Vertical (feet)**	**Value Source**	**Sensitivity**
Cahokia Alluvium	UCU	alluvial deposits	20	2	0.2	calibrated	see Table 5-3
Entire Domain	NA	NA	1	0.1	0.01	calibrated	- - -

Notes:
[1] The concentrations from the end of the calibrated transport model were imported as initial concentrations for the prediction model runs.
- - - = not tested
CCR = coal combustion residuals
mg/L = milligrams per liter
NA = not applicable
PAP = Primary Ash Pond

Hydrostratigraphic Unit
UD = upper drift
LCU = lower confining unit
UA = uppermost aquifer
UCU = upper confining unit
PMP = potential migration pathway

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TABLE 5-3. TRANSPORT MODEL INPUT SENSITIVITY (CALIBRATION)
GROUNDWATER MODELING REPORT
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

		Storage and Specific Yield				Effective Porosity				Dispersivity			
Well ID	Calibration on Concentration (mg/L)	Concentration (mg/L)	Sensitivity [1]	Concentration (mg/L)	Sensitivity [1]	Concentration (mg/L)	Sensitivity [1]	Concentration (mg/L)	Sensitivity [1]	Concentration (mg/L)	Sensitivity [1]	Concentration (mg/L)	Sensitivity [1]
APW02	3960.7	3960.5	Negligible	3960.8	Negligible	3982.6	Negligible	3947.1	Negligible	3947.1	Negligible	3960.7	Negligible
APW03	128.9	128.9	Negligible	128.9	Negligible	129.1	Negligible	128.7	Negligible	128.7	Negligible	128.7	Negligible
APW04	1676.9	1676.9	Negligible	1677.0	Negligible	1684.9	Negligible	1664.8	Negligible	1664.8	Negligible	1669.8	Negligible
APW05	0.3	0.3	Negligible	0.3	Negligible	0.8	High	0.2	Moderate	0.2	Moderately High	0.3	Negligible
APW05S	116.3	116.4	Negligible	116.3	Negligible	119.5	Low	113.6	Low	113.6	Low	116.3	Negligible
APW06	0.0	0.0	Negligible	0.0	Negligible	0.0	High	0.0	Moderately High	0.0	Moderately High	0.0	Negligible
APW07	15.7	15.7	Negligible	15.7	Negligible	45.5	High	6.9	Moderately High	6.9	Moderately High	15.7	Negligible
APW08	9.9	9.9	Negligible	9.9	Negligible	38.2	High	3.8	Moderately High	3.8	Moderately High	11.7	Moderate
APW09	16.3	16.3	Negligible	16.3	Negligible	54.8	High	7.0	Moderately High	7.0	Moderately High	22.0	Moderate
APW10	340.4	340.3	Negligible	340.3	Negligible	522.1	Moderately High	226.6	Moderate	226.6	Moderate	467.7	Moderate
APW11	2.5	2.5	Negligible	2.5	Negligible	5.8	High	1.2	Moderately High	1.2	Moderately High	2.5	Negligible
APW12	984.8	984.8	Negligible	984.8	Negligible	1205.2	Moderate	733.7	Moderate	733.7	Moderate	954.4	Low
APW13	85.2	85.2	Negligible	85.1	Negligible	150.5	Moderately High	48.8	Moderate	48.8	Moderate	118.5	Moderate
APW14	96.8	96.8	Negligible	96.7	Negligible	165.0	Moderately High	57.1	Moderate	57.1	Moderate	131.5	Moderate
APW15	9.0	9.0	Negligible	9.0	Negligible	37.9	High	2.0	Moderately High	2.0	Moderately High	11.6	Moderate
APW16	1.8	1.8	Negligible	1.8	Negligible	7.7	High	0.8	Moderately High	0.8	Moderately High	2.8	Moderately High
APW17	15.9	15.9	Negligible	15.9	Negligible	51.7	High	6.2	Moderately High	6.2	Moderately High	15.9	Negligible
APW18	87.6	87.6	Negligible	87.6	Negligible	209.9	High	41.0	Moderately High	41.0	Moderately High	87.7	Negligible
		S*0.1 Sy*0.5[2]		S*10 Sy*2[2]		Porosity-0.05		Porosity+0.05		Disp zone 11*0.5		Disp zone 11*1.5	

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] sensitivity test used steady state flow and transient transport
ID = identification
mg/L = milligrams per liter
S = storativity
Sy = specific yield
Disp = dispersivity

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

Closure Scenario Number (Drainage Length)	Primary and Secondary AP- CBR	Primary and Secondary AP - CIP Removal Area	Primary Ash Pond - CIP Consolidation and Cover System Area	Landfill Consolidation Area 1 and 2	Notes
Input Parameter					
Climate-General					
City	Newton, IL	Newton, IL	Newton, IL	Newton, IL	Nearby city to the Site within HELP database
Latitude	38.93	38.93	38.93	38.93	Site latitude
Evaporative Zone Depth	18	18	18	18	Estimated based on geographic location (Illinois) and uppermost soil type (Tolaymat, T. and Krause, M 2020)
Maximum Leaf Area Index	4.5	4.5	4.5	4.5	Maximum for geographic location (Illinois) (Tolaymat, T. and Krause, M, 2020)
Growing Season Period, Average Wind Speed, and Quarterly Relative Humidity	Terre Haute, IN	Terre Haute, IN	Terre Haute, IN	Terre Haute, IN	Nearby city to the Newton Ash Pond within HELP database
Number of Years for Synthetic Data Generation	30	30	30	30	
Temperature, Evapotranspiration, and Precipitation	Precipitation, temperature, and solar radiation was simulated based on HELP V4 weather simulation for: Lat/Long: 38.93/-88.28	Precipitation, temperature, and solar radiation was simulated based on HELP V4 weather simulation for: Lat/Long: 38.93/-88.28	Precipitation, temperature, and solar radiation was simulated based on HELP V4 weather simulation for: Lat/Long: 38.93/-88.28	Precipitation, temperature, and solar radiation was simulated based on HELP V4 weather simulation for: Lat/Long: 38.93/-88.29	
Soils-General					
% where runoff possible	100	100	100	100	
Area (acres)	413.3	148.3	265	11.7	CBR - Removal Area based on HCR (Ramboll, 2021); CIP - Consolidation and Cover System Area based on construction drawing for Newton Primary and Secondary Ash Pond; CIP -Removal Area equals the difference; Landfill Consolidation Area based on HDR drawings
Specify Initial Moisture Content	No	No	No	No	
Surface Water/Snow	Model Calculated	Model Calculated	Model Calculated	Model Calculated	
Soils-Layers					
1	Unsaturated UD Material (HELP Final Cover Soil)	Unsaturated UD Material (HELP Final Cover Soil)	Vegetative Soil Layer (HELP Final Cover Soil [topmost layer])	Protective Cover Layer (HELP Final Cover Soil [topmost layer])	Layers details for CBR, CIP, and Landfill areas based on grading plans, construction drawings, and cover system design for Newton Ash Pond and Landfill
2			Protective Soil Layer (HELP Vertical Percolation Layer)	Protective Cover Layer (HELP Vertical Percolation Layer)	
3			Geocomposite Drainage Layer(HELP Geosynthetic Drainage Net)	Geocomposite Drainage Layer(HELP Geosynthetic Drainage Net)	
4			Geomembrane Liner	Geomembrane Liner	
5			Unsaturated CCR Material (HELP Waste)	Unsaturated CCR Material (HELP Waste)	
6				Geocomposite Drainage Layer	
7				Geomembrane Liner	
8				Clay Liner	

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

Closure Scenario Number (Drainage Length)	Primary and Secondary AP- CBR	Primary and Secondary AP - CIP Removal Area	Primary Ash Pond - CIP Consolidation and Cover System Area	Landfill Consolidation Area 1 and 2	Notes
Soil Parameters--Layer 1					
Type	1	1	1	1	Vertical Percolation Layer (Cover Soil)
Thickness (in)	60	60	6	4	For CBR and CIP removal areas, layer 1 thickness is the average thickness of unsaturated backfill material placed after removal
Texture	43	43	10	10	Defaults used
Description	Silty Clay	Silty Clay	Sandy Clay Loam	Sandy Clay Loam	
Saturated Hydraulic Conductivity (cm/s)	1.45E-06	1.45E-06	1.20E-04	1.20E-04	Hydraulic conductivity supplied by HDR construction plans
Soil Parameters--Layer 2					
Type	--	--	1	1	Vertical Percolation Layer (PAP) and Cover Soil (Landfill)
Thickness (in)	--	--	18	32	design thickness
Texture	--	--	43	43	Custom for Ash Pond - CIP Consolidation and Cover System Area and default for landfill
Description	--	--	Sandy Silty Clay	Sandy Silty Clay	
Saturated Hydraulic Conductivity (cm/s)	--	--	1.00E-05	1.00E-05	Custom for PAP and default for landfill
Soil Parameters--Layer 3					
Type	--	--	2	2	Lateral Drainage Layer
Thickness (in)	--	--	0.2	0.2	design thickness
Texture	--	--	20	20	Defaults used
Description	--	--	Drainage Net (0.5cm)	Drainage Net (0.5cm)	
Saturated Hydraulic Conductivity (cm/s)	--	--	1.00E+01	1.00E+01	Defaults used
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)	--	--	156	768	design thickness
Texture	--	--	30	30	Defaults used
Description	--	--	High-Density Electric Plant Coal Fly Ash	High-Density Electric Plant Coal Fly Ash	
Saturated Hydraulic Conductivity (cm/s)		--	5.00E-05	5.00E-05	defaults used

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

Closure Scenario Number (Drainage Length)	Primary and Secondary AP- CBR	Primary and Secondary AP - CIP Removal Area	Primary Ash Pond - CIP Consolidation and Cover System Area	Landfill Consolidation Area 1 and 2	Notes
Soil Parameters--Layer 6					
Type	--	--	--	2	Drainage Liner
Thickness (in)	--	--	--	12	design thickness
Texture	--	--	--	44	Defaults used
Description	--	--	--	Drainage Layer	
Saturated Hydraulic Conductivity (cm/s)		--	--	1.00E-01	Defaults used
Soil Parameters--Layer 7					
Type	--	--	--	4	Flexible Membrane Liner
Thickness (in)	--	--	--	0.06	design thickness
Texture	--	--	--	35	Defaults used
Description	--	--	--	HDPE Membrane	
Saturated Hydraulic Conductivity (cm/s)		--	--	2.00E-13	Defaults used
Soil Parameters--Layer 8					
Type	--	--	--	3	Drainage Liner
Thickness (in)	--	--	--	36	design thickness
Texture	--	--	--	16	Defaults used
Description	--	--	--	Liiner Soil (High)	
Saturated Hydraulic Conductivity (cm/s)	--	--	--	1.00E-07	Defaults used
Soils--Runoff					
Runoff Curve Number	88.7	88.9	84.4	89.8	HELP-computed curve number
Slope	1.00%	1.00%	2.00%	2.00%	Estimated from construction design drawings
Length (ft)	3600	2300	1500	600	estimated maximum flow path
Vegetation	fair	fair	fair	fair	fai rindicating fair stand of grass on sruface of soil backfill
Execution Parameters					
Years	30	30	30	30	
Report Daily	No	No	No	No	
Report Monthly	No	No	No	No	
Report Annual	Yes	Yes	Yes	Yes	
Output Parameter					
Unsaturated Percolation Rate (in/yr)	**4.38**	**4.29**	**0.042**	**0.000003**	

Notes:
% = 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:

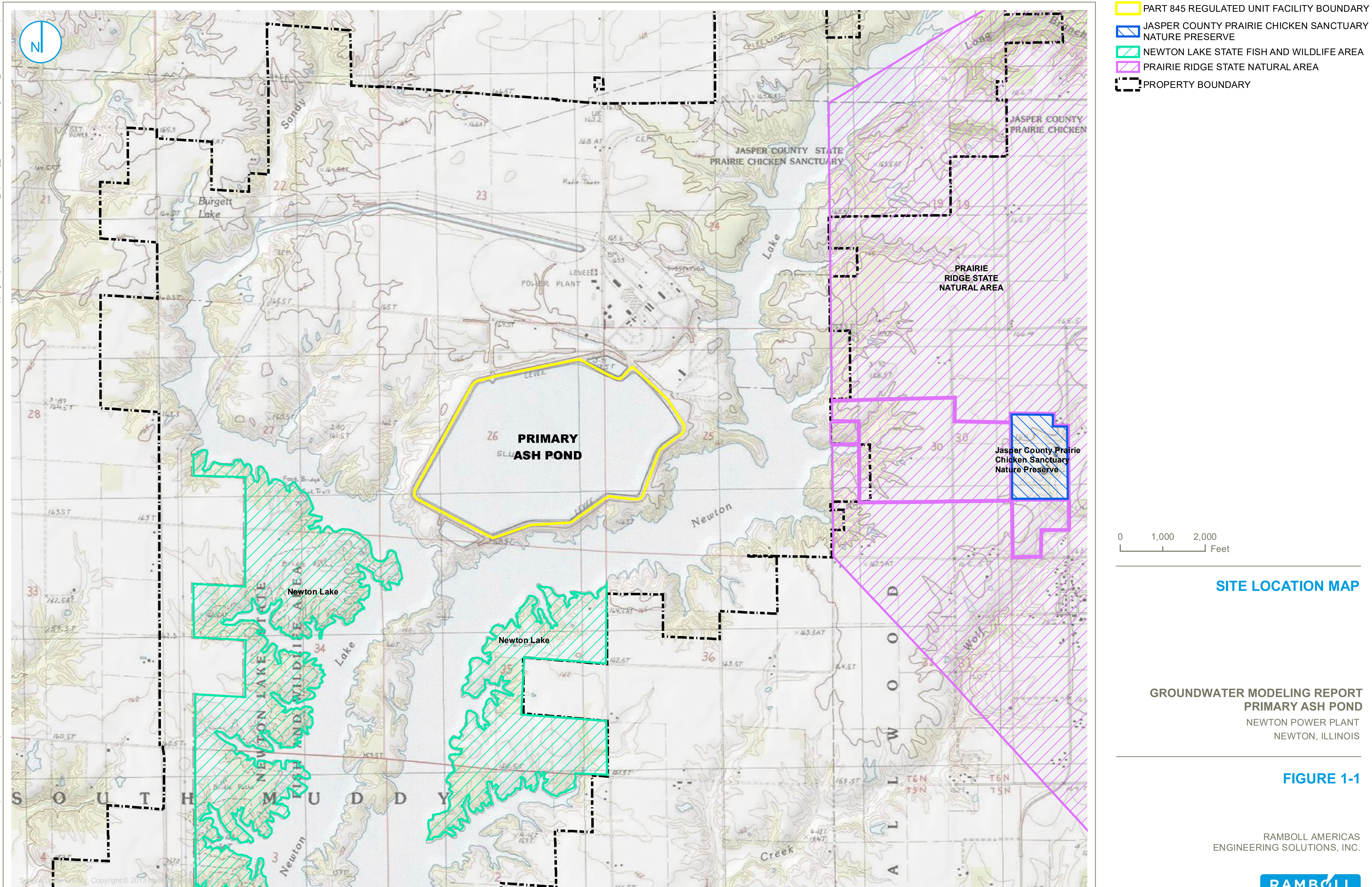
Tolaymat, T. and Krause, M, 2020. Hydrologic Evaluation of Landfill Performance: HELP 4.0 User Manual . United States Environmental Protection Agency, Washington, DC, EPA/600/B 20/219.
Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021. Hydrogeologic Site Characterization Report. Newton Primary Ash Pond. Newton Power Plant. Newton, Illinois.

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

Hydrostratigraphic Unit/Recharge Area	Notes	Recharge Zone	Sulfate Concentration (mg/L)	Recharge (ft/day)	Recharge (in/yr)	Constant Concentration Layer	Constant Concentration (mg/L)
Scenario 1: CIP							
Fill Unit - PAP	CCR	2	130	8.90E-06	0.039	2&3	130.0
Fill Unit - PAP	CCR	11	11,000	8.90E-06	0.039	-	-
Fill Unit - PAP	CCR	12	3,000	8.90E-06	0.039	-	-
Removal Area - PAP	FILL	13	0	9.93E-04	4.35	-	
Scenario 2: CBR							
Removal Area - PAP	FILL	2	0	1.00E-03	4.38	-	-
Removal Area - PAP	FILL	11	0	1.00E-03	4.38	-	-
Removal Area - PAP	FILL	12	0	1.00E-03	4.38	-	-

Notes:
CCR = coal combustion residuals
mg/L = milligrams per liter
ft/day = feet per day
in/yr = inches per year
PAP = Primary Ash Pond

FIGURES



SITE LOCATION MAP

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 1-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure 1-1_Site Location Map.mxd

PROJECT: 1940101010-007 | DATED: 4/11/2022 | DESIGNER: STOLZSD

PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
PROPERTY BOUNDARY

0 500 1,000 Feet

SITE MAP

GROUNDWATER MODELLING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 1-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\Model_Figures\Newton\Groundwater_Modelling_Report_2022\Figure 1_Site Map.mxd

PROJECT: 194010010-007 | DATED: 3/29/2022 | DESIGNER: galarnmc

PORE WATER WELL
MONITORING WELL
STAFF GAGE, CCR UNIT
STAFF GAGE, RIVER
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE

0 400 800 Feet

MONITORING WELL LOCATION MAP

GROUNDWATER MODELLING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

PROJECT: 194010101 0-007 | DATED: 3/29/2022 | DESIGNER: galammc

Y:\Mapping\Projects\22\2285\MXD\Model_Figures\Newton\Groundwater_Modelling_Report_2022\Figure 3_Monitoring Well Location Map.mxd

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Newton\Figure 3-3_GWE_Contours_20210427.mxd

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE

NOTES:
1. ELEVATIONS IN PARENTHESES WERE NOT USED FOR CONTOURING.
2. NM = NOT MEASURED
3. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988

0 400 800 Feet

UPPERMOST AQUIFER GROUNDWATER ELEVATION CONTOURS APRIL 27, 2021

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 2-2

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 194010101010-007 | DATED: 10/19/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\23\2285\MXD\845_Operating_Permit\Newton\Figure 3-4_GWE_Contours_20210714.mxd

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE

NOTES:

1.ELEVATIONS IN PARENTHESIS WERE NOT USED FOR CONTOURING.
2. NM = NOT MEASURED
3. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988

0 400 800 Feet

UPPERMOST AQUIFER GROUNDWATER ELEVATION CONTOURS
JULY 14, 2021

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

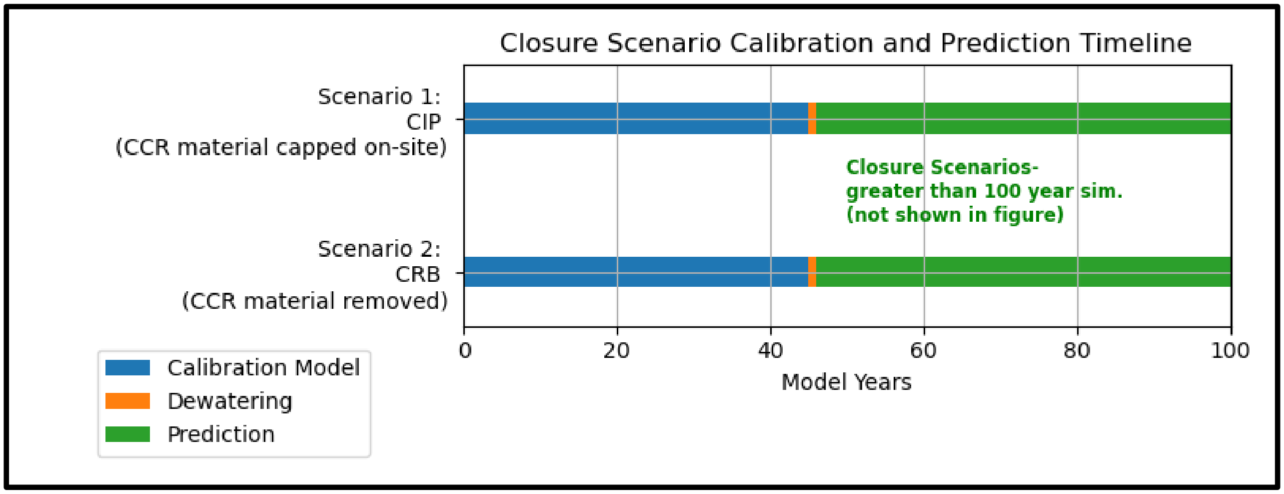
FIGURE 2-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 194010101010-007 | DATED: 10/19/2021 | DESIGNER: STOLZSD

FIGURE 4-1



CLOSURE SCENARIO CALIBRATION AND PREDICTION MODEL

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTOWN POWER PLANT
NEWTOWN, ILLINOIS

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\Model_Figures\Newton\Groundwater_Modelling_Report_2022\Figure 4_Model Domain.mxd

PROJECT: 194010010-007 | DATED: 3/29/2022 | DESIGNER: galarnmc

CCR
UD
UA
RIVER
LAKE
COOLING FLUME
MODEL DOMAIN
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE

0 0.25 0.5 Miles

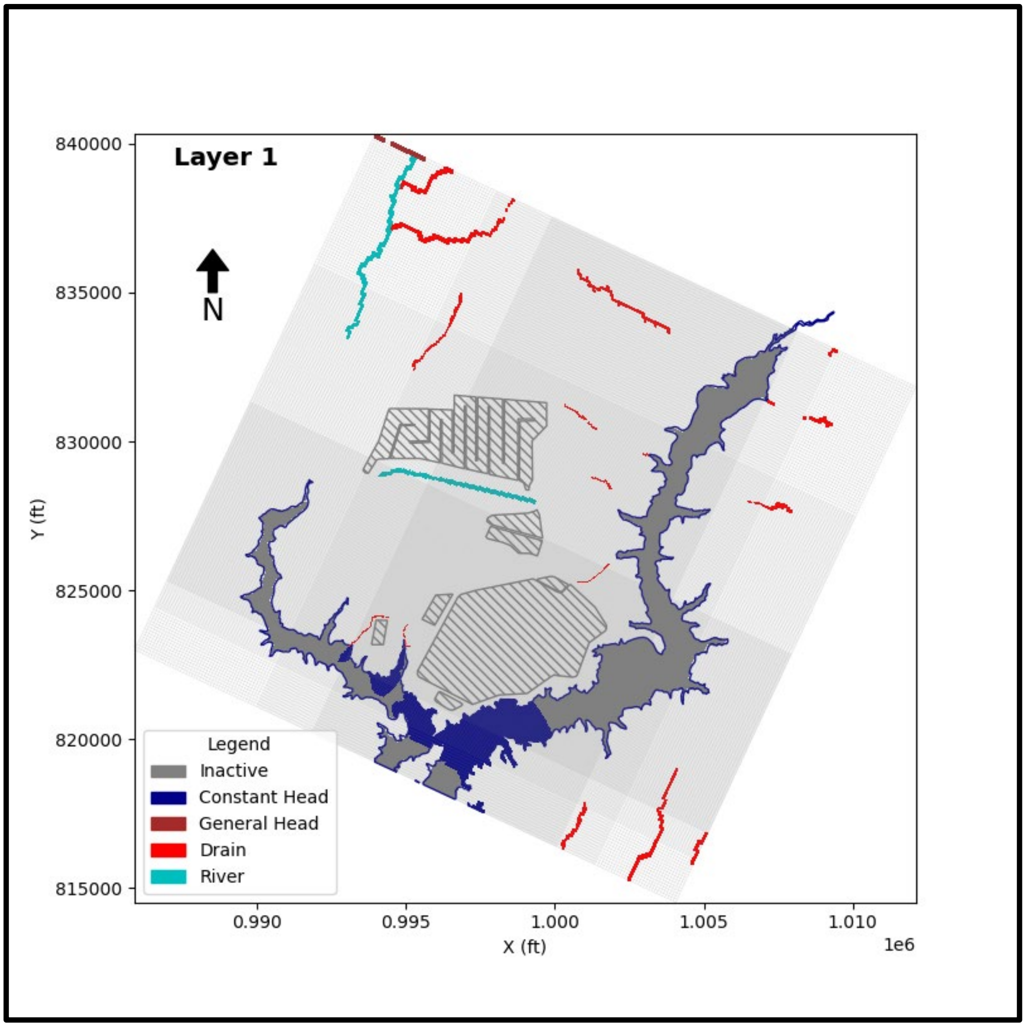
MODEL AREA MAP

GROUNDWATER MODELLING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

FIGURE 5-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

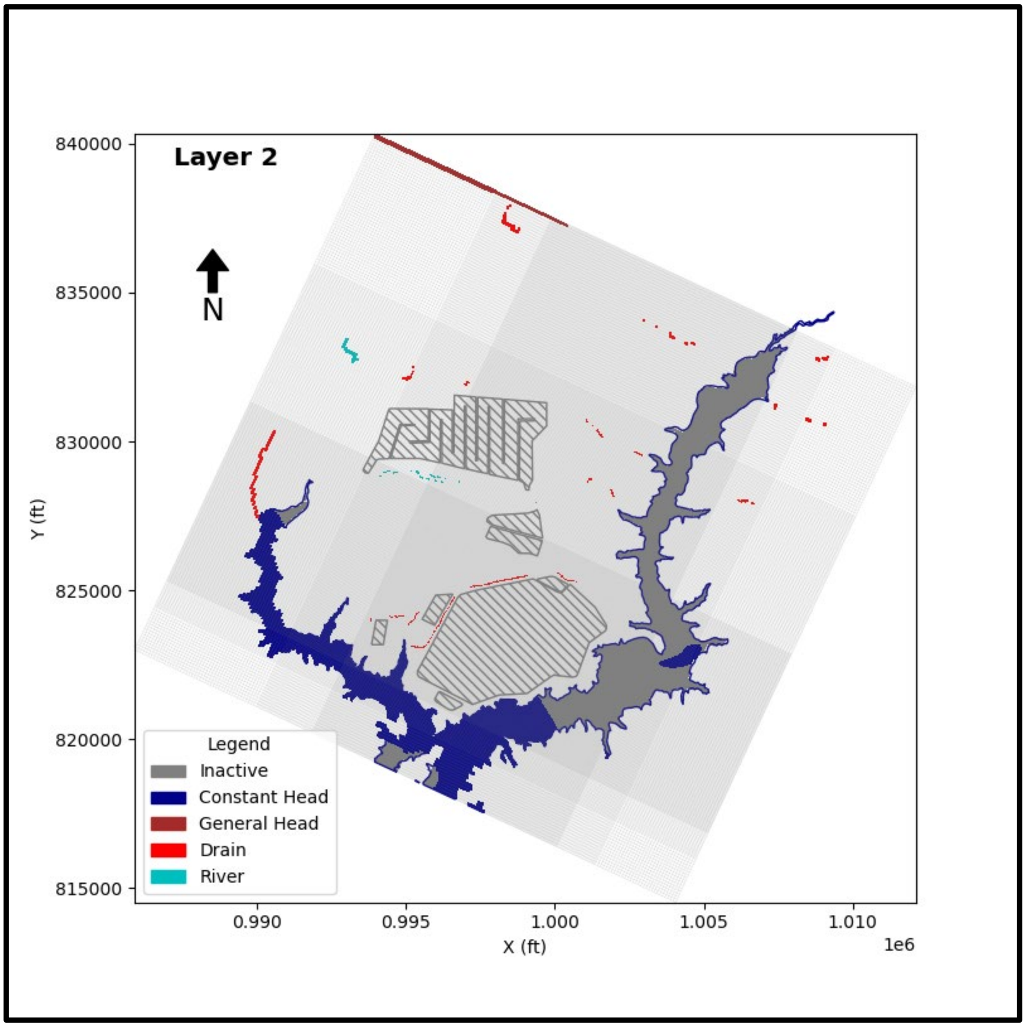
RAMBOLL



BOUNDARY CONDITIONS FOR LAYER 1 OF THE CALIBRATED NUMERICAL MODEL

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

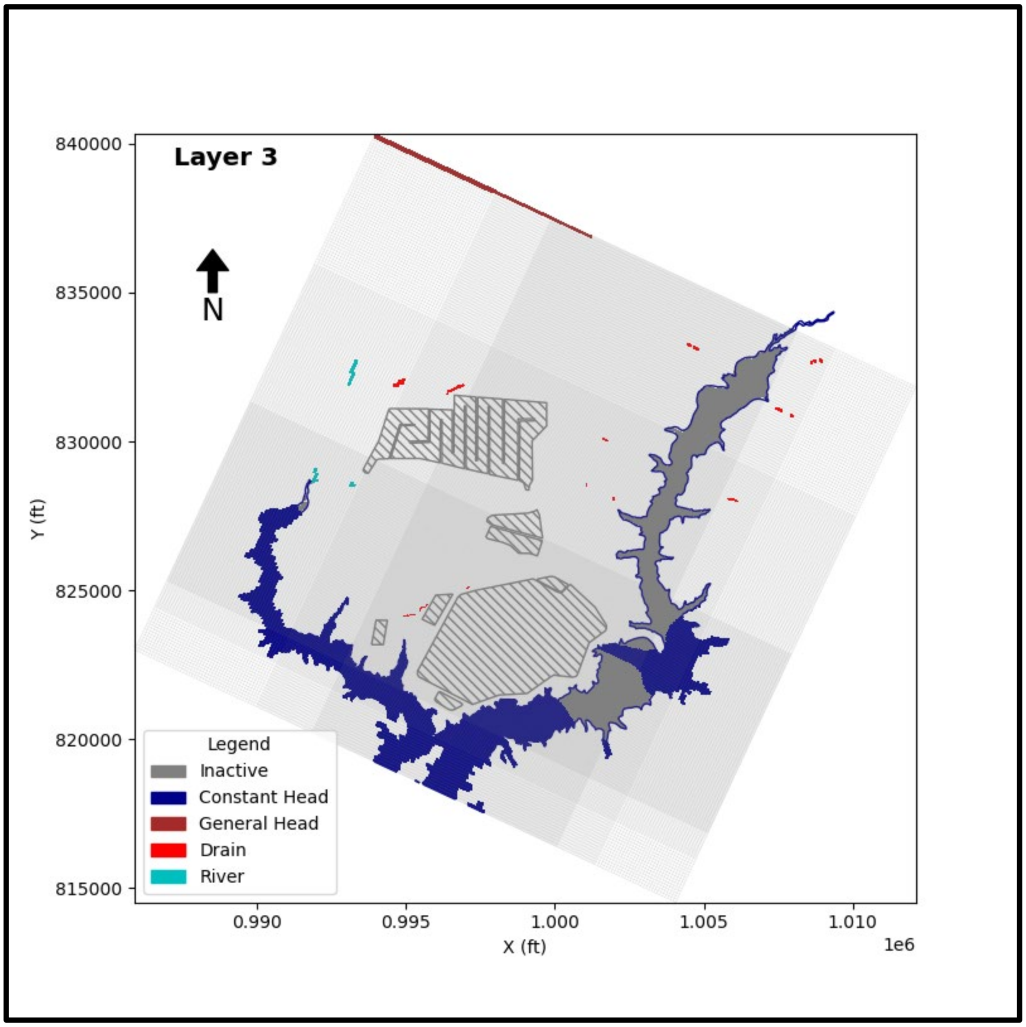
FIGURE 5-3



BOUNDARY CONDITIONS FOR LAYER 2 OF THE CALIBRATED NUMERICAL MODEL

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

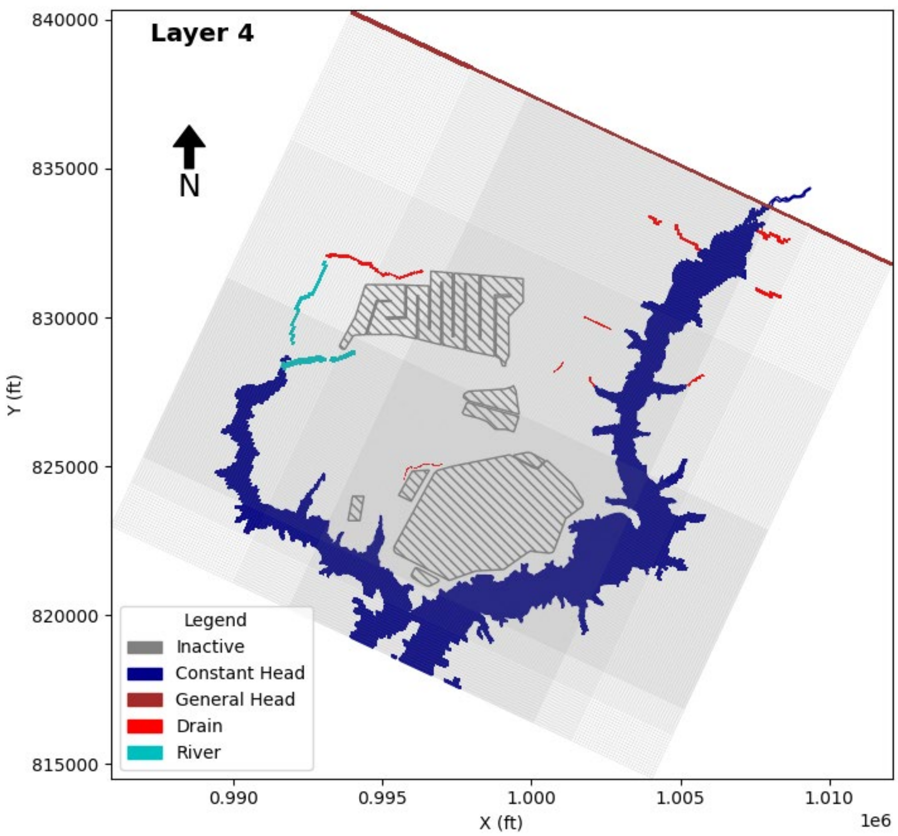
RAMBOLL



BOUNDARY CONDITIONS FOR LAYER 3 OF THE CALIBRATED NUMERICAL MODEL

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

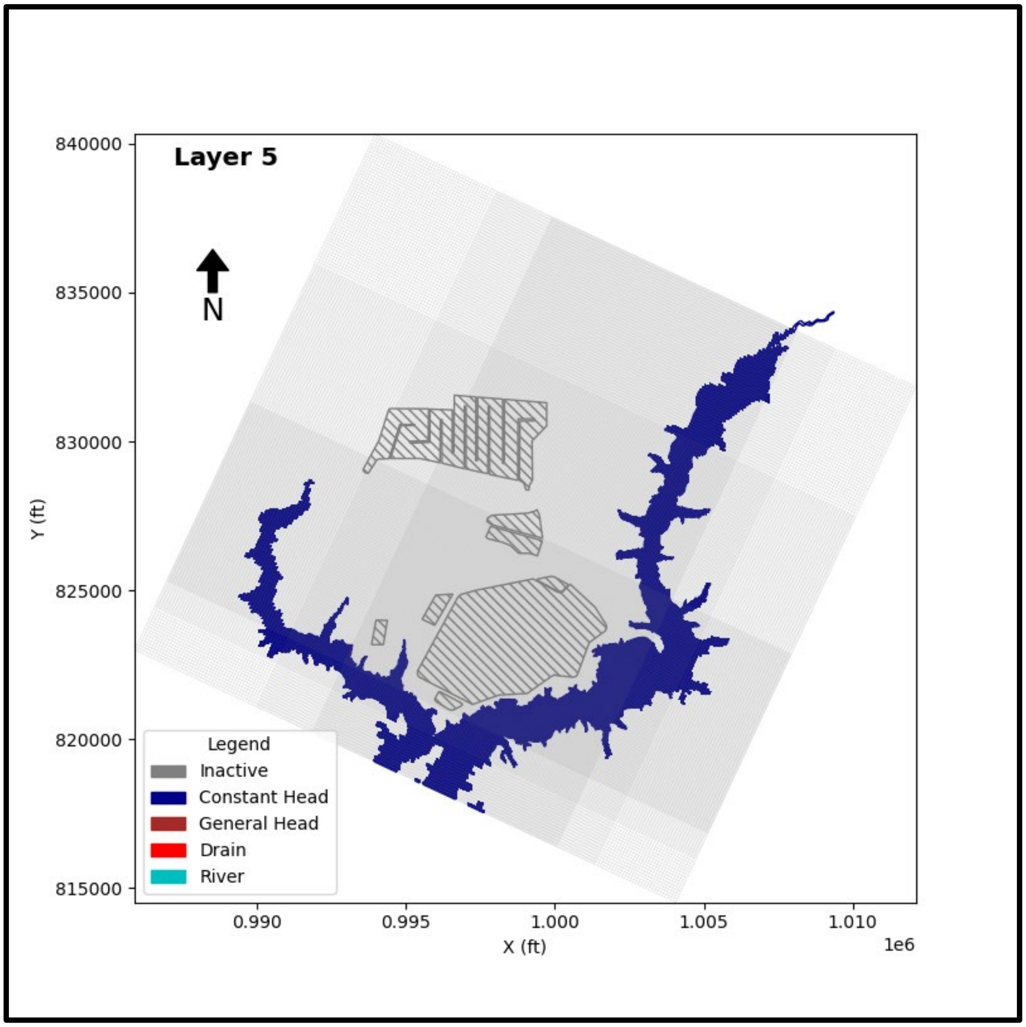
RAMBOLL



BOUNDARY CONDITIONS FOR LAYER 4 OF THE CALIBRATED NUMERICAL MODEL

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

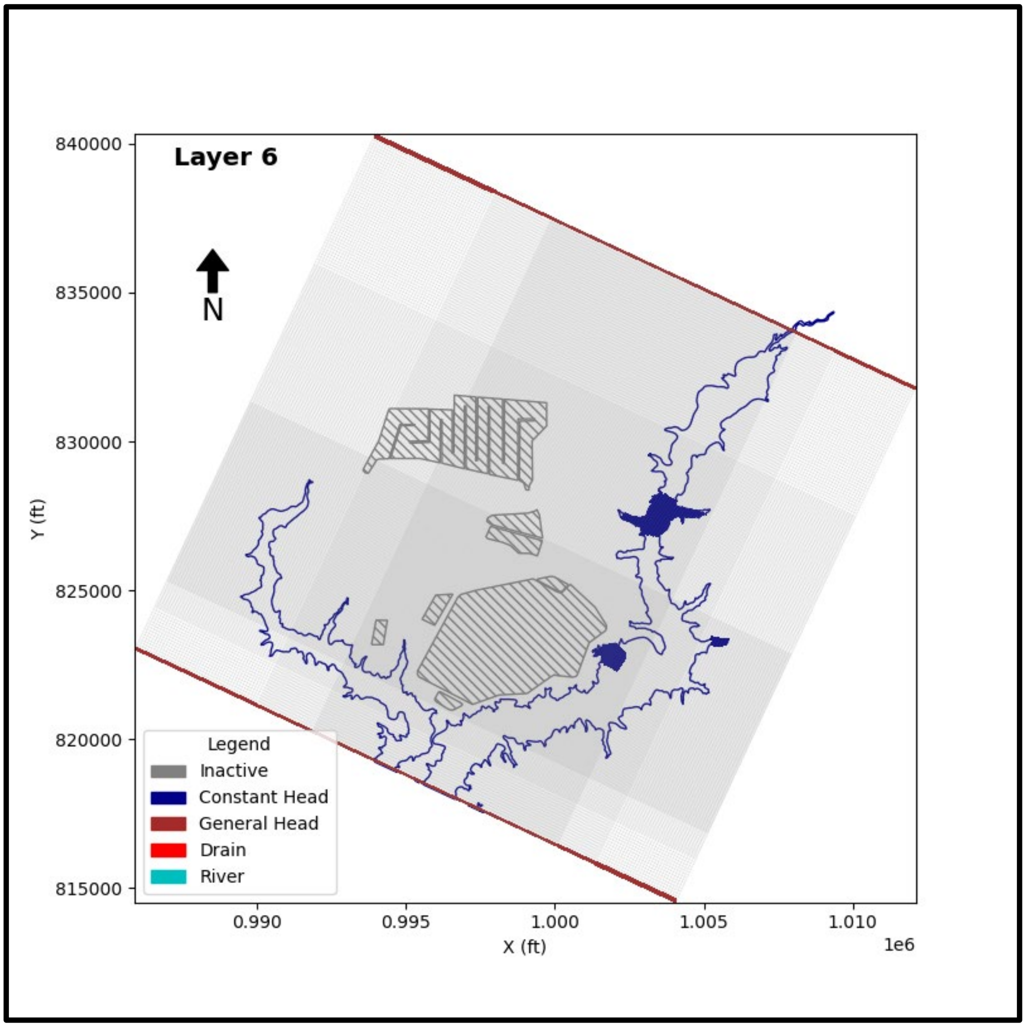
RAMBOLL



BOUNDARY CONDITIONS FOR LAYER 5 OF THE CALIBRATED NUMERICAL MODEL

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

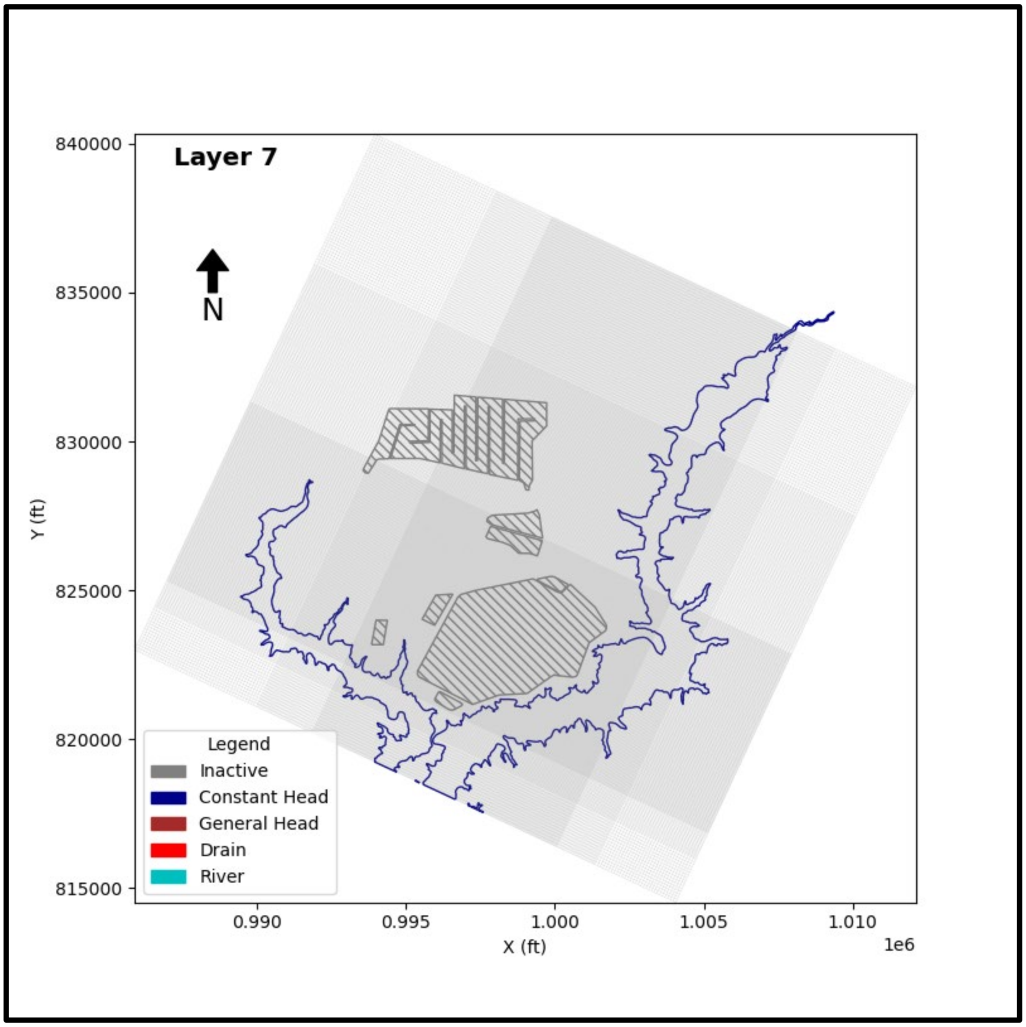
RAMBOLL



BOUNDARY CONDITIONS FOR LAYER 6 OF THE CALIBRATED NUMERICAL MODEL

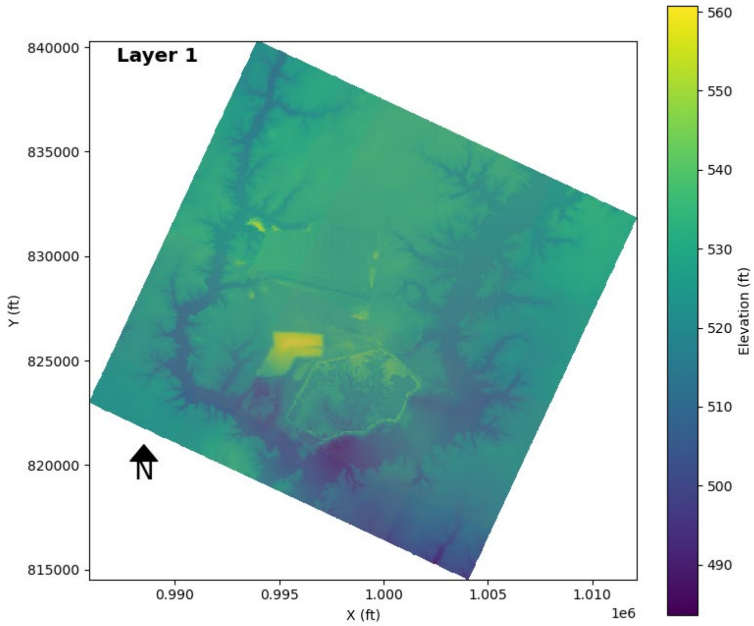
GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL



BOUNDARY CONDITIONS FOR LAYER 7 OF THE CALIBRATED NUMERICAL MODEL

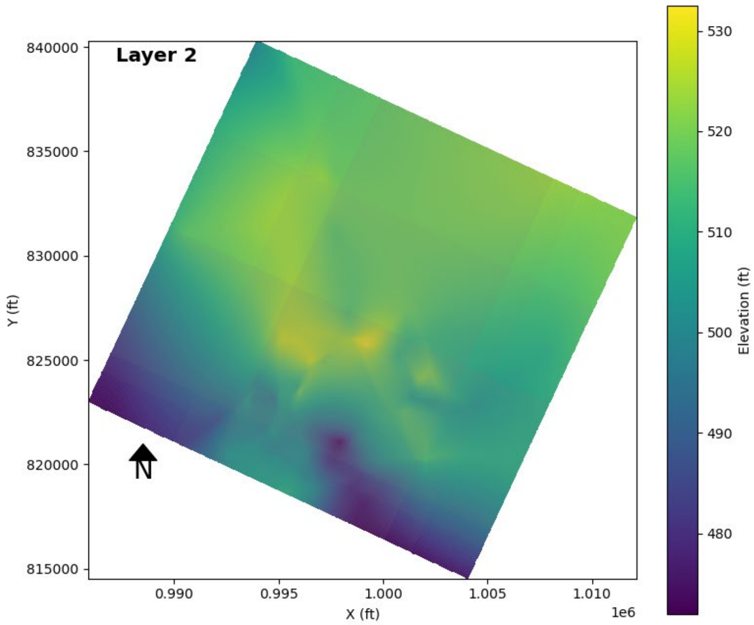
GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS



BASE OF MODEL LAYER 1

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

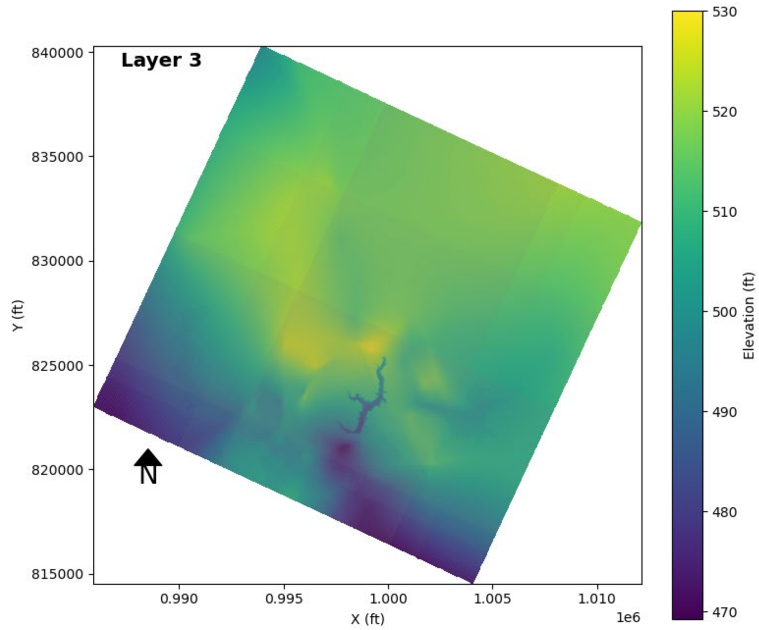
FIGURE 5-10



BASE OF MODEL LAYER 2

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

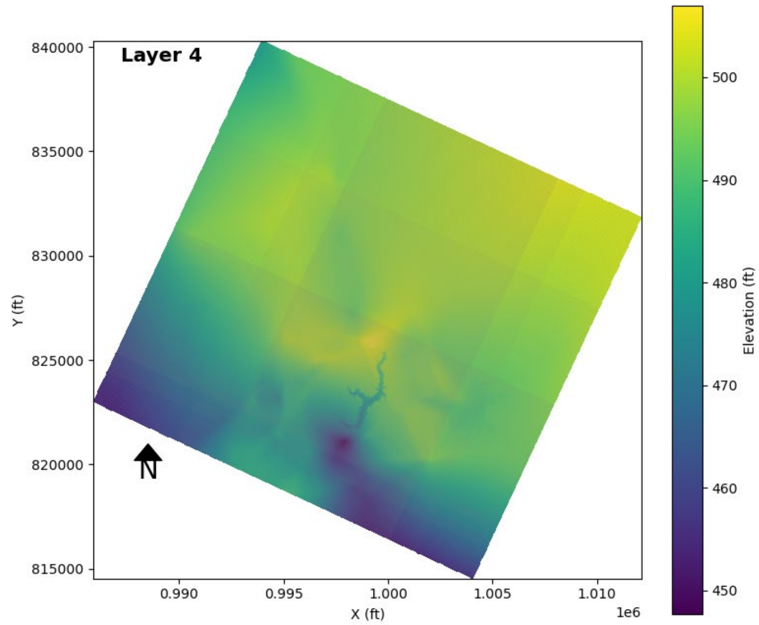
RAMBOLL



BASE OF MODEL LAYER 3

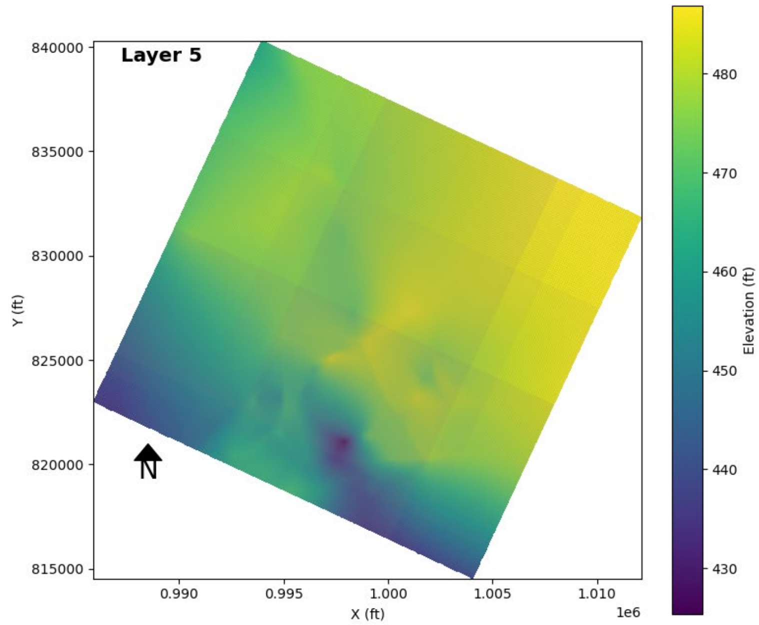
GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL



BASE OF MODEL LAYER 4

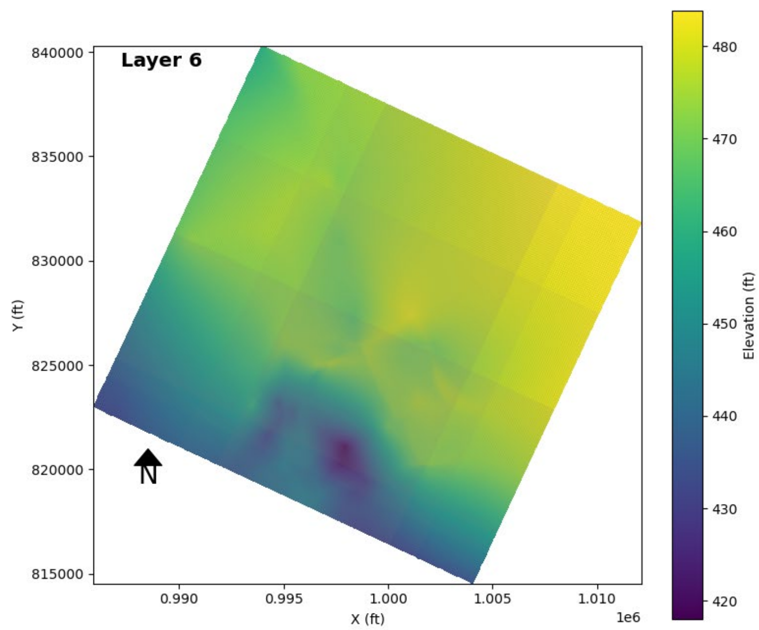
GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS



BASE OF MODEL LAYER 5

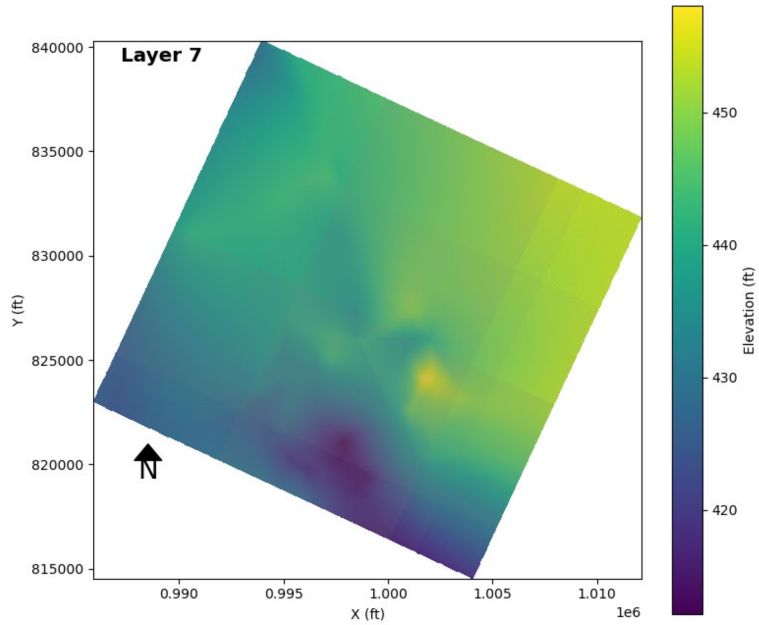
GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL



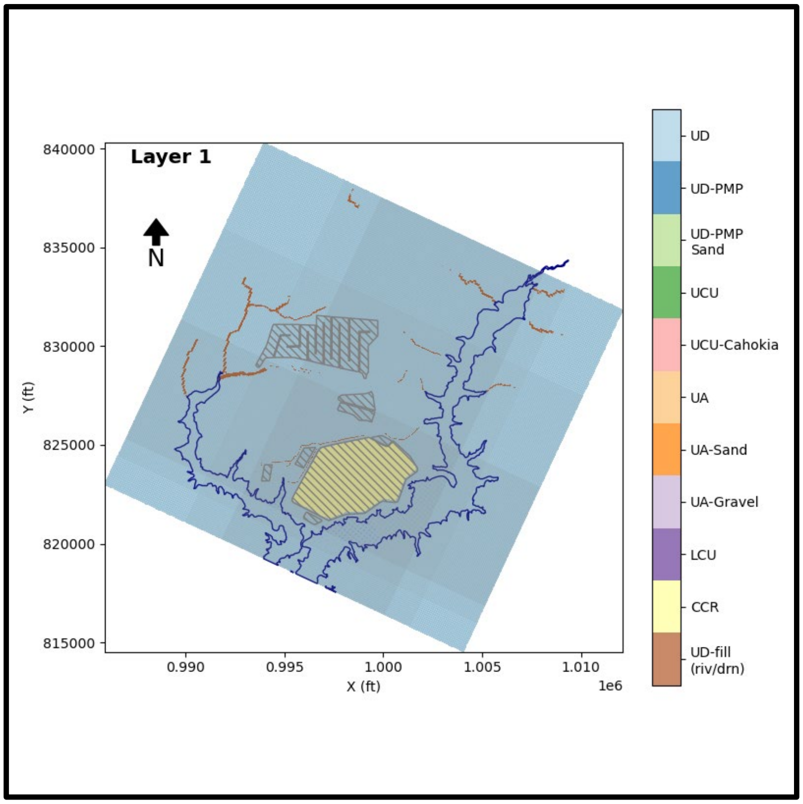
BASE OF MODEL LAYER 6

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS



BASE OF MODEL LAYER 7

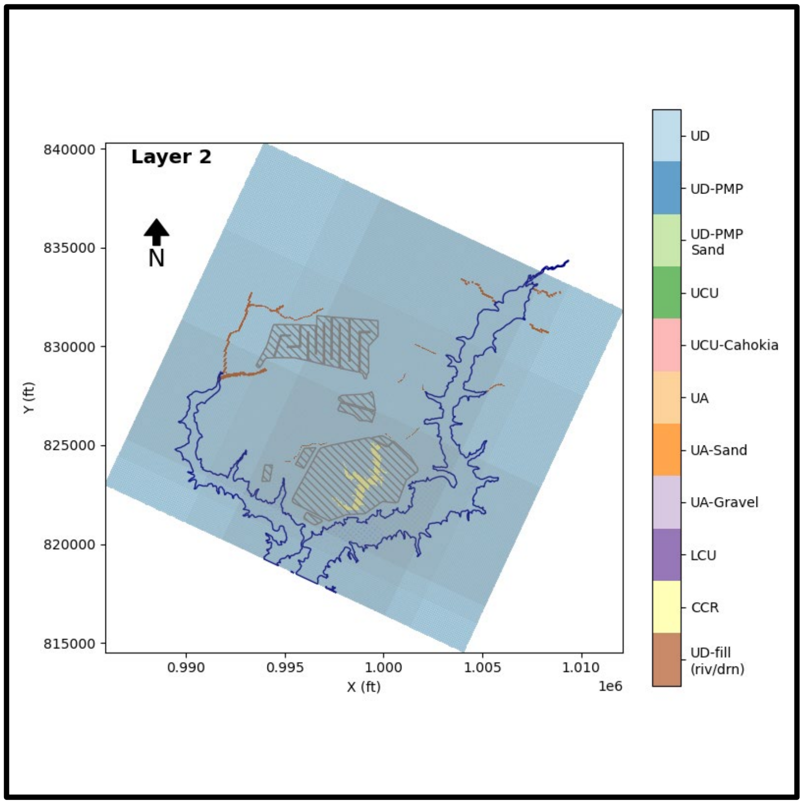
GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS



SPATIAL DISTRIBUTION OF HYDROSTRATIGRAPHIC LAYERS FOR LAYER 1 IN THE NUMERICAL MODEL

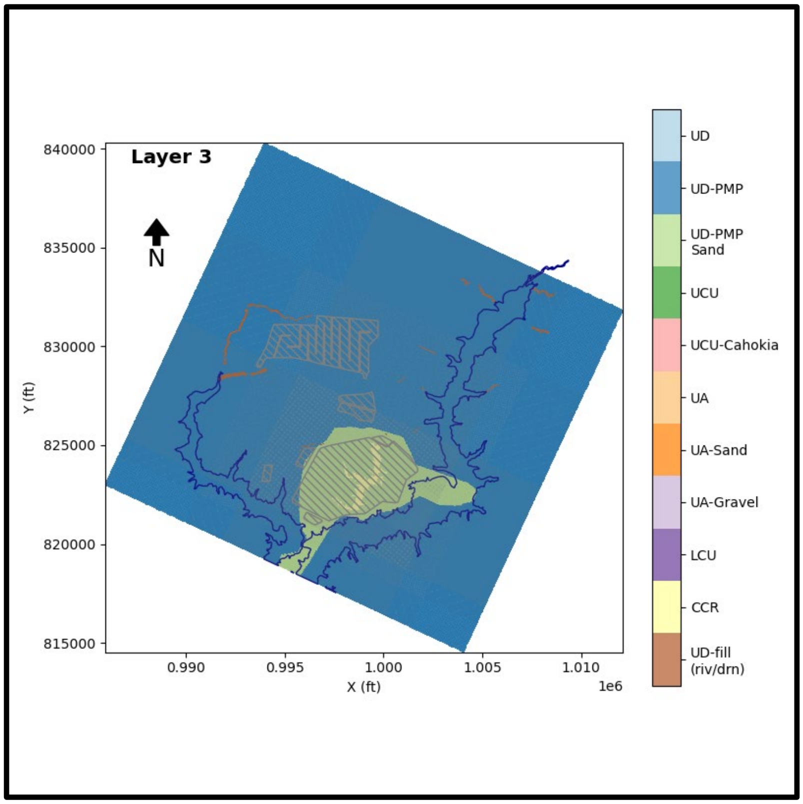
GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL



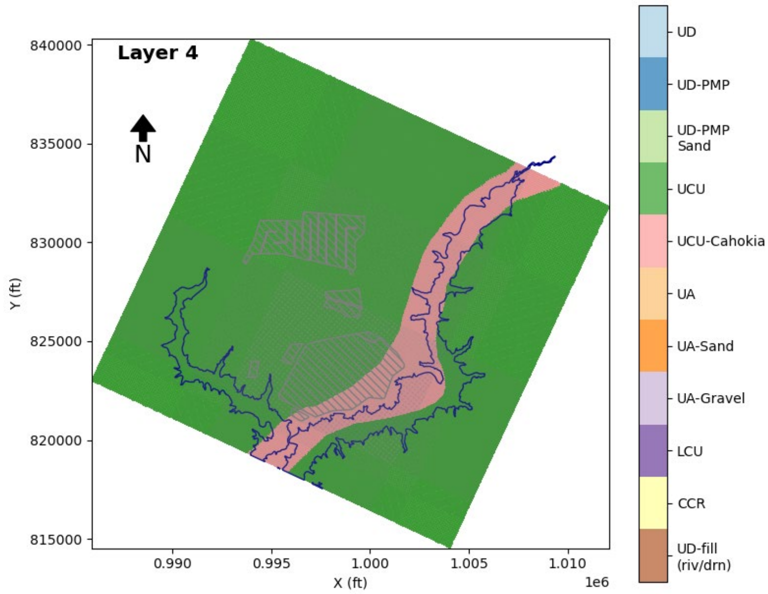
SPATIAL DISTRIBUTION OF HYDROSTRATIGRAPHIC LAYERS FOR LAYER 2 IN THE NUMERICAL MODEL

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS



SPATIAL DISTRIBUTION OF HYDROSTRATIGRAPHIC LAYERS FOR LAYER 3 IN THE NUMERICAL MODEL

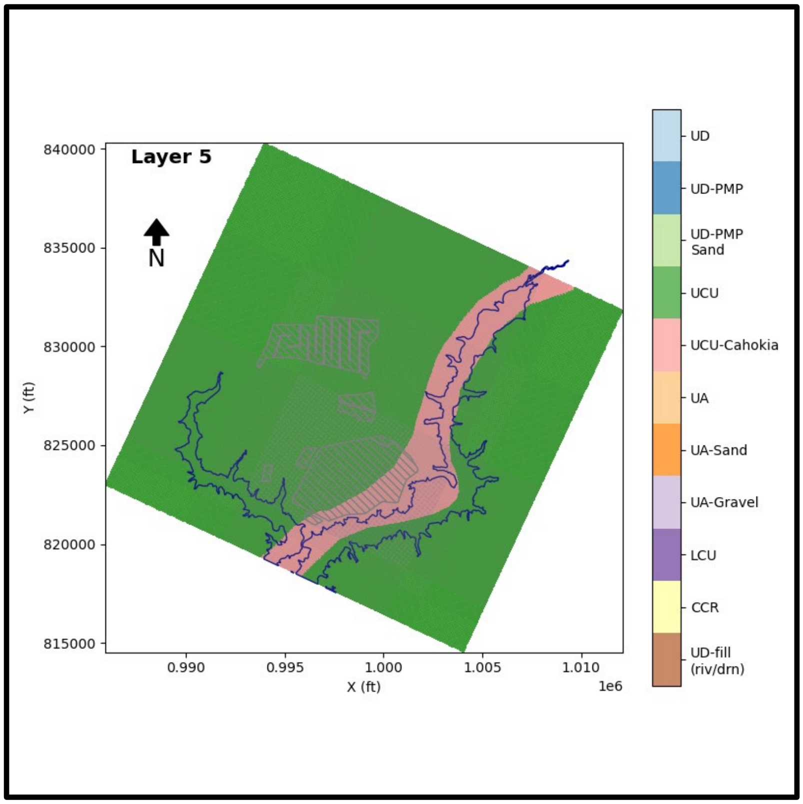
GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS



SPATIAL DISTRIBUTION OF HYDROSTRATIGRAPHIC LAYERS FOR LAYER 4 IN THE NUMERICAL MODEL

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

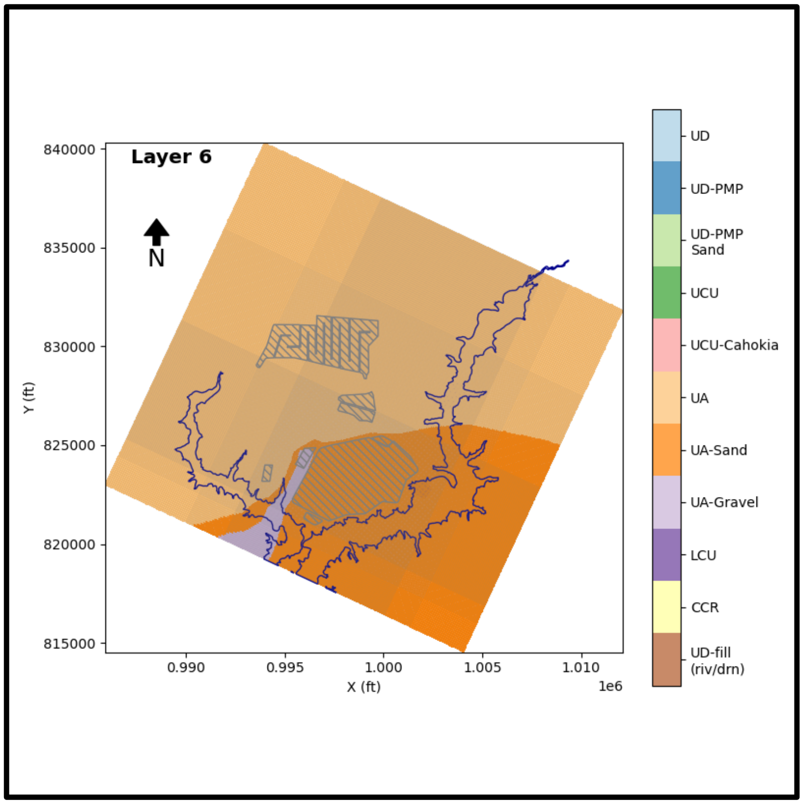
RAMBOLL



SPATIAL DISTRIBUTION OF HYDROSTRATIGRAPHIC LAYERS FOR LAYER 5 IN THE NUMERICAL MODEL

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

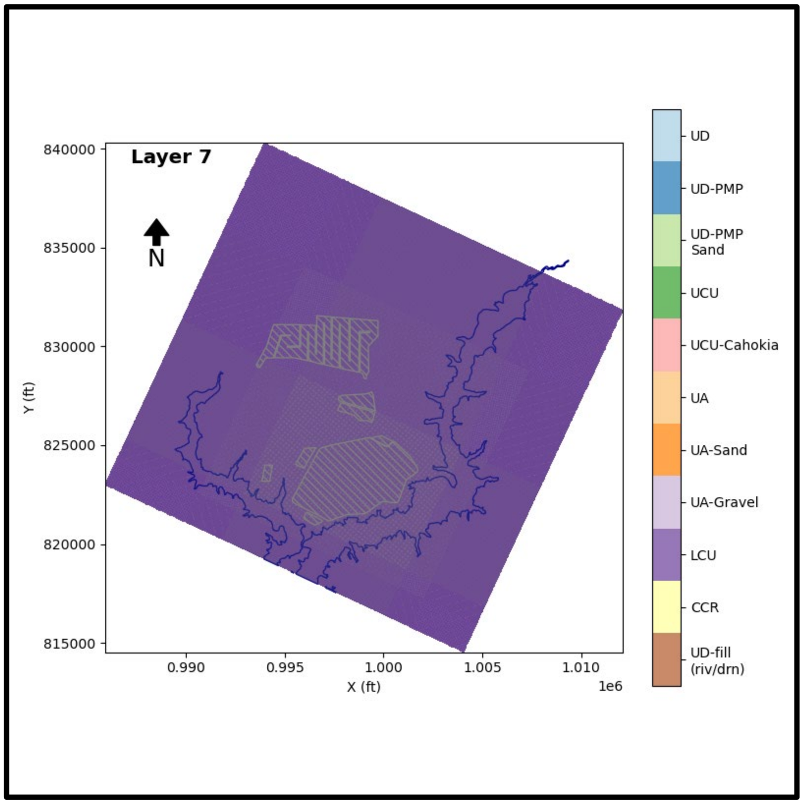
RAMBOLL



SPATIAL DISTRIBUTION OF HYDROSTRATIGRAPHIC LAYERS FOR LAYER 6 IN THE NUMERICAL MODEL

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

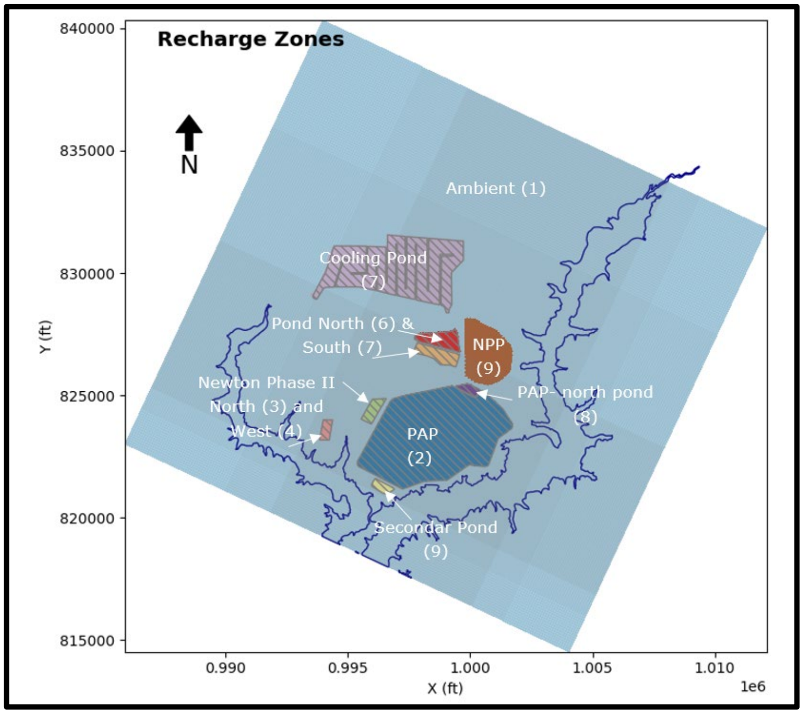
RAMBOLL



SPATIAL DISTRIBUTION OF HYDROSTRATIGRAPHIC LAYERS FOR LAYER 7 IN THE NUMERICAL MODEL

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

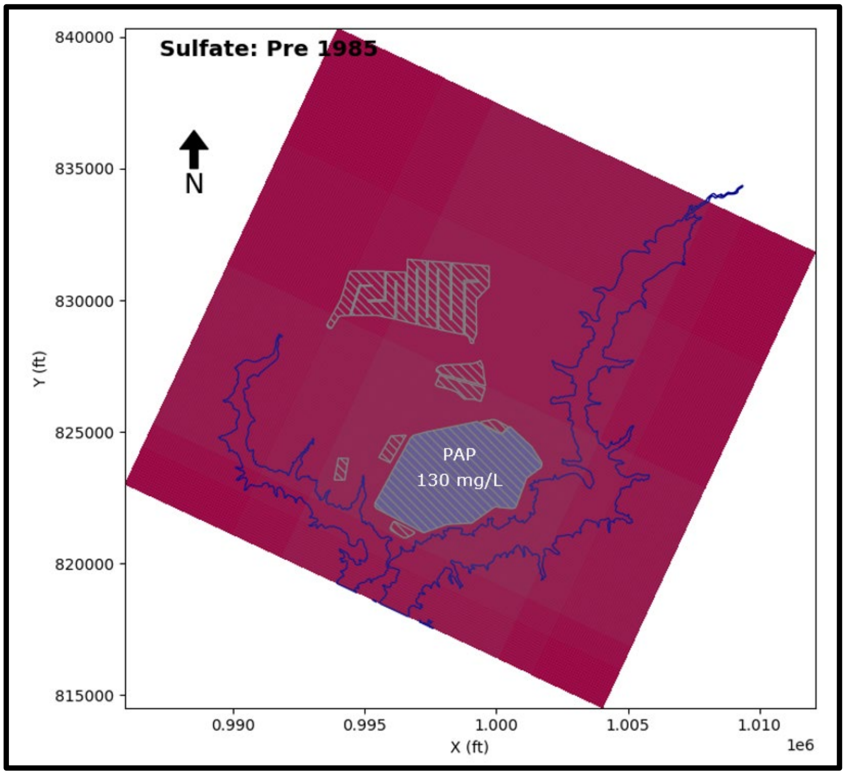
RAMBOLL

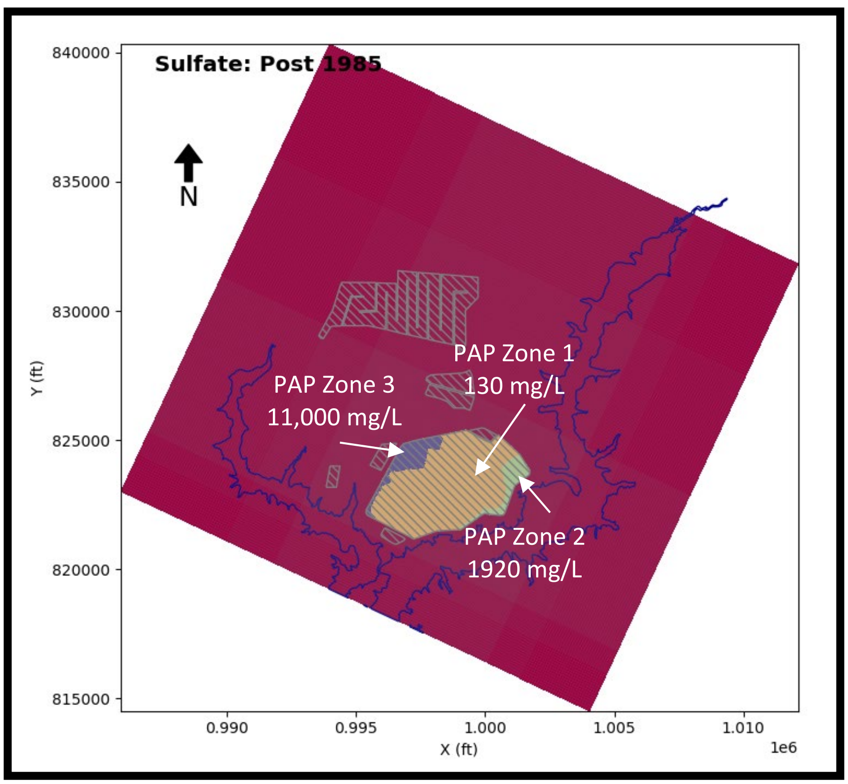


MODEL RECHARGE DISTRIBUTION (STEADY STATE CALIBRATION MODEL)

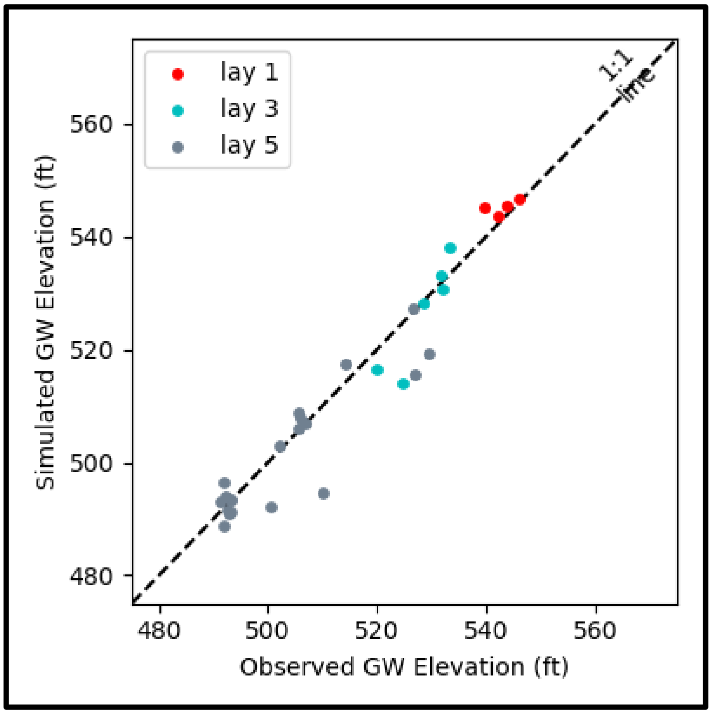
GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL





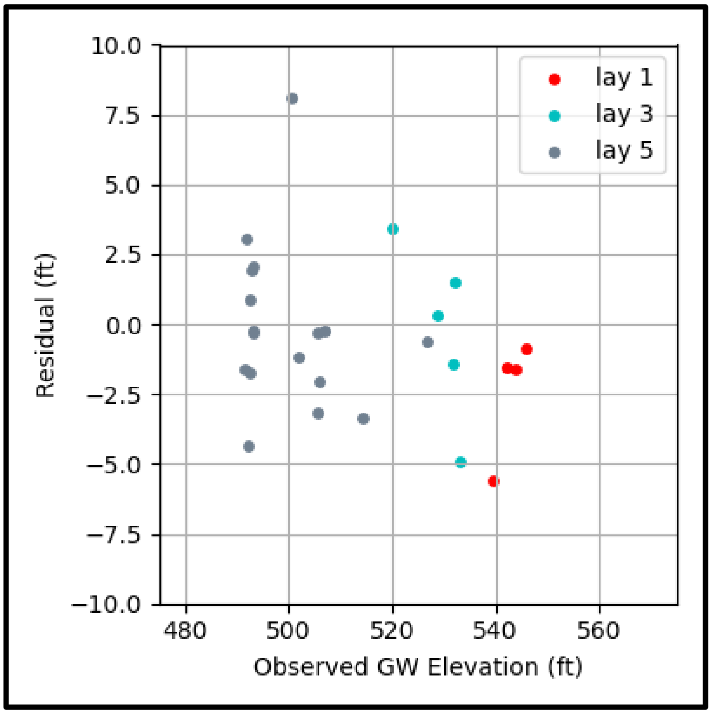
MODEL RECHARGE DISTRIBUTION FOR TRANSPORT MODEL FOR PRE AND POST 1985



OBSERVED VERSUS SIMULATED STEADY STATE GROUNDWATER LEVELS FROM THE CALIBRATION MODEL

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

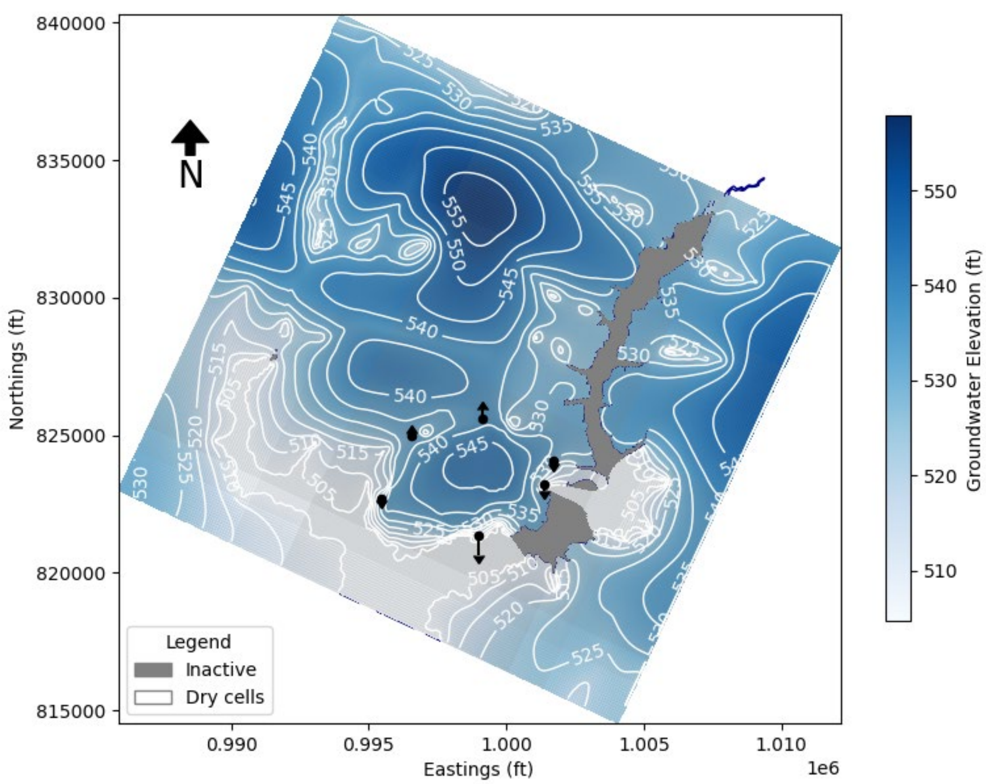
RAMBOLL



SIMULATED GROUNDWATER LEVEL RESIDUALS FROM THE CALIBRATED MODEL

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL

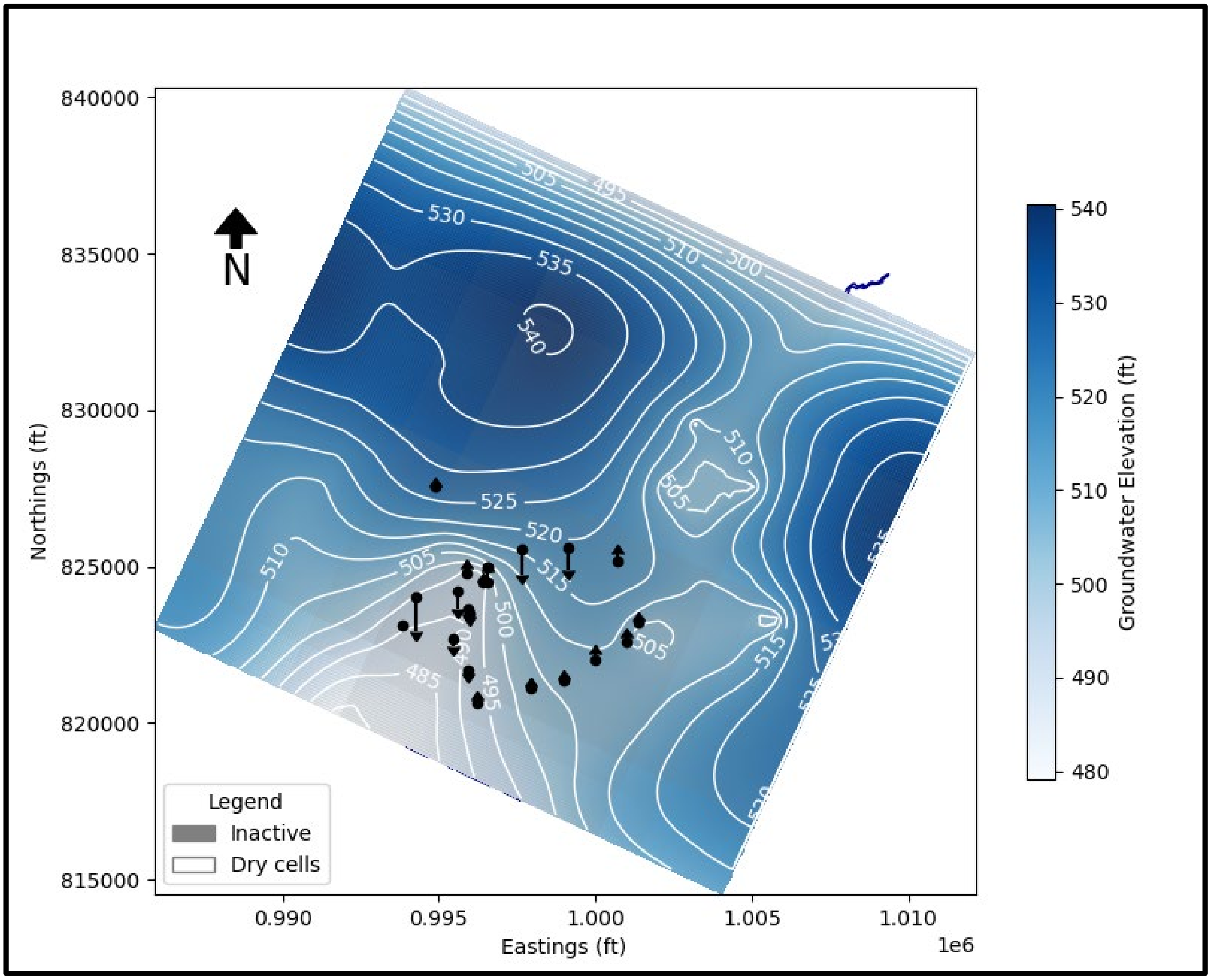


NOTE: BLACK DOTS INDICATE WELLS AND ARROW DIRECTION INDICATES BIAS IN SIMULATED GROUNDWATER LEVEL (NORTH ARROW = OVERESTIMATION, SOUTH ARROW = UNDERESTIMATION)

SIMULATED STEADY STATE GROUNDWATER LEVEL CONTOURS FROM UD/PMP (LAYER 3) FROM THE CALIBRATED MODEL

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL

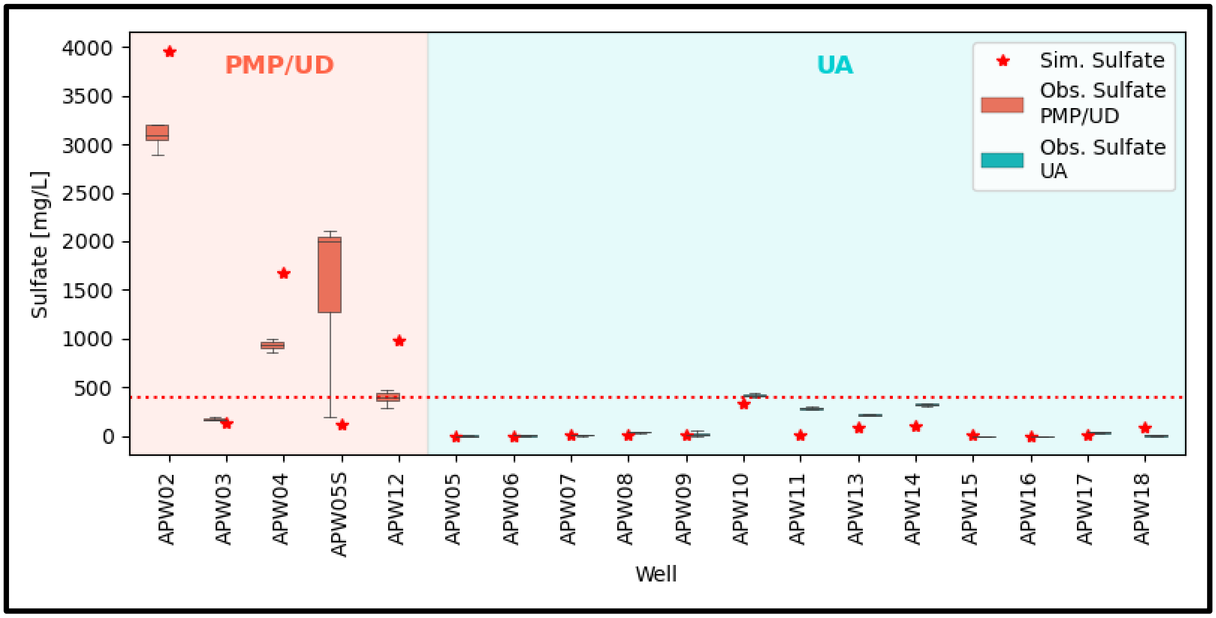


NOTE: BLACK DOTS INDICATE WELLS AND ARROW DIRECTION INDICATES BIAS IN SIMULATED GROUNDWATER LEVEL (NORTH ARROW = OVERESTIMATION, SOUTH ARROW = UNDERESTIMATION)

SIMULATED STEADY STATE GROUNDWATER LEVEL CONTOURS FROM UA (LAYER 6) FROM THE CALIBRATED MODEL

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL

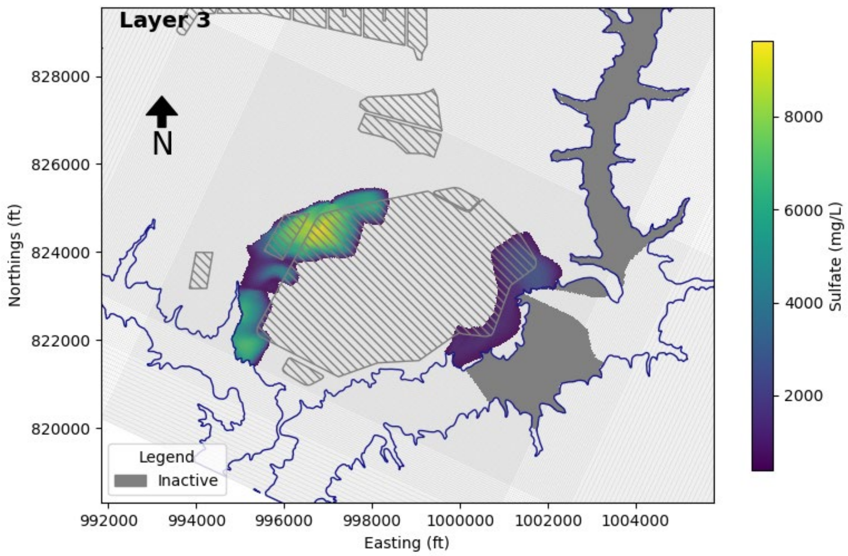


OBSERVED VERSUS SIMULATED SULFATE CONCENTRATIONS (mg/L)
(Obs. = Observed and Sim. = Simulated)

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL

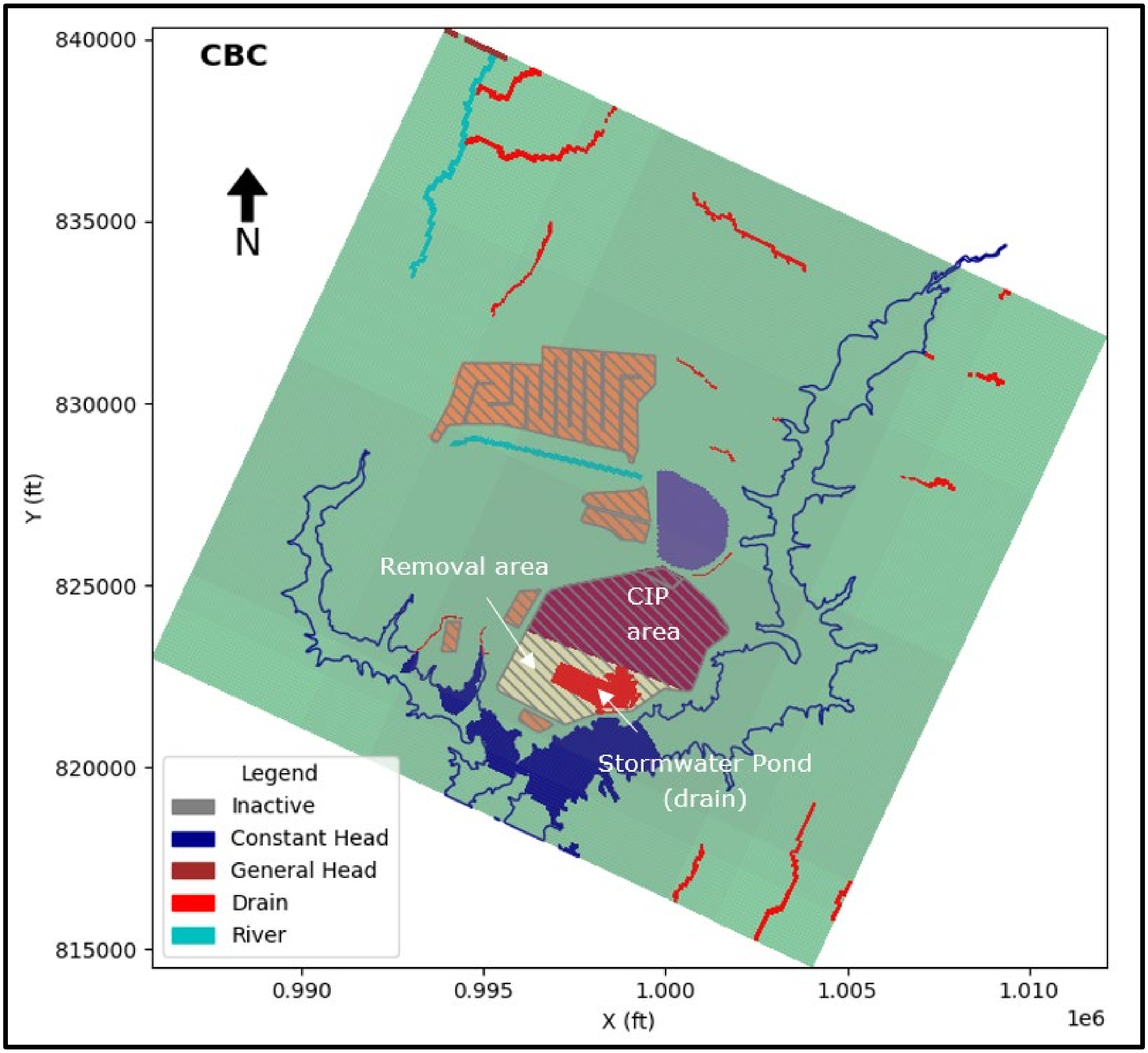
FIGURE 5-30



SIMULATED SULFATE PLUME OF THE UD/PMP FROM THE TRANSIENT MODEL

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

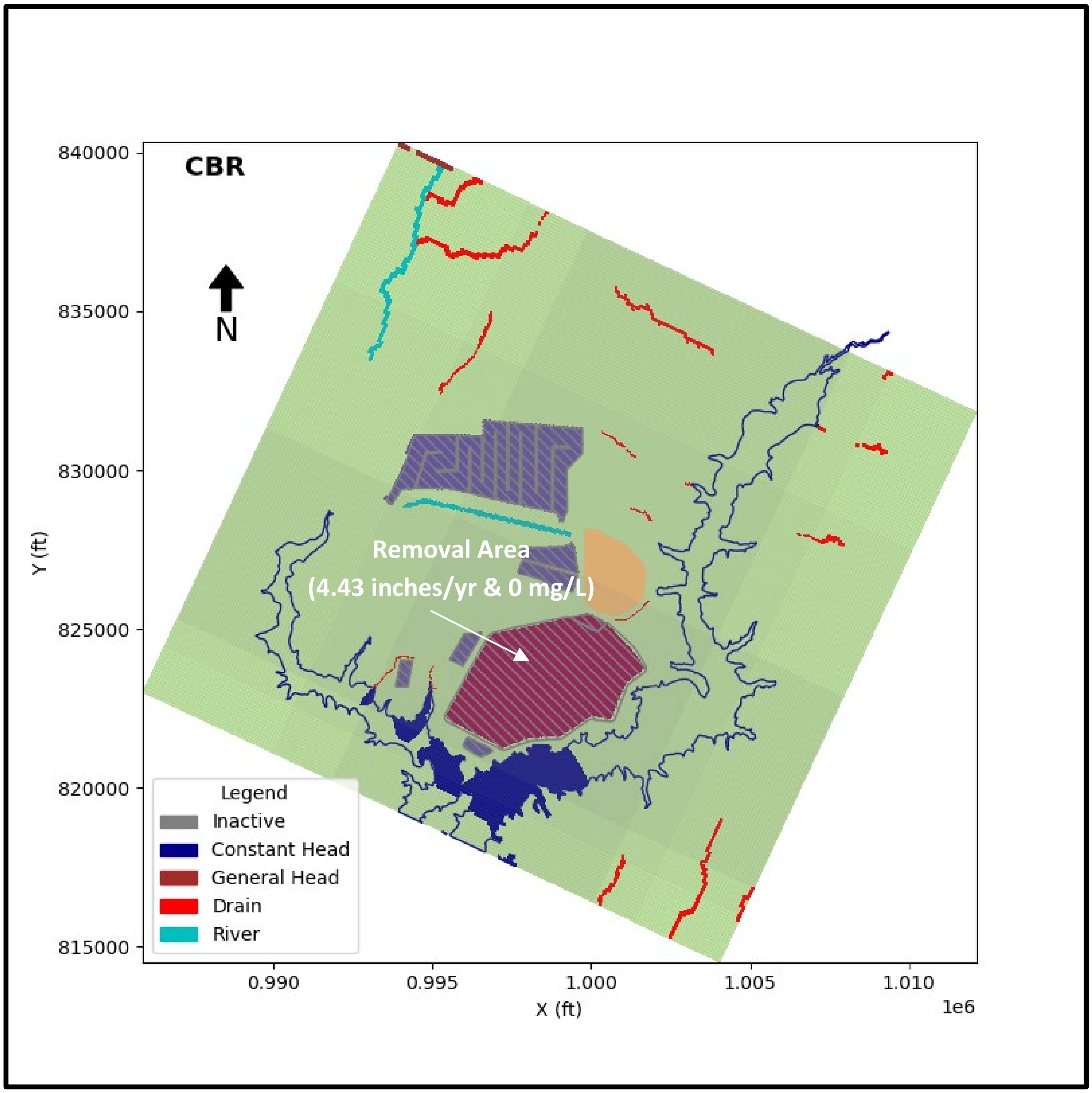
RAMBOLL



CIP RECHARGE AND STORMWATER POND MODIFICATIONS

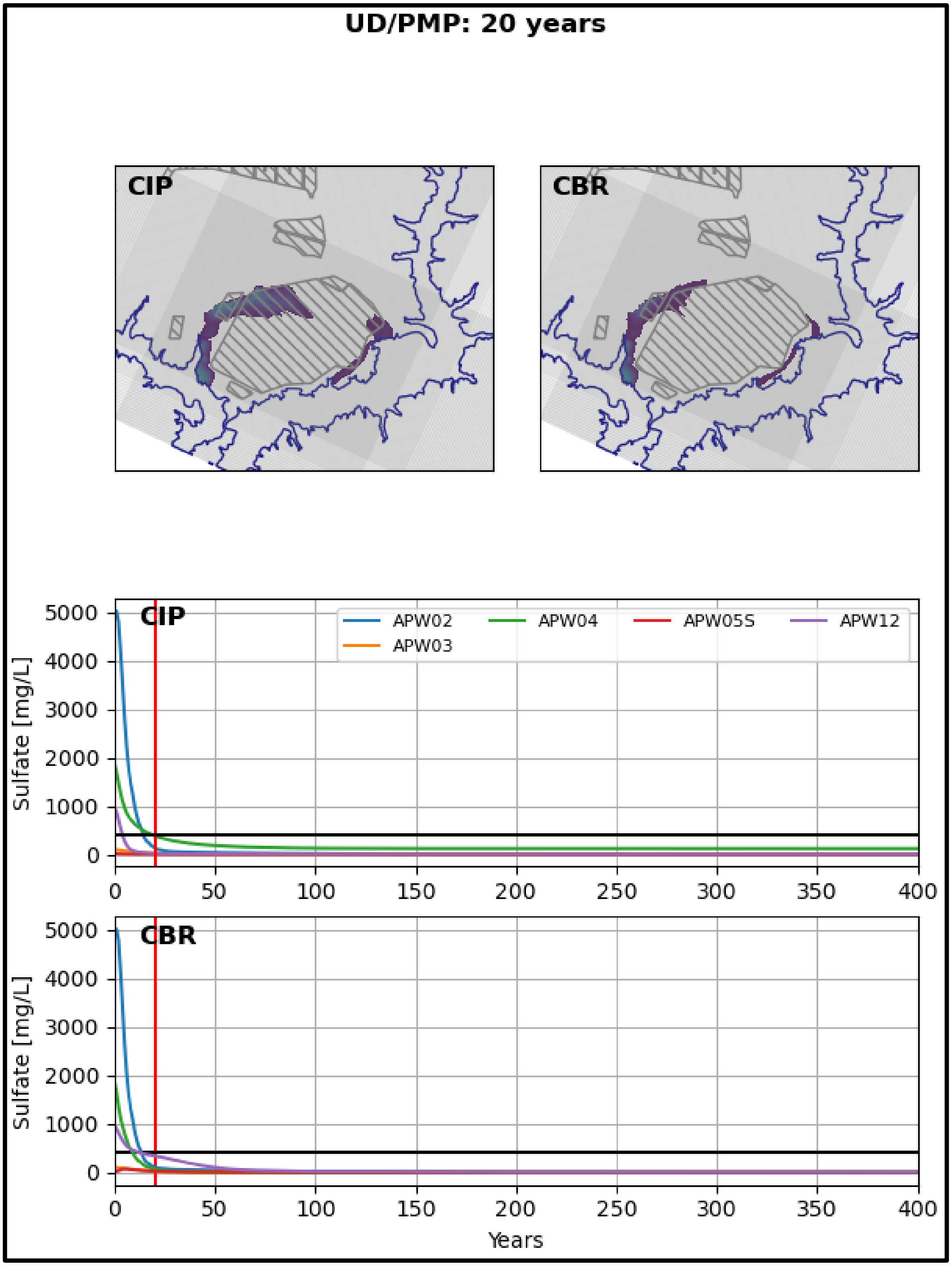
GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL



CBR RECHARGE MODIFICATIONS AND REMOVAL AREA

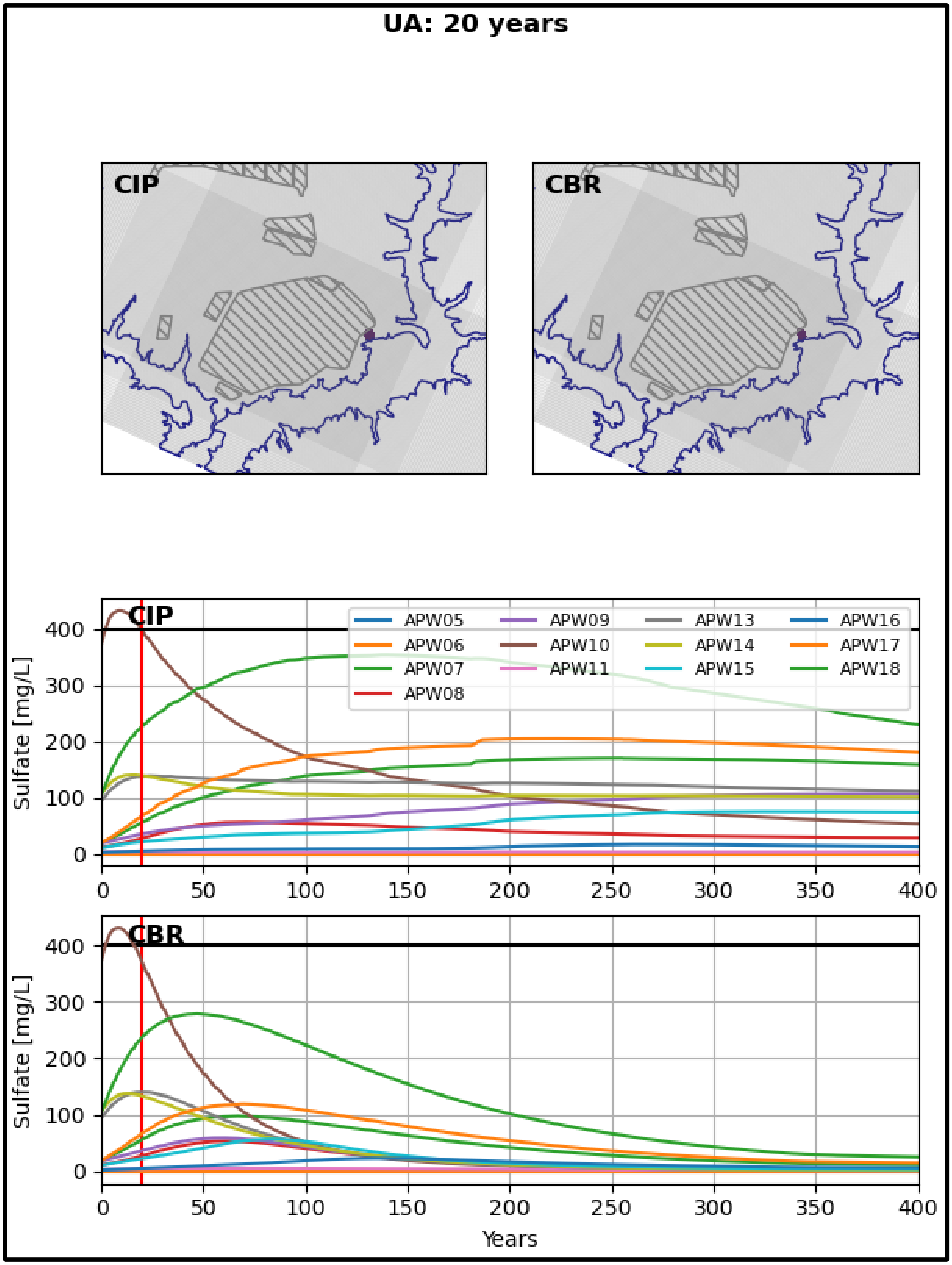
GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS



SIMULATED SULFATE PLUME OF THE UD/PMP FOR THE CIP AND CBR SCENARIOS AFTER 20 YEARS

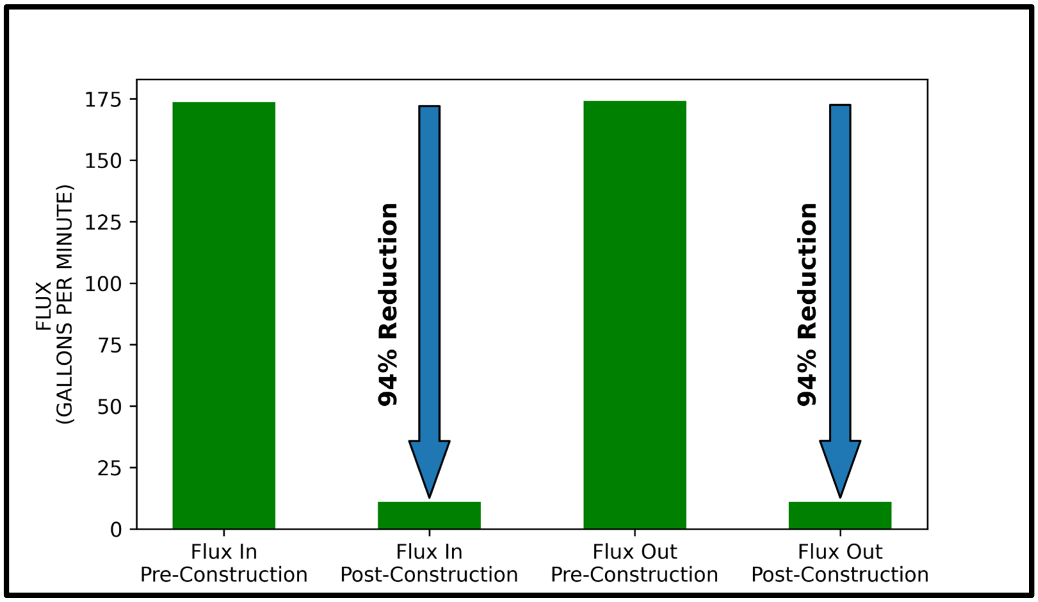
GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL



SIMULATED SULFATE PLUME OF THE UA FOR THE CIP AND CBR SCENARIOS AFTER 20 YEARS

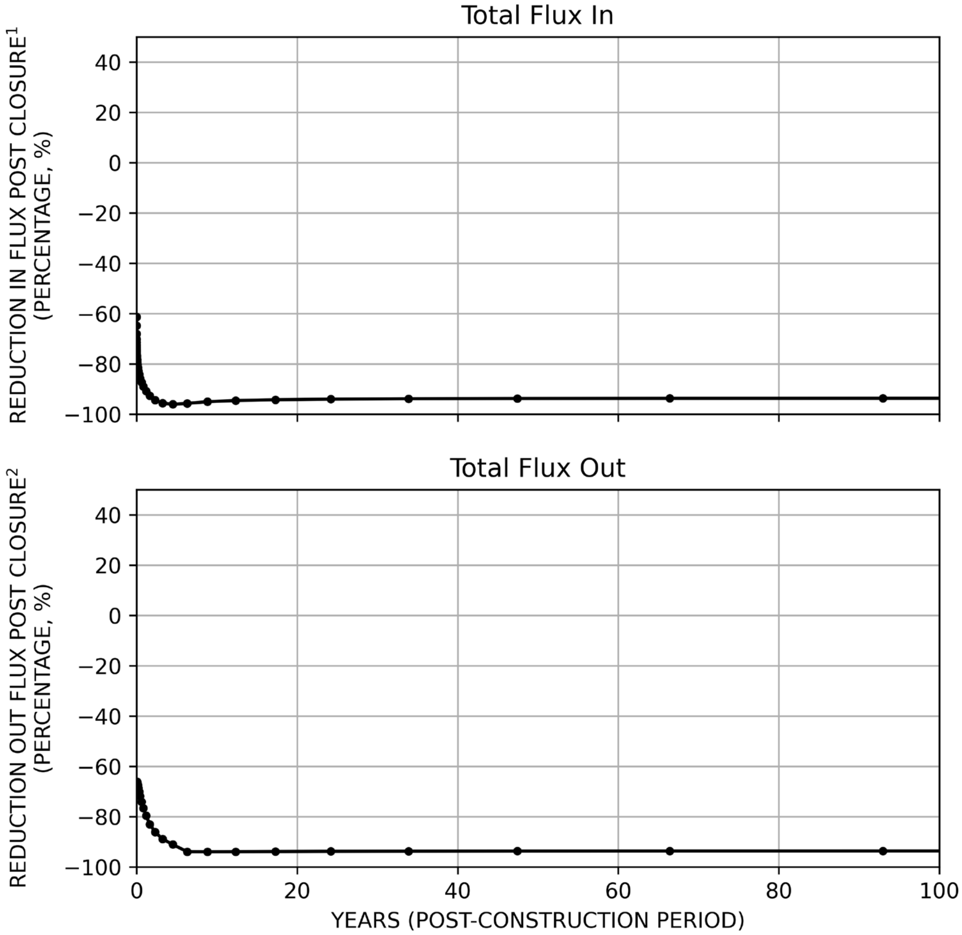
GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS



SCENARIO 1 (CIP) –
HYDRAULIC STEADY STATE REDUCTIONS IN TOTAL FLUX IN AND OUT OF FILL UNIT (CCR)

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL



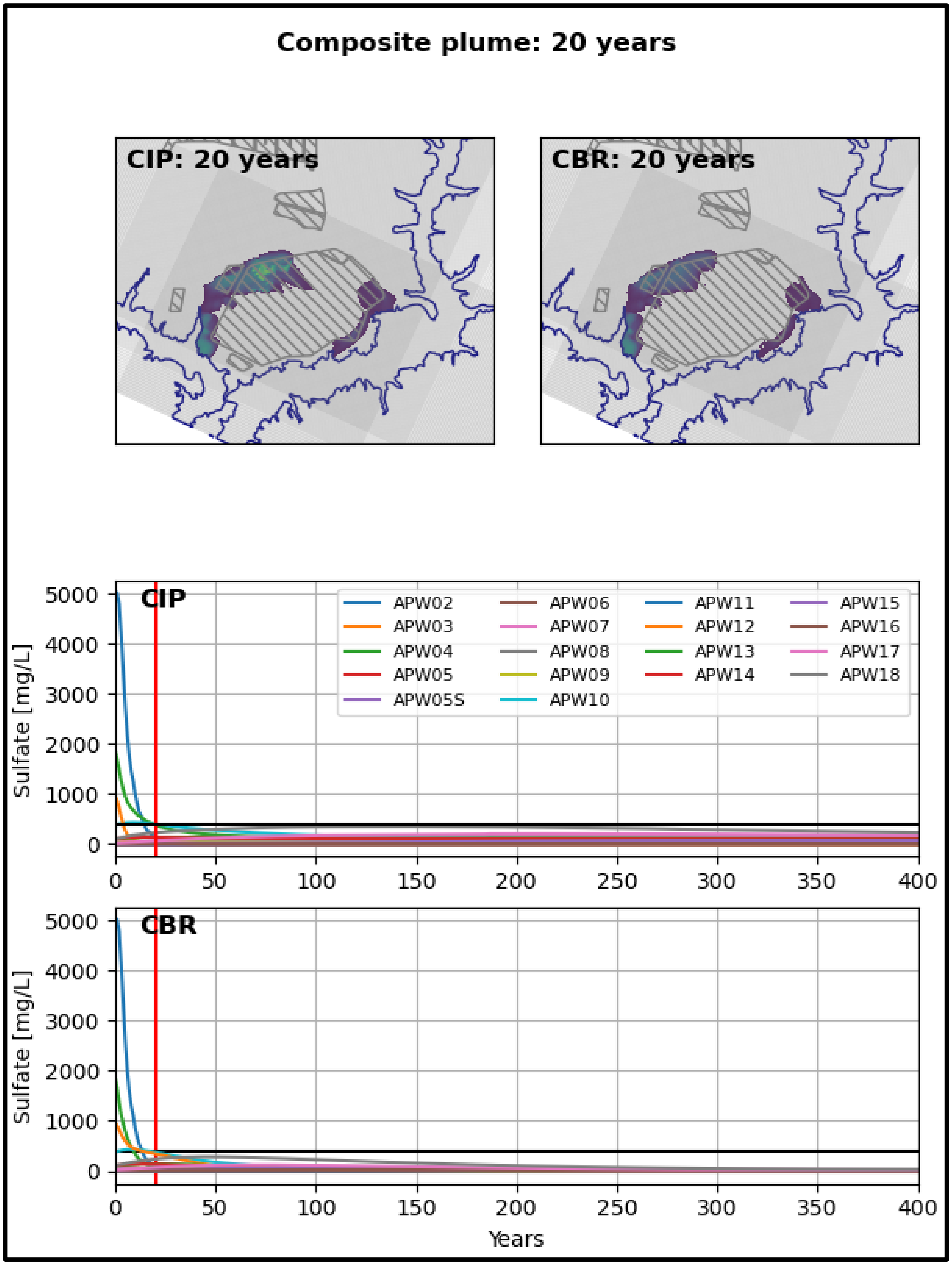
[1] Reduction in flux in compared to flux in at the end of the calibration model (model period of 45 years). Reduction in flux in are expressed as negative percentages to illustrate decreases in flux over time.

[2] Reduction in flux out compared to flux out at the end of the calibration model (model period of 45 years). Reduction in flux out are expressed as negative percentages to illustrate decreases in flux over time.

SCENARIO 1 (CIP) –
REDUCTIONS IN TOTAL FLUX IN AND OUT OF FILL UNIT (CCR)

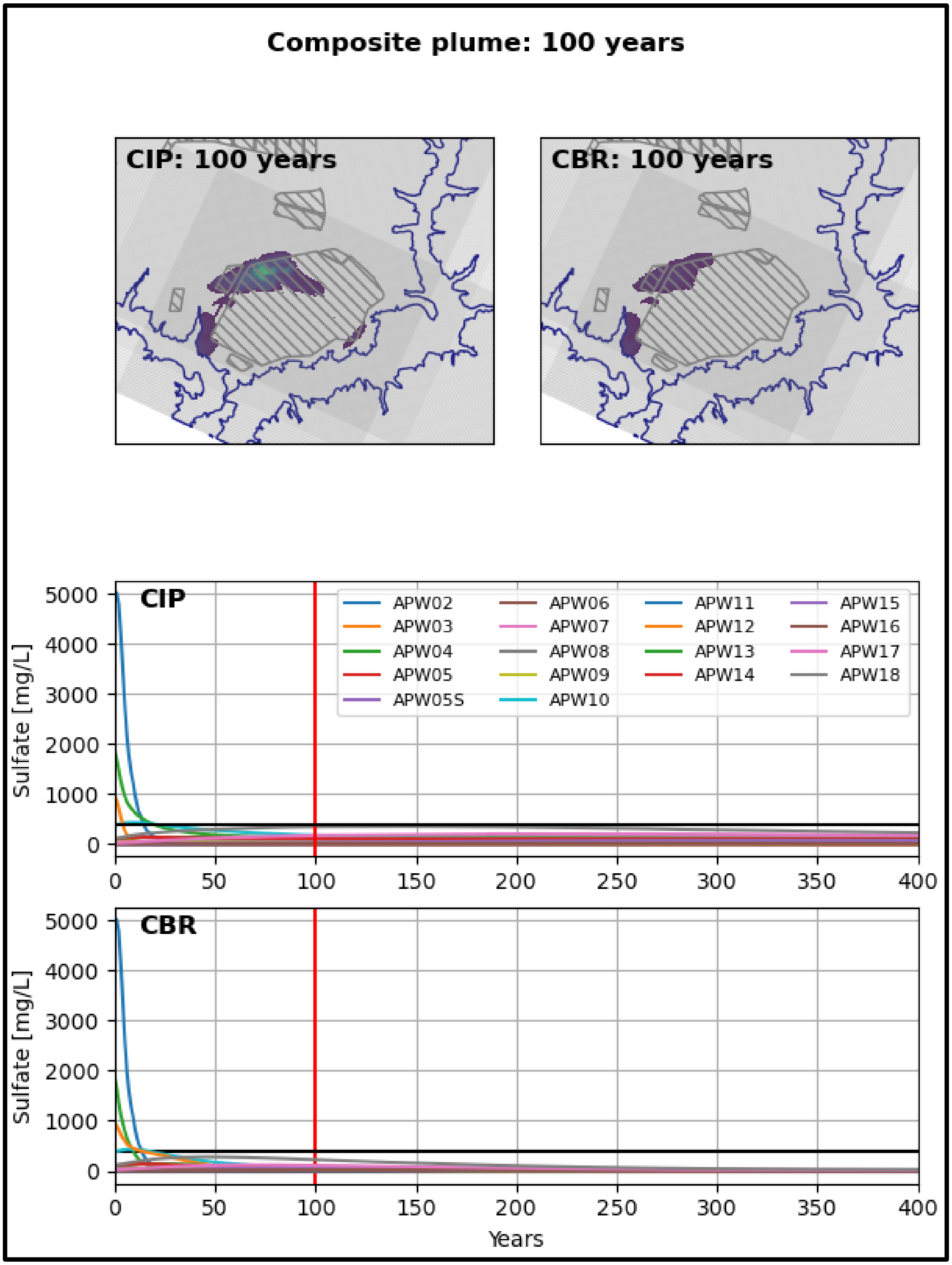
GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL



MAXIMUM EXTENT OF THE SULFATE PLUME FOR THE CIP AND CBR SCENARIOS AFTER 20 YEARS

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS



MAXIMUM EXTENT OF THE SULFATE PLUME FOR THE CIP AND CBR SCENARIOS AFTER 100 YEARS

GROUNDWATER MODELING REPORT
PRIMARY ASH POND
NEWTON POWER PLANT
NEWTON, ILLINOIS

RAMBOLL

APPENDICES

APPENDIX A
EVALUATION OF POTENTIAL GWPS EXCEEDANCES

TECHNICAL MEMORANDUM

DATE April 15, 2022 21454831

TO David Mitchell, Stu Cravens, Vic Modeer
Illinois Power Generating Company

CC Brian Hennings - Ramboll

FROM Roberta Russell, Jeffrey Ingram, Pat Behling - Golder **EMAIL** **jingram@golder.com**

EVALUATION OF POTENTIAL GWPS EXCEEDANCES, PRIMARY ASH POND, NEWTON POWER PLANT, JASPER COUNTY, ILLINOIS

1.0 INTRODUCTION

Illinois Power Generating Company (IPGC) currently operates the Newton Power Plant (NPP or Site) located in Jasper County, Illinois. The Primary Ash Pond (PAP, Illinois Environmental Protection Agency [IEPA] ID No. W0798070001-01) is a surface impoundment used to manage coal combustion residuals (CCRs) at the NPP. The PAP is regulated under Part 845 *"Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments"* (State CCR Rule or Part 845) which was promulgated by the Illinois Pollution Control Board (IPCB) on April 21, 2021.

IPGC is currently preparing a Construction Permit application for the PAP as required under Section 845.220 which requires groundwater modelling be completed for the known potential exceedances of groundwater protection standards (GWPS) as outlined in the Operating Permit application (Burns and McDonnell 2021). In October 2021, Ramboll Americas Engineering Solutions, Inc. (Ramboll) identified potential GWPS exceedances for pH in certain monitoring wells in the vicinity of the PAP (Ramboll 2021a). This Technical Memorandum was developed to further evaluate these potential GWPS exceedances.

1.1 Site Setting

The NPP is located in Jasper County Illinois, approximately 20 miles southeast of Effingham and 7 miles southwest of Newton, in Section 26 and 25, Township 6 North, Range 8 East. The NPP has one CCR surface impoundment (the PAP) with a surface area of 404 acres and a non-CCR Secondary Pond with a surface area of 9.3 acres. The PAP currently receives bottom ash, fly ash, and low-volume wastewater from the plant's two coal-fired boilers.

The NPP is situated in a predominantly agricultural area with fields located on the north, west and southern boarders of the property. The eastern border of the property is the Prairie Ridge State Natural Area. The PAP is adjacent to Newton Lake on the southern and eastern sides, with the NPP generating station located to the north of the PAP, and the site's Utility Waste Landfills located to the west.

Six hydrogeologic units are present at the NPP. They are described as follows in the Hydrogeologic Site Characterization Report (Ramboll 2021b), in downward order:

- **CCR:** CCR, consisting mostly of bottom and fly ash. CCR is present from the surface (approximately 545 to 555 feet above mean sea level (ft MSL) down to approximately 475 feet msl at its deepest portions.
- **Upper Drift (UD) / Potential Migration Pathway (PMP):** The UD consists of low-permeability silts and clays of the Peoria Silt and Sangamon Soil units. In some areas, discontinuous lenses of the sandier Hagarstown Member are also present, making up the PMP.
- **Upper Confining Unit (UCU):** the UCU comprises a thick sequence of low-permeability clays and silts of the Vandalia Till Unit. This unit is laterally continuous and is present from the base of the PAP down to the top of the uppermost aquifer.
- **Uppermost Aquifer (UA):** the UA comprises the Mulberry Grove Formation and generally consists of fine to coarse, poorly- to well-graded sands, with occasional clayey sand layers and gravels.
- **Lower Confining Unit (LCU):** This unit consists of the Smithboro Till Member and is generally made up of compact glacial till consisting of low-permeability silty clays and clayey silts with trace sand and gravel.
- **Bedrock Confining Unit (BCU):** Bedrock below the unconsolidated deposits, consisting of shale of the Mattoon Formation.

Groundwater elevations within the PAP are high when compared to the surrounding aquifer, creating a downward gradient between the PAP and the surrounding aquifer. Below the PAP, groundwater migrates downward and laterally through the UD and UCU into the UA. Additionally, as displayed in **Figure 1**, groundwater in the UA flows from the north to the southeast in the eastern portion of the pond and to the south/southwest in the western portion of the pond (Ramboll 2021a).

2.0 POTENTIAL GWPS EXCEEDANCES AND MONITORING WELL DETAILS

As required by Section 845.230 (d)(2)(M), an evaluation of the history of potential GWPS exceedances was completed for the Operating Permit application (Burns and McDonnell 2021; Ramboll 2021b). Data collected since 2015 from the PAP monitoring well network were evaluated using statistical methods described in the Statistical Analysis Plan included in the Operating Permit application (Appendix I, Ramboll 2021c). The following monitoring wells and potential exceedances of the GWPSs are evaluated in this Technical Memorandum:

- **pH at APW04:** For pH, a lower confidence limit (LCL) of 6.1 (in Standard Units; SU) was calculated below the lower GWPS of 6.4. APW04 is located to the east/southeast of the PAP, downgradient of the PAP based on typical flow directions within the UD and UCU. The well is screened in sandy clays of the UD (PMP) from 7.7 to 17.7 FT BGS (513.75 to 503.75 FT MSL).
- **pH at APW12:** For pH, a lower confidence limit (LCL) of 6.2 was calculated below the lower GWPS of 6.4. APW12 is located to the east/northeast of the PAP, typically upgradient of the general groundwater flow direction within the UD and PMP. The well is screened in a mixture of silty clays and sands of the UD (PMP) from 20.0 to 30.0 FT BGS (523.33 to 513.33 FT MSL).

3.0 EVIDENCE THAT POTENTIAL GWPS EXCEEDANCES ARE NOT RELATED TO THE PAP

Groundwater data for monitoring wells that exhibited potential pH GWPS exceedances, background monitoring wells and porewater samples from the PAP were evaluated. The review of these data indicates that the GWPS exceedances are not related to the PAP, as described in the following line of evidence.

- **The pH of CCR porewater is significantly higher than the pH in monitoring wells APW12 and APW04 and the pH ranges recorded in the PMP are likely naturally occurring.**

The pH of porewater within the PAP ranges from approximately 8.6 to 12.2 with an average of 10.7, while pH in all PMP wells (APW02, APW03, APW04, APW5S, APW12) ranges from 6.0 to 7.2, with an average of 6.7 (Table 1). The pH of groundwater in background wells within the UA ranges from 6.4 to 7.8. Due to the high pH values within the PAP, it would be expected that any releases from the PAP would increase the pH in downgradient wells. However, as demonstrated in **Table** 1, downgradient wells within the PMP report pH values significantly lower than in the PAP.

	Background Wells	Upper Drift Wells	PAP Porewater
pH Average	7.5	6.7	10.7
pH Min	6.4	6.0	8.6
pH Max	7.8	7.2	12.4

Table 1. Summary of average, minimum and maximum pH values (in SU) in background wells (APW05, APW06), UD wells (APW02, APW03, APW04, APW05S and APW12) and the PAP.

In addition, pH is consistently slightly lower in all PMP wells compared to background wells (Tables 1 and 2). The average pH values across the PMP wells are similar, i.e. within 0.5 SU of one another. Given the consistency of average pH values across the PMP, it is likely that the slightly lower pH is naturally occurring in the PMP.

Sample Date	APW05	APW06	APW02	APW03	APW04	APW05S	APW12
Well Formation	**UA**	**UA**	**UD/PMP**	**UD/PMP**	**UD/PMP**	**UD/PMP**	**UD/PMP**
2/17/2021	7.20	6.40	6.60	6.70	6.50	6.60	6.20
3/10/2021	7.70	7.70	7.00	7.20	6.90	7.00	6.50
3/30/2021	7.20	7.10	6.60	6.30	6.10	--	6.00
4/28/2021	7.49	7.69	6.68	7.00	6.86	6.84	6.40
5/25/2021	7.54	7.71	6.67	7.05	6.90	6.86	6.54
6/17/2021	7.73	7.69	6.62	6.98	6.81	6.82	6.45
6/30/2021	7.55	7.61	6.58	7.03	6.80	6.73	6.29
7/15/2021	7.78	7.49	6.55	6.93	6.76	6.77	6.54
Average	**7.52**	**7.42**	**6.66**	**6.90**	**6.70**	**6.80**	**6.37**

Table 2. pH data (in SU) for 2021 sampling events for background wells (APW05, APW06) and PMP wells (APW02, APW03, APW04, APW05S, APW12).

Therefore, the CCR unit is not the cause of the pH values statistically below the lower pH GWPS at APW12 and APW04.

4.0 CLOSING

Golder appreciates the opportunity to serve as your consultant on this project. If you have any questions concerning this Technical Memorandum or need additional information, please contact the undersigned.

Golder Associates USA Inc.

Roberta Russell
Senior Consultant, Geologist

Patrick J. Behling
Principal, Practice Leader

JSI/RR/PJB

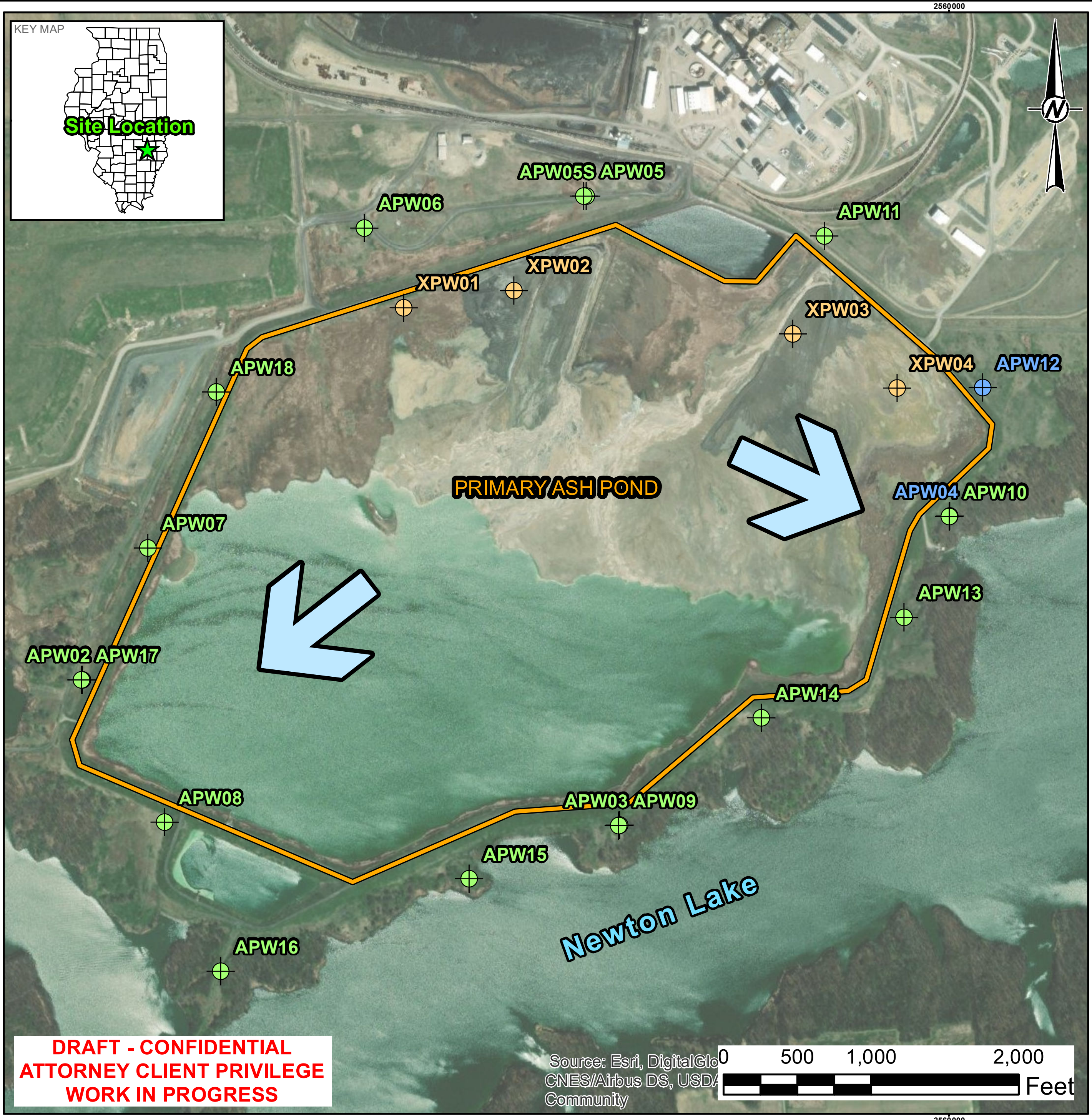
5.0 REFERENCES

Burns and McDonnell 2021. Initial Operating Permit, Newton Ash Pond. October 25.

Ramboll 2021a. History of Potential Exceedances, Newton Ash Pond, Newton Power Plant. October 17.

Ramboll 2021b. Hydrogeologic Site Characterization Report, Primary Ash Pond, Newton Power Plant. October 25.

Ramboll 2021c. Statistical Analysis Plan, Primary Ash Pond, Newton Power Plan. October 25.



LEGEND

- Primary Ash Pond - CCR Unit ID
- Part 845 Groundwater Sample Location With no Potential pH Exceedance
- CCR Pore Water Sample Location
- Part 845 Groundwater Sample Location With a Potential pH Exceedance
- Typical Groundwater Flow Directions

NOTE(S)

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.

REFERENCE(S)

1. RAMBOLL 2021, TABLE 2 SUMMARY OF POTENTIAL EXCEEDANCES.
2. RAMBOLL 2021. GROUNDWATER MONITORING PLAN, PRIMARY ASH POND, NEWTON POWER PLANT, NEWTON ILLINOIS.

CLIENT
ILLINOIS POWER GENERATING COMPANY

PROJECT
NEWTON POWER PLANT - EVALUATION OF POTENTIAL GWPS EXCEEDANCES

TITLE
NEWTON MONITORING WELL LOCATIONS AND TYPICAL GROUNDWATER FLOW DIRECTION

CONSULTANT
wsp GOLDER

YYYY-MM-DD	2022-02-01
DESIGNED	BTT
PREPARED	BTT
REVIEWED	JSI
APPROVED	PJB

PROJECT NO.	PHASE	FIGURE
21454831	0004	1

PATH: C:\Users\lingram\Golder Associates\21454831, Vistra IL MNA Part 845 Support - Project Files\5_Technical Work\Phase4 - Newton\4.11-Figures\MNA-Figures\Figure 1 - Site Location Map - DRAFT.mxd PRINTED ON: 2022-04-07 AT: 8:20:29 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

APPENDIX B
MODFLOW, MT3DMS, HELP MODEL, AND FLUX EVALUATION DATA EXPORT FILES (ELECTRONIC ONLY)

APPENDIX C
EVALUATION OF PARTITION COEFFICIENT RESULTS

TECHNICAL MEMORANDUM

DATE March 30, 2022 **Project No.** 21454831

TO David Mitchell, Stu Cravens, Vic Modeer
Illinois Power Generating Company

CC Brian Henning - Ramboll

FROM Golder Associates USA Inc. **EMAIL** **Jeffrey_Ingram@golder.com**

EVALUATION OF PARTITION COEFFICIENT RESULTS, PRIMARY ASH POND (CCR UNIT 501), NEWTON POWER PLANT, JASPER COUNTY, ILLINOIS

1.0 INTRODUCTION

Illinois Power Generating Company (IPGC) operates the Newton Power Plant (NPP) located in Jasper County, Illinois. The Primary Ash Pond (PAP or Site), Illinois Environmental Protection Agency [IEPA] ID No. W0798070001-01 is a 404-acre unlined surface impoundment used to manage coal combustion residuals (CCRs) at the NPP. The PAP is regulated under Part 845 *"Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments"* (State CCR Rule or Part 845) which was promulgated by the Illinois Pollution Control Board (IPCB) on April 21, 2021. WSP Golder (Golder) is assisting IPGC with Part 845 compliance at the Site.

IPGC is currently preparing a Construction Permit application for the PAP as required under Section 845.220. As a part of the Construction Permit application, groundwater modeling is being completed for known potential exceedances of groundwater protection standards (GWPS) as outlined in the Operating Permit application for the PAP (Burns and McDonnell 2021). In the Operating Permit (October 2021), Ramboll Americas Engineering Solutions, Inc. (Ramboll) identified potential GWPS exceedances for several compounds potentially associated with the PAP, including lithium and sulfate. Batch adsorption testing was conducted to generate site-specific partition coefficient results for these parameters for use in the groundwater models. Site-specific partition coefficients were also developed for boron for its use in groundwater modeling. This Technical Memorandum summarizes the results of the batch adsorption testing.

2.0 OVERVIEW

In August 2021, Golder conducted a field investigation at the PAP which included the completion of seven (7) soil/rock borings ranging in depth from 15 to 90 feet below ground surface (ft bgs; Golder 2021). As a part of that investigation, soil and groundwater samples were submitted to SiREM laboratories (Guelph, ON) for batch solid/liquid partitioning testing. A summary of the soil samples used for the batch testing is provided in Table 1.

Table 1: Batch Attenuation Testing Data Summary

Groundwater Sample ID	Soil Sample ID	Soil: Water Ratio
APW-04	N-SB-05 (60.0-67.1 ft bgs)	2:1
		1:1
		1:5
		1:10
		1:20
APW-14	N-SB-04 (12.0-18.0 ft bgs)	2:1
		1:1
		1:5
		1:10
		1:20

Notes:

1) Ft bgs – Feet below ground surface

Site-specific partitioning coefficients were determined for constituents of interest (COIs) lithium and sulfate, identified based on statistical evaluation of potential groundwater exceedances calculated at the Site (Burns and McDonnell 2021). Site-specific partitioning coefficients were also determined for boron for its potential use in groundwater modeling, despite not being detected at statistically significant levels above the site GWPS. Two groundwater samples (APW-04 and APW-14) and two soil samples (N-SB-05 60.0-67.1 ft bgs and N-SB-04 12.0-18.0 ft bgs) were used for batch attenuation testing at various ratios (Table 1). For each treatment, 0.1 L of groundwater was brought in contact with an amount of soil (0.004 to 0.2 kg, dependent on the ratio) over a seven-day period. Each contact water/soil microcosm was amended (spiked) with meta-arsenite, boric acid, lithium chloride, and sodium sulfate to a target concentration of arsenic, boron, lithium, and sulfate, respectively (Table 2). After the seven-day contact period, COI and boron concentrations were analyzed in the contact water. The control samples (i.e., groundwater samples APW-04 and APW-14) were only analyzed at the initiation of testing. The oxidation/reduction potential (redox) and pH were measured for each batch test at the beginning and end of the contact period and in the control samples. Arsenic is not currently a COI at the Site and, therefore, was not evaluated as part of this report. However, arsenic may be revisited in the future, thus meta-arsenite was included as an amendment (Table 2).

Table 2: Microcosm amendment and target concentration for COIs

COI	Groundwater Sample	Amendment	Target Concentration (mg/L)
Arsenic	APW-04	346.80 µL of a 2 g/L As(III) solution	0.2
	APW-14	344.72 µL of a 2 g/L As(III) solution	
Boron	APW-04	11.40 mL of a 10 g/L H_3BO_3 solution	10

	APW-14	11.32 mL of a 10 g/L H_3BO_3 solution	
Lithium	APW-04	3.40 mL of a 1 g/L LiCl solution	0.3
	APW-14	3.39 mL of a 1 g/L LiCl solution	
Sulfate	APW-04	12.20 mL of a 100 g/L Na_2SO_4 solution	774
	APW-14	24.41 mL of a 100 g/L Na_2SO_4 solution	

Notes:
1) g/L – grams per liter
2) mL – milliliter
3) µg/L – micrograms per liter
4) mg/L – milligrams per liter
5) As(III) – arsenite
6) H_3BO_3 – boric acid
7) LiCl – lithium chloride
8) Na_2SO_4 — sodium sulfate

The results of batch attenuation testing (Tables 3 and 4) were used to calculate the following adsorption isotherms for each COI:

- Linear: $q_e = K_D * C_e$
- Langmuir: $C_e/q_e = 1/(K_L * q_m) + C_e/q_m$
- Freundlich: $\log(q_e) = \log(K_F) + (1/n)\log(C_e)$

Where

K_D, K_L, and K_F = the linear, Langmuir, and Freundlich partition coefficients, respectively (in liters per kilogram; L/kg).

q_e = concentration of the adsorbate in soil

C_e = aqueous concentration of the adsorbate

q_m = 1/slope in the linear expression of the isotherm

n = non-linearity constant

3.0 SUMMARY OF RESULTS

Figures that show the linear, Langmuir, and Freundlich isotherms for each COI are provided in Appendix A. The partition coefficient values for APW-04 and APW-14 are presented in Tables 5 and 6, respectively. The results of the batch adsorption testing can be summarized as follows:

- **Boron**: Calculated K_D values for APW-04 and APW-14 were -1.35 and -0.89 L/kg, respectively, K_L values -6.2E+4 and -1.6E+5 L/kg, respectively, and K_F values 57.4 and 68.7 L/kg, respectively. For comparison, in Strenge and Peterson (1989), partition coefficients for boron range from 0.19 to 1.3 L/kg, depending on pH conditions and the amount of sorbent (i.e. clay, organic matter, and iron and aluminum oxyhydroxide) present.

- **Lithium:** Calculated K_D values for APW-04 and APW-14 were 4.49 and 5.58 L/kg, respectively, K_L values 6.2E+7 and 1.6E+8 L/kg, respectively, and K_F values 135 and 230 L/kg, respectively. In Strenge and Peterson (1989), partition coefficients for lithium range from 0 to 0.8 L/kg, depending on pH conditions and the amount of sorbent present.
- **Sulfate**: Calculated K_D values for APW-04 and APW-14 were 3.58 and -25.6 L/kg, respectively, K_L values -626 and -2,200 L/kg, respectively, and K_F values 4.11 and 2.14E+11 L/kg, respectively. In Strenge and Peterson (1989), partition coefficients for sulfate are 0.0 L/kg, regardless of pH conditions and the amount of sorbent present.
- **pH and Redox**: Generally, after the seven-day contact time, the pH of each contact water was consistent with the pH of the control samples (7.03 and 7.00 for APW-04 and APW-14, respectively), ranging from 7.02 to 7.06 across the batch tests. The average redox values of the control samples after the seven-day contact time were 40 mV and -26 mV for APW-04 and APW-14, respectively. The redox value of contact water ranged from -111 to +40 mV across treatments.

4.0 REFERENCES

Burns and McDonnell, 2021. Initial Operating Permit Newton Ash Pond.

Golder Associates Inc. 2021. Technical Memorandum: Monitored Natural Attenuation Field Investigation Status Update, Primary Ash Pond (CCR Unit 501) Newton Power Plant, Jasper County, Illinois.

Strenge, D. and Peterson, S. 1989. Chemical Data Bases for the Multimedia Environmental Pollutant Assessment System (MEPAS) (No. PNL-7145). Pacific Northwest Lab., Richland, WA (USA).

5.0 CLOSING

Golder appreciates the opportunity to serve as your consultant on this project. If you have any questions concerning this technical memorandum or need additional information, please contact the undersigned.

Golder Associates USA Inc.

Jeffrey Ingram
Senior Consultant, Geologist

Pat Behling
Practice Leader

CK/JSI/PJB

Attachments Appendix A – Partition Coefficient Graphs

Table 3: Batch Attenuation Testing Results, APW-04

Geologic Material Sample ID	Treatment	Date	Day	Replicate	Dissolved Boron	Dissolved Lithium	Dissolved Sulfate	pH	ORP
					mg/L	mg/L	mg/L	SU	mV
	Groundwater Only Control	2/15/2022	0	APW-04-1a	9.2	0.28	1,097	6.92	2
				APW-04-2a	9.5	0.29	1,077	6.92	29
				Average Concentration (mg/L)	9.3	0.28	1,087	6.92	16
		2/22/2022	7	APW-04-1	9.2	0.26	721	7.02	67
				APW-04-2	9.4	0.25	407	7.04	13
				Average Concentration (mg/L)	9.3	0.26	564	7.03	40
N-SB-05 (60.0-67.1 ft bgs)	2:1 Soil:Water Ratio	2/15/2022	0						
		2/22/2022	7	N-SB-05-(60.0-67.1) :APW-04 2:1-1	5.9	<0.10	440	7.02	-20
				N-SB-05-(60.0-67.1) :APW-04 2:1-2	5.8	<0.10	463	7.02	-43
				Average Concentration (mg/L)	5.9	ND	451	7.02	-32
	1:1 Soil:Water Ratio	2/15/2022	0						
		2/22/2022	7	N-SB-05-(60.0-67.1) :APW-04 1:1-1	7.2	0.13	807	7.02	-49
				N-SB-05-(60.0-67.1) :APW-04 1:1-2	7.4	0.14	740	7.02	-48
				Average Concentration (mg/L)	7.3	0.14	773	7.02	-49
	1:5 Soil:Water Ratio	2/15/2022	0						
		2/22/2022	7	N-SB-05-(60.0-67.1) :APW-04 1:5-1	8.6	0.17	813	7.04	-40
				N-SB-05-(60.0-67.1) :APW-04 1:5-2	9.6	0.24	788	7.02	-70
				Average Concentration (mg/L)	9.1	0.21	800	7.03	-55
	1:10 Soil:Water Ratio	2/15/2022	0						
		2/22/2022	7	N-SB-05-(60.0-67.1) :APW-04 1:10-1	10	0.26	889	7.02	-92
				N-SB-05-(60.0-67.1) :APW-04 1:10-2	9.6	0.25	996	7.02	-52
				Average Concentration (mg/L)	10	0.26	943	7.02	-72
	1:20 Soil:Water Ratio	2/15/2022	0						
		2/22/2022	7	N-SB-05-(60.0-67.1) :APW-04 1:20-1	9.2	0.24	776	7.03	-27
				N-SB-05-(60.0-67.1) :APW-04 1:20-2	8.9	0.23	1,212	7.02	-5
				Average Concentration (mg/L)	9.1	0.24	994	7.03	-16

Notes:
1) mg/L- Miligrams per liter
2) SU - Standard Units
3) mV - milivolts
4) ORP - Oxidation Reduction Potential
5) ND - non-detect

Table 4: Batch Attenuation Testing Results, APW-14

Geologic Material Sample ID	Treatment	Date	Day	Replicate	Dissolved Boron	Dissolved Lithium	Dissolved Sulfate	pH	ORP
					mg/L	mg/L	mg/L	SU	mV
	Groundwater Only Control	2/15/2022	0	APW-14-1a	9.5	0.28	1,010	6.99	17
				APW-14-2a	9.6	0.28	1,004	6.99	4
				Average Concentration (mg/L)	9.5	0.28	1,007	6.99	11
		2/22/2022	7	APW-14-1	9.2	0.25	1,366	7.00	-28
				APW-14-2	10.0	0.25	773	7.00	-24
				Average Concentration (mg/L)	9.6	0.25	1,069	7.00	-26
N-SB-04 (12.0-18.0 ft bgs)	2:1 Soil:Water Ratio	2/15/2022	0						
		2/22/2022	7	N-SB-04-(12.0-18.0) :APW-14 2:1-1	5.6	<0.10	773	7.02	-72
				N-SB-04-(12.0-18.0) :APW-14 2:1-2	5.6	<0.10	938	7.02	-150
				Average Concentration (mg/L)	5.6	ND	856	7.02	-111
	1:1 Soil:Water Ratio	2/15/2022	0						
		2/22/2022	7	N-SB-04-(12.0-18.0) :APW-14 1:1-1	7.2	0.15	853	7.03	-47
				N-SB-04-(12.0-18.0) :APW-14 1:1-2	7.0	0.13	630	7.04	35
				Average Concentration (mg/L)	7.1	0.14	741	7.04	-6
	1:5 Soil:Water Ratio	2/15/2022	0						
		2/22/2022	7	N-SB-04-(12.0-18.0) :APW-14 1:5-1	10.2	0.26	716	7.06	53
				N-SB-04-(12.0-18.0) :APW-14 1:5-2	8.9	0.20	1,081	7.05	17
				Average Concentration (mg/L)	9.6	0.23	899	7.06	35
	1:10 Soil:Water Ratio	2/15/2022	0						
		2/22/2022	7	N-SB-04-(12.0-18.0) :APW-14 1:10-1	10	0.22	914	7.05	21
				N-SB-04-(12.0-18.0) :APW-14 1:10-2	9.7	0.23	998	7.06	34
				Average Concentration (mg/L)	10	0.23	956	7.06	28
	1:20 Soil:Water Ratio	2/15/2022	0						
		2/22/2022	7	N-SB-04-(12.0-18.0) :APW-14 1:20-1	9.8	0.26	650	7.08	41
				N-SB-04-(12.0-18.0) :APW-14 1:20-2	9.0	0.24	724	7.04	38
				Average Concentration (mg/L)	9.4	0.25	687	7.06	40

Notes:
1) mg/L- Miligrams per liter
2) SU - Standard Units
3) mV - milivolts
4) ORP - Oxidation Reduction Potential
5) ND - non-detect

Table 5: Partition Coefficient Results, APW-04

Analyte	Isotherm	Variable	With Soil Mass
Boron	Raw Data R^2		0.16
	Linear K_D (L/kg)		-1.35
	Langmuir	R^2	0.03
		q_m (mg/g)	-0.003
		K_L (L/kg)	-6.23E+04
	Freundlich	R^2	0.01
		1/n	0.379
		K_F (L/kg)	57.39
Lithium	Raw Data R^2		0.20
	Linear K_D (L/kg)		4.49
	Langmuir	R^2	0.94
		q_m (mg/g)	0.009
		K_L (L/kg)	6.16E+07
	Freundlich	R^2	0.23
		1/n	0.101
		K_F (L/kg)	135.83
Sulfate	Raw Data R^2		0.62
	Linear K_D (L/kg)		3.58
	Langmuir	R^2	0.13
		q_m (mg/g)	-0.999
		K_L (L/kg)	-6.26E+02
	Freundlich	R^2	0.53
		1/n	1.924
		K_F (L/kg)	4.11

Note(s):

K_D: linear partition coefficient

K_L: Langmuir partition coefficient

K_F: Freundlich partition coefficient

q_m: 1/slope in the linear expression of the isotherm

n: non-linearity constant

Table 6: Partition Coefficient Results, APW-14

Analyte	Isotherm	Variable	With Soil Mass
Boron	Raw Data R^2		0.37
	Linear K_D (L/kg)		-0.89
	Langmuir	R^2	0.18
		q_m (mg/g)	0.000
		K_L (L/kg)	-1.56E+05
	Freundlich	R^2	0.99
		1/n	0.280
		K_F (L/kg)	68.65
Lithium	Raw Data R^2		0.57
	Linear K_D (L/kg)		5.58
	Langmuir	R^2	1.00
		q_m (mg/g)	0.034
		K_L (L/kg)	1.55E+08
	Freundlich	R^2	0.54
		1/n	0.031
		K_F (L/kg)	230.83
Sulfate	Raw Data R^2		0.47
	Linear K_D (L/kg)		-25.60
	Langmuir	R^2	0.07
		q_m (mg/g)	0.166
		K_L (L/kg)	-2.20E+03
	Freundlich	R^2	0.33
		1/n	-6.626
		K_F (L/kg)	2.14E+11

Note(s):

K_D: linear partition coefficient

K_L: Langmuir partition coefficient

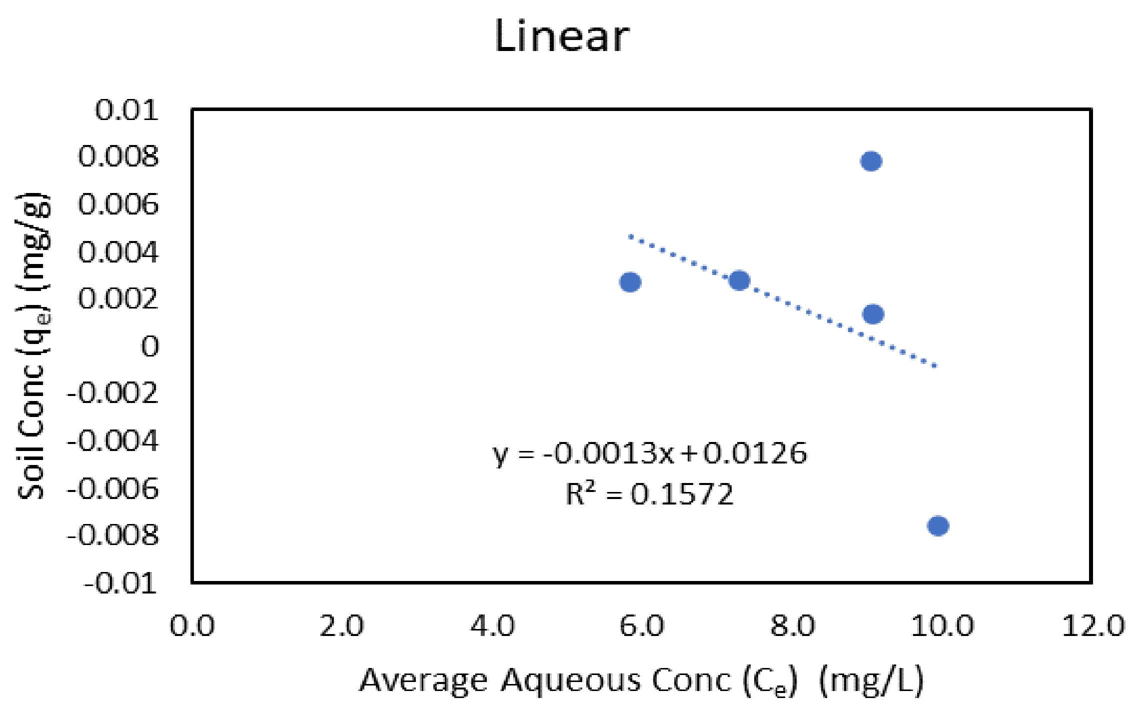
K_F: Freundlich partition coefficient

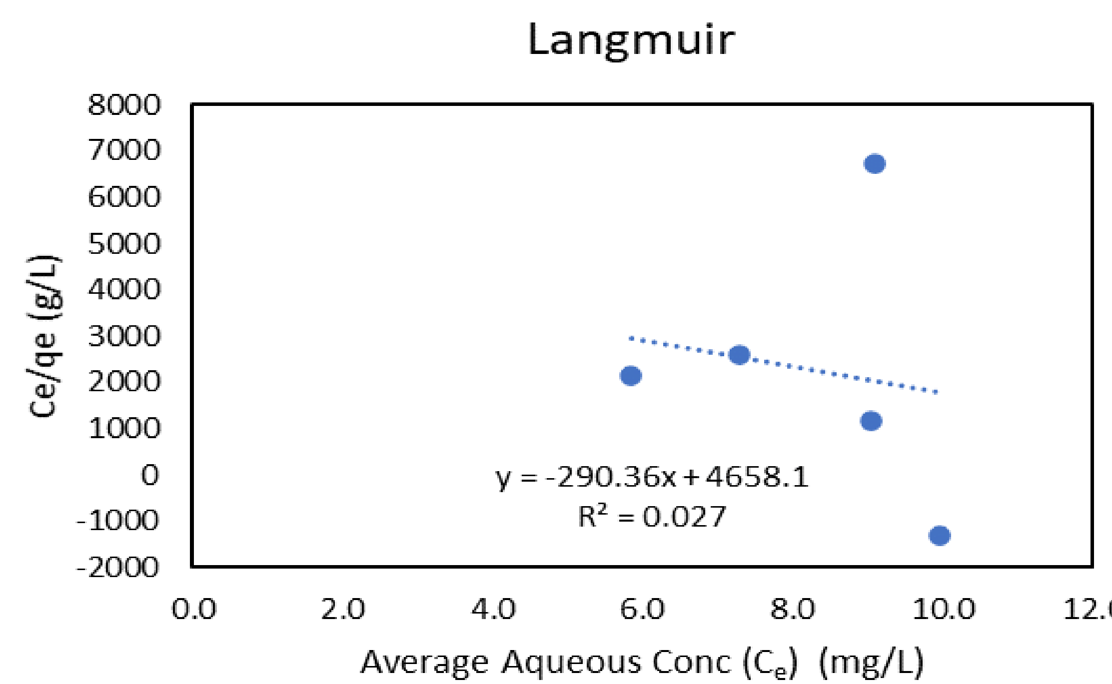
q_m: 1/slope in the linear expression of the isotherm

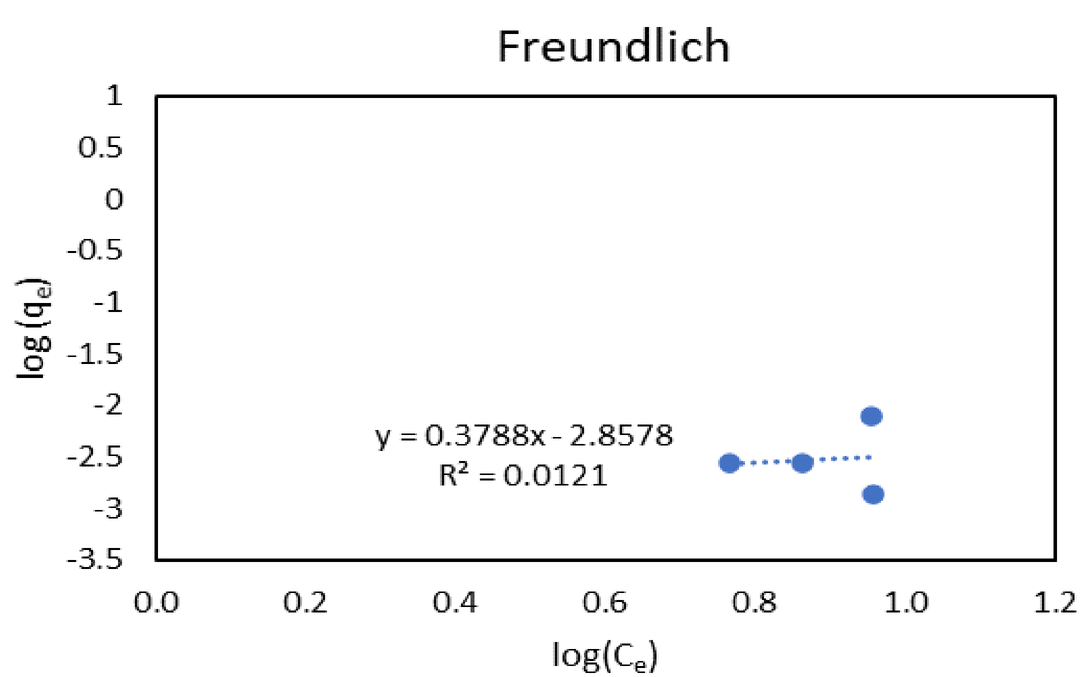
n: non-linearity constant

APPENDIX A

Partition Coefficient Graphs







Note(s):
mg/L: milligrams per liter
mg/g: milligrams per gram
g/L: grams per liter
Ce: aqueous concentration of the adsorbate
qe: concentration of the adsorbate in soil

CLIENT
ILLINOIS POWER GENERATING COMPANY
NEWTON PRIMARY ASH POND (CCR UNIT 501)

PROJECT
EVALUATION OF PARTITION COEFFICIENT RESULTS PAP

CONSULTANT
WSP GOLDER

TITLE
APW-04 BORON PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
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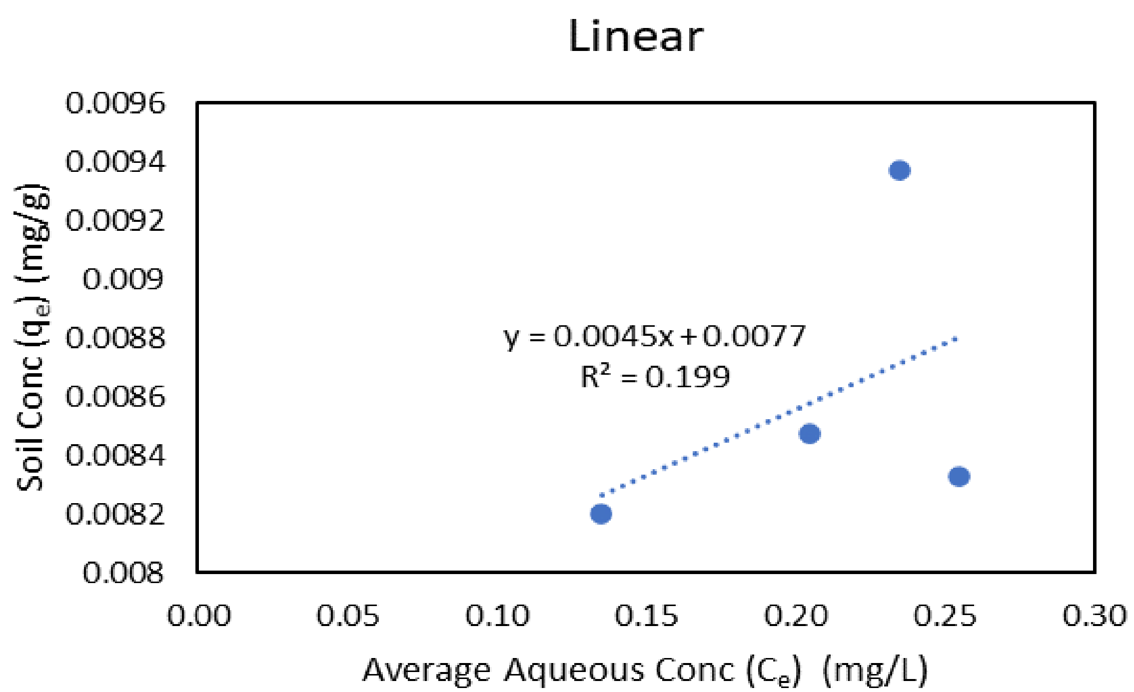

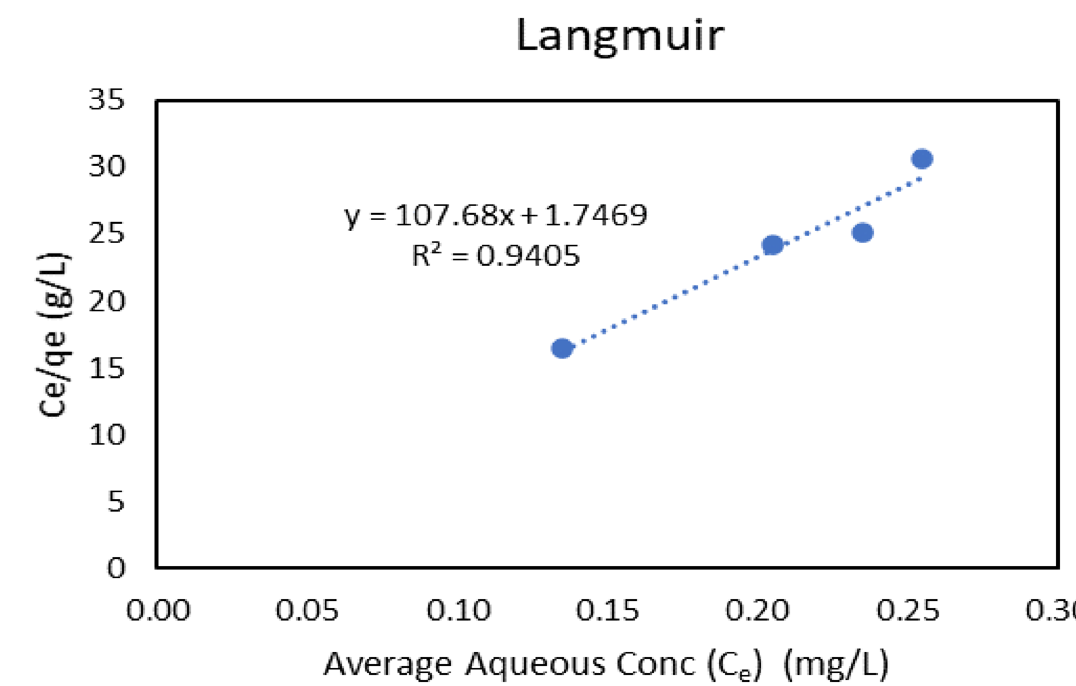

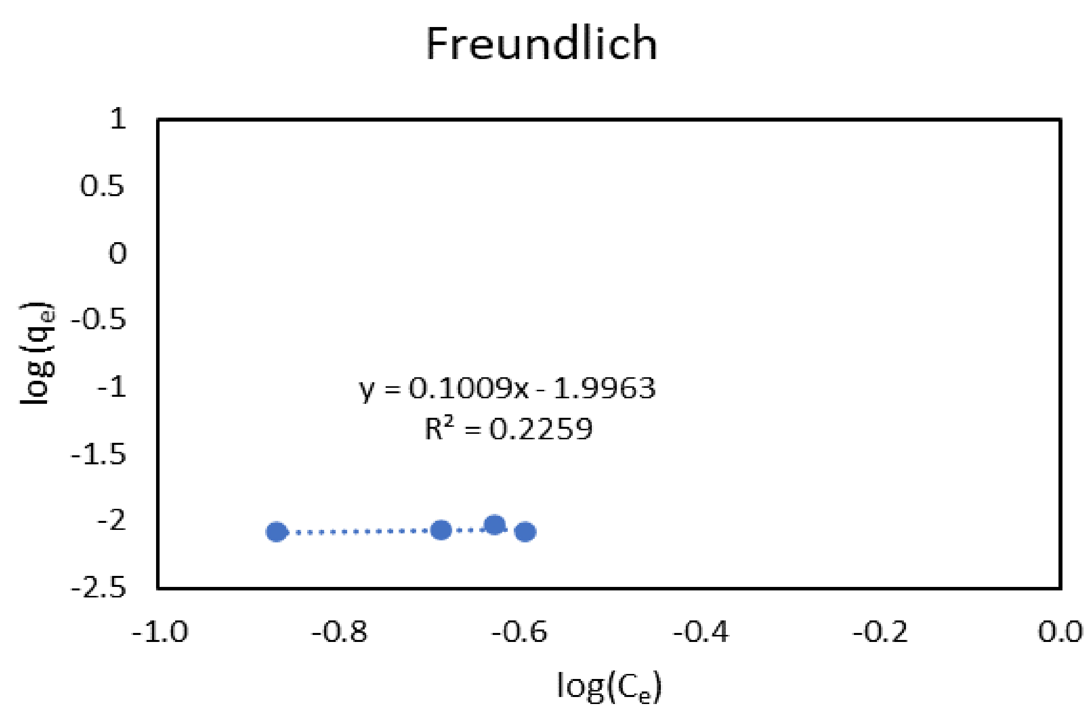

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EVALUATION OF PARTITION COEFFICIENT RESULTS PAP

CONSULTANT
WSP GOLDER

TITLE
APW-04 LITHIUM PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
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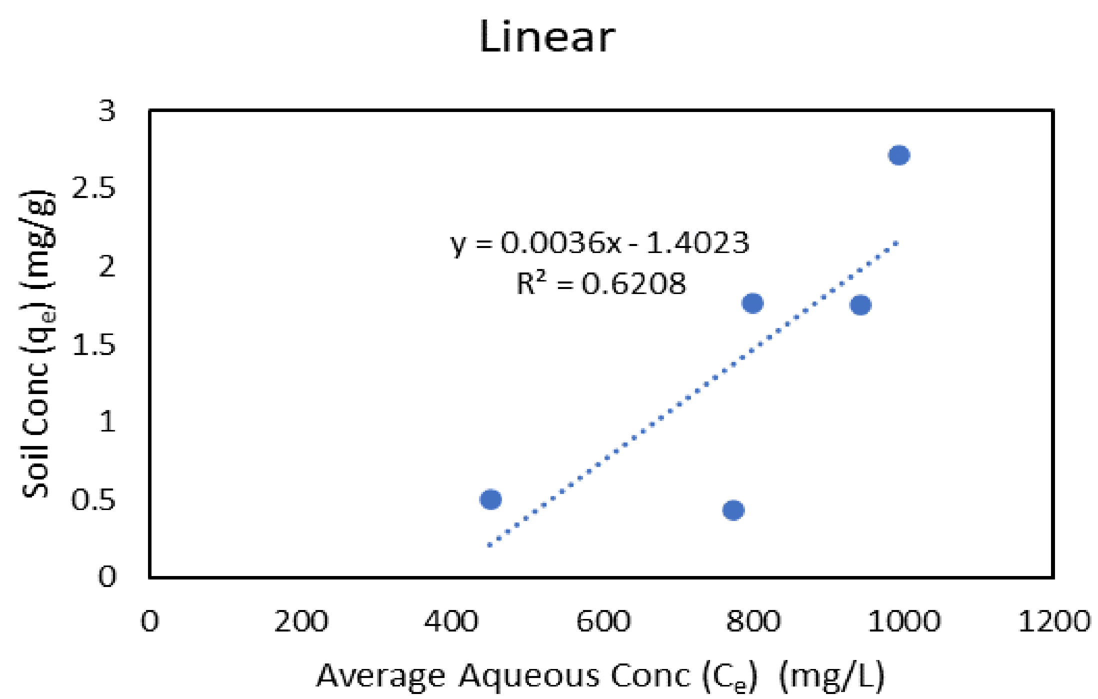

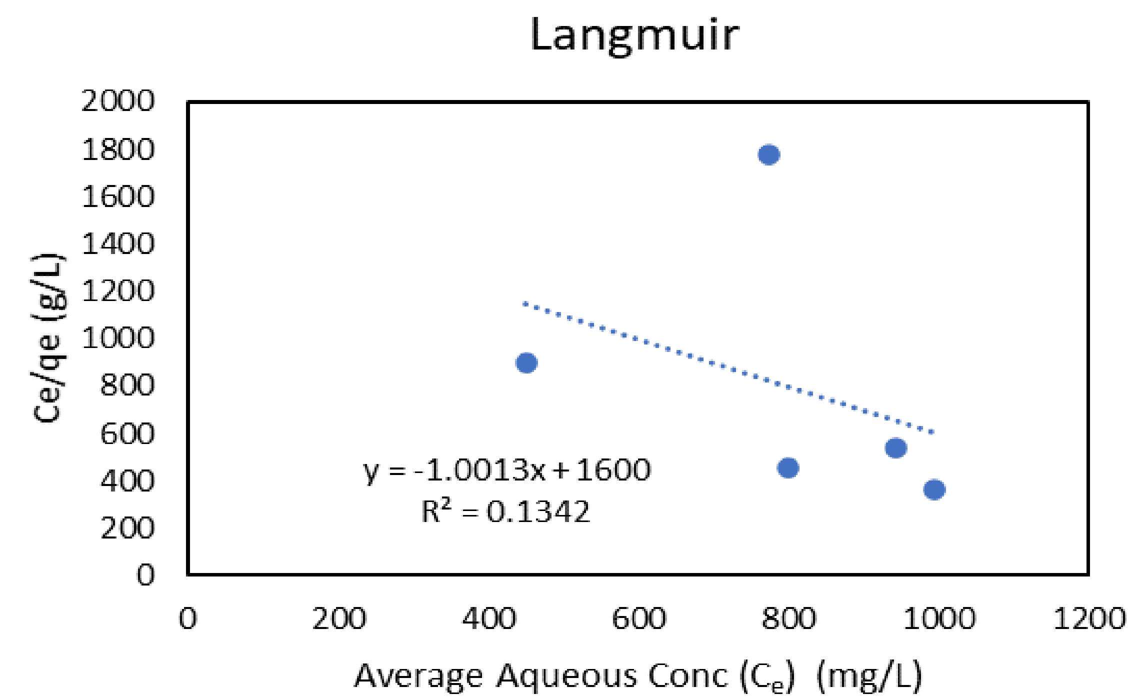

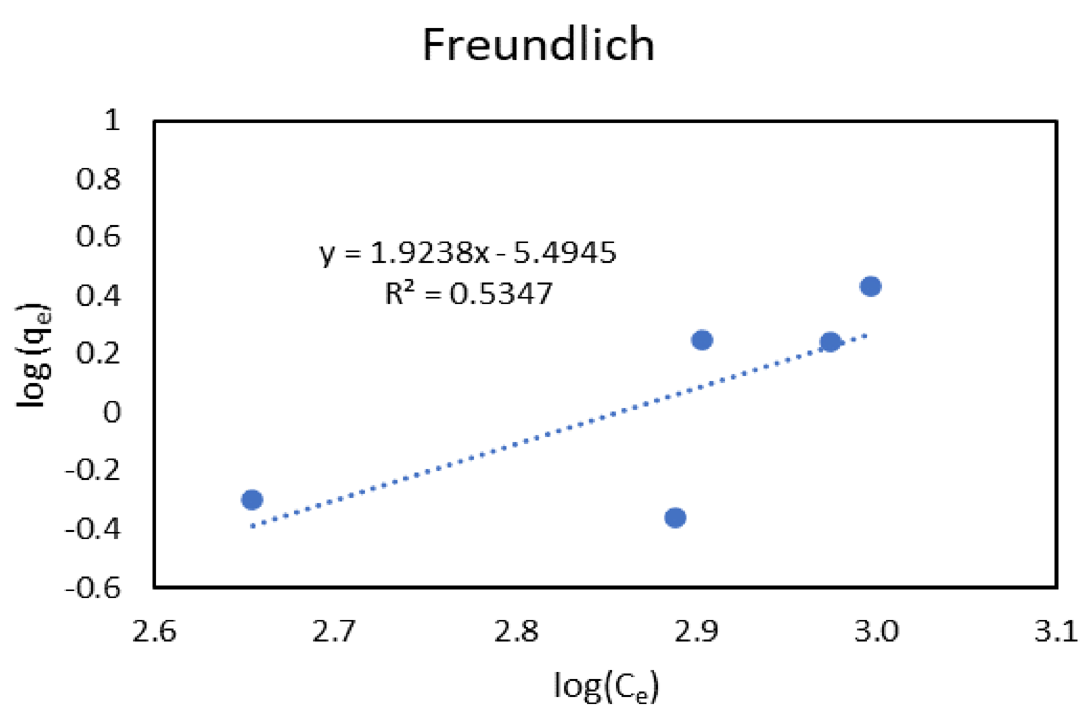

Note(s):
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g/L: grams per liter
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PROJECT
EVALUATION OF PARTITION COEFFICIENT RESULTS PAP

CONSULTANT
WSP GOLDER

TITLE
APW-04 SULFATE PARTITION COEFFICIENTS

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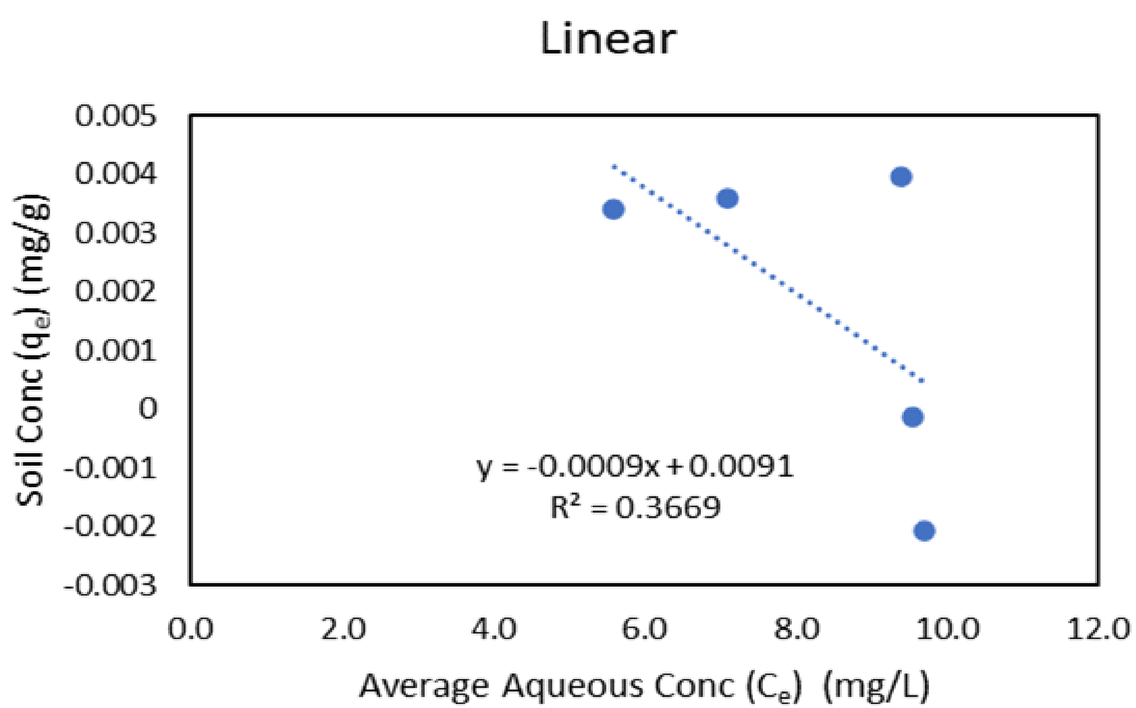

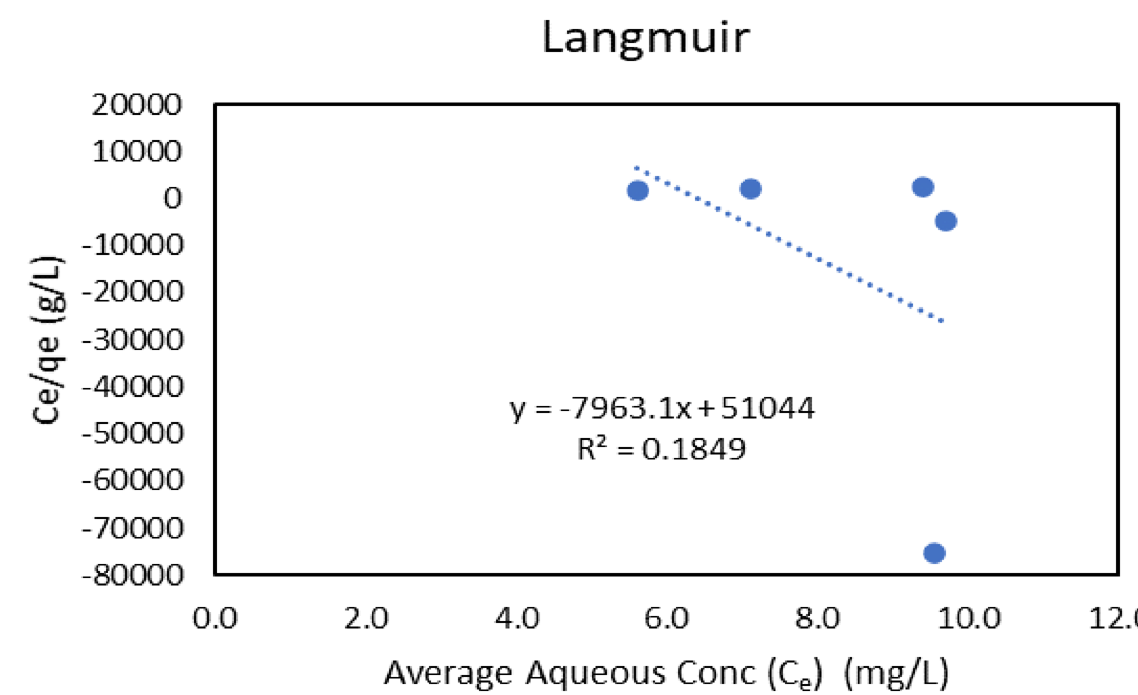

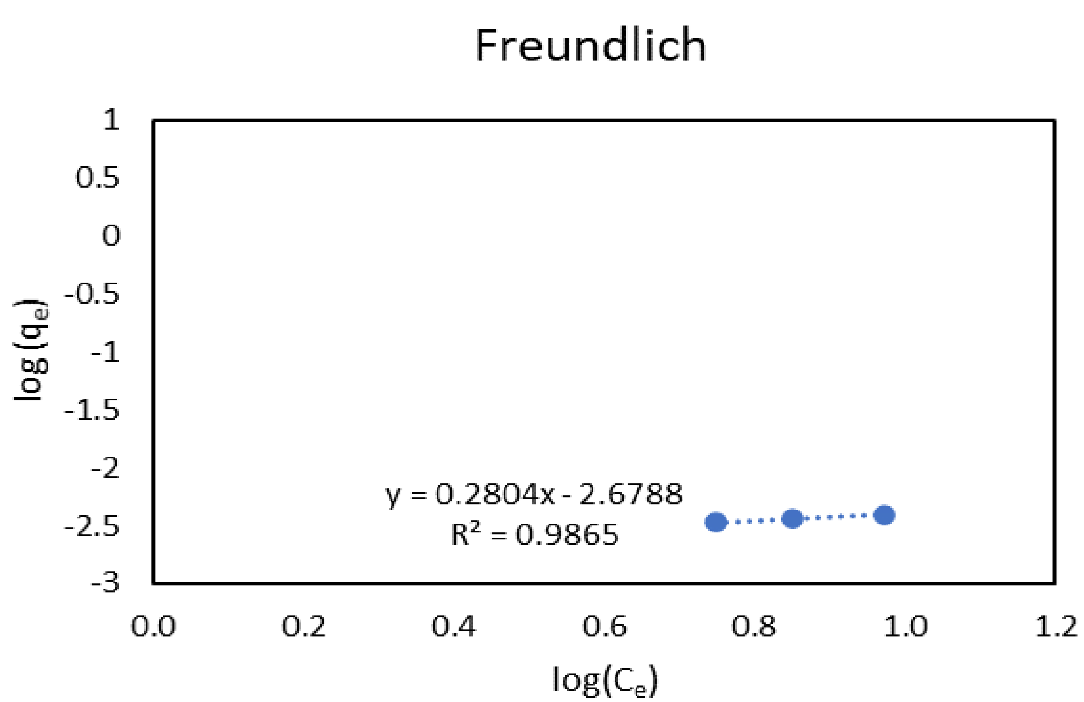

Note(s):
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mg/g: milligrams per gram
g/L: grams per liter
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PROJECT
EVALUATION OF PARTITION COEFFICIENT RESULTS PAP

CONSULTANT
WSP GOLDER

TITLE
APW-14 BORON PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
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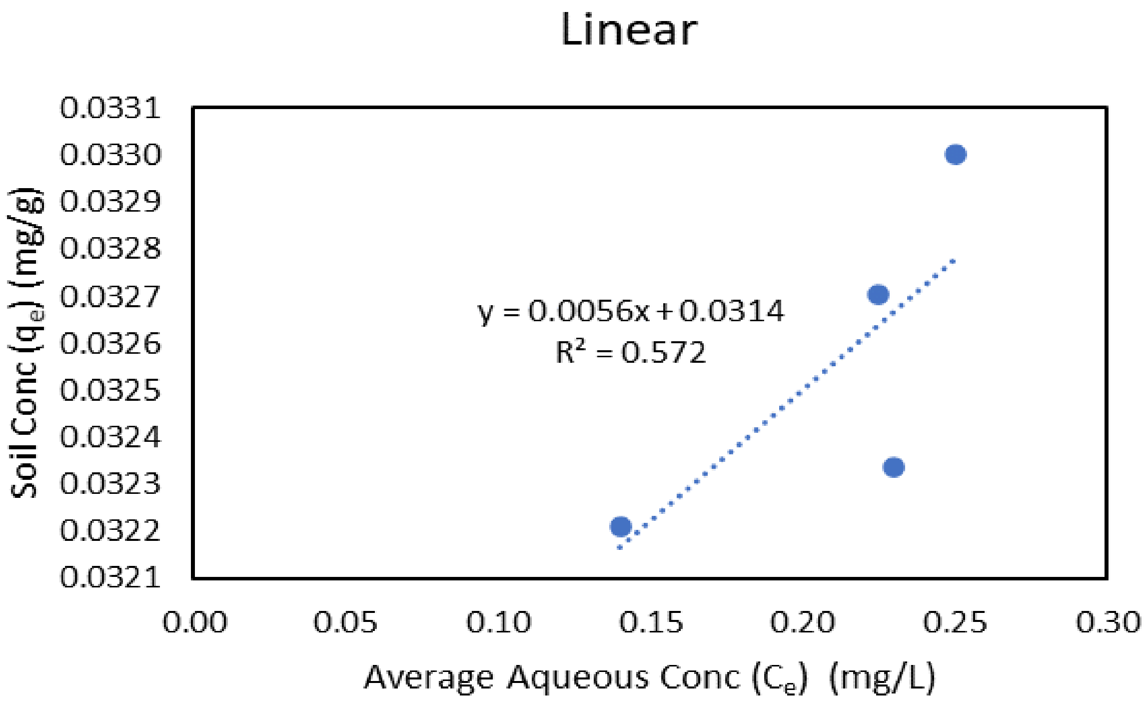

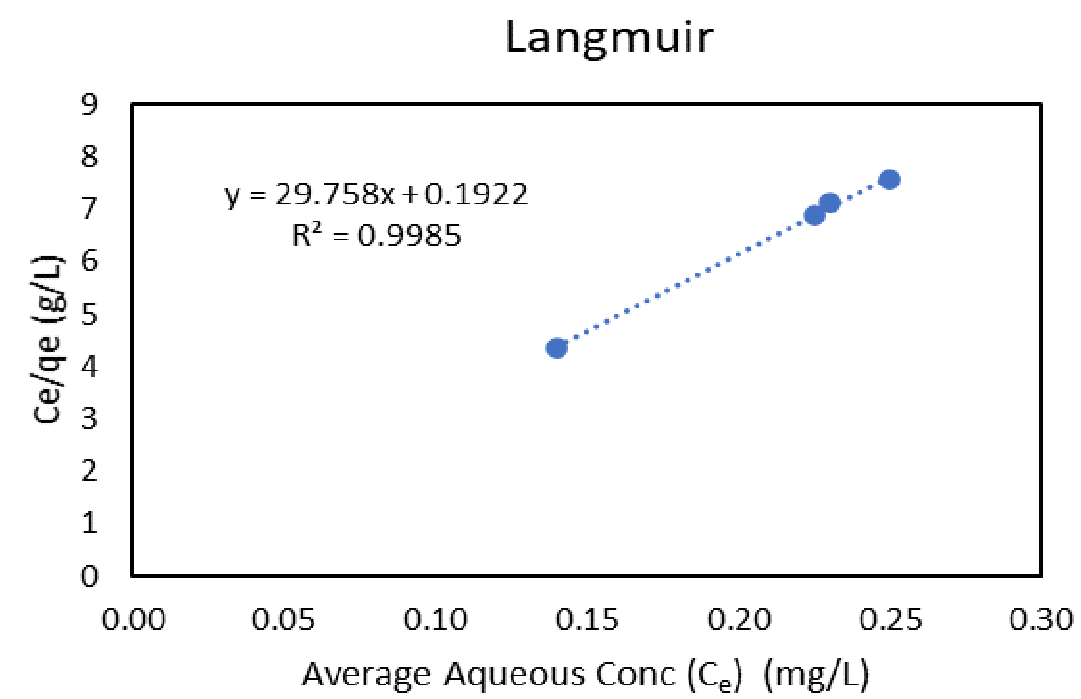

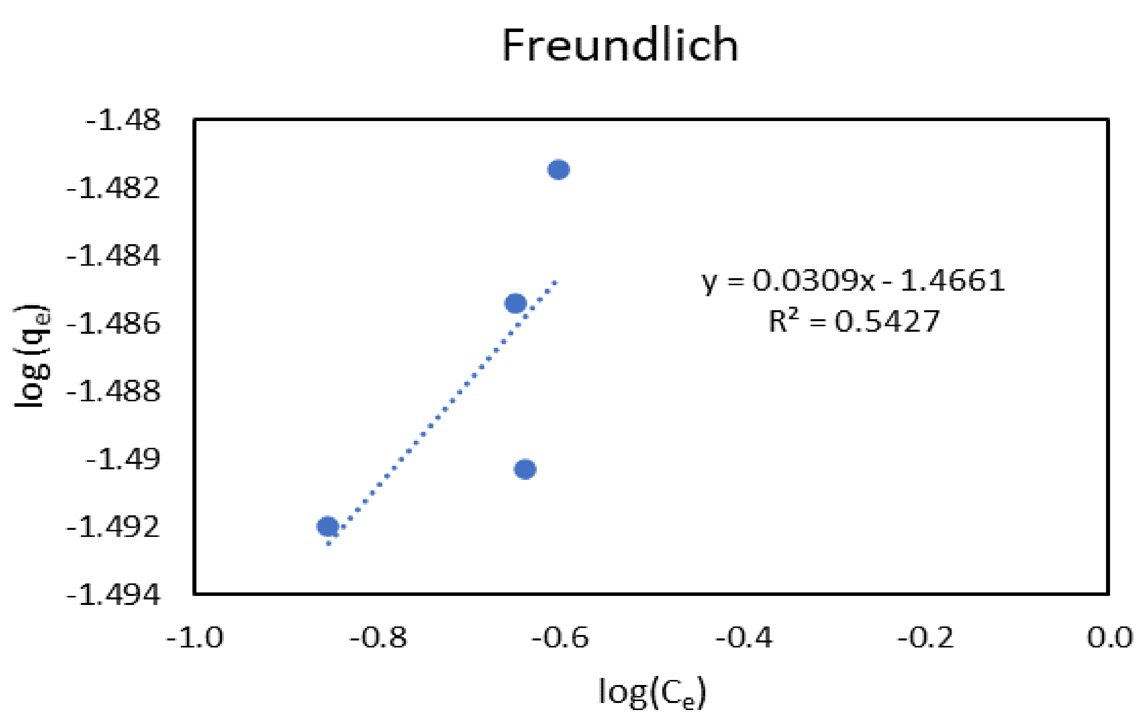

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NEWTON PRIMARY ASH POND (CCR UNIT 501)

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EVALUATION OF PARTITION COEFFICIENT RESULTS PAP

CONSULTANT
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TITLE
APW-14 LITHIUM PARTITION COEFFICIENTS

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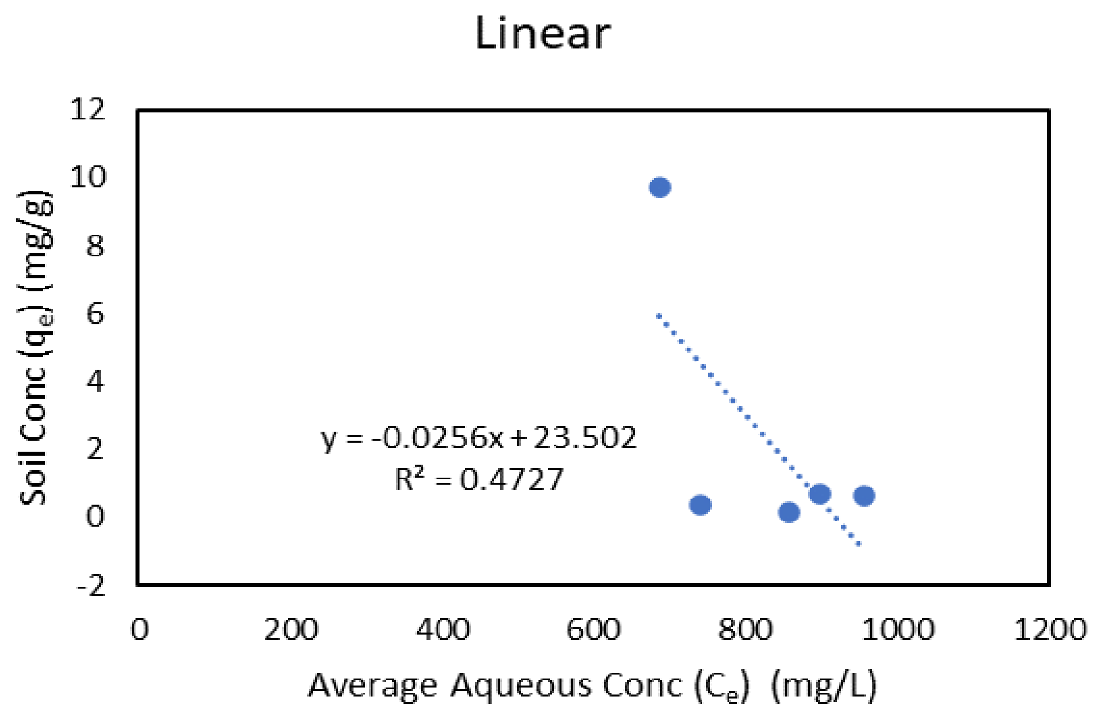

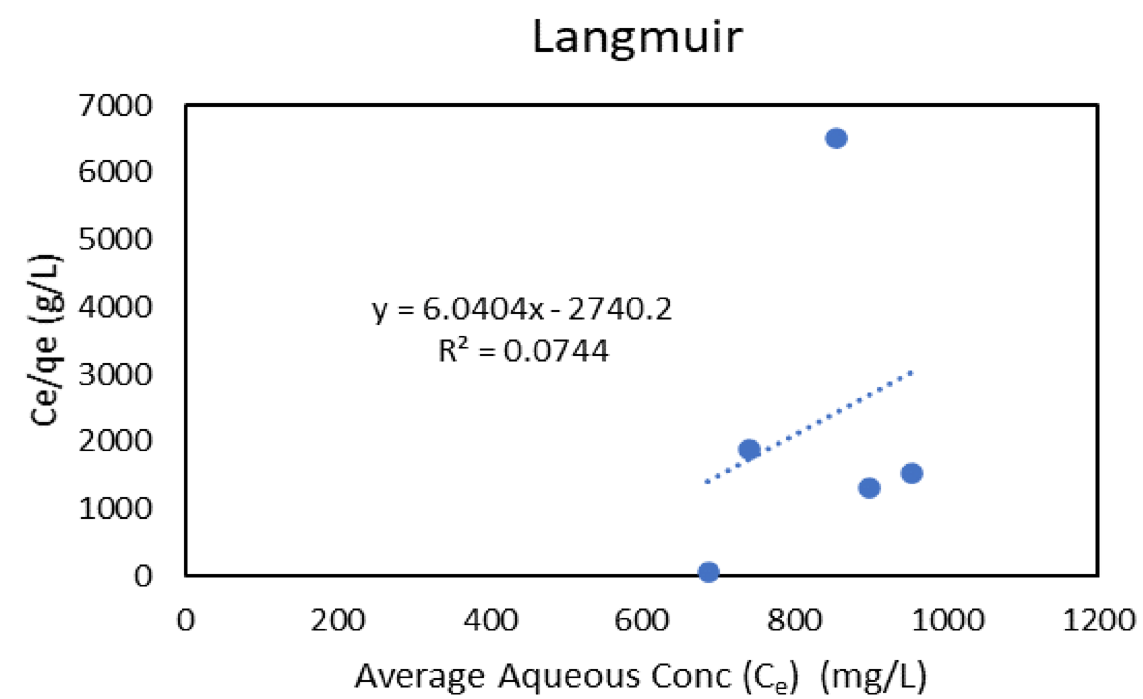

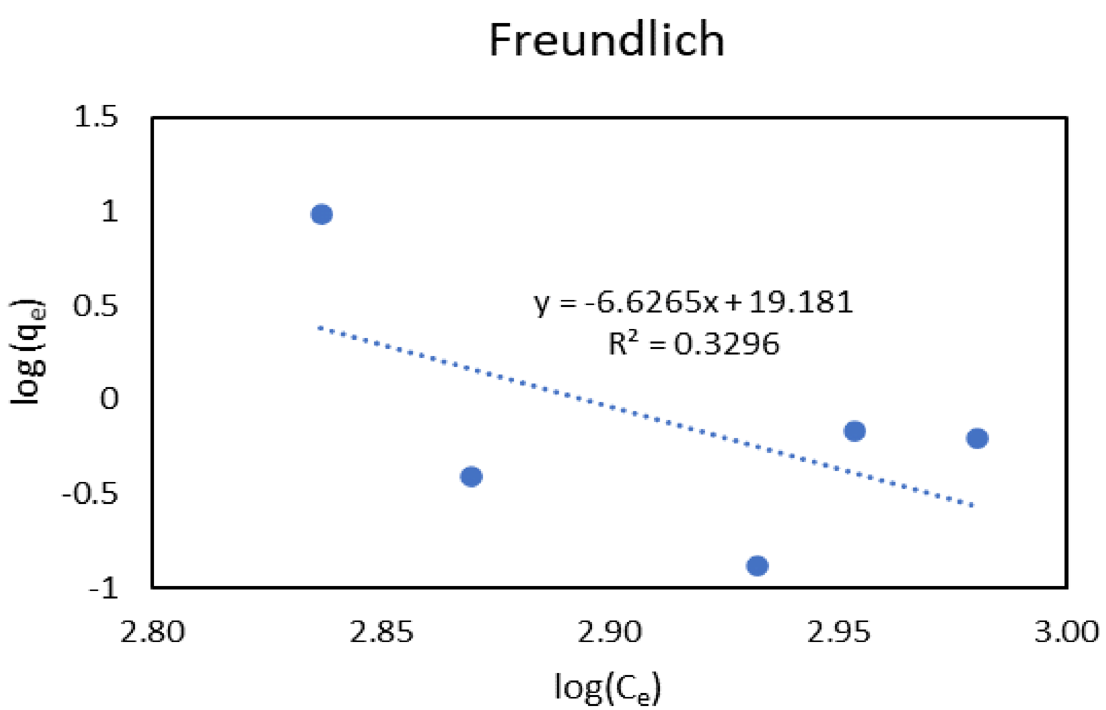

Note(s):
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CLIENT
ILLINOIS POWER GENERATING COMPANY
NEWTON PRIMARY ASH POND (CCR UNIT 501)

PROJECT
EVALUATION OF PARTITION COEFFICIENT RESULTS PAP

CONSULTANT

TITLE
APW-14 SULFATE PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
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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: NEW AP CBR **Simulated On:** 4/15/2022 8:55

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)

Silty Clay

Material Texture Number 43

Thickness	=	60	inches
Porosity	=	0.452	vol/vol
Field Capacity	=	0.411	vol/vol
Wilting Point	=	0.311	vol/vol
Initial Soil Water Content	=	0.4381	vol/vol
Effective Sat. Hyd. Conductivity	=	1.45E-06	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	88.7	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	413.3	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	7.651	inches
Upper Limit of Evaporative Storage	=	8.136	inches
Lower Limit of Evaporative Storage	=	5.598	inches
Initial Snow Water	=	1.570044	inches
Initial Water in Layer Materials	=	26.284	inches
Total Initial Water	=	27.854	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.93	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	120	days
End of Growing Season (Julian Date)	=	300	days

Average Wind Speed	=	8 mph
Average 1st Quarter Relative Humidity	=	73 %
Average 2nd Quarter Relative Humidity	=	71 %
Average 3rd Quarter Relative Humidity	=	75 %
Average 4th Quarter Relative Humidity	=	75 %

Note: Evapotranspiration data was obtained for Newton, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
3.464157	2.363177	4.307613	4.875747	5.596821	4.968593
3.874885	3.10377	3.080127	3.602883	4.376843	2.870644

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
39	38.7	47.8	61.1	70.7	80.8
84.9	82.3	72.7	58.1	47.1	38.2

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28

Average Annual Totals Summary

Title: Newton Ash Pond
Simulated on: 4/15/2022 8:57

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	46.49	[5.78]	69,740,858.4	100.00
Runoff	12.610	[4.666]	18,918,136.8	27.13
Evapotranspiration	29.590	[2.377]	44,393,677.7	63.66
Subprofile1				
Percolation/leakage through Layer 1	4.380870	[1.077458]	6,572,527.9	9.42
Water storage				
Change in water storage	-0.0956	[1.0769]	-143,483.9	-0.21

* 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: NEW AP CIP Rem   Simulated On: 15/04/2022 09:58

Layer 1
Type 1 - Vertical Percolation Layer (Cover Soil)
Silty Clay
Material Texture Number 43

Thickness	=	60	inches
Porosity	=	0.452	vol/vol
Field Capacity	=	0.411	vol/vol
Wilting Point	=	0.311	vol/vol
Initial Soil Water Content	=	0.4381	vol/vol
Effective Sat. Hyd. Conductivity	=	1.45E-06	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	88.9	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	148.3	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	7.652	inches
Upper Limit of Evaporative Storage	=	8.136	inches
Lower Limit of Evaporative Storage	=	5.598	inches
Initial Snow Water	=	1.570044	inches
Initial Water in Layer Materials	=	26.285	inches
Total Initial Water	=	27.855	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.93	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	120	days
End of Growing Season (Julian Date)	=	300	days

Average Wind Speed	=	8 mph
Average 1st Quarter Relative Humidity	=	73 %
Average 2nd Quarter Relative Humidity	=	71 %
Average 3rd Quarter Relative Humidity	=	75 %
Average 4th Quarter Relative Humidity	=	75 %

Note: Evapotranspiration data was obtained for Newton, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
3.464157	2.363177	4.307613	4.875747	5.596821	4.968593
3.874885	3.10377	3.080127	3.602883	4.376843	2.870644

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
39	38.7	47.8	61.1	70.7	80.8
84.9	82.3	72.7	58.1	47.1	38.2

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28

Average Annual Totals Summary

Title: Newton Ash Pond
Simulated on: 15/04/2022 10:00

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	46.49	[5.78]	25,024,363.2	100.00
Runoff	12.733	[4.682]	6,854,402.4	27.39
Evapotranspiration	29.555	[2.373]	15,910,257.1	63.58
Subprofile1				
Percolation/leakage through Layer 1	4.293314	[1.064874]	2,311,215.5	9.24
Water storage				
Change in water storage	-0.0957	[1.0763]	-51,511.8	-0.21

* 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: NEW AP CIP Cons   Simulated On: 15/04/2022 10:12

Layer 1
Type 1 - Vertical Percolation Layer (Cover Soil)
SCL - Sandy Clay Loam
Material Texture Number 10

Thickness	=	6	inches
Porosity	=	0.398	vol/vol
Field Capacity	=	0.244	vol/vol
Wilting Point	=	0.136	vol/vol
Initial Soil Water Content	=	0.2475	vol/vol
Effective Sat. Hyd. Conductivity	=	1.20E-04	cm/sec

Layer 2
Type 1 - Vertical Percolation Layer
Sandy Silty Clay - PAP
Material Texture Number 43

Thickness	=	18	inches
Porosity	=	0.4	vol/vol
Field Capacity	=	0.35	vol/vol
Wilting Point	=	0.3	vol/vol
Initial Soil Water Content	=	0.3706	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-05	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	=	0.0581	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	2	%
Drainage Length	=	1500	ft

Layer 4

Type 4 - Flexible Membrane Liner
LDPE Membrane
Material Texture Number 36

Thickness	=	0.04	inches
Effective Sat. Hyd. Conductivity	=	4.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 5
Type 1 - Vertical Percolation Layer (Waste)
High-Density Electric Plant Coal Fly Ash
Material Texture Number 30

Thickness	=	156	inches
Porosity	=	0.541	vol/vol
Field Capacity	=	0.187	vol/vol
Wilting Point	=	0.047	vol/vol
Initial Soil Water Content	=	0.1871	vol/vol
Effective Sat. Hyd. Conductivity	=	5.00E-05	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	84.4	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	265	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	5.928	inches
Upper Limit of Evaporative Storage	=	7.188	inches
Lower Limit of Evaporative Storage	=	4.416	inches
Initial Snow Water	=	1.570044	inches
Initial Water in Layer Materials	=	37.354	inches
Total Initial Water	=	38.924	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.93	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	120	days

End of Growing Season (Julian Date)	=	300	days
Average Wind Speed	=	8	mph
Average 1st Quarter Relative Humidity	=	73	%
Average 2nd Quarter Relative Humidity	=	71	%
Average 3rd Quarter Relative Humidity	=	75	%
Average 4th Quarter Relative Humidity	=	75	%

Note: Evapotranspiration data was obtained for Newton, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
3.464157	2.363177	4.307613	4.875747	5.596821	4.968593
3.874885	3.10377	3.080127	3.602883	4.376843	2.870644

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
39	38.7	47.8	61.1	70.7	80.8
84.9	82.3	72.7	58.1	47.1	38.2

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28

Average Annual Totals Summary

Title: Newton Ash Pond
Simulated on: 15/04/2022 10:15

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	46.49	[5.78]	44,716,495.2	100.00
Runoff	5.561	[3.492]	5,349,478.7	11.96
Evapotranspiration	30.979	[2.74]	29,800,414.9	66.64
Subprofile1				
Lateral drainage collected from Layer 3	9.9514	[2.1689]	9,572,702.5	21.41
Percolation/leakage through Layer 4	0.041772	[0.018348]	40,183.0	0.09
Average Head on Top of Layer 4	1.4441	[0.6401]	---	---
Subprofile2				
Percolation/leakage through Layer 5	0.042250	[0.019041]	40,642.1	0.09
Water storage				
Change in water storage	-0.0486	[1.0288]	-46,743.0	-0.10

* 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: NEW AP LF Cons   Simulated On: 15/04/2022 09:22

Layer 1
Type 2 - Lateral Drainage Layer
SCL - Sandy Clay Loam
Material Texture Number 10

Thickness	=	4	inches
Porosity	=	0.398	vol/vol
Field Capacity	=	0.244	vol/vol
Wilting Point	=	0.136	vol/vol
Initial Soil Water Content	=	0.2658	vol/vol
Effective Sat. Hyd. Conductivity	=	1.20E-04	cm/sec
Slope	=	0	%
Drainage Length	=	0	ft

Layer 2
Type 1 - Vertical Percolation Layer
Sandy Silty Clay - PSL
Material Texture Number 43

Thickness	=	32	inches
Porosity	=	0.4	vol/vol
Field Capacity	=	0.35	vol/vol
Wilting Point	=	0.3	vol/vol
Initial Soil Water Content	=	0.3679	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-05	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	=	0.0394	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+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)

High-Density Electric Plant Coal Fly Ash

Material Texture Number 30

Thickness	=	768	inches
Porosity	=	0.541	vol/vol
Field Capacity	=	0.187	vol/vol
Wilting Point	=	0.047	vol/vol
Initial Soil Water Content	=	0.187	vol/vol
Effective Sat. Hyd. Conductivity	=	5.00E-05	cm/sec

Layer 6

Type 2 - Lateral Drainage Layer

Granular Drainage Layer

Material Texture Number 44

Thickness	=	12	inches
Porosity	=	0.417	vol/vol
Field Capacity	=	0.045	vol/vol
Wilting Point	=	0.018	vol/vol
Initial Soil Water Content	=	0.045	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-01	cm/sec
Slope	=	2	%
Drainage Length	=	150	ft

Layer 7

Type 4 - Flexible Membrane Liner

HDPE Membrane

Material Texture Number 35

Thickness	=	0.06	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 8

Type 3 - Barrier Soil Liner

Liner Soil (High)

Material Texture Number 16

Thickness	=	36	inches
Porosity	=	0.427	vol/vol
Field Capacity	=	0.418	vol/vol
Wilting Point	=	0.367	vol/vol
Initial Soil Water Content	=	0.427	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-07	cm/sec

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	=	85.2	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	11.7	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	6.13	inches
Upper Limit of Evaporative Storage	=	7.192	inches
Lower Limit of Evaporative Storage	=	4.744	inches
Initial Snow Water	=	1.570044	inches
Initial Water in Layer Materials	=	172.373	inches
Total Initial Water	=	173.943	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.93	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	120	days
End of Growing Season (Julian Date)	=	300	days
Average Wind Speed	=	8	mph
Average 1st Quarter Relative Humidity	=	73	%
Average 2nd Quarter Relative Humidity	=	71	%
Average 3rd Quarter Relative Humidity	=	75	%
Average 4th Quarter Relative Humidity	=	75	%

Note: Evapotranspiration data was obtained for Newton, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
3.464157	2.363177	4.307613	4.875747	5.596821	4.968593
3.874885	3.10377	3.080127	3.602883	4.376843	2.870644

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.29

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
39	38.7	47.8	61.1	70.7	80.8
84.9	82.3	72.7	58.1	47.1	38.2

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.29
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.29

Average Annual Totals Summary

Title: Newton LF Cons
Simulated on: 15/04/2022 09:24

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	46.49	[5.78]	1,974,275.4	100.00
Runoff	6.157	[3.7]	261,476.2	13.24
Evapotranspiration	30.509	[2.68]	1,295,750.3	65.63
Subprofile1				
Lateral drainage collected from Layer 3	9.8649	[2.3407]	418,972.5	21.22
Percolation/leakage through Layer 4	0.000668	[0.000143]	28.4	0.00
Average Head on Top of Layer 4	0.0143	[0.0034]	---	---
Subprofile2				
Lateral drainage collected from Layer 6	0.0007	[0.0001]	28.3	0.00
Percolation/leakage through Layer 8	0.000003	[0]	0.1064	0.00
Average Head on Top of Layer 7	0.0000	[0]	---	---
Water storage				
Change in water storage	-0.0460	[1.0053]	-1,952.0	-0.10

* 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: NEW AP Default **Simulated On:** 7/12/2022 18:17

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
SCL - Sandy Clay Loam
Material Texture Number 10

Thickness	=	6	inches
Porosity	=	0.398	vol/vol
Field Capacity	=	0.244	vol/vol
Wilting Point	=	0.136	vol/vol
Initial Soil Water Content	=	0.2475	vol/vol
Effective Sat. Hyd. Conductivity	=	1.20E-04	cm/sec

Layer 2

Type 1 - Vertical Percolation Layer
Sandy Silty Clay - PAP
Material Texture Number 43

Thickness	=	30	inches
Porosity	=	0.4	vol/vol
Field Capacity	=	0.35	vol/vol
Wilting Point	=	0.3	vol/vol
Initial Soil Water Content	=	0.3718	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-05	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	=	0.092	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	2	%
Drainage Length	=	1500	ft

Layer 4

Type 4 - Flexible Membrane Liner
LDPE Membrane
Material Texture Number 36

Thickness	=	0.04	inches
Effective Sat. Hyd. Conductivity	=	4.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 5

Type 1 - Vertical Percolation Layer (Waste)
High-Density Electric Plant Coal Fly Ash
Material Texture Number 30

Thickness	=	156	inches
Porosity	=	0.541	vol/vol
Field Capacity	=	0.187	vol/vol
Wilting Point	=	0.047	vol/vol
Initial Soil Water Content	=	0.1872	vol/vol
Effective Sat. Hyd. Conductivity	=	5.00E-05	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	84.4	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	265	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	5.92	inches
Upper Limit of Evaporative Storage	=	7.188	inches
Lower Limit of Evaporative Storage	=	4.416	inches
Initial Snow Water	=	1.570044	inches
Initial Water in Layer Materials	=	41.857	inches
Total Initial Water	=	43.427	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.93	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	120	days

End of Growing Season (Julian Date)	=	300	days
Average Wind Speed	=	8	mph
Average 1st Quarter Relative Humidity	=	73	%
Average 2nd Quarter Relative Humidity	=	71	%
Average 3rd Quarter Relative Humidity	=	75	%
Average 4th Quarter Relative Humidity	=	75	%

Note: Evapotranspiration data was obtained for Newton, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
3.464157	2.363177	4.307613	4.875747	5.596821	4.968593
3.874885	3.10377	3.080127	3.602883	4.376843	2.870644

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
39	38.7	47.8	61.1	70.7	80.8
84.9	82.3	72.7	58.1	47.1	38.2

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28

Average Annual Totals Summary

Title: NEW AP Default
Simulated on: 7/12/2022 18:18

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	46.49	[5.78]	44,716,495.2	100.00
Runoff	5.416	[3.469]	5,210,333.7	11.65
Evapotranspiration	30.948	[2.734]	29,770,001.9	66.57
Subprofile1				
Lateral drainage collected from Layer 3	10.1178	[2.2092]	9,732,826.8	21.77
Percolation/leakage through Layer 4	0.053103	[0.027784]	51,082.0	0.11
Average Head on Top of Layer 4	1.8201	[0.9543]	---	---
Subprofile2				
Percolation/leakage through Layer 5	0.054052	[0.028093]	51,994.9	0.12
Water storage				
Change in water storage	-0.0506	[1.0901]	-48,662.0	-0.11

* 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: NEW AP Default Earth   Simulated On: 27/06/2022 11:01

Layer 1
Type 1 - Vertical Percolation Layer (Cover Soil)
SCL - Sandy Clay Loam
Material Texture Number 10

Thickness	=	6	inches
Porosity	=	0.398	vol/vol
Field Capacity	=	0.244	vol/vol
Wilting Point	=	0.136	vol/vol
Initial Soil Water Content	=	0.3858	vol/vol
Effective Sat. Hyd. Conductivity	=	1.20E-04	cm/sec

Layer 2
Type 1 - Vertical Percolation Layer
Sandy Silty Clay - PAP
Material Texture Number 43

Thickness	=	30	inches
Porosity	=	0.4	vol/vol
Field Capacity	=	0.35	vol/vol
Wilting Point	=	0.3	vol/vol
Initial Soil Water Content	=	0.4	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-05	cm/sec

Layer 3
Type 3 - Barrier Soil Liner
Liner Soil (High)
Material Texture Number 16

Thickness	=	36	inches
Porosity	=	0.427	vol/vol
Field Capacity	=	0.418	vol/vol
Wilting Point	=	0.367	vol/vol
Initial Soil Water Content	=	0.427	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-07	cm/sec

Layer 4
Type 1 - Vertical Percolation Layer (Waste)
High-Density Electric Plant Coal Fly Ash

Material Texture Number 30

Thickness	=	156	inches
Porosity	=	0.541	vol/vol
Field Capacity	=	0.187	vol/vol
Wilting Point	=	0.047	vol/vol
Initial Soil Water Content	=	0.1996	vol/vol
Effective Sat. Hyd. Conductivity	=	5.00E-05	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	84.4	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	265	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	7.115	inches
Upper Limit of Evaporative Storage	=	7.188	inches
Lower Limit of Evaporative Storage	=	4.416	inches
Initial Snow Water	=	1.570044	inches
Initial Water in Layer Materials	=	60.819	inches
Total Initial Water	=	62.389	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.93	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	120	days
End of Growing Season (Julian Date)	=	300	days
Average Wind Speed	=	8	mph
Average 1st Quarter Relative Humidity	=	73	%
Average 2nd Quarter Relative Humidity	=	71	%
Average 3rd Quarter Relative Humidity	=	75	%
Average 4th Quarter Relative Humidity	=	75	%

Note: Evapotranspiration data was obtained for Newton, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec

3.464157	2.363177	4.307613	4.875747	5.596821	4.968593
3.874885	3.10377	3.080127	3.602883	4.376843	2.870644

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
39	38.7	47.8	61.1	70.7	80.8
84.9	82.3	72.7	58.1	47.1	38.2

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28

Average Annual Totals Summary

Title: NEW AP Default Earth
Simulated on: 27/06/2022 11:02

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	46.49	[5.78]	44,716,495.2	100.00
Runoff	12.238	[4.888]	11,772,719.1	26.33
Evapotranspiration	32.236	[2.871]	31,009,280.2	69.35
Subprofile1				
Percolation/leakage through Layer 3	2.070136	[0.059537]	1,991,367.4	4.45
Average Head on Top of Layer 3	23.9878	[1.7467]	---	---
Subprofile2				
Percolation/leakage through Layer 4	1.821708	[0.604523]	1,752,392.2	3.92
Water storage				
Change in water storage	0.1893	[1.099]	182,103.7	0.41

* 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
NEWTON POWER PLANT
PRIMARY ASH POND
NEWTON, ILLINOIS

Calibration Model					
Model	**Model Period (years)**	**HSU**	**Total Flux In[1] (ft^3/d)**	**Total Flux In (gpm)**	
Calibration Model	45	Fill Unit (CCR)	33427.89	173.65	
Model	**Model Period (years)**	**HSU**	**Total Flux Out[1] (ft^3/d)**	**Total Flux Out (gpm)**	
Calibration Model	45	Fill Unit (CCR)	-33528.40	-174.17	
Scenario 1: CIP (CCR removal from the northwest areas of the Ash Pond, consolidation to the northeast, central and southern areas of the Ash Pond, and construction of a cover system over the remaining CCR)					
Prediction Model	**Construction Period (years)**	**HSU**	**Total Flux In[1] (ft^3/d)**	**Total Flux In (gpm)**	**Reduction in Flux In Post Closure[2] (Percentage, %)**
CIP	182	Fill Unit (CCR)	2125.05	11.04	94%
Prediction Model	**Construction Period (years)**	**HSU**	**Total Flux Out[1] (ft^3/d)**	**Total Flux Out (gpm)**	**Reduction in Flux Out Post Closure[2] (Percentage, %)**
CIP	182	Fill Unit (CCR)	-2137.29	-11.10	94%

[O: SLN 6/27/22; C: BGH 6/29/22]

Notes:
1. Total flux in and out source data provided in flux calculation data files included in Appendix B.
2. Reduction in flux as compared to flux at the end of calibration model (model period of 45 years).

CCR = coal combustion residuals
CIP = Closure In Place
HSU = Hydrostratigraphic Unit
% = percentage
ft^3/d = cubic feet per day
gpm = gallons per minute

Attachment C

History of Construction Report

AECOM

October 2016

Illinois Power Generating Company
6725 North 500th Street
Newton, IL 62448

RE: History of Construction
USEPA Final CCR Rule, 40 CFR § 257.73(c)
Newton Power Station
Newton, Illinois

On behalf of Illinois Power Generating Company, AECOM has prepared the following history of construction for the Primary Ash Pond at the Newton Power Station in accordance with 40 CFR § 257.73(c).

BACKGROUND

40 CFR § 257.73(c)(1) requires the owner or operator of an existing coal combustion residual (CCR) surface impoundment that either (1) has a height of five feet or more and a storage volume of 20 acre-feet or more, or (2) has a height of 20 feet or more to compile a history of construction by October 17, 2016 that contains, to the extent feasible, the information specified in 40 CFR § 257.73(c)(1)(i)–(xii).

The history of construction presented herein was compiled based on existing documentation, to the extent that it is reasonably and readily available (see 80 Fed. Reg. 21302, 21380 [April 17, 2015]), and AECOM's site experience. AECOM's document review included record drawings, geotechnical investigations, etc. for the Primary Ash Pond at the Newton Power Station.

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HISTORY OF CONSTRUCTION

§ 257.73(c)(1)(i): The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.

Owner: Illinois Power Generating Company

Address: 1500 Eastport Drive
Collinsville, IL 62234

CCR Unit: Primary Ash Pond

The Primary Ash Pond does not have a state assigned identification number.

§ 257.73(c)(1)(ii): The location of the CCR unit identified on the most recent USGS $7^1/_2$ or 15 minute topographic quadrangle map or a topographic map of equivalent scale if a USGS map is not available.

The location of the Primary Ash Pond has been identified on an USGS 7-1/2 minute topographic quadrangle map in **Appendix A**.

§ 257.73(c)(1)(iii): A statement of the purpose for which the CCR unit is being used.

The Primary Ash Pond is being used to store and dispose of bottom ash and economizer ash and to clarify non-CCR plant process wastewater. A portion of the bottom ash is reclaimed from the Primary Ash Pond for beneficial reuse.

§ 257.73(c)(1)(iv): The name and size in acres of the watershed where the CCR unit is located.

The entire Primary Ash Pond and most of the Newton Power Station are located in the Weather Creek Watershed with a 12-digit Hydrologic Unit Code (HUC) of 051201140504 and a drainage area of 31,573 acres. The other portion of the Newton Power Station is located in the Newton Lake Watershed with a 12-digit Hydrologic Unit Code (HUC) of 051201140503 and a drainage area of 967 acres (USGS, 2016).

§ 257.73(c)(1)(v): A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.

The foundation materials consist of upper clay and lower clay. The physical characteristics properties of the upper clay layer are described as lean clay, fat clay, clayey sand, fat clay with sand, lean clay with sand, silty sand, silty clay, silty clay with sand, sandy lean clay. The upper clay soils exhibit a stiff to hard consistency. The physical characteristics of the lower clay layer are described as glacial till consisting of sandy lean clay, silty sand, clayey silt with sand, silty clay with sand, well graded sand with silt, lean clay, fat clay, clayey sand, silty clay, lean clay with sand, clayey sand with silt, and fat clay with sand. The consistency of the lower clay is very stiff to hard. A summary of the available 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 Material Engineering Properties

Material	Unit Weight (pcf)	Effective (drained) Shear Strength Parameters		Total (undrained) Shear Strength Parameters	
		Effective Friction Angle ϕ′ (deg)	Effective Cohesion c′ (psf)	S_u/σ'_c	Minimum C_u (psf)
Upper Clay	130	29	0	0.40 ($\sigma'_c \geq$ 2,000 psf) 0.63 ($\sigma'_c <$ 2,000 psf)	-
Lower Clay	130	33	3,700	-	5,000

The Primary Ash Pond is an enclosed impoundment with embankments and does not have abutments.

§ 257.73(c)(1)(vi): A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of site preparation and construction of each zone of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.

Physical properties for the embankment are described as lean clay, lean clay with sand, silty clay, silty clay with sand, sandy lean clay, fat clay, fat clay with gravel and sand, fat clay with sand and silt, fat clay with sand, and clayey silt. An available summary of the engineering properties of the Primary Ash Pond embankment is presented in **Table 2** below. The engineering properties are based on previous geotechnical explorations and laboratory testing.

Table 2. Summary of Construction Material Engineering Properties

Material	Unit Weight (pcf)	Drained Strength		Undrained Strength
		Effective Friction Angle ϕ′ (deg)	Effective Cohesion c′ (psf)	S_u/σ'_c
Embankment Fill	130	31	0	0.41 ($\sigma'_c \geq$ 500 psf) 1.39 ($\sigma'_c <$ 500 psf)

The method of site preparation and construction of the Primary Ash Pond is not reasonably and readily available.

The approximate dates of construction of each successive stage of construction of the Primary Ash Pond are provided in **Table 3** below.

Table 3. Approximate dates of construction of each successive stage of construction.

Date	Event
1977	Construction of Primary Ash Pond
2009	Both Primary Ash Pond discharge pipes were lined with cured-in-place pipe (CIPP)
2014	Three areas along the interior berm were re-graded and covered with rip-rap

§ 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 Primary 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).

	Primary Ash Pond
Dimensional plan view (all zones)	S-69
Dimensional cross sections	S-70
Foundation Improvements	Not Applicable
Drainage Provisions	Not Applicable
Spillways and Outlets	S-50
Diversion Ditches	Not Applicable
Instrument Locations	Plate 2, Fig. No. 2A
Slope Protection	S-70
Normal Operating Pool Elevation	Not Available
Maximum Pool Elevation	Not Available
Approximate Maximum Depth of CCR in 2016	49 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 the CCR unit due to malfunction or mis-operation were identified.

§ 257.73(c)(1)(viii): A description of the type, purpose, and location of existing instrumentation.

Existing instrumentation at the Primary Ash Pond include vibrating-wire and open-standpipe piezometers. The purpose of the piezometers is to measure the pore water pressures within and around the impoundment. Two (2) open-standpipe piezometers (B-2 and B-3) were installed in 2010 and the locations are presented on Plate 2 in **Appendix C**. Fourteen (14) vibrating-wire piezometers were installed in 2015 and the locations are presented on Figure 2A in **Appendix C**.

§ 257.73(c)(1)(ix): Area-capacity curves for the CCR unit.

Area-capacity curves for the Primary Ash Pond are not reasonably and readily available.

§ 257.73(c)(1)(x): A description of each spillway and diversion design features and capacities and calculations used in their determination.

The Primary Ash Pond contains two concrete, stop-log weir box structures that discharge to the Secondary Pond. Weir box 1-A is located at the bottom of the embankment and is connected to the lower 30-inch diameter (dia.) cured-in-place pipe (CIPP). Weir Box 1-B is located approximately halfway up the embankment is connected to the upper 30-inch dia. CIPP. Both discharge pipes were originally 30-inch dia. corrugated metal pipe (CMP) and were lined in 2008 (see section § 257.73(c)(1)(xii) below for further information). The lower discharge pipe from weir box 1A passes through the embankment between the Primary Ash Pond and Secondary Pond. The upper discharge pipe from weir box 1B connects to the lower discharge pipe within the embankment. In 2016, the discharge capacity of the Primary Ash Pond was evaluated using HydroCAD 10 software modeling a 1,000-year, 24-hour rainfall event. The results of the HydroCAD 10 analysis are presented below in **Table 5**.

Table 5. Results of HydroCAD 10 analyses

	Primary Ash Pond
Approximate Minimum Berm Elevation[1] (ft)	552.7
Approximate Emergency Spillway Elevation[1] (ft)	Not Applicable
Starting Pool Elevation[1] (ft)	534.0
Peak Elevation[1] (ft)	534.9
Time to Peak (hr)	17.0
Surface Area (ac)	169.0
Storage[2] (ac-ft)	159.4

Note: 1. Elevations are based on NAVD88 datum
2. Storage given is from Starting Pool Elevation to Peak Elevation.

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§ 257.73(c)(1)(xi): The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.

The construction specifications for the Primary Ash Pond are not reasonably and readily available.

The provisions for surveillance, maintenance, and repair of the Primary Ash Pond are located in *Operation and Maintenance Manual for Primary and Secondary Ash Ponds* (presented in **Appendix D**).

The operations and maintenance plan for the Primary Ash Pond is currently being revised by Illinois Power Generating Company. This section will be updated when the new operations and maintenance plan is available.

§ 257.73(c)(1)(xii): Any record or knowledge of structural instability of the CCR unit.

In September, 2008, a sinkhole was observed over the Primary Ash Pond discharge pipes. After performing a video inspection, it is believed that an open joint in the primary 30-inch dia. CMP discharge pipe allowed for soil to enter the discharge pipe and cause an internal void in the embankment. The sinkhole was backfilled and compacted with soil and a cured-in-place pipe (CIPP) was installed in both the upper and lower discharge pipes to prevent further internal erosion to the embankment. Following completion of the discharge pipe modification, grout was injected at several locations within the sinkhole to ensure any remaining voids were filled surrounding the discharge pipes. Information about this event can be found in the letter presented in **Appendix E**.

There is no record or knowledge of any other structural instability of the Primary Ash Pond at Newton Power Station.

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

AECOM

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: Newton Power Station Drawings
Appendix C: Newton Primary Ash Pond Boring and Piezometer Locations
Appendix D: Operation and Maintenance Manual for Primary and Secondary Ash Ponds
Appendix E: Newton Power Plant Site Visit Report 9-12-08, Hanson (2008)

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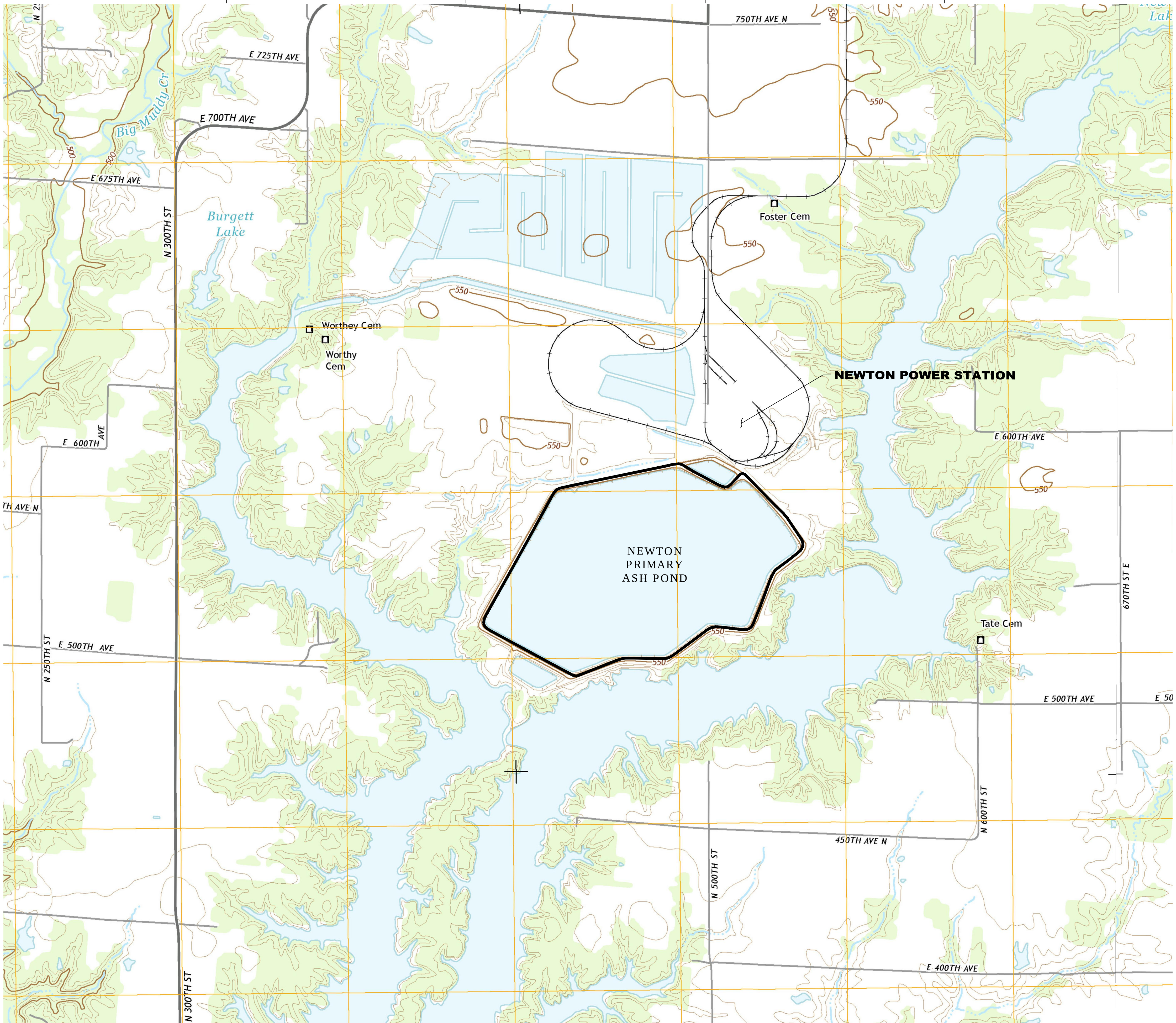
Appendix A: History of Construction Vicinity Map



LEGEND

CCR UNITS

SOURCE:
MAP PROVIDED FROM ELECTRONIC USGS DIGITAL RASTER GRAPHIC 7.5 MINUTE TOPOGRAPHIC MAP OF NEWTON, ILLINOIS AND LATONA, 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)

ILLINOIS POWER GENERATING COMPANY
6725 North 500th St.,
Newton, IL 62448

HISTORY OF CONSTRUCTION

NEWTON POWER STATION
NEWTON, 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

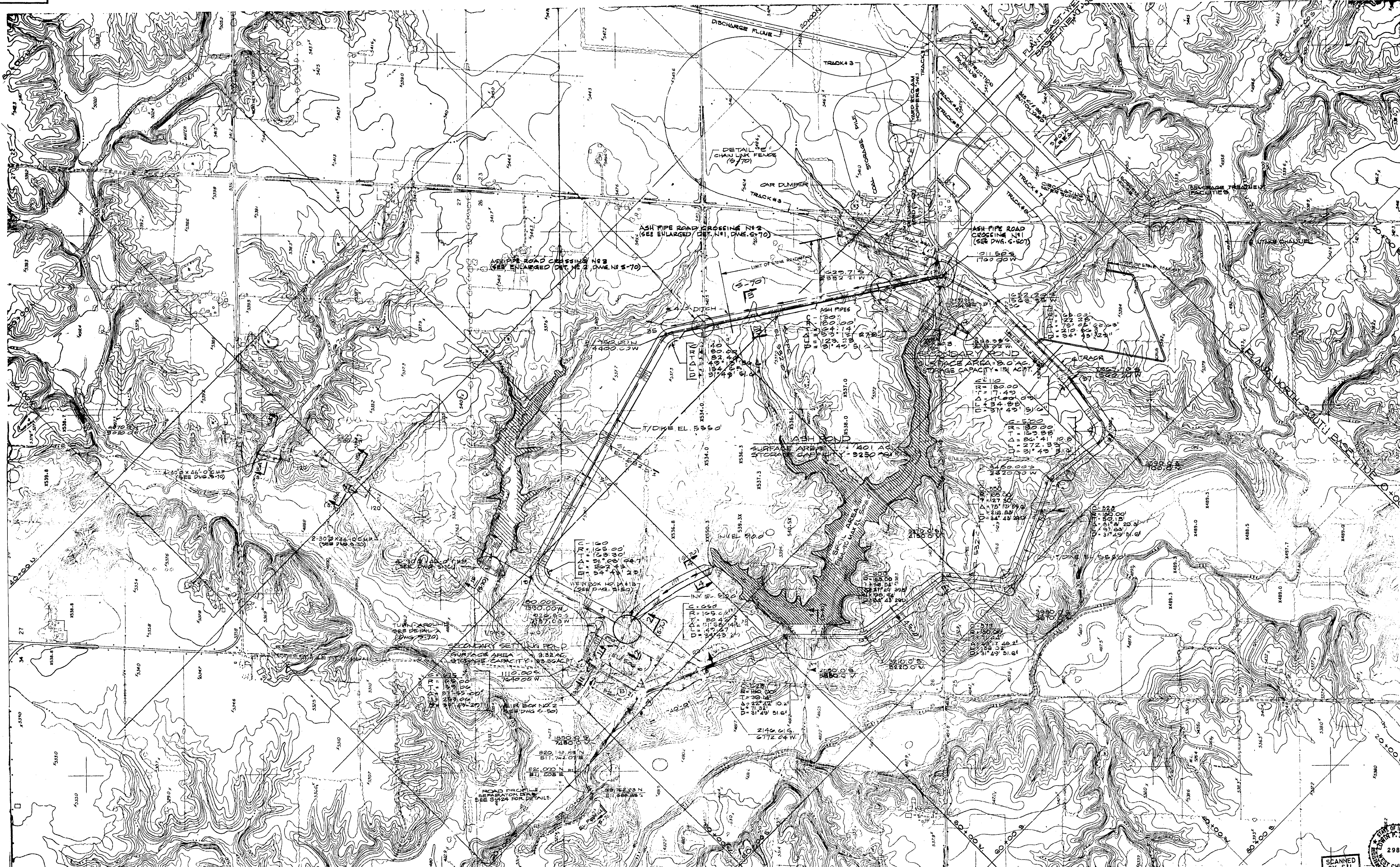
AECOM DRAWING PATH: P:\Projects\Geotech\60428794_DynegyCCR\13_Construction History\04 Technical Production\9_Newton\References\Vicinity Location Map References\Figures\C-01 History of Construction Vicinity Map (Newton)_ZJF.dwg

NANAK, MATT, 8/24/2016 5:35 PM

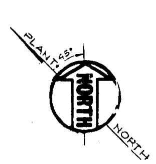
Appendix B: Newton Power Station Drawings

1. "Ash Pond & SO_2 Disposal Pond", Drawing No. S-69, Revision N, 29 July, 1994, Sargent & Lundy Engineers.
2. "Ash Pond Dike, Profile, Details, & Sections", Drawing No. S-70, Revision M, 8 April, 1994, Sargent & Lundy Engineers.
3. "Weir Box Structures at Primary and Secondary Settling Ponds", Drawing No. S-50, Revision K, 25 March, 1994, Sargent & Lundy Engineers.

69-S



POINT NO.	SIDE	CURVE NO.	R	T	Δ	L	D
8	ASH POND		100'	52.87'	49°43' 13.6"	86.78	57°17' 45.60"
8	SECONDARY ASH POND		65'	140.29'	130°16' 46.4"	147.80	88°08' 51.69"
21	LAKESIDE (A)		165'	49.55	33°25' 06.4"	96.27	34°43' 29.00"
21	LAKESIDE (B)		65'	70.49'	94°36' 00.0"	107.32	88°08' 51.69"
36	ASH POND (A)		57.5'	57.50	90°00' 00.0"	90.27	99°38' 41.53"
36	SECONDARY POND (B)		57.5	77.59	106°54' 52.38"	107.24	99°38' 41.53"
39	SECONDARY POND		57.5	161.37	140°46' 29.17"	141.21	99°58' 41.53"



NOTES

7. THE WATER LEVEL IN ASH POND SHALL BE MAINTAINED AT AN ELEVATION 10'-0" ABOVE THE SEDIMENT LEVEL FOR ENVIRONMENTAL PURPOSES.

NOTES

1. FOR GENERAL NOTES SEE DWG. S-14.
2. ALL WORK SHOWN IN THIS DRAWING SHALL BE DONE BY SUPERSTRUCTURE CONTRACTOR IN ACCORDANCE WITH JOB SPEC. A-3022.
3. ALL EXTERIOR SIDE SLOPES OF DIKE BELOW ELEV. 510.0' THAT IS TO BE CONSTRUCTED BEFORE LAKE FILLING. SHALL BE PROVIDED WITH 24" STONE RIPRAP ON 24" SAND AND GRAVEL FILTER BEDDING AS SHOWN ON DWG. S-70. AND ALL DIKE CONSTRUCTION SHALL BE DONE IN ACCORDANCE WITH JOB SPEC. A-3017 AND A-3022.
4. ALL DIKE TOPS AND SIDE SLOPES AND ALL EXTERNAL DITCHES SHALL BE PROVIDED WITH 4" TOPSOIL AND SEEDED IN ACCORDANCE WITH JOB SPEC. A-3017 AND A-3022.
5. EXISTING LOW AREAS SHALL BE FILLED WITH SPOILMATERIAL AS REQUIRED FOR SPOIL DISPOSAL SPOILS SHALL BE PLACED IN LAYERS AND GRADED PROPERLY FOR DRAINAGE.
6. REMOVED "HOLD" FROM SO_2 POND AREAS FOR CLEARING. SLOPE STAKING & CROSS- SECTIONING ONLY.

REFERENCE DRAWINGS

S-19	SITE CONTOURS AND DEVELOPMENT PLAN SHEET 4.
S-39	GRADING AND DRAINAGE PLAN, PLANT AREA SHEET 2.
S-40	GRADING AND DRAINAGE PLAN, PLANT AREA SHEET 3.
S-50	WEIR BOX STRUCTURES AT PRIMARY AND SECONDARY SETTLING PONDS.
S-70	ASH POND DIKE PROFILE DETAILS & SECTION
S-507	GRADING & DRAINAGE PLAN- PLANT AREA- SHT7.

Drawing Release Record

Rev	Date	Init	Description
N	07-29-94	TM	SCANNED BY S&L
A	11-29-74	CRB	[illegible]
B	2-10-75	[illegible]	REMOVED SO_2 [illegible]
C			HOLD [illegible]
D	7-15-75	[illegible]	[illegible]
E	12-21-75	CRB	REMOVED HOLD OF SO_2 [illegible]
F	7-12-76	CRB	[illegible]
G	9-13-76	CRB	ADD WEIR BOXES & REMOVE HOLD ON [illegible]
	—	—	WEIR BOX [illegible]
	—	—	REV. ROAD [illegible]
H	1-24-77	CRB	ADD. SEC. 15-15
J	10-21-77	SPL	SHOWN LIMIT OF STONE [illegible]
K	11-8-79	[illegible]	REV. STORAGE CAPACITIES CORRESPONDING TO DIKE [illegible]
L	7-8-80	RTJ	REC. REVISION
M	2-20-[illegible]	[illegible]	SENT TO CLIENT

ASH POND & SO_2 DISPOSAL POND
NEWTON POWER STATION UNIT 1
CENTRAL ILL PUBLIC SERVICE CO.
NEWTON, ILLINOIS

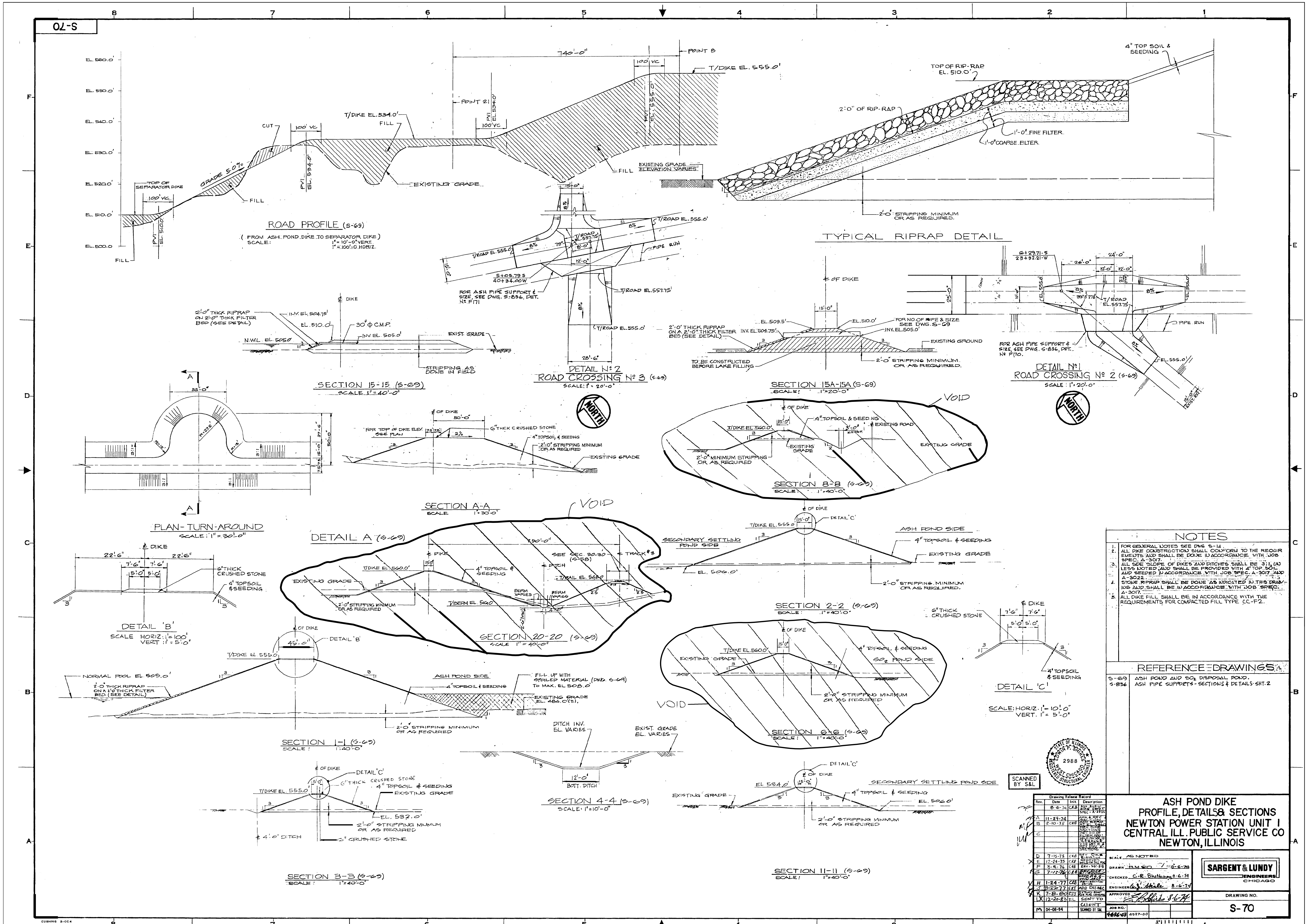
SCALE 1" = 400'-0" & U.N.
DRAWN B. SANCHEZ 8-6-74
CHECKED C. R. Bhattacharya 8-6-74
ENGINEER A. J. Shale 8-6-74
APPROVED [illegible]
JOB NO. 4486-03 4486-15 [illegible]

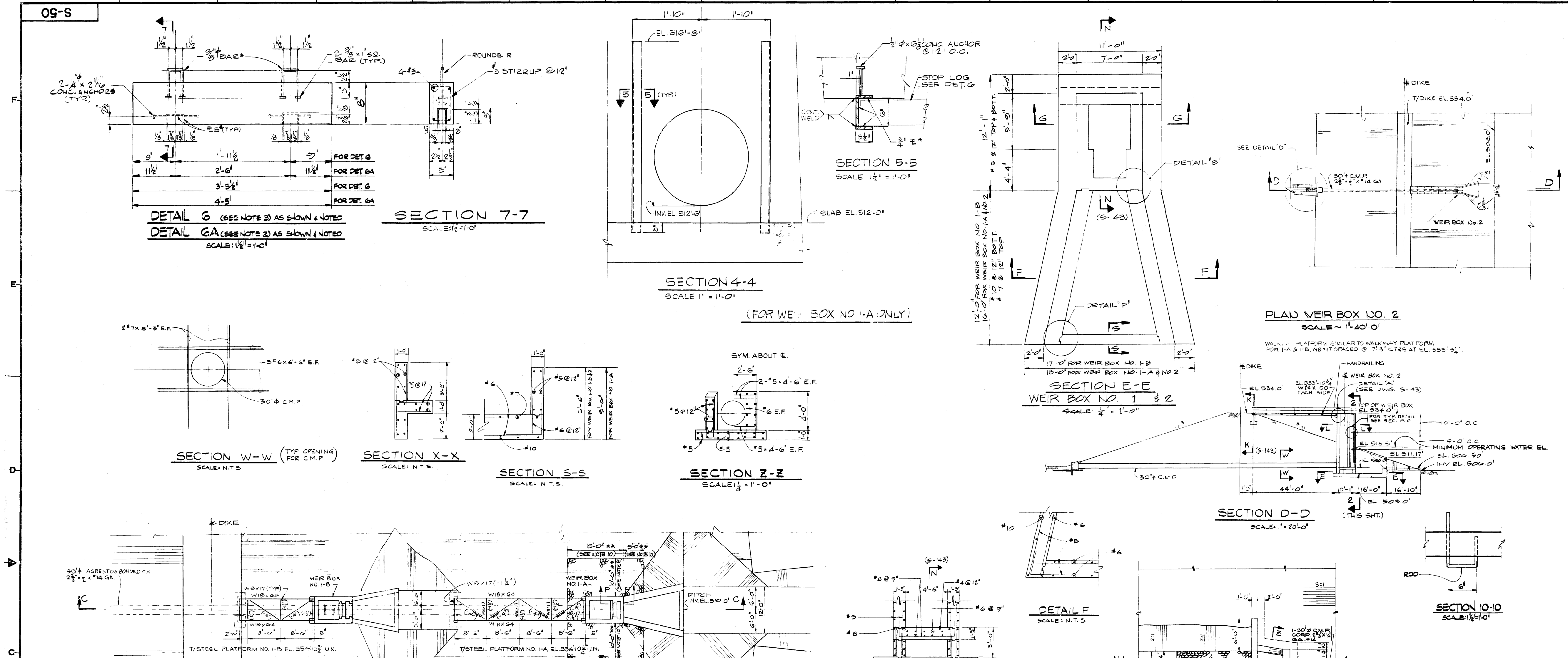
SARGENT & LUNDY ENGINEERS CHICAGO

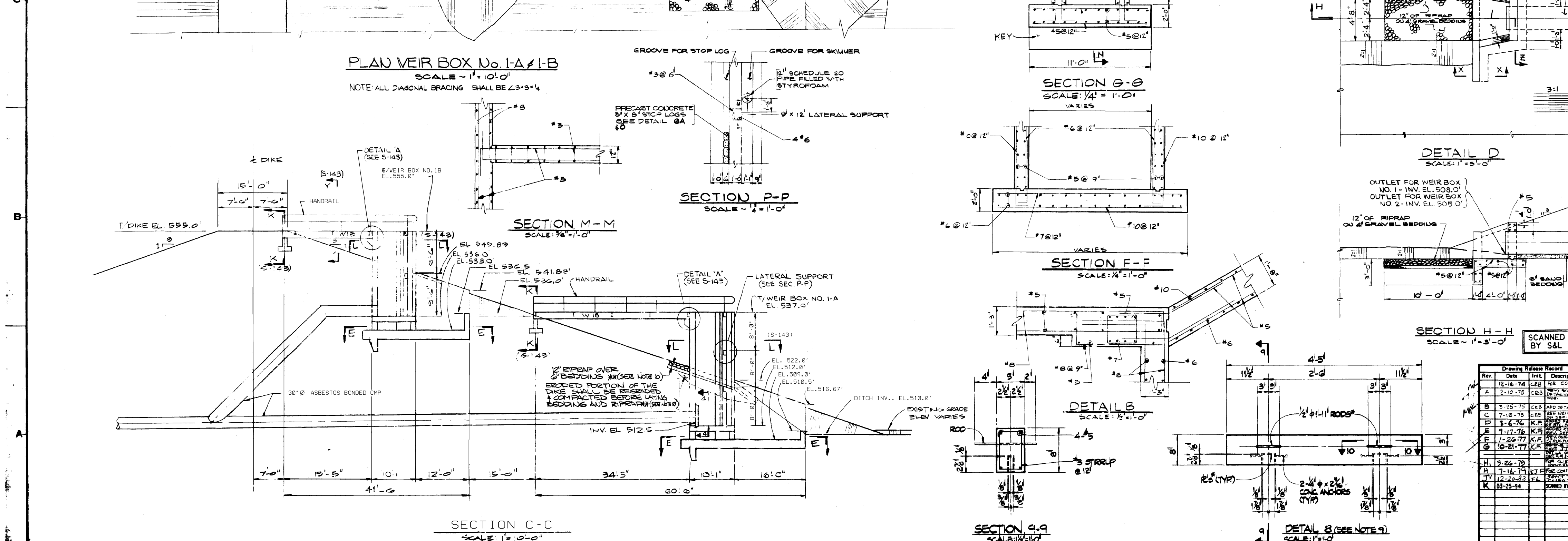
DRAWING NO. S-69

SCANNED BY S&L

STATE OF ILLINOIS EDWIN P. SHIRES 2988 WEST CHICAGO REGISTERED STRUCTURAL ENGINEER


S-70
ROAD PROFILE (S-69)
(FROM ASH POND DIKE TO SEPARATOR DIKE)
TYPICAL RIPRAP DETAIL
SECTION 15-15 (S-69)
DETAIL Nº 2
ROAD CROSSING Nº 3 (S-69)
SECTION 15A-15A (S-69)
DETAIL Nº 1
ROAD CROSSING Nº 2 (S-69)
PLAN-TURN-AROUND
SECTION A-A
DETAIL A (S-69)
SECTION 20-20 (S-69)
SECTION 8-8 (S-69)
SECTION 2-2 (S-69)
DETAIL 'B'
SECTION 6-6 (S-69)
DETAIL 'C'
SECTION 1-1 (S-69)
SECTION 4-4 (S-69)
SECTION 3-3 (S-69)
SECTION 11-11 (S-69)
VOID
NOTES
1. FOR GENERAL NOTES SEE DWG S-14.
2. ALL DIKE CONSTRUCTION SHALL CONFORM TO THE REQUIREMENTS AND SHALL BE DONE IN ACCORDANCE WITH JOB SPEC. A-3017.
3. ALL SIDE SLOPE OF DIKES AND DITCHES SHALL BE 3:1, UNLESS NOTED, AND SHALL BE PROVIDED WITH 4' TOP SOIL AND SEEDED IN ACCORDANCE WITH JOB SPEC. A-3017 AND A-3022.
4. STONE RIPRAP SHALL BE DONE AS INDICATED IN THIS DRAWING AND SHALL BE IN ACCORDANCE WITH JOB SPEC. A-3017.
5. ALL DIKE FILL SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS FOR COMPACTED FILL TYPE CC-F2.
REFERENCE DRAWINGS
S-69 ASH POND AND SO2 DISPOSAL POND.
S-836 ASH PIPE SUPPORTS - SECTIONS & DETAILS - SHT. 2
ASH POND DIKE
PROFILE, DETAILS & SECTIONS
NEWTON POWER STATION UNIT I
CENTRAL ILL. PUBLIC SERVICE CO
NEWTON, ILLINOIS
SCALE AS NOTED
CHECKED C.R. Bhattacharya 8-6-74
ENGINEER 8-6-74
APPROVED 8-6-74
SARGENT & LUNDY ENGINEERS CHICAGO
DRAWING NO. S-70
JOB NO. 4486-03 4927-00
SCANNED BY S&L





NOTES

1. FOR GENERAL NOTES SEE DWG. S-14
2. NUMBER OF STOP LOGS REQUIRED FOR DET. 6A
   FOR WEIR BOX 1A 19 STOP LOGS REQUIRED
   18 S.L. FUTURE
   FOR WEIR BOX 1B 14 S.L. REQUIRED
   14 S.L. FUTURE
   FOR WEIR BOX 2 20 S.L. REQUIRED
   21 S.L. FUTURE
3. NUMBER OF STOP LOGS REQUIRED FOR DET. 6
   FOR WEIR BOX 1A 4 S.L. REQUIRED
   3 S.L. FUTURE
4. ALL WORKS SHOWN IN THIS DRAWING SHALL BE DONE BY SUPERSTRUCTURE CONTRACTOR IN ACCORDANCE WITH SPECIFICATION A-3094 UNLESS NOTED.
5. STONE RIPRAP SHALL BE DONE TO CONFORM WITH THE DIMENSION AS SHOWN IN THIS DRAWING, UNLESS NOTED, AND SHALL BE IN ACCORDANCE WITH JOB SPECIFICATION A-3017 AND A-3022.
6. WEIR BOX NO. 1-B MAY BE CONSTRUCTED WHEN ASH LEVEL IN THE PRIMARY SETTLING POND REACHES ELEVATION 531.0'.
7. WALKWAY PLATFORM FOR WEIR BOX NO. 1-A HAS BEEN DESIGNED TO BE REUSED FOR WEIR BOX NO. 1-B, AFTER CUTTING OFF 15'-0" FROM THE WEST END. SEE DETAIL "A" AND SECTION S-S (DWG. S-143) FOR END DETAILS.
8. *INDICATES THE STEEL TO BE GALVANIZED ACCORDING TO S&L STANDARD 1743.
9. NUMBER OF STOP LOGS REQUIRED FOR DET. 8.
   FOR WEIR BOX 2-1 S.L. REQUIRED. STOP LOG SHALL BE USED WITH & IMMEDIATELY BELOW THE FLOW MEASURING WEIR ONLY.
10. **DENOTES WORK TO BE DONE BY THE "EROSION REPAIR WORK CONTRACTOR IN ACCORDANCE WITH S&L SPEC. 6121-001.

REFERENCE DRAWINGS

S-64	WEIR BOXES PLANS, SECTIONS & DETAILS
S-69	ASH POND & SO_2 DISPOSAL POND
S-70	ASH POND DIKE, PROFILE, DETAILS & SECTIONS
S-143	OIL SEPARATOR & WEIR BOX SECTIONS & DETAILS

Drawing Release Record

Rev.	Date	Init.	Description
	12-16-74	CRB	FOR CONST.
A	2-10-75	CRB	REV. SKIMMER DETAIL FOR 12" Ø PIPE.
B	3-25-75	CRB	ADD DETAILS
C	7-16-75	CRB	REV. WEIR BOX ON SEC. POND
D	8-6-76	K.F.	ADDED DETAILS OF STL. EMBMT.
E	9-17-76	K.F.	ADDED KEYS AND REV. DETAILS
F	1-26-77	K.F.	REV. OUTLET WORK STRUCTURE
G	10-21-77	K.F.	REMOVE DET. C & SECT. J-J, ADD DET. 6A, DET. 8 SEC. 9-9 & SEC. 10-10
H1	3-26-79		FOR CLIENT COMMENTS
H	7-16-79	KJF	FOR CONST.
J	12-20-83	FL	SENT TO CLIENT
K	03-25-94		SCANNED BY S&L

WEIR BOX STRUCTURES AT PRIMARY AND SECONDARY SETTLING PONDS
NEWTON POWER STATION UNIT 1
CENTRAL ILL. PUBLIC SERVICE CO.
NEWTON, ILLINOIS

SCALE AS NOTED
DRAWN B. SANCHEZ 12-16-74
CHECKED C. R. Bhattacharya 12-16-74
ENGINEER A. J. Skale 12-18-74
APPROVED E. P. Shires 11-12-79
JOB NO. 4486-03

SARGENT & LUNDY ENGINEERS CHICAGO

DRAWING NO. S-50

Appendix C: Newton Primary Ash Pond Boring and Piezometer Locations

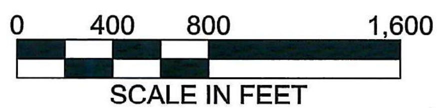
NOTES

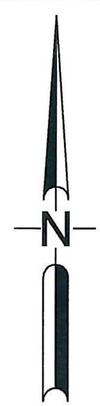
1. Plan adapted from an aerial photograph courtesy of Google Earth.

LEGEND

● Boring Location

Slope Stability Cross Section





Drawn By: SLC	Ck'd By: SLC	App'vd By: SLC
Date: 11-10-10	Date: 12/21/10	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Newton Power Station
Newton, Illinois

AERIAL PHOTOGRAPH OF SITE AND BORING LOCATIONS

Project Number J017150.01

PLATE 2

XXX-X### — EXPLORATION METHOD (B=BORING, C=CPT, P=PIEZOMETER); ID NUMBER; STATION ABBREVIATION

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

LEGEND

PIEZOMETER LOCATION

CCR UNIT BERM ALIGNMENT

0 600
APPROXIMATE SCALE FEET

N

Illinois Power Generating Company		PROJECT NO. 60440378
AECOM		
DRN. BY: djd October 2015 DSGN. BY: eg CHKD. BY: eg	Newton Primary Ash Pond Piezometer Locations	FIG. NO. 2A

File: P:\PROJECTS\GEOTECH\60428794_DYNEGYCCR\04TASKS\00 PROGRAM TASKS\1.0 TASK 1 INITIAL UNIT ASSESSMENT\CCR FACT SHEETS\SITE MAPS\FIGURE 2A PIEZOMETER LOCATION PLAN (NEWTON PRIMARY ASH POND).DWG Last edited: NOV. 04, 15 @ 1:32 p.m. by: david_deguire

AECOM

Appendix D: Operation and Maintenance Manual for Primary and Secondary Ash Ponds

Ameren Energy Generating

Newton Power Station

Operational Procedure

X-XXX-XXXX--XXX

Operation & Maintenance Manual for Primary and Secondary Ash Ponds

Effective Date: xx/xx/xxxx

Reason for Change: New Procedure

Approved By: *x* ______________________ Date: xx/xx/xxxx

x
Lindel Wenthe

Responsible Department: Newton Power Station, Technical Services Department

- ☐ This entire document shall be in the field during procedure performance.
- ☐ The following portions of this procedure shall be in the field during procedure performance: ______________________
- ☐ __________ from this procedure shall be in the field during procedure performance.
- ☐ No part of this procedure is required to be in the field during procedure performance.

Table of Contents

1.0 Purpose

1.1 This procedure is intended to ensure the safe and environmentally responsible operation and use of all water impoundment and levee structures at Newton Power Station facility. The primary purpose of Newton's Primary, Secondary Ash Ponds, and SO2 Chemical Pond are for the storage of fly ash and treatment of fly ash sluice water to meet NPDES Permit Conditions. This procedure then assures:

1.1.1 The embankment structures and flow regulating structures are properly operated and maintained.

1.1.2 Inspections of these structures are conducted.

1.1.3 A maintenance program will be performed.

1.1.4 Communication takes place with the Dam Safety Staff regarding the structures' condition and operation.

2.0 Scope

2.1 This procedure applies to all onsite personnel and the Dam Safety Group staff.

3.0 Responsibilities

3.1 On-site Technical Services – Conducts ash pond and levee embankment and structure observations and completes the inspections, reporting any undesirable conditions to the Supervising Engineer, Dam Safety.

3.2 On-site personnel – Operates the facilities as described in this Operational Procedure. Reports any conditions noted during routine activities to the shift supervisor. Coordinates scheduling of maintenance as required to maintain proper operations of the ash pond facility.

3.3 Shift Supervisor (SS) - Calls Technical Service personnel when structure concerns are reported. Make entries into the shift log book indicating the concern and actions taken.

3.4 Supervising Engineer, Dam Safety - Conducts annual detailed dam safety inspections and provides a report with findings and recommendations.

4.0 Historical Information

4.1 Construction began in 1972 and concluded in 1982. Unit 1 was placed in service in 1977; Unit 2 went into commercial operation in 1982.

5.0 Flow Regulating Structures

5.1 Embankments

- Primary Ash Pond (Bottom Ash)
  Top of ash pond berm elevation was designed at Elevation 555.00'.
  Therefore, normal high pool elevation is 450.00. This allows for 2.9 feet of storage depth over the top of the ash pond outlet structure; or approximately 116 acre-ft storage or 37,850,000 gallons (45% of 89 acres times 2.9' deep).

- Secondary Ash Pond (Bottom Ash)

5.2 Structures

- Primary Ash Pond Outlet Structures - The water level in the pond is regulated by stop logs in the concrete outlet structures on the south side of the Primary Ash pond. Plans showing the outlet structures and walkways are on file. The main pond outlet structure shall be checked regularly (at least weekly or more often if there are excessive rain events) to ensure proper pond discharge. Elevation of the top of the main structure is 537.00'. Elevation of the walkway is 537.00'. Normal depth of flow over the drop structure is 3 to 4 inches during non-rainfall discharge. A 30-inch diameter CMP exits the outlet structure directly to the secondary settling pond.
- Secondary Ash Pond Outlet Structures - The water level in the pond is regulated by the pond outlet structures on the south side of the Secondary Ash pond. Plans showing the outlet structures and walkways are on file. The Secondary Ash Pond outlet structure shall be checked regularly (at least weekly or more often if there are excessive rain events) to ensure proper pond discharge. Elevation of the top of the structure is 534.00'. Elevation of the walkway is 534.00'. Minimum operating water level elevation is 516.50'. Normal depth of flow over the drop structure is 3 to 4 inches during non-rainfall discharge. A 30-inch diameter CMP exits the outlet structure directly to Newton Lake.
- Primary Ash Pond Process Water Discharge Pipe – This culvert regulates the level of water in the Primary Ash Pond. There are two possible inlets in the Primary ash pond outlet structures. Inlet Flowline elevations of the Primary Ash Pond pipe are 512.50' and 536.00'. Both inlets are connected into the same 30" CMP roughly halfway through the embankment. The outlet elevation of these combined pipes is 508.00'. These combined pipes failed once in the past at the point of connection of the top pipe into the main pipe and caused the embankment to erode from the inside and

caused a sinkhole to develop. The solution that was devised to deal with the problem was to line the entire 30" CMP with a cured in place liner. This rehabilitated the corrugated metal pipe and restored the interior integrity of the outlet pipe. The embankment was then filled with clam material and returned to service.

- Secondary Ash Pond Bottom Ash/Process Water Culvert Pipe – This 30" corrugated metal culvert pipe regulates the level of water in the Secondary Ash Pond. This pipe was also lined with a cured in-place liner. Inlet flowline elevation of the Secondary Ash Pond outlet pipe is 506.00'. The outlet elevation of this pipe is 505.00'.

6.0 Operations Requirements

Normal Operation - Plant personnel shall monitor the level of all ash pond basins within the perimeter ash pond berm on a daily basis. If levels within any of the basins exceed the prescribed maximum levels, action shall be taken immediately to remedy the situation.

Normal Operating Levels	
Primary Ash Pond Outlet	508'
Secondary Ash Pond Outlet Structure	505'
Primary Ash Pond Water Level	536'
Secondary Ash Pond Water Level	516.5'

Emergency Conditions – If a condition arises where there is a possibility of an embankment failure, then the following procedures will be followed:

1. Notify the Supervising Engineer Dam Safety immediately.
2. The pond level will be lowered by portable pumps. Monitor the embankment for changed conditions.
3. Initiate Emergency Action Plan

7.0 Maintenance Requirements

7.1 Maintenance Program - The plant's impoundment and flood prevention structures shall be inspected and maintained in a manner to ensure safe and environmentally responsible operations. A regular maintenance program shall be performed and shall consist of the following inspection items:

1. Earth embankments: Walk the crest, side slopes, and downstream toe of the dam concentrating on surface erosion, seepage, cracks, settlement, slumps, slides, and animal burrows. Frequency of inspection: Quarterly.

2. Vegetation: Grass should be a thick vigorous growth to stabilize the earth embankment soils and prevent erosion form occurring. Note the height of the grass; if greater than one foot a mowing of the area should be scheduled before the next inspection. There should be NO trees on the earth embankment and none within a minimum of 20 feet of the embankment toe or other structures. Frequency of inspection: Weekly.
3. Pond Outlet Structure: Check for any debris or other obstructions around the concrete inlet which may block or restrict the flow of water. Check for the development of any rusty areas on the concrete, and seepage, cracking, breaking, or spalling of concrete. Check for settlement or cracking in the walkway structure. Frequency of inspection: Monthly.
4. Outlet Pipe Slide Gate: Check the structure for development of any rusty areas on the concrete, and seepage, cracking, breaking, or spalling of concrete. Check the slide gate stem, grease the stem, and operate the slide gate through its full range of motion to ensure proper operation. Check for buildup of debris in the manhole. Frequency of inspection: Quarterly.
5. Pond/Levee Perimeter: Check the perimeter of the embankment and levee for a distance of at least 100 feet from the toe for signs of seepage or boils. Inspection frequency for levee will be determined by Dam Safety Engineer during flood events. Frequency of ash pond embankment inspection: Quarterly for ash pond embankment.
6. Special Inspections – Special inspections of ash pond berms shall be performed after earthquakes, floods, water level exceedance in the ponds, or heavy rainfall events. Inspection and report shall be equal to an annual inspection level of detail. Water level in the pond should be noted after a heavy rainfall. Dam Safety staff shall accompany plant personnel on special inspections. Frequency: As required.

8.0 Maintenance Logs

8.1 Plant personnel shall maintain an up-to-date log of operations (water levels, gate adjustments, inlet and outlet flows, serpentine channels, etc.), visual observations, unusual occurrences, and maintenance performed. The log book shall be reviewed during the Annual Engineering Inspection. Logs shall be kept for the life of the plant.

9.0 Contact Numbers

Plant Environmental Supervisor: David Heath / 618-783-0311
Plant Shift Supervisors Office: 217-783-0344

Plant Control Room: 217-783-0501 / 217-783-0502
Supervising Engineer Dam Safety: Steve Bluemner / 314-554-6298
Dam Safety Staff Contact: Dan Haarmann / 217-371-4853

10.0 References

10.1 AER - DSP-004, "Dam Safety Program for Non-Illinois Department of Natural Resources (non-IDNR) Regulated Facilities"

10.2 Drawings

Drawing Number	Sheet Name	Date
S-50	Weir Box Structures at Primary and Secondary Settling Ponds	12-16-74
S-69	Ash Pond and SO2 Disposal Pond	8-6-74
S-70	Ash Pond Dike Profile, Details & Sections	8-6-74
S-836	Ash Pipe Supports Sections and Details SHT #2	2-8-80

11.0 Records

	Record Type	Responsible Person	Retention Period	Location
11.1	Copies of weekly inspections	Plant Technical Services	Life of plant	Onsite Environmental Supervisor and Dam Safety Department office
11.2	Copies of Quarterly inspections	Plant Technical Services	Life of plant	Onsite Environmental Supervisor and Dam Safety Department office
11.3	Log Book	Plant Technical Services	Life of plant	Onsite Environmental Supervisor office

AECOM

Appendix E: Newton Power Plant Site Visit Report 9-12-08, Hanson (2008)

MEMORANDUM
(Form QAP 17.2.3, Rev. 2)

TO: Dan Whalen DATE: 9/15/08

FROM: John Jenkins

SUBJECT: Ameren Newton Power Plant
Site Visit Report 9-12-08

On Friday September 12, 2008, I made a site visit to Newton Power Station to observe a sinkhole that has developed on the ash pond dike. I was accompanied by Matt Frerking and Jim Marshall of Ameren.

The sinkhole has developed on the downstream crest of the dike between the primary (upper) and secondary (lower) ash ponds (see attached photos). The sinkhole was first observed the morning of September 12, 2008 after a heavy rain. The sinkhole is circular in shape with a diameter of approximately 12 ft. The depth to the bottom of the sinkhole is estimated to be 10 to 12 ft. The sinkhole has developed directly over the location where two discharge pipes between the primary and secondary ponds are joined (see attached Section C-C). The discharge pipes are 30 in. diameter corrugated metal pipes (CMP) installed in the late 1970's. There was no indication of ground movement in the form of settlement or bulging of the dike embankment outside the area of the sinkhole. The water level in the primary ash pond is approximately El. 536 and the water level in the secondary pond is maintained at minimum El. 516.5. There has been no significant fluctuation of the water levels in either pond for over 6 months. The top of the dike is at El. 555 and the top of the discharge pipe below the sinkhole location is approximately El. 514. Therefore, the depth below the ground surface to the top of the pipe at the sinkhole location is approximately 41 ft.

Based on the location of the sinkhole relative to the discharge pipes and considering the age of the metal pipes, it appears that the most likely cause of the sinkhole is due to loss of soil material through a hole or holes in the discharge pipes. In particular, the connection between the two pipes is suspect. The pipe discharges into the secondary pond below the water level and therefore there is no way to visually observe the discharge for soil deposits. If the cause of the sinkhole is due to loss of material through holes in the pipes, this process could have been occurring over several years. There is the possibility that there is a void or voids that extend from the ground surface to the discharge pipes, and it would be expected that the sinkhole would continue to develop over time. It is possible that additional settlement or sloughing of soil material on the downstream crest of the embankment in the immediate vicinity of the sinkhole will occur in the near future. However, considering the relatively low level of water in the primary ash pond relative to the top of the dike embankment, the dike should remain stable even if local failures in the upper portion of the dike occur.

It was agreed that the following actions be taken.

- The existing sinkhole should be filled with soil material to prevent further sloughing and expanding of the sides of the sinkhole. The material should be placed with a backhoe and compacted with the backhoe bucket. No mechanical compaction of the soil should be attempted. The top of the filled area should be crowned to prevent ponding in the area of the sinkhole, and the sinkhole area should be monitored daily for additional settlement or movement.
- The primary ash pond level should be lowered in order to allow the pipes to be dewatered and inspected by camera. Jim Marshall estimates that it may take more than a week to draw the water down to the required depth.
- Based on the results of the camera survey, a plan for repair of the discharge pipes will be developed. The repair plan may include slipform lining of the pipes and/or excavation to repair isolated areas.
- Due to the unknown extent of the sinkhole void and to the possibility of additional voids being present along the length of the discharge pipe, Hanson will evaluate alternative methods for investigating the presence of voids below the ground surface, including the use of ground penetrating radar.

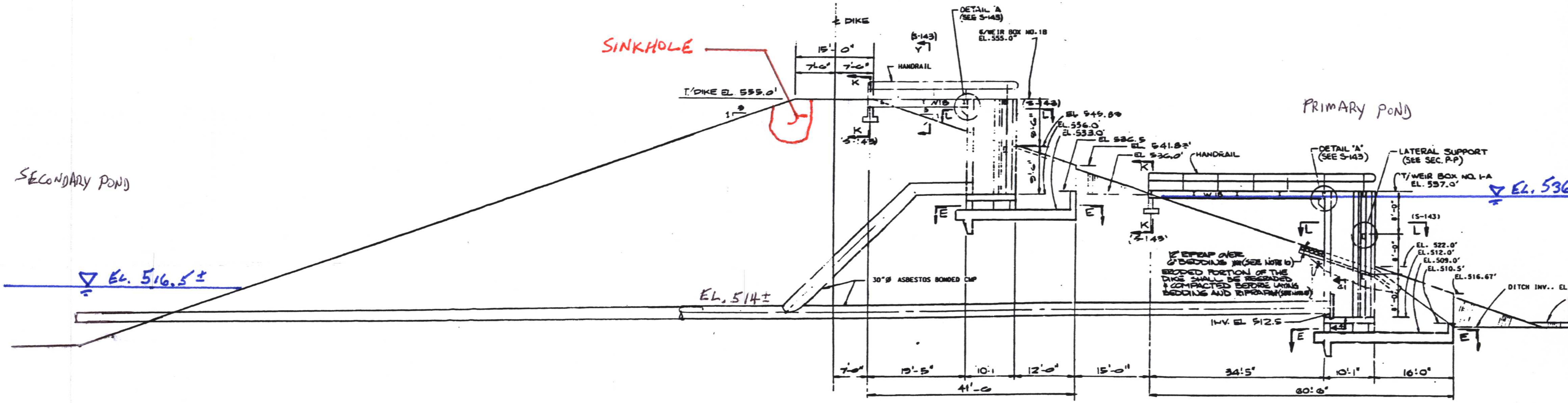
View of Sinkhole Looking Northwest Along Dike

View of Sinkhole Looking Southeast Along Dike

Close-Up of Sinkhole

View of Bottom of Sinkhole

View of Sinkhole Looking Southwest Towards the Secondary Pond and Lake



SECTION C–C
SCALE: 1"=10'-0"

Geosyntec consultants

1 McBride and Son Center Drive, Suite 202
Chesterfield, MO 63005
PH 636-812-0800
www.geosyntec.com

October 11, 2021

Illinois Power Generating Company
6725 North 500th Street
Newton, Illinois, 62448

Subject: USEPA CCR Rule and IEPA Part 845 Rule Applicability Cross-Reference
2021 USEPA CCR Rule Periodic Certification Report
Primary Ash Pond, Newton Power Plant, Newton, Illinois

At the request of Illinois Power Generating Company (IPGC), Geosyntec Consultants (Geosyntec) has prepared this letter to document how the attached 2021 United States Environmental Protection Agency (USEPA) CCR Rule Periodic Certification Report (Report) was prepared in accordance with both the Federal USEPA CCR Rule[1] and the state-specific Illinois Environmental Protection Agency (IEPA) Part 845 Rule[2]. Specific sections of the report and the applicable sections of the USEPA CCR Rule and Illinois Part 845 Rule are cross-referenced in **Table 1**. A certification from a Qualified Professional Engineer for each of the CCR Rule sections listed in **Table 1** is provided in Section 10 of the attached Report. This certification statement is also applicable to each section of the Part 845 Rule listed in **Table 1.**

Table 1 – USEPA CCR Rule and Illinois Part 845 Rule Cross-Reference

Report Section	USEPA CCR Rule		Illinois Part 845 Rule	
3	§257.73 (a)(2)	Hazard Potential Classification	845.440	Hazard Potential Classification Assessment[3]
4	§257.73 (c)(1)	History of Construction	845.220(a)	Design and Construction Plans (Construction History)
5	§257.73 (d)(1)	Structural Stability Assessment	845.450 (a) and (c)	Structural Stability Assessment
6	§257.73 (e)(1)	Safety Factor Assessment	845.460 (a-b)	Safety Factor Assessment
7	§257.82 (a)(1-3)	Adequacy of Inflow Design Control System Plan	845.510(a), (c)(1), (c)(3)	Hydrologic and Hydraulic Capacity Requirements / Inflow Design Flood Control System Plan
	§257.82 (b)	Discharge from CCR Unit	845.510(b)	Discharge from CCR Surface Impoundment

[1] United Stated Environmental Protection Agency, 2015. *40 CFR Parts 257 and 261, Hazardous and Solid Waste Management System, Disposal of Coal Combustion Residuals from Electric Utilities, Final Rule.*
[2] State of Illinois, Joint Committee on Administrative Rule, Administrative Code (2021). *Title 35: Environmental Protection, Subtitle G: Waste Disposal, Chapter I: Pollution Control Board, Subchapter j: Coal Combustion Waste Surface Impoundment, Part 845 Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments.*
[3] "Significant" and "High" hazard, per the CCR Rule[1], are equivalent to Class II and Class I hazard potential, respectively, per Part 845[2].

CLOSING

This letter has been prepared to demonstrate that the content and Qualified Professional Engineer Certification of the 2021 Periodic USEPA CCR Rule Certification Report fulfills the corresponding requirements of Part 845 of Illinois Administrative Code listed in **Table 1**.

Sincerely,

Panos Andonyadis, P.E.
Senior Engineer

John Seymour, P.E.
Senior Principal

2021 USEPA CCR RULE PERIODIC CERTIFICATION REPORT §257.73(a)(2), (c), (d[1]), (e) and §257.82 PRIMARY ASH POND Newton Power Plant Newton, Illinois

Submitted to

Illinois Power Generating Company

6725 North 500th Street
Newton, Illinois 62448

Submitted by

Geosyntec consultants

engineers | scientists | innovators

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

October 11, 2021

[1] Except for §257.73(d)(1)(vi).

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LIST OF TABLES

LIST OF DRAWINGS

LIST OF ATTACHMENTS

EXECUTIVE SUMMARY

This Periodic United States Environmental Protection Agency (USEPA) Coal Combustion Residuals (CCR) Rule [1] certification report (Periodic Certification Report) for the Primary Ash Pond (PAP) [2] at the Newton Power Plant (NPP), also known as Newton Power Station, has been prepared in accordance with Rule 40, Code of Federal Regulations (CFR) §257, herein referred to as the "CCR Rule" [1]. The CCR Rule requires that initial certifications for existing CCR surface impoundment, completed in 2016 and subsequently posted on Illinois Power Generating Company (IPGC) CCR Website ([2], [3], [4], [5], [6]) be updated on a five-year basis.

The initial certification reports developed in 2016 and 2017 ([2], [3], [4], [5], [6]) were independently reviewed by Geosyntec. Additionally, field observations, interviews with power plant staff, updated engineering analyses, and evaluations were performed to compare conditions in 2021 at the PAP relative to the 2016 and 2017 initial certifications. These tasks identified that updates are not required for the Initial Hazard Potential Classification. However, due to changes at the site and technical review comments, updates were required and were performed for the:

- History of Construction Report,
- Initial Structural Stability Assessment,
- Initial Safety Factor Assessment, and
- Initial Inflow Design Flood Control System Plan.

Geosyntec's evaluations of the initial certification reports and updated analyses identified that the PAP meets all requirements for hazard potential classification, history of construction reporting, structural stability, safety factor assessment, and hydrologic and hydraulic control, with the exception of the structural integrity of hydraulic structures (§257.73(d)(1)(vi)), which was certified by others. **Table 1** provides a summary of the initial 2016 certifications and the updated 2021 periodic certifications.

[2] The PAP is also referred to as ID Number W0798070001-01, Primary Ash Pond by the Illinois Environmental Protection Agency (IEPA); CCR unit ID 401 by EEI; and IL50719 within the National Inventory of Dams (NID) maintained by the Illinois Department of Natural Resources (IDNR). Within this document it is referred to as the PAP.

Table 1 – Periodic Certification Summary

	CCR Rule Reference	Requirement Summary	2016 Initial Certification		2021 Periodic Certification	
			Requirement Met?	Comments	Requirement Met?	Comments
Hazard Potential Classification						
3	§257.73(a)(2)	Document hazard potential classification	Yes	Impoundment was determined to have Significant hazard potential classification [2].	Yes	Updates were not determined to be necessary. Geosyntec recommends retaining the Significant hazard potential classification.
History of Construction						
4	§257.73(c)(1)	Compile a history of construction	Yes	History of Construction report was prepared for the PAP [3].	Yes	A letter listing updates to the History of Construction report is provided in **Attachment C**.
Structural Stability Assessment						
5	§257.73(d)(1)(i)	Stable foundations and abutments	Yes	Foundations were found to be stable. Abutments are not present [7].	Yes	Foundations and abutments were found to be stable after performing updated slope stability analyses.
	§257.73(d)(1)(ii)	Adequate slope protection	Yes	Slope protection is adequate [7].	Yes	No changes were identified that may affect this requirement.
	§257.73(d)(1)(iii)	Sufficiency of embankment compaction	Yes	Embankment compaction is sufficient for expected ranges in loading conditions [7].	Yes	Dike compaction was found to be sufficient after performing updated slope stability analyses.
	§257.73(d)(1)(iv)	Presence and condition of slope vegetation	Yes	Vegetation is present on interior and exterior slopes and is maintained. [7].	Yes	No changes were identified that may affect this requirement.
	§257.73(d)(1)(v)(A) and (B)	Adequacy of spillway design and management	Yes	Spillways are adequately designed and constructed and adequately manage flow during 1,000-year flood [7].	Yes	Spillways were found to be adequately designed and constructed and are expected to adequately manage flow during the 1,000-year flood, after performing updated hydrologic and hydraulic analyses.
	§257.73(d)(1)(vi)	Structural integrity of hydraulic structures	Yes	Hydraulic structures passing through the embankment were inspected and found to maintain structural integrity [7].	Periodic certification of §257.73(d)(1)(vi) was independently completed by Luminant in 2020 [8].	
	§257.73(d)(1)(vii)	Stability of downstream slopes inundated by water body.	Yes	Downstream slopes adjacent to Newton Lake and the Secondary Pond are expected to remain stable during inundation [7].	Yes	Downstream slopes were found to be stable after performing updated sudden drawdown slope stability analyses.
Safety Factor Assessment						
6	§257.73(e)(1)(i)	Maximum storage pool safety factor must be at least 1.50	Yes	Safety factors were calculated to be 1.66 and higher [5].	Yes	Safety factors from updated slope stability analyses were calculated to be 1.66 and higher.
	§257.73(e)(1)(ii)	Maximum surcharge pool safety factor must be at least 1.40	Yes	Safety factors were calculated to be 1.66 and higher [5].	Yes	Safety factors from updated slope stability analyses were calculated to be 1.66 and higher.
	§257.73(e)(1)(iii)	Seismic safety factor must be at least 1.00	Yes	Safety factors were calculated to be 1.07 and higher [5].	Yes	Safety factors from updated slope stability analyses were calculated to be 1.07 and higher.
	§257.73(e)(1)(iv)	For embankment construction of soils that have susceptible to liquefaction, safety factor must be at least 1.20	Not Applicable	Embankment soils were not susceptible to liquefaction [5].	Not Applicable	No changes were identified that may affect this requirement.
Inflow Design Flood Control System Plan						
8	§257.82(a)(1), (2), (3)	Adequacy of inflow design control system plan.	Yes	Flood control system adequately managed inflow and peak discharge during the 1,000-year, 24-hour, Inflow Design Flood [7].	Yes	The flood control system was found to adequately manage inflow and peak discharge during the 1,000-year, 24-hour, Inflow Design Flood, after performing updated hydrologic and hydraulic analyses.
	§257.82(b)	Discharge from CCR Unit	Yes	Discharge from the CCR Unit is routed through a NPDES-permitted outfall during both normal and 1,000-year, 24-hour Inflow Design Flood conditions [6].	Yes	Discharge from the CCR Unit is routed through a NPDES-permitted outfall during both normal and 1,000-year, 24-hour Inflow Design Flood conditions, after performing updated hydrologic and hydraulic analyses.

SECTION 1

INTRODUCTION AND BACKGROUND

This Periodic United States Environmental Protection Agency (USEPA) Coal Combustion Residual (CCR) Rule [1] Certification Report was prepared by Geosyntec Consultants (Geosyntec) for Illinois Power Generating Company (IPGC) to document the periodic certification of the Primary Ash Pond (PAP) at the Newton Power Plant (NPP), also known as the Newton Power Station, located at 6725 N 500th Street, Newton, Illinois, 62448. The location of NPP is provided in **Figure 1**, and a site plan showing the location of the PAP and landfill, among other closed and open CCR units and non-CCR surface impoundments, is provided in **Figure 2**.

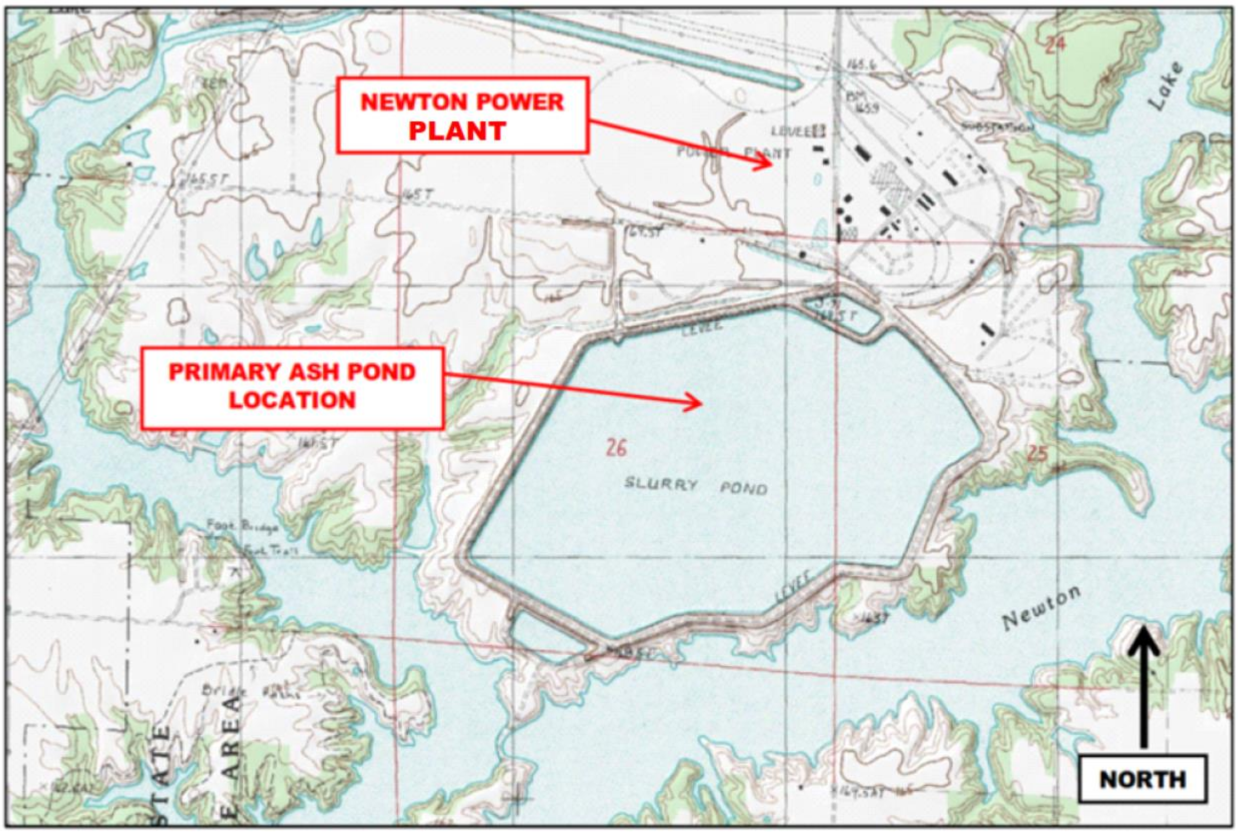


Figure 1 – Site Location Map (from AECOM, 2016)

Figure 2 – Site Plan

1.1 PAP Description

The PAP is utilized for managing CCR materials generated by NPP. The PAP has a Significant hazard potential, based on the initial hazard potential classification assessment performed by Stantec in 2016 in accordance with §257.73(a)(2) [2].

The PAP receives fly ash, bottom ash, and other miscellaneous non-CCR process waters produced by NPP. Bottom ash is sluiced from the north perimeter of the PAP on either side of the Secondary Settlement Pond, which is a non-CCR basin included within the footprint of the Primary Ash Pond. The outfall structure in the PAP discharges through the perimeter embankment into the Secondary Pond, which is a non-CCR basin that ultimately discharges into Newton Lake via a National Pollutant Discharge Elimination System (NPDES)-permitted outfall.

Two adjacent spillway structures are present at the PAP: the principal spillway structure and the secondary spillway structure. Only the principal structure is used to control outflow during both normal operational and flood conditions. The spillway structures are both identical square concrete riser structures, with inflow controlled by a series of stoplogs. Inflow into the structures is transmitted to the Secondary Pond through 30-inch diameter corrugated metal pipes that have been slip lined and now have an inside diameter of 28 inches. The principal spillway structure is located at a lower elevation than the secondary spillway structure, with a top of weir box elevation of 537 feet and a pipe invert elevation of 512.5 feet (presumed to be NGVD29 datum based on the date of the design drawings). The secondary spillway structure is located directly upslope from the primary structure and has a top of weir box elevation of 555 feet, which is the design crest elevation of the earthen embankment, and a pipe invert elevation of 533 feet. The 28-inch diameter slip lined outlet pipes from both structures converge within the earthen embankment into a single 28-inch slip lined outlet pipe that discharges into the Secondary Pond. The purpose of the secondary spillway structure is to be a supplemental spillway for the Primary Ash Pond under conditions where the pool level is significantly increased above the current normal pool to allow for additional storage volume [7].

The surface area of the impoundment is approximately 400 acres, and the embankment is a continuous structure (a ring embankment), which has a total perimeter length of approximately 3.2 miles and a maximum height above the exterior grade of 72 feet where the downstream toe of the embankment is underneath the normal pool level of the downstream Newton Lake. Typical embankment heights range from 14 to 42 feet. The embankment was constructed as a homogenous earthen structure with well-compacted clayey fill. Portions of the south embankment directly adjacent to Newton Lake include crushed stone near the waterline for erosion protection. The upstream and downstream slope orientations are typically 3H:1V (horizontal to vertical) but range from about 2.5H:1V to 3.4H:1V. Embankment crest widths range from approximately 12 to 50 feet, and the crest is covered with a gravel access road [7].

The pool elevation of the pond is controlled by the configuration of the outflow structure and plant process inflows. At the time of the periodic survey, was approximately[3] 535.5 feet. Crest elevations range from approximately 553 to 555 feet, and the minimum crest elevation is 552.7 feet [7].

Initial certifications for the PAP for Hazard Potential Classification (§257.73(a)(2)), History of Construction (§257.73(c)), Structural Stability Assessment (§257.73(d)), Safety Factor Assessment (§257.73(e)(1)), and Inflow Design Flood Control System Plan (§257.82) were completed by Stantec and AECOM in 2016 and 2017 and subsequently posted to IPGC's CCR Website ([2], [3], [4], [5], [6]).

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

1.2 Report Objectives

These following objectives are associated with this report:

- Compare site conditions from 2015/2016 to site conditions in 2020/2021, and evaluate if updates are required to the:
    - §257.73(a)(2) Hazard Potential Classification [2];
    - §257.73(c) History of Construction [3];
    - §257.73(d) Structural Stability Assessment [4];
    - §257.73(e) Safety Factor Assessment [5], and/or
    - §257.82 Inflow Design Flood Control System Plan [6].
- Independently review the Hazard Potential Classification ([2], [9]), Structural Stability Assessment ([4], [7]), Safety Factor Assessment ([5], [7]), and Inflow Design Flood Control System Plan ([6], [7]) reports to determine if updates may be required based on technical considerations.
    - The History of Construction report [3] was not independently reviewed for technical considerations, as this report contained historical information primarily developed prior to promulgation of the CCR Rule [1] for the CCR units at NPP, and did not include calculations or other information used to certify performance and/or integrity of the impoundments under §257.73(a)(2)-(3), §257.73(c)-(e), or §257.82.
- If updates are required, they will be performed and documented within this report.
- Confirm that the PAP meets all of the requirements associated with §257.73(a)(2), (c), (d), (e), and §257.82, or, if the PAP does not meet all requirements, provide recommendations for compliance with these sections of the CCR Rule [1].

SECTION 2

COMPARISON OF 2015/16 AND 2020/21 SITE CONDITIONS

2.1 Overview

This section describes the comparison of conditions at the PAP between the start of the initial CCR certification program in 2015 and subsequent collection of periodic certification site data in 2020 and 2021.

2.2 Review of Annual Inspection Reports

Annual onsite inspections for the PAP were performed between 2016 and 2020 ([10], [11], [12], [13], [14] and, [15]) and were certified by a licensed professional engineer in accordance with §257.83(b). Each inspection report stated the following information, relative to the previous inspection:

- A statement that no changes in geometry of the impounding structure were observed since the previous inspection.
- Information on maximum recorded instrumentation readings and water levels.
- Approximate volumes of impounded water and CCR at the time of inspection.
- A statement that no appearances of actual or potential structural weakness or other disruptive conditions were observed.
- A statement that no other changes which may have affected the stability or operation of the impounding structure were observed.

In summary, the reports did not indicate any significant changes to the PAP between 2015 and 2020.

2.3 Review of Instrumentation Data

Twelve piezometers are present at the PAP and were monitored monthly between August 5, 2015 and April 29, 2021 [16]. Geosyntec reviewed the piezometer data to evaluate if significant fluctuations, partially increases in phreatic levels, may have occurred between development of the initial structural stability and factor of safety certifications [7], [4], [5]) and April 29, 2021. Available piezometer readings are plotted in **Attachment A**.

In summary, the peak measured groundwater levels for several piezometers were up to 10 ft higher than the phreatic conditions considered during the initial certification. These changes could impact the results of the factor of safety analyses required for the structural stability and factor of safety certifications ([7], [4], [5]). Specifically, up to four cross sections were identified with significant changes in phreatic conditions.

2.4 Comparison of 2015 to 2020 Surveys

Surveys conducted at the site by Weaver Consultants (Weaver) in 2015 [17] and IngenAE, LLC (IngenAE) in 2020 [18] were compared within AutoCAD Civil3D 2021 software. This comparison quantified changes in the volume of CCR placed within the PAP and considered volumetric changes above and below the starting water surface elevation (SWSE) used for the 2016 §257.82 inflow design flood control plan hydraulic analysis [7]. Potential changes to embankment geometry were also evaluated. This comparison is presented in side-by-side views of each survey in **Drawing 1**, and a plan view isopach map denoting changes in ground surface elevation in **Drawing 2**. A summary of the water elevations and changes in CCR volumes is provided in **Table 2**.

Table 2 – 2015 and 2020 Survey Comparison

Initial Surveyed Pool Elevation (ft)	534.0
Periodic Surveyed Pool Elevation (ft)	535.5
Initial §257.82 Starting Water Surface Elevation (SWSE) (ft)	534.0
Total Change in CCR Volume (CY)	98,711 (fill)
Change in CCR Volume Above SWSE (CY)	185,376 (fill)
Change in CCR Volume Below SWSE (CY)	-86,913 (cut)

The comparison indicated that approximately 98,711 CY of CCR was placed in the PAP between the initial and periodic survey, thereby leading to a potential for the peak water surface elevation (PWSE) to increase during the inflow design 1,000-year flood event. Also, the measured water surface elevation for the periodic survey is higher than the water levels estimated for both normal and a 1,000-yr flood events event in the initial certifications (**Section 7**).

No significant changes to embankment geometry appeared to have occurred between the initial and periodic surveys, as shown on the isopach. However, along the northern embankments there appears to be material stockpiled upstream of the embankments which would have increased the loading on the embankments. It is further noted that there are two areas along the southern embankment that appear to be cut and apparently excavated since the initial survey. Such excavation is not known to have occurred and it is likely this apparent cut is a byproduct of survey discrepancy between the initial and periodic bathymetric surveys.

2.5 Comparison of 2015 to 2020 Aerial Photography

Aerial photographs of the PAP collected by Weaver in 2015 [17] and IngenAE in 2020 [18] were compared to visually evaluate if potential site changes (i.e., changes to the embankment, outlet structures, limits of CCR, other appurtenances) may have occurred. A comparison of these aerial photographs is provided in **Drawing 3**, and the following changes were identified:

- A few mounds of new earth built up along the northern embankments; and
- No clear change in the ash delta or shoreline was observed; and
- It appears the water level of the impounded pond may have been higher in 2015.

2.6 Comparison of Initial and Periodic Site Visits

An initial site visit to the PAP was conducted by AECOM in 2015 and documented with a Site Visit Summary and corresponding photographs [19]. A site visit was conducted by Geosyntec on May 21, 2021, with Panos Andonyadis, P.E., conducting the site visit. The site visit was intended to evaluate potential changes at the site since 2015 (i.e., modification to the embankment, outlet structures or other appurtenances, limits of CCR, maintenance programs, repairs), in addition to performing visual observations of the PAP to evaluate if the structural stability requirements (§257.73(d)) were still met. The site visit included walking the perimeter of the PAP, visually observing conditions, recording filed notes, and collecting photographs. The site visit is documented in a photographic log provided in **Attachment B**. A summary of significant findings from the periodic site visit is provided below:

- The perimeter embankments appear to be structurally stable as no signs of structural or foundation instability were observed
- No new development was observed in the vicinity of the PAP, although the observation was limited to the portions of the vicinity visible form the crest of the PAP dike.
- No significant changes were observed since the previous certification.

2.7 Interview with Power Plant Staff

An interview with Ken Schafer of the NPP was conducted by Panos Andonyadis of Geosyntec on May 21, 2021. Mr. Schafer was employed at NPP between 2015 and 2021, The interview included a discussion of potential changes that that may have occurred at the PAP since development of the initial certifications ([2], [3], [4], [5], [6], [7]) in 2015 and 2016. between 2015 and 2020. A summary of the interview is provided below.

- Were any construction projects completed for the PAP between 2015 and 2021, and, if so, are design drawings and/or details available?

  - No repairs were performed since the initial certification.

- Were there any changes to the purpose of the PAP between 2015 and 2021?

  - No, the impoundment continues to receive sluiced ash, sluiced bottom ash, and plant waste water.

- Were there any changes to the to the instrumentation program and/or physical instruments for the PAP between 2015 and 2021?

  - No.

- Are area-capacity curves for the PAP available?

  - No area-capacity curves have been developed.

- Were there any changes to spillways and/or diversion features for the PAP completed between 2015 and 2021?

  - No changes to the spillway were made.

- Were there any changes to construction specifications, surveillance, maintenance, and repair procedures for the PAP between 2015 and 2021?

  - No changes were made.

- Were there any instances of embankment and/or structural instability for the PAP between 2015 and 2021?

  - A repair of a slough was performed on the upstream side of the southernmost embankment. The damage appears to have been caused by wave related erosion and is limited to the area of a previous repair.

SECTION 3

HAZARD POTENTIAL CLASSIFICATION - §257.73(a)(2)

3.1 Overview of 2016 Initial Hazard Potential Classification

The Initial Hazard Potential Classification (Initial HPC) was prepared by Stantec Consulting Services, Inc. (Stantec) in 2016 ([2], [9]), following the requirements of §257.73(a)(2). The Initial HPC included the following information:

- Performing a visual analysis to evaluate potential hazards associated with a failure of the PAP perimeter embankment, along all sides of the PAP.
- Evaluation of potential breach flow paths were evaluated using elevation data and aerial imagery to evaluate potential impacts to downstream structures, infrastructure, frequently occupied facilities/areas, and waterways [2].
- While a breach map is not included in the Initial HPC, it is included within the §257.73(a)(3) Initial Emergency Action Plan prepared by Stantec [20].

The visual analysis indicated that none of the breach scenarios appeared to impact occupied structures, although a breach of the east embankment could impact an infrequently-used gravel site access road and a breach of the north, northeast or east embankment could impact a nearby railroad. The Initial HPC concluded that none of breach scenarios considered would be likely to result in a probable loss of human life, although the breach could cause CCR to be released into the Newton Lake, thereby causing environmental damage. The Initial HPC therefore recommended a "Significant" hazard potential classification for the PAP [2].

3.2 Review of Initial HPC

Geosyntec performed a review of the Initial HPC ([2], [9]) in terms of technical approach, input parameters, assessment of the results, and applicable requirements of the CCR Rule [1]. No significant technical issues were noted within the technical review, although a detailed review (e.g., check) of the calculations was not performed.

3.3 Summary of Site Changes Affecting the Initial HPC

Geosyntec did not identify any changes at the site that may affect the HPC. No new structures, infrastructure, frequently occupied facilities/areas, or waterways were present in the probable breach area indicated in the Initial EmAP [20], although Geosyntec's evaluation of new structures was limited to visual observations completed from the dike crest during the site visit and a review of available aerial imagery provided by IngenAE in 2020 [18]. Additionally, no significant changes to the topography in the probable breach were identified.

3.4 Periodic HPC

Geosyntec recommends retaining the "Significant" hazard potential classification for the PAP, per §257.73(A)(2), based on the lack of site changes potentially affecting the Initial HPC occurring since the initial HPC was developed, as described in **Section 3.2**. Updates to the Initial HPC reports ([2], [9]) are not recommended at this time.

SECTION 4

HISTORY OF CONSTRUCTION REPORT - §257.73(c)

4.1 Overview of Initial HoC

The Initial History of Construction report (Initial HoC) was prepared by AECOM in 2016 [3], following the requirements of §257.73(c), and included information on the PAP. The Initial HoC included the following information for each CCR surface impoundment:

- The name and address of the owner/operator,
- Location maps,
- Statements of purpose,
- The names and size of the surrounding watershed,
- A description of the foundation and abutment materials,
- A description of the embankment materials,
- Approximate dates and stages of construction,
- A list of available design and engineering drawings,
- A summary of instrumentation,
- A statement that area-capacity curves are not available,
- Information on spillway structures,
- A statement that the constructions specifications are not available,
- Inspection and surveillance plans,
- Information on operational and maintenance procedures, and
- A statement of observed historical structural instability that occurred at the PAP.

4.2 Summary of Site Affecting the Initial HoC

Several significant changes were identified at the site that occurred after development of the initial HoC report [3] and are described below:

- A state identification number (ID) of W0798070001-01 was assigned to the PAP by the Illinois Environmental Protection Agency (IEPA).

- Revised area-capacity curves and spillway design calculations for the PAP were prepared as part of the updated periodic Inflow Design Flood Control System Plan, as described in **Section 7.3**.

A letter documenting changes to the HoC report is provided in **Attachment C**.

SECTION 5

STRUCTURAL STABILITY ASSESSMENT - §257.73(d)

5.1 Overview of Initial SSA

The Initial Structural Stability Assessment (Initial SSA) was prepared by AECOM in 2016 ([4], [7]) following the requirements of §257.73(d)(1), and included the following evaluations:

- Stability of embankment foundations, embankment abutments, slope protection, embankment compaction, and slope vegetation,
- Spillway stability including capacity, structural stability and integrity;
- Stability and structural integrity of hydraulic structures; and
- Downstream slope stability under sudden drawdown conditions for a downstream water body.

The Initial SSA concluded that the PAP met all structural stability requirements for §257.73(d)(1)(i)-(vii).

A periodic certification of the structural stability and structural integrity of hydraulic outfall structures (§257.73(d)(1)(vi)) was performed by Luminant in 2020 [8]. This certification independently determined that the criteria was met due to the condition of the spillway pipes and the soil types within the embankment. Therefore, the review and certification of §257.73(d)(1)(vi) was not included within the scope of this report.

The Initial SSA referenced the results of the Initial Structural Factor Assessment (Initial SFA) ([5], [7]), to demonstrate stability of the stability of foundations and abutments (§257.73(d)(1)(i)) and sufficiency of dike compaction (§257.73(d)(1)(iii)) portions of the SSA criteria. This included stating that slope stability analyses for slip surfaces passing through the foundation met or exceeded the criteria listed in §257.73(e)(1), for the stability of foundations and abutments. For the sufficiency of dike compaction, this included stating that slope stability analyses for slip surfaces passing through the dike also met or exceeded the §257.73(e)(1) criteria.

Additionally, the Initial SSA included a sudden drawdown slope stability analysis to evaluate the effect of a drawdown event in the adjacent Newton Lake from the 100-year flood pool to an empty-pool condition, as required by §257.73(3)(1)(vii) for CCR units where the downstream slopes are inundated by an adjacent water body. The minimum acceptable factor of safety for this loading condition was assumed to be 1.3 based on US Army Corps of Engineers guidance [21].

5.2 Review of Initial SSA

Geosyntec performed a review of the Initial SSA ([4], [7]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing photographs collected in 2015 and used to demonstrate compliance with §257.73(d)(1)(i)-(vii).
- Reviewing geotechnical calculations used to demonstrate the stability of foundations, per §257.73(d)(1)(i), sufficiency of embankment compaction, per §257.73(d)(1)(iii), and downstream slope inundation/stability, per §257.73(d)(1)(vii), in terms of supporting geotechnical investigation and testing data, input parameters, analysis methodology, selection of critical cross-sections, and loading conditions.
- Reviewing completeness and technical approach of closed-circuit television (CCTV) inspections used to evaluate the stability of hydraulic structures, per §257.73(d)(1)(vi).

No significant technical issues were noted within the technical review, although a detailed review (e.g., check) of the calculations was not performed.

5.3 Summary of Site Changes Affecting the Initial SSA

Several changes at the site that occurred after development of the Initial SSA were identified. These changes required updates to the Initial SSA and are described below:

- The Initial SSA utilized the results of the Initial Inflow Design Flood Control System Plan (IDF) to demonstrate compliance with the adequacy of spillway design and management (§257.73(d)(1)(v)(A)-(B)). The Initial IDF was subsequently updated to develop a Periodic IDF, based on site changes, as discussed in **Section 7**.
- The Initial SSA utilized the slope stability analysis results of the Initial Safety Factor Assessment (SFA) as part of the compliance demonstration for the stability of foundations and abutments (§257.73(d)(1)(i)) and sufficiency of dike compaction (§257.73(d)(1)(iii)) as discussed in **Section 5.1**. The Initial SSA also utilized sudden drawdown slope stability analyses performed using the same cross-sections and input data as the Initial SFA to demonstrate compliance with downstream slope inundation/stability (§257.73(d)(1)(vii). The Initial SFA slope stability analyses, including the sudden drawdown analyses, were subsequently updated to develop a Periodic SFA, based on site changes, as discussed in **Section 6.4**.

5.4 Periodic SSA

The Periodic SFA (**Section 6.4**) indicates that foundations and abutments are stable and dike compaction is sufficient for expected ranges in loading conditions, as slope stability factors of safety were found to meet or exceed the requirements of §257.73(e)(1), including for static maximums storage pool conditions and post-earthquake (i.e., liquefaction) loading conditions considering seismically-induced strength loss in the foundation soils. Therefore, the requirements of §257.73(d)(1)(i) and §257.73(d)(1)(iii) are met for the Periodic SSA.

The Periodic IDF (**Section 7.4**) indicates that spillways are adequately designed and constructed to adequately manage flow during the PMF flood, as the spillways can adequately manage flow during peak discharge from the PMP storm event without overtopping of the embankments. Therefore, the requirements of §257.73(d)(1)(v)(A)-(B) are met for the Periodic SSA.

Certification of §257.73(d)(1)(vi) was independently performed by Luminant [8] and is not included within the scope of this report.

SECTION 6

SAFETY FACTOR ASSESSMENT - §257.73(e)(1)

6.1 Overview of Initial SFA

The Initial Safety Factor Assessment (Initial SFA) was prepared by AECOM in 2016 [7], following the requirements of §257.73(e)(1). The Initial SFA included the following information:

- A geotechnical investigation program with in-situ and laboratory testing;
- An assessment of the potential for liquefaction in the embankment and foundation soils;
- The development of ten slope stability cross-sections for limit equilibrium stability analysis utilizing GeoStudio SLOPE/W software; and
- The analysis of all cross-sections for maximum storage pool, maximum surcharge pool, and seismic loading conditions.

The Initial SFA concluded that the PAP met all safety factor requirements, per §257.73(e), as all calculated safety factors were equal to or higher than the minimum required values.

6.2 Review of Initial SFA

Geosyntec performed a review of the Initial SFA ([5], [7]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing geotechnical calculations used to demonstrate the acceptable safety factors, per §257.73(e)(1), in terms of:
  - Completeness and adequacy of supporting geotechnical investigation and testing data;
  - Completeness and approach of liquefaction triggering assessments;
  - Input parameters, analysis methodology, selection of critical cross-sections, and loading conditions utilized for slope stability analyses; and
  - Phreatic conditions based on piezometric data, as discussed in **Section 2.3**.

No significant technical issues were noted within the technical review, although a detailed review (e.g., check) of the calculations was not performed.

6.3 Summary of Site Changes Affecting the Initial SFA

Several changes at the site that occurred after development of the Initial SFA were identified. These changes required updates to the Initial SFA and are described below:

- The groundwater levels measured since 2015 (**Section 2.3**) appear to be up to 10 ft higher than the phreatic surface modeled for the perimeter embankments during the Initial SFA ([5], [7]). Therefore, the phreatic surface needed to be updated to reflect the critical levels observed since 2015.

- The Periodic IDF (**Section 7.4)** found that the normal pool elevation within the PAP increased from 534.0 to 537.0 ft, resulting in 3.0 ft more water loading on the embankment dikes than was considered in the Initial SFA for the maximum storage pool, seismic loading conditions (§257.73(e)(1)(i) and (iii)), and sudden drawdown loading condition (§257.73(d)(1)(ii)). Peak water surface elevations during the IDF also increased from 534.9 to 538.2 ft, resulting in 3.3 ft more water loading on the embankment dikes than was considered in the Initial SFA for the maximum surcharge pool loading conditions (§257.73(e)(1)(i)).

6.4 Periodic SFA

Geosyntec revised existing slope stability analyses associated with the Initial SFA ([5], [7]) for the ten cross- sections of PAP to account for the increase in normal and peak pool loadings, and phreatic level changes as described in **Section 2.3** and **Section 7.4**. This included revising the slope stability analyses evaluating sudden drawdown conditions in the cross-sections adjacent to the downstream water body that were utilized as part of the Initial SSA (**Section 6.2**). The following approach and input data were used to revise the analyses:

- Water levels in the PAP for the maximum storage pool, seismic slope stability analysis, and sudden drawdown loading conditions were increased to El. 537.0 ft, based on the Periodic IDF (**Section 7.4)**.

- Water levels in the PAP for the maximum surcharge pool slope stability analysis loading conditions were increased to El. 538.2 ft, based on the Periodic IDF (**Section 7.4)**.

- According to updated groundwater level monitoring plot (**Section 2.3**), the phreatic level in the location of related piezometers increased for all the loading conditions from El. 534 to El. 538 ft in cross-section “E”, from El. 537 to El. 539 ft in cross-section “F”, from El. 535 to El. 544 ft in cross-section “G”, and from El. 535 to El. 541 ft in cross-section “K”.

- All other analysis input data and settings from the Initial SFA ([5], [7]), were utilized, including, but not limited to, subsurface stratigraphy and soil strengths, phreatic conditions, ground surface geometry, software package and version, slip surface search routines and methods, and input data for the seismic analyses.

Factors of safety from the Periodic SFA are summarized in **Table 3** and confirm that the PAP meets the requirements of §257.73(e)(1). Slope stability analysis output associated with the Initial SFA is provided in **Attachment D**.

Table 3 – Factors of Safety from Periodic SFA

	Structural Stability Assessment (§257.73(d)) and Safety Factor Assessment (§257.73(e))				**Structural Stability Assessment (§257.73(d))**
Cross-Section	**Maximum Storage Pool §257.73(e)(1)(i) Minimum Required = 1.50**	**Maximum Surcharge Pool[1] §257.73(e)(1)(ii) Minimum Required = 1.40**	**Seismic §257.73(e)(1)(iii) Minimum Required = 1.00**	**Dike Liquefaction §257.73(e)(1)(iv) Minimum Required = 1.20**	**Sudden Drawdown §257.73(d)(1)(ii) Minimum Required = 1.30**
A	1.82	1.82	1.26	N/A	N/A
B	1.81	1.81	1.07*	N/A	1.59*
C	1.67	1.67	1.11	N/A	1.67
D	1.76	1.76	1.23	N/A	1.76
E	2.18	2.18	1.91	N/A	N/A
F	1.93	1.93	1.45	N/A	N/A
G	1.98	1.98	1.46	N/A	N/A
H	1.81	1.81	1.36	N/A	N/A
I	1.66*	1.66*	1.43	N/A	1.61
K	1.73	1.74	1.17	N/A	1.73

Notes:
*Indicates critical cross-section (i.e., lowest calculated factor of safety out of the ten cross-sections analyzed)
N/A – Loading condition is not applicable.

SECTION 7

INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN - §257.82

7.1 Overview of 2016 Inflow Design Flood Control System Plan

The Initial Inflow Design Flood Control System Plan (Initial IDF) was prepared by AECOM in 2016 [7], following the requirements of §257.82. The Initial IDF included the following information:

- A hydraulic and hydrologic analysis, performed for the 1,000-year design flood event because of the hazard potential classification of “Significant”, which corresponded to 9.01 inches of rainfall over a 24-hour period.
- The Initial IDF utilized a HydroCAD Version 10 model to evaluate spillway flows and pool level increases during the design flood, with a starting water surface elevation of 534.0 ft.

The Initial IDF concluded that the PAP met the requirements of §257.82, as the peak water surface estimated by the HydroCAD model was elevation 534.9 ft, relative to a minimum PAP embankment crest elevation of 552.7 ft. Therefore, overtopping was not expected. The Initial IDF also evaluated the potential for discharge from the CCR unit and determined that discharge from the PAP during normal and inflow design flood conditions was expected to be routed through the existing spillway and NPDES-permitted outfall.

7.2 Review of Initial IDF

Geosyntec performed a review of the Initial IDF ([6], [7]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing the return interval used vs. the hazard potential classification.
- Reviewing the rainfall depth and distribution for appropriateness.
- Performing a high-level review of the inputs to the hydrological modeling.
- Reviewing the hydrologic model parameters for spillway parameters, starting pool elevation, and storage vs. the reference data.
- Reviewing the overall Initial IDF vs. the applicable requirements of the CCR Rule

Several review comments were identified during review of the Initial IDF. The comments are described below:

- The Initial IDF utilized the National Resource Conservation Service (NRCS) Type II rainfall distribution type [22]. Geosyntec recommend utilizing the Huff 3rd Quartile distribution for areas less than 10 square miles [23] for the reasons listed below.
  - Huff 3rd Quartile distribution was determined to be a more appropriate representation of a 1,000-year, 24-hour storm event per the Illinois State Water Survey (ISWS) Circular 173 [24] which developed standardized rainfall distributions from compiled rainfall data at sites throughout Illinois.
  - Illinois Department of Natural Resources, Office of Water Resources (IDNR-OWR) [25] recommends use of the Huff Quartile distributions in Circular 173 when using frequency events to determine the spillway design flood inflow hydrograph, "*The suggested method to distribute this rainfall is described in the ISWS publication, Circular 173, "Time Distributions of Heavy Rainstorms in Illinois"*.
- The process inflows (ash sluice and wastewater) included within the hydrologic and hydraulic analysis file were daily averages which are less than the maximum pump rate (i.e., worst-case scenario).

7.3 Summary of Site Changes Affecting the Initial IDF

Two changes at the site that occurred after development of the Initial IDF were identified. These changes required updates to the Initial IDF and are described below:

- Approximately 98,700 CY of CRR were placed above the SWSE utilized for the Initial IDF certification, thereby altering the stage-storage curve for the PAP relative to the Initial IDF.
- The operative water level of the impoundment is higher, thereby altering the SWSE for the PAP relative to the Initial IDF.

7.4 Periodic IDF

Geosyntec revised the HydroCAD model associated with the Initial IDF to account for the revised rainfall distribution type, cessation of process flows, and additional CCR placement, as described in **Sections 7.2** and **7.3**. The following approach and input data were used for the revised analyses and are referenced in **Attachment E** as appropriate:

- Stage-storage (i.e., area-capacity) curves for the PAP were updated based on the 2020 site survey [18].

- A revised stage-volume curves for the PAP and Secondary Pond were prepared based on measuring the storage volume of the ponds at every one-foot increment of depth from an elevation at the bottom of the ponds (495 ft PAP; 505 ft Secondary Pond) to the perimeter dike embankment's approximate minimum crest elevation (552 ft PAP; 532 ft Secondary Pond). This analysis identified an overall increase of 129,070 CY (80 ac-ft) of storage volume at the PAP and an overall decrease of 14,520 CY (9 ac-ft) of storage volume at the Secondary Pond from 2016 to 2021.

- The SWSE within the PAP was updated from 534.0 ft to 537.0 ft as this is the invert of the pond outlet structure. The 2020 site survey showed a water surface elevation (WSE) of 535.5 ft; however, the greater elevation of the outlet invert and the surveyed WSE was used as the SWSE to provide conservatism in the model.

- The SWSE within the Secondary Pond was updated from 520.0 ft to 519.9 ft to reflect the 2020 site survey. The primary outlet invert elevation from the Secondary Pond is 505 ft; however, the greater elevation of the outlet invert and the surveyed WSE was used as the SWSE to provide conservatism in the model.

- Updated the inflows from the Ash Sluice from 3.88 cfs for 14 hours per day to 13.37 cfs for 14 hours per day for the duration of the modeled simulation. This more accurately reflects the full load operation of the pumps described in the Initial Full Certification Report (two pumps at 3,000 gpm each, operating 14 hours/day under full load).

- Wastewater inflows were updated from 11.64 cfs for 24 hours per day to 23.39 cfs for 12 hours per day for the duration of the modeled simulation. This more accurately reflects the full load operation of the pumps described in the Initial Full Certification Report (five pumps at 2,100 gpm each, operating 60 pump hours/day).

- The time of concentration (ToC) was updated for drainage areas to the PAP and Secondary Pond from 16.7 minutes (PAP) and 5 minutes (Secondary Pond) to 6 minutes to reflect direct run-on inflow in accordance with TR-20 [22].

- The primary outlet structure from the PAP was updated to reflect the description in the Initial Full Certification Report with no noted changes to the outlet structures.

    - The outlet invert elevation was updated from 512.0 ft to 512.18 ft to reflect the described invert elevation of 512.5 ft using the NGVD29 datum. This was converted to the NAVD88 datum to be consistent with the vertical datum used for the IDF HydroCAD model.

    - Added a weir box riser structure by routing a 28-inch diameter horizontal orifice to the existing outlet culvert. The invert of the riser was set to 537.0 ft. The dimensions of the riser structure were not available; therefore, the riser structure was sized in the model to be consistent with the downstream culvert; this was assumed to be a conservatively restrictive outlet.

- The routing method for the model was updated to more accurately account for routing between the ponds and Lake Newton. The Reach Routing Method was updated from “Storage Indication+ Translation” to “Dynamic Storage Indication”. The Pond Routing Method was updated from “Storage – Indication” to “Dynamic Storage Indication”.

- The tailwater conditions of the PAP and Secondary Pond were changed from fixed elevations to “Automated” to more accurately account for routing between the ponds.

- Lake Newton was changed to be represented by a link instead of a pond, which allowed a fixed water surface of 504.33 ft (based on 2020 survey of outlet invert elevation).

- The outlet invert elevation of the culvert outlet from the Secondary Pond was updated to 504.33 ft to reflect the 2020 site survey.

- All other input data and settings from the Initial IDF HydroCAD model were utilized, including, but not limited to software package and version, runoff method, rainfall depth, analysis time span and analysis time step.

The results of the Updated IDF are summarized in **Table 4** and confirm that the PAP meets the requirements of §257.82(a)-(b), as the peak water surface elevation does not exceed the minimum perimeter dike crest elevations. Additionally, all discharge from the PAP is routed through the existing spillway system to the NPDES-permitted outfall, during both normal and IDF conditions. Updated area-capacity curves and HydroCAD model output is provided in **Attachment E**.

Table 4- Water Levels from Periodic IDF

	Primary Ash Pond		
Analysis	**Starting Water Surface Elevation (ft)**	**Peak Water Surface Elevation (ft)**	**Minimum Dike Crest Elevation (ft)**
Initial IDF	534.0	534.9	552.0
Updated Periodic IDF	537.0	538.2	552.0
Initial to Periodic Change[1]	+3.0	+3.3	

Notes:
[1]Postive change indicates increase in the WSE relative to the Initial IDF, negative change indicates decrease in the WSE, relative to the Initial IDF.

SECTION 8

CONCLUSIONS

The PAP at NPP was evaluated relative to the USEPA CCR Rule periodic assessment requirements for:

- Hazard potential classification (§257.73(a)(2)),
- History of Construction reporting (§257.73(d)),
- Structural stability assessment (§257.73(d)), with the exception of §257.73(d)(1)(vi) that was independently certified by Luminant [8];
- Safety factor assessment (§257.73(e)), and
- Inflow design flood control system planning (§257.82).

Based on the evaluations presented herein, the referenced requirements are satisfied.

SECTION 9

CERTIFICATION STATEMENT

CCR Unit: Illinois Power Generating Company, Newton Power Plant, Primary Ash Pond

I, Panos Andonyadis, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this 2021 USEPA CCR Rule Periodic Certification Report, has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the periodic assessment of the hazard potential classification, history of construction report, structural stability, safety factors, and inflow design flood control system planning, dated October 2021, were conducted in accordance with the requirements of 40 CFR §257.73(a)(2), (c), (d), (e), and §257.82, with the exception of §257.73(d)(1)(vi)) that was independently certified by others.

Panos Andonyadis

OCTOBER 11, 2021

Date

SECTION 10

REFERENCES

[1] United States Environmental Protection Agency, 40 CFR Parts 257 and 261; Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule, 2015.

[2] Stantec Consulting Services Inc., "Initial Hazard Potetnial Classificaiton Assessment, EPA Final CCR Rule, Primary Ash Pond, Newton Power Station, Jasper County, Illinois," Fenton, MO, October 12, 2016.

[3] AECOM, "History of Construction, USEPA Final CCR Rule, Newton Power Station, Newton, Illinois," October 2016.

[4] AECOM, "CCR Rule Report: Initial Structural Stability Assessment For Primary Ash Pond At Newton Power Station," St. Louis, MO, October 2016.

[5] AECOM, "CCR Rule Report: Initial Safety Factor Assessment For Primary Ash Pond At Newton Power Station," St. Louis, MO, October 2016.

[6] AECOM, "CCR Rule Report: Initial Inflow Design Flood Control System Plan For Primary Ash Pond At Newton Power Station," St. Louis, MO, October 2016.

[7] AECOM, "CCR Certification Report: Initial Structural Stability Assessment, Initial Safety Factor Assessment, and Initial Inflow Design Flood Control System Plan for Primary Ash Pond at Newton Power Station," St. Louis, MO, October 2016.

[8] V. Modeer, "Primary Ash Pond Structural Stability Assessment, Illinois Power Resrouces Generationg, LLC, Newton Power Station," Luminant, October 1, 2020.

[9] Stantec Consulting Services, Inc., "Documentation of Initial Hazard Potential Classificaiton Assessment, Primary Ash Pond, Newton Power Station, Jasper County, Illinois," October 12, 2016.

[10] J. Knutelski and J. Campbell, *Annual CCR Surface Impoundment Inspection Report (per 40 CFR 257.83(b)(2)), Newton Power Station, Primary Ash Pond*, January 18, 2016.

[11] J. Knutelski and J. Campbell, *Annual CCR Surface Impoundment Inspection Report (per 40 CFR 257.83(b)(2)), Newton Power Station, Primary Ash Pond*, January 18, 2017.

[12] J. Knutelski and J. Campbell, *Annual CCR Surface Impoundment Inspection Report (per 40 CFR 257.83(b)(2)), Newton Power Station, Primary Ash Pond*, February 7, 2018.

[13] J. Knutelski, *Annual Inspection by a Qualified Professional Engineer, 40 CFR 257.83(b), Newton Power Station, Primary Ash Pond*, January 10, 2019.

[14] Knutelski, James, *Annual Inspection by a Qualified Professional Engineer, 40 CFR §257.83(b), Newton Power Station, Primary Ash Pond*, January 10, 2020.

[15] James Knutelski, *Annual Inspection by a Qualified Professional Engineer, 40 CFR §257.83(b), Newton Power Station, Primary Ash Pond*, January 06, 2021.

[16] Geocyntec Consultants Inc., "Newton Piezo Measurements_20160121," Geocyntec Consultants Inc., Chesterfield, MO, 2021.

[17] Weaver Consultants Group, "Dynegy, Collinsville, IL, 2015 - Newton Topography," Collinsville, IL, December 2015.

[18] IngenAE, "Luminant, Dynegy Midwest Generation, LLC, Newton Power Station, December 2020 Topography," Earth City, Missouri, March 12, 2021.

[19] AECOM, "Draft CCR Unit Initial Site Visit Summary, Dynegy CCR Compliance Program," June 24, 2015.

[20] Stantec Consulting Services Inc, "Illinois Power Generating Company, Newton Power Station, City of Newton, Jasper County, IL, Emergency Action Plan, Primary Ash Pond (NID # IL50719)," Fenton, MO, April 13, 2017.

[21] U.S. Army Corps of Engineers, "Slope Stability, EM 1110-2-1902," October 31, 2003.

[22] Natural Resources Conservation Service, Conservation Engineering Division, "Urban Hydrology for Small Watersheds (TR-55)," United States Department of Agriculture, June 1985.

[23] F. A. Huff and J. R. Angel, "Frequency Distributions and Hydroclimatic Characteristics of Heavy Rainstorms in Illinois," State Water Survey Division, Department of Energy and Natural Resoruces, State of Illinois, Champaign, Illinois, 1989.

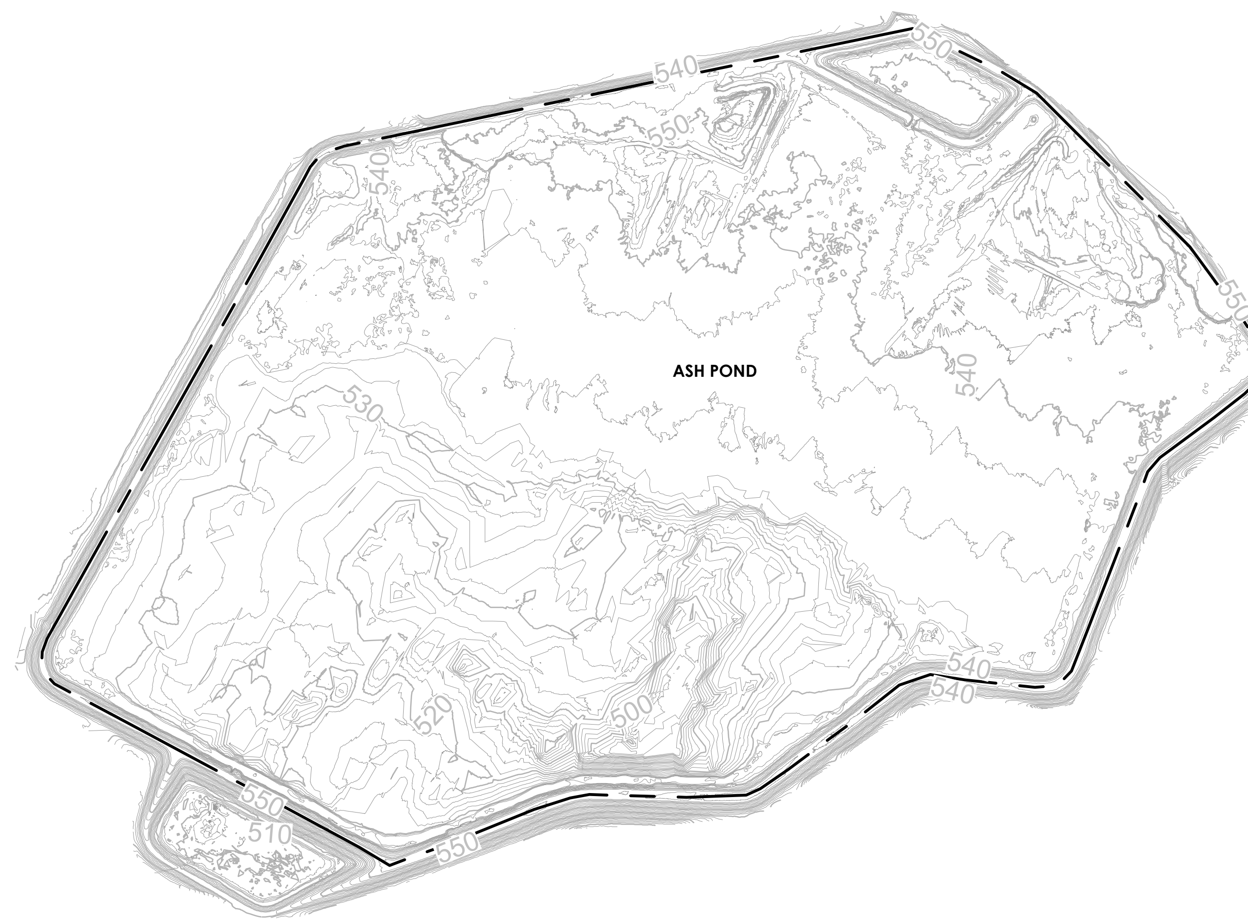
[24] F. A. Huff, "Time Distributions of Heavy Rainstorms in Illinois," State Water Survey, Department of Energy and Natural Resoruces, State of Illinois, Champaign, Illinois, 1990.

[25] Office of Natural Resources, "Procedural Guidelines for Preparation of Technical Data to be included in Applications for Permits for Construction and Maintenance of Dams," Department of Natural Resoruces, State of Illinois, Springfield, Illinois, Undated.

DRAWINGS

N

INITIAL SURVEY
12-01-2015 TOPOGRAPHY



PERIODIC SURVEY
02-26-2021 TOPOGRAPHY

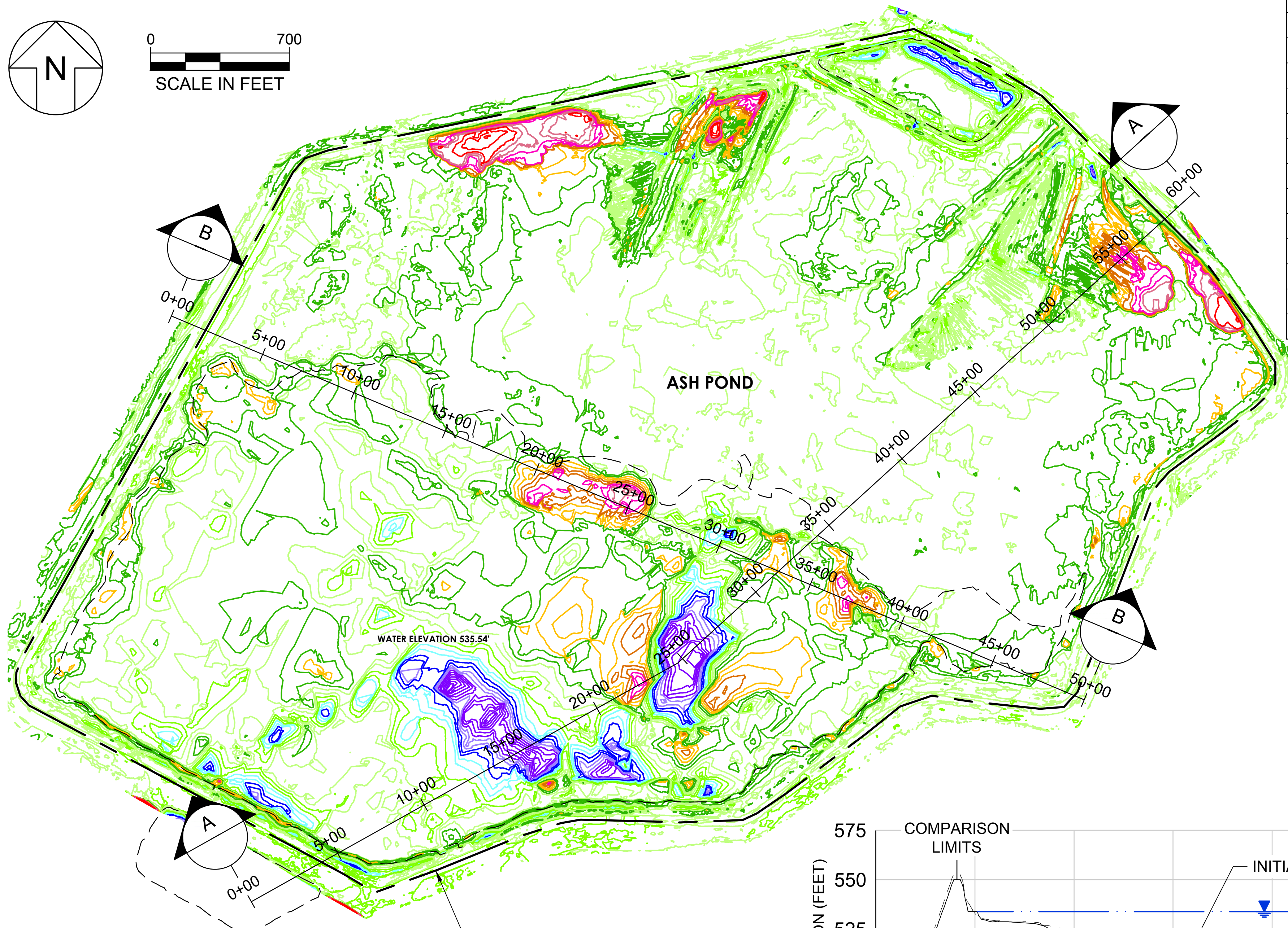
0 1,000
SCALE IN FEET

NOTES:

1. THE INITIAL SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “DYNEGY, COLLINSVILLE, ILLINOIS, 2015 - NEWTON TOPOGRAPHY”, PREPARED BY WEAVER CONSULTANTS GROUP, DATED DECEMBER 1, 2015.
2. THE PERIODIC SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “LUMINANT, ILLINOIS POWER GENERATING COMPANY, NEWTON POWER STATION, DECEMBER 2020 TOPOGRAPHY”, PREPARED BY INGENAE, DATED FEBRUARY 26, 2021.
3. ALL SURVEY DATA WAS COLLECTED IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) AND NORTH AMERICAN DATUM OF 1983 (NAD83) FOR VERTICAL AND HORIZONTAL COORDINATES, RESPECTIVELY.

INITIAL TO PERIODIC SURVEY COMPARISON ASH POND NEWTON POWER PLANT NEWTON, ILLINOIS		
Geosyntec consultants		DRAWING 1
GLP8027.08	MAY 2021	

SCALE IN FEET: 0 – 700

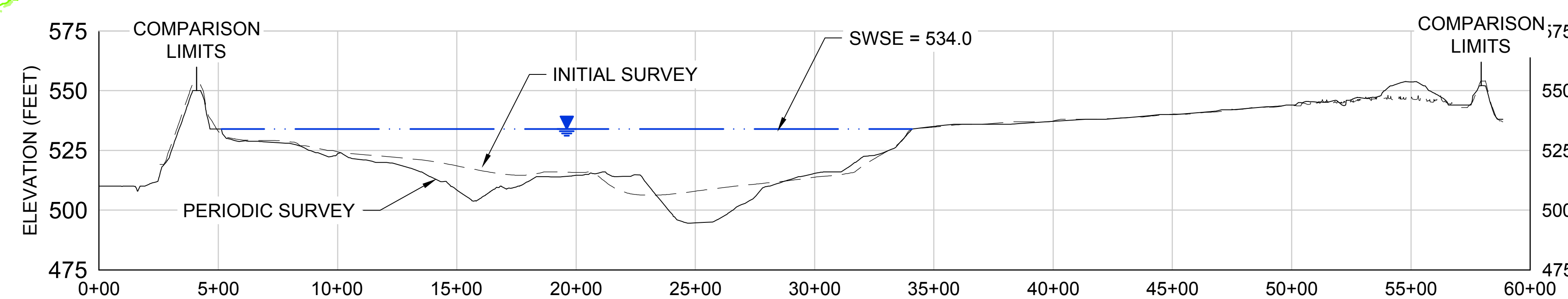


ISOPACH CONTOUR KEY		
COLOR	MIN ELEV	MAX ELEV
(purple)	-17	-10
(light purple)	-10	-8
(blue)	-8	-6
(cyan)	-6	-4
(green)	-4	-2
(light green)	-2	0
(dark green)	0	2
(yellow)	2	4
(orange)	4	6
(magenta)	6	8
(pink)	8	10
(red)	10	26

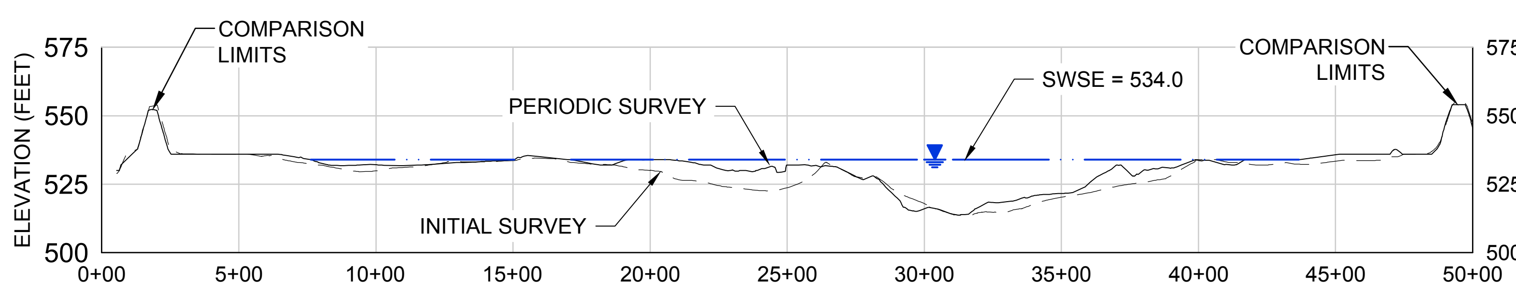
INITIAL TO PERIODIC SURVEY COMPARISON SUMMARY			
SURFACE IMPOUNDMENT	CUT	FILL	NET (CU. YD.)
ASH POND	467,675	566,386	98,711(FILL)
ABOVE SWSE	144,793	330,169	185,376 (FILL)
BELOW SWSE	322,591	235,677	86,913 (CUT)

NOTES:

1. THE INITIAL SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED "DYNEGY, COLLINSVILLE, ILLINOIS, 2015 - NEWTON TOPOGRAPHY", PREPARED BY WEAVER CONSULTANTS GROUP, DATED DECEMBER 1, 2015.
2. THE PERIODIC SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED "LUMINANT, ILLINOIS POWER GENERATING COMPANY, NEWTON POWER STATION, DECEMBER 2020 TOPOGRAPHY", PREPARED BY INGENAE, DATED FEBRUARY 26, 2021.
3. ALL SURVEY DATA WAS COLLECTED IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) AND NORTH AMERICAN DATUM OF 1983 (NAD83) FOR VERTICAL AND HORIZONTAL COORDINATES, RESPECTIVELY.
4. THE STARTING WATER SURFACE ELEVATION (SWSE) OF THE PRIMARY ASH POND IS EL. 534.0 FT, AS NOTED IN THE REPORT TITLED "CCR CERTIFICATION REPORT: INITIAL STRUCTURAL STABILITY ASSESSMENT, INITIAL SAFETY FACTOR ASSESSMENT, AND INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN FOR PRIMARY ASH POND AT NEWTON POWER STATION", PREPARED BY AECOM, DATED OCTOBER, 2016.



SECTION A



SECTION B

HORZ: SCALE IN FEET 0 – 700

VERT: SCALE IN FEET 0 – 70

SURVEY COMPARISON ISOPACH
NEWTON POWER PLANT
NEWTON, ILLINOIS

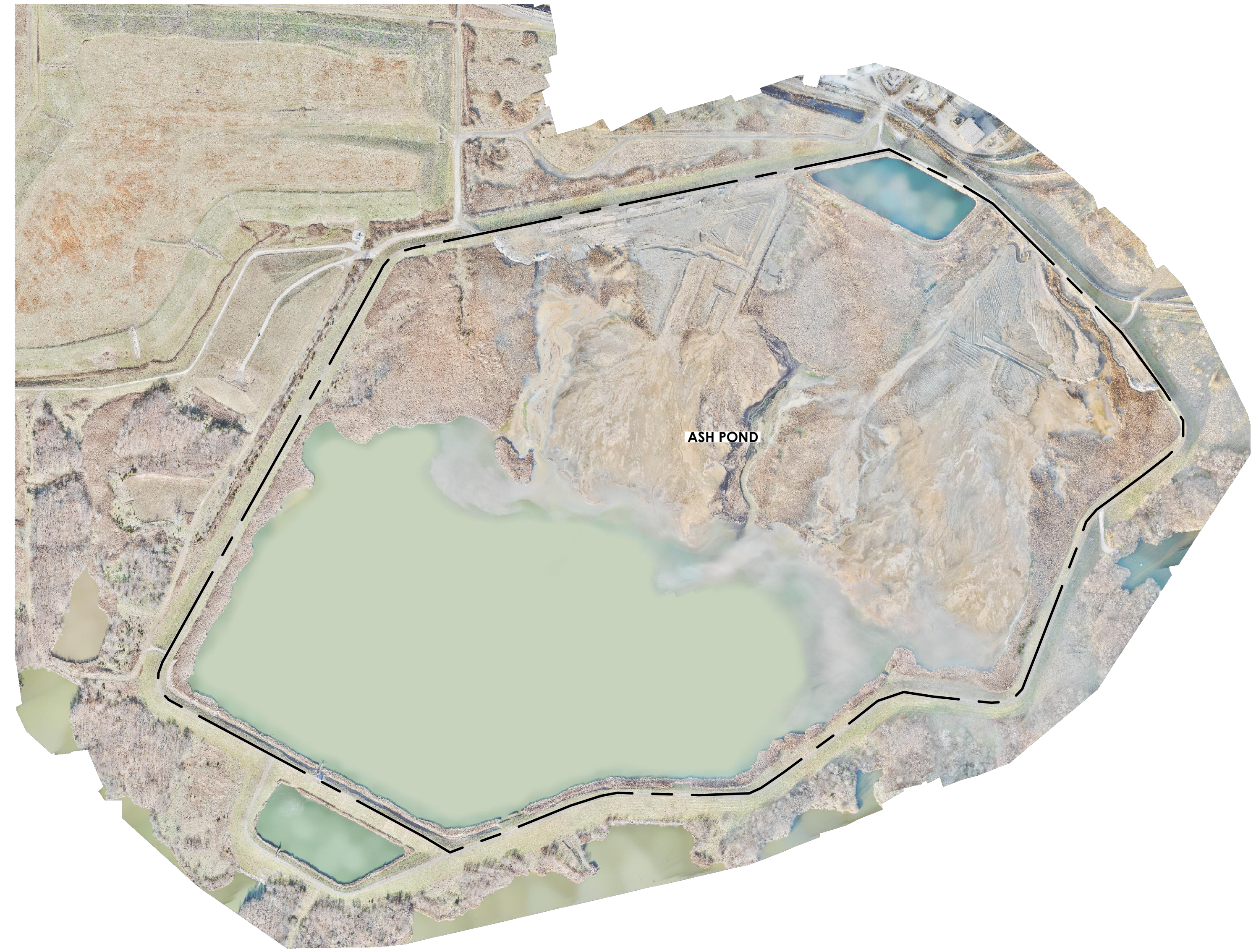
Geosyntec consultants

DRAWING 2

GLP8027.08 | MAY 2021

N

INITIAL AERIAL
12-01-2015 IMAGERY



PERIODIC AERIAL
02-26-2021 IMAGERY

0 1,000
SCALE IN FEET

NOTES:

1. THE INITIAL IMAGERY WAS TAKEN FROM THE DRAWING PACKAGE TITLED "DYNEGY, COLLINSVILLE, ILLINOIS, 2015 - NEWTON TOPOGRAPHY", PREPARED BY WEAVER CONSULTANTS GROUP, DATED DECEMBER 1, 2015.
2. THE PERIODIC IMAGERY WAS TAKEN FROM THE DRAWING PACKAGE TITLED "LUMINANT, ILLINOIS POWER GENERATING COMPANY, NEWTON POWER STATION, DECEMBER 2020 TOPOGRAPHY", PREPARED BY INGENAE, DATED FEBRUARY 26, 2021.

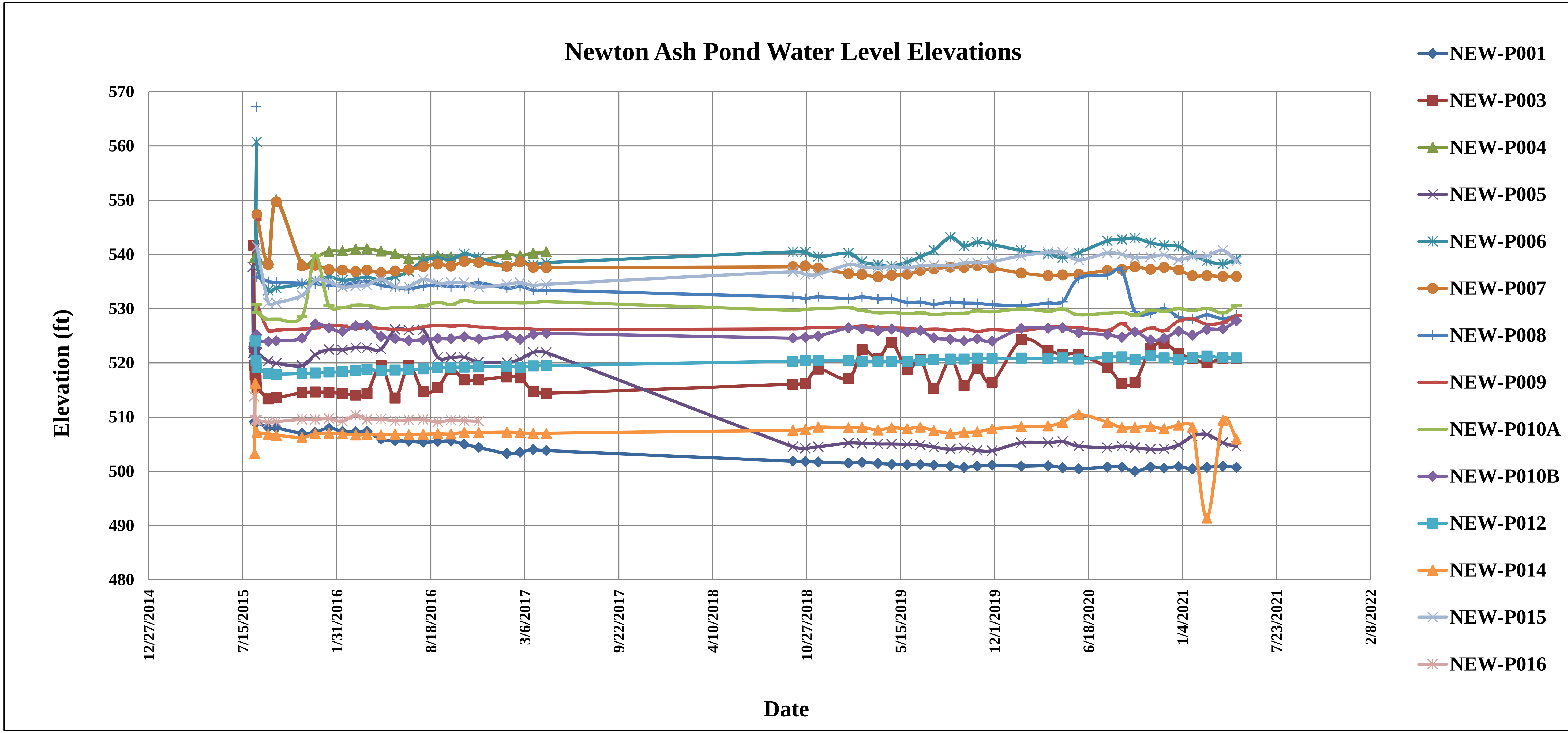
INITIAL TO PERIODIC AERIAL IMAGERY COMPARISON ASH POND NEWTON POWER PLANT NEWTON, ILLINOIS		
Geosyntec consultants		DRAWING 3
GLP8027.08	MAY 2021	

P:\CADD\PROJECTS\VISTRA PONDS\NEWTON\GLP802708F02 - Last Saved by: KHanavec on 5/24/21

ATTACHMENTS

Attachment A

PAP Piezometer Data Plots



NOTES:

1. Piezometer data was taken from the spreadsheet titled "Newton Piezo Measurements_20160121", provided by the Newton Power Station.

PIEZOMETER DATA
PERIODIC CERTIFICATION
NEWTON POWER PLANT
NEWTON, ILLINOIS

Geosyntec consultants

Figure 1

GLP8027

6/2/2021

Attachment B

PAP Site Visit Photolog

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: Primary Ash Pond	**Site:** Newton Power Plant

Photo: 01

Date: 5/21/2021

Direction Facing: NW

Comments: Photo of the ash pond from the east embankment. Example of vegetative coverage and phragmites within the ash basin.

Photo: 02

Date: 5/21/2021

Direction Facing: NE

Comments: Example of vegetative coverage for the downstream slope along the northeast embankment.

GEOSYNTEC CONSULTANTS
Photographic Record

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: Primary Ash Pond	**Site:** Newton Power Plant

Photo: 03 **Date:** 5/21/2021 **Direction Facing:** W **Comments:** Photo taken from the east embankment. Example of vegetative cover along the upstream slope of the embankment.	
Photo: 04 **Date:** 5/21/2021 **Direction Facing:** SW **Comments:** Photo taken from the east embankment. Example of vegetative cover along the downstream slope of the embankment.	

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: Primary Ash Pond	**Site:** Newton Power Plant

Photo: 05

Date: 5/21/2021

Direction Facing: E

Comments: Example of the vegetative cover of the upstream side of the embankment and within the ash basin. Some tree growth and phragmite growth within the ash basin.

Photo: 06

Date: 5/21/2021

Direction Facing: E

Comments: Tallest downstream slope along the south embankment and Newton Lake. Complete vegetative cover with no signs of instability or evidence of rapid draw down.

GEOSYNTEC CONSULTANTS
Photographic Record

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: Primary Ash Pond	**Site:** Newton Power Plant

Photo: 07 **Date:** 5/21/2021 **Direction Facing:** E **Comments:** Upstream side of southern embankment. Example of vegetative cover. No signs of instability and erosion.	
Photo: 08 **Date:** 5/21/2021 **Direction Facing:** W **Comments:** Wave damage erosion observed along the downstream side of the southern embankment. At present this does not appear to be a stability concern for the embankment.	

GEOSYNTEC CONSULTANTS
Photographic Record

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: Primary Ash Pond	**Site:** Newton Power Plant

Photo: 09

Date: 5/21/2021

Direction Facing: E

Comments: Downstream side of the southern embankment. Good vegetative cover, no tree growth or signs of erosion or instability.

Photo: 10

Date: 5/21/2021

Direction Facing: NW

Comments: Upstream side of the southwest embankment. Good vegetative cover, no tree growth or signs of erosion or instability.

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: Primary Ash Pond	**Site:** Newton Power Plant

Photo: 11

Date: 5/21/2021

Direction Facing: N

Comments: Discharge point for the secondary Pond outlet pipe.

Photo: 12

Date: 5/21/2021

Direction Facing: N

Comments: Secondary pond downstream side embankments. Good vegetative cover, no tree growth or signs of erosion or instability.

GEOSYNTEC CONSULTANTS **Photographic Record**		Geosyntec consultants
Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027	
CCR Unit: Primary Ash Pond	**Site:** Newton Power Plant	

Photo: 13 **Date:** 5/21/2021 **Direction Facing:** NE **Comments:** Primary ash pond discharge structure. No signs of erosion along the structure and no signs of deterioration or damage of the structure.	
Photo: 14 **Date:** 5/21/2021 **Direction Facing:** N **Comments:** Downstream side of the western embankment. Good vegetative cover, no tree growth or signs of erosion or instability. Some vegetative growth observed on the embankment crest.	

GEOSYNTEC CONSULTANTS
Photographic Record

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: Primary Ash Pond	**Site:** Newton Power Plant

Photo: 15

Date: 5/21/2021

Direction Facing: W

Comments: Some erosion along the access ramp on the western embankment. Geosyntec recommended regrading the ramp as part of regular maintenance.

Photo: 16

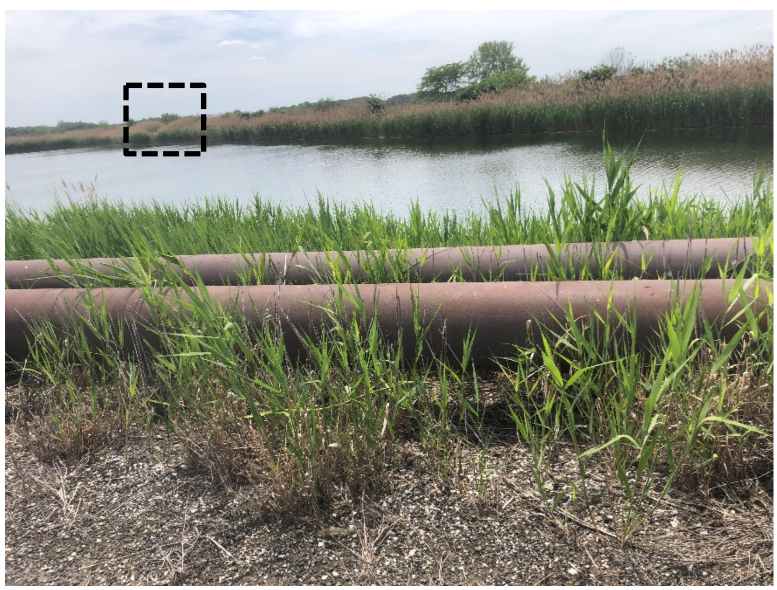
Date: 5/21/2021

Direction Facing: N

Comments: Downstream side of the western embankment. Good vegetative cover, no tree growth or signs of erosion or instability.

GEOSYNTEC CONSULTANTS **Photographic Record**	Geosyntec consultants
Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: Primary Ash Pond	**Site:** Newton Power Plant

Photo: 17	
Date: 5/21/2021	
Direction Facing: S	
Comments: Sluice discharge west of the Secondary Settlement Pond. Discharge channel and sluiced ash flow to the southwest.	

Photo: 18	
Date: 5/21/2021	
Direction Facing: S	
Comments: Secondary Settlement Pond. Breach with Primary Ash Pond is visible. Phragmite growth observed along the separation berm between Primary Ash Pond and Secondary Settlement Pond.	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Illinois Power Generating Company **Project Number:** GLP8027

CCR Unit: Primary Ash Pond **Site:** Newton Power Plant

Photo: 19

Date: 5/21/2021

Direction Facing: NW

Comments: Downstream side of the northeastern embankment. Good vegetative cover, no tree growth or signs of erosion or instability.

Photo: 20

Date: 5/21/2021

Direction Facing: S

Comments: Erosion and poor vegetative cover underneath the sluice pipe racks along the northern embankment. Geosyntec recommended reseeding or applying erosion protective features on the side slope as part of regular maintenance.

Attachment C

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 2021

Illinois Power Generating Company
6725 North 500th Street
Newton, Illinois 62448

Subject: Periodic History of Construction Report Update Letter
USEPA Final CCR Rule, 40 CFR §257.73(c)
Newton Power Plant
Newton, Illinois

At the request of Illinois Power Generating Company (IPGC), Geosyntec Consultants (Geosyntec) has prepared this Letter to documents updates to the Initial History of Construction (HoC) report for the Newton Power Plant (NPP), also known as the Newton Power Station (NEW). 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 NEW, which included the existing CCR surface impoundment, the Primary Ash Pond (PAP), was prepared and subsequently posted to IPGC'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).

IPGC retained Geosyntec to review the Initial HoC report, review reasonably and readily available information for the PAP generated since the Initial HoC report was prepared, and perform a site visit to NEW 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 PAP and NPP, as they pertain the requirements of §257.73(c)(1)(i)-(xii)

UPDATES TO HISTORY OF CONSTRUCTION REPORT

Geosyntec's evaluation for the NPP PAP determined that no known significant changes requiring updates to the information in the Initial HoC report pertaining to §257.73(c)(1)(ii)-(vi), (viii), (ix), (xi), and (xii) of the CCR Rule had occurred since the Initial HoC report was developed.

However, Geosyntec's evaluation determined that significant changes at the NEW PAP pertaining to §257.73(c)(1)(i), (vii), and (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.

<u>*Primary Ash Pond*</u>
The PAP was in operation from 1977 until today, for a total of approximately 44 years [1].

CCR placed in the PAP has included bottom ash and economizer ash, in addition to other non-CCR plant process wastewater [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.

A state identification numbers (IDs) for the PAP was assigned by the Illinois Environmental Protection Agency (IEPA). The ID is listed in **Table 1**.

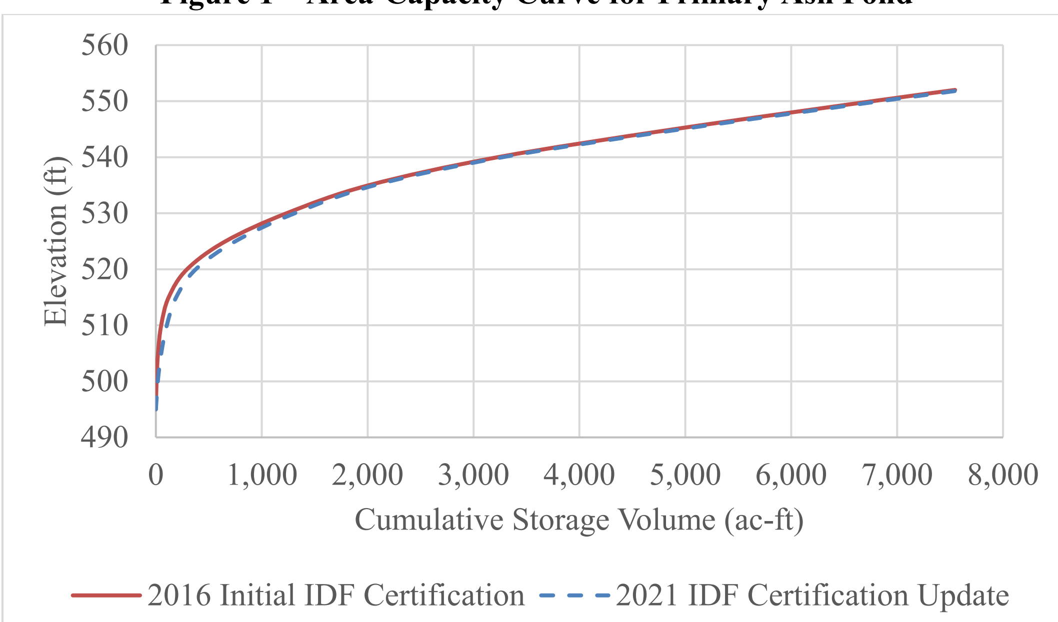
Table 1 – IEPA ID Numbers

CCR Surface Impoundment	State ID
Primary Ash Pond (PAP)	W0798070001-01

§ 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.

Updated area-capacity curves were prepared for the PAP in 2021. These curves are provided in **Figures 1**.

Figure 1 – Area-Capacity Curve for Primary 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 PAP has sufficient storage capacity and will not overtop the embankments during the Probable Maximum Precipitation (PMP), 24-hour, storm event. The results of the calculations are provided in **Table 2**.

Table 2 – Results of Updated Discharge Capacity Calculations

	Primary Ash Pond
Approximate Berm Minimum Elevation[1], ft	553.0
Starting Water Surface Elevation[1] (SWSE), ft	537.0
Peak Water Surface Elevation[1] (PWSE), ft	538.2
Time to Peak, hr	24.0
Surface Area[2], ac	272.0
Storage[3], ac-ft	281.1

Notes:
[1]Elevations are based on the NAVD88 datum
[2] Surface Area is defined as the water surface area at the PWSE
[3]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 PAP at the NEW since the Initial HoC was developed, based on reasonably and readily available information provided by IPGC, observed by Geosyntec during the site visit, or generated by Geosyntec as part of subsequent calculations.

Sincerely,

Panos Andonyadis, P.E.
Senior Engineer

John Seymour, P.E.
Senior Principal

REFERENCES

[1] AECOM, "History of Construction, USEPA Final CCR Rule, 40 CFR § 257.73(c), Newton Power Station, Newton, 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.

Attachment D

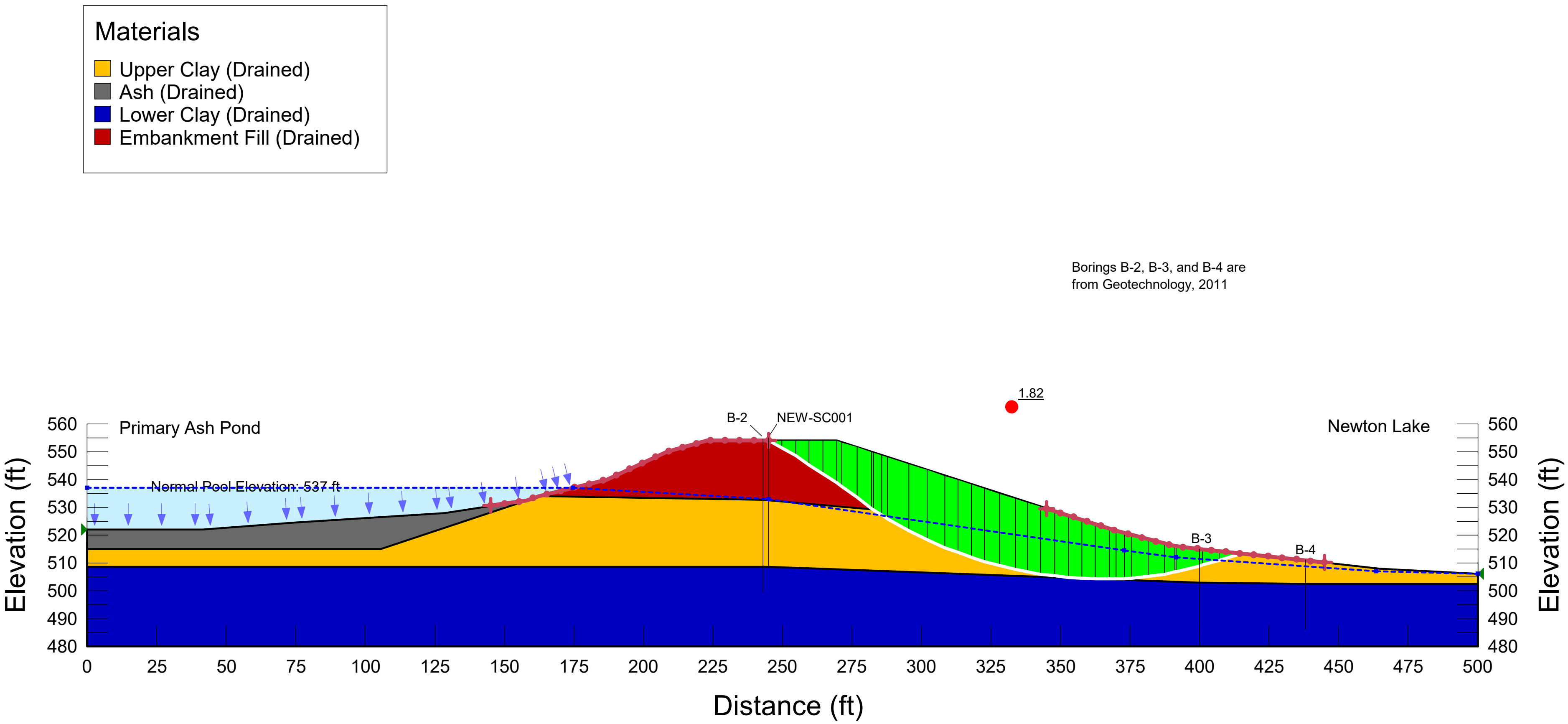
Periodic Structural Stability and Safety Factor Assessment Analyses

Calculated By: MJN Date: 6/17/2016
Checked By: VMCh Date: 6/20/2016
Modified By: PK Date: 9/01/2021
Checked By:ZJF Date: 9/08/2021

Project Name: Newton Primary Ash Pond Stability Analysis-Section A

Analysis: Long Term (Drained)

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Ash (Drained) Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 0 psf Phi': 30 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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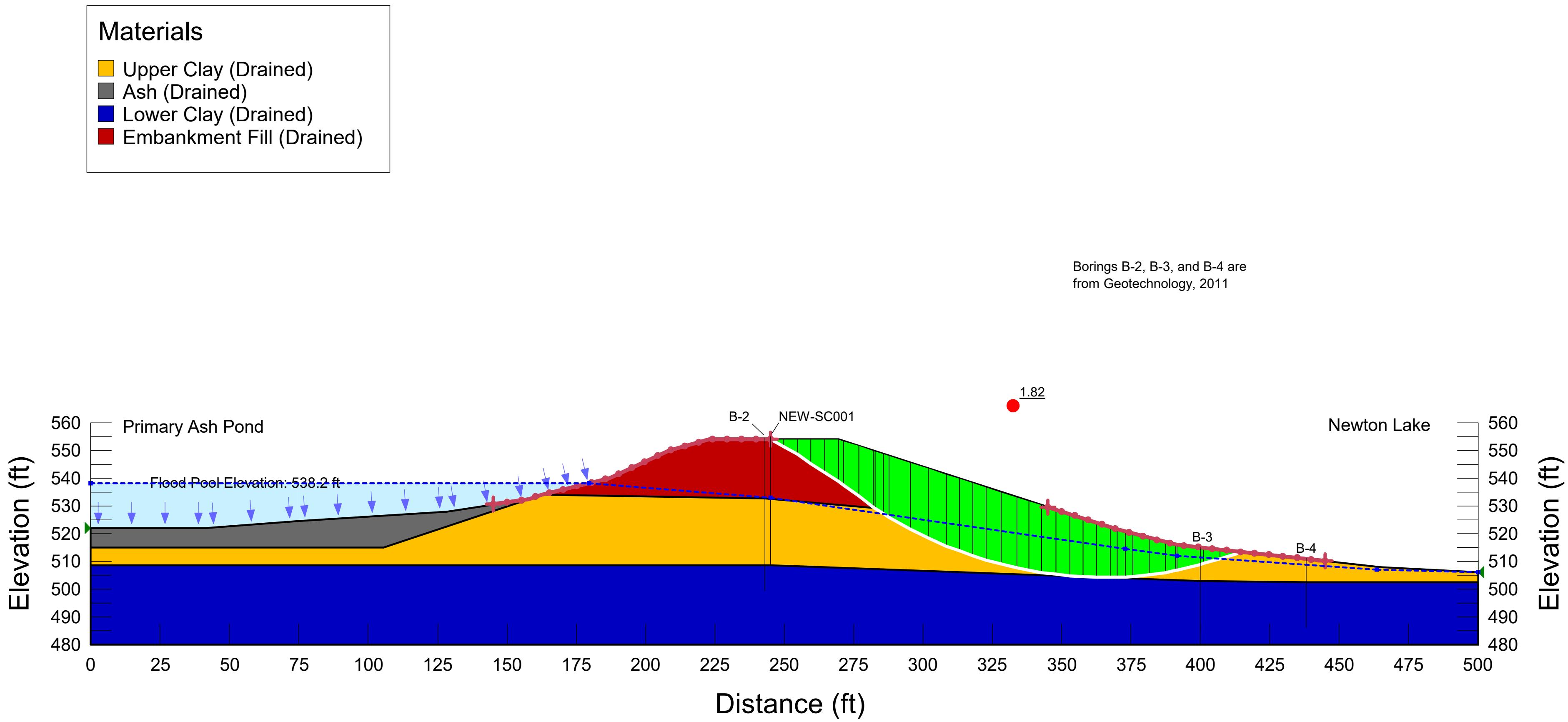
Calculated By: MJN Date: 6/17/2016
Checked By: VMCh Date: 6/20/2016
Modified By: PK Date: 9/01/2021
Checked By:ZJF Date: 9/08/2021

Project Name: Newton Primary Ash Pond Stability Analysis-Section A

Analysis: Surcharge (Drained)

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Ash (Drained) Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 0 psf Phi': 30 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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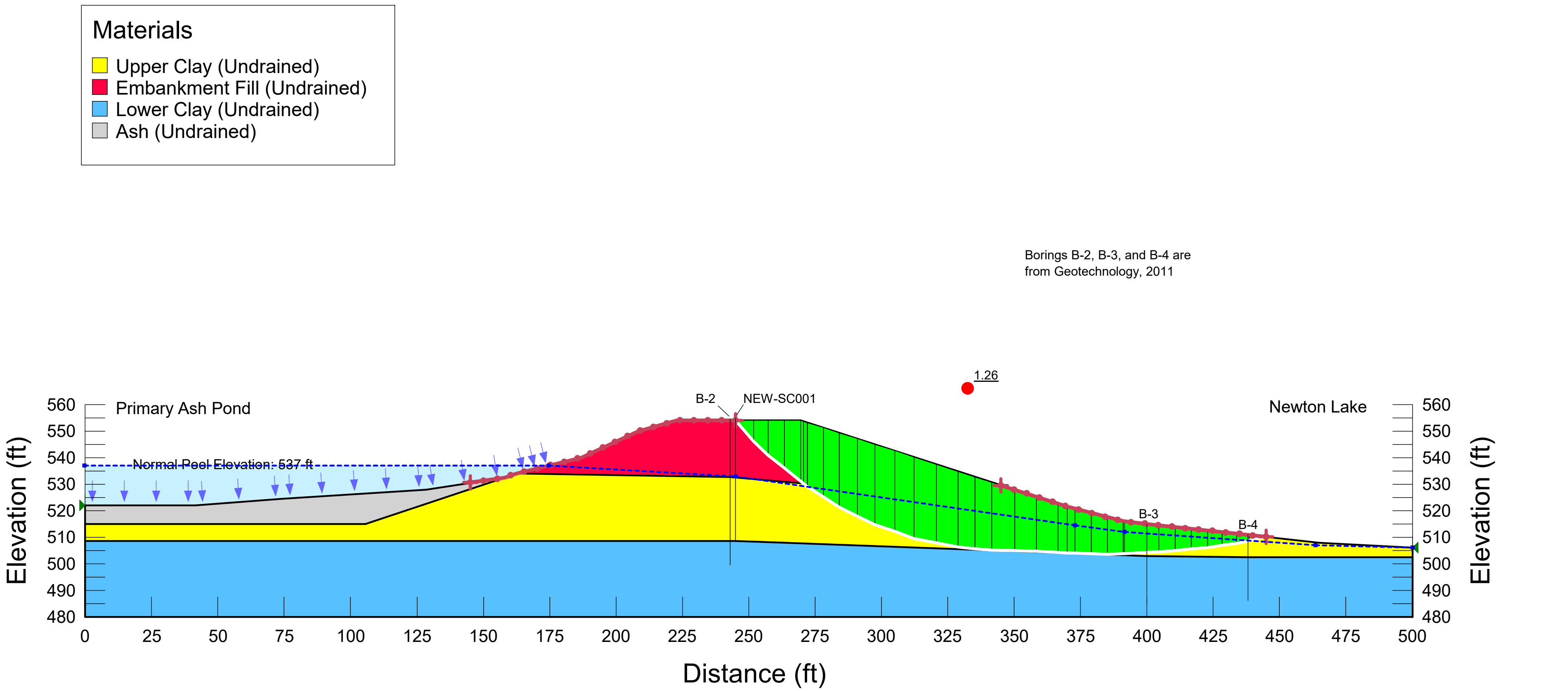
Calculated By: MJN   Date: 6/17/2016
Checked By: VMCh   Date: 6/20/2016
Modified By: PK   Date: 9/01/2021
Checked By:ZJF   Date: 9/08/2021

Project Name: Newton Primary Ash Pond Stability Analysis-Section A

Analysis: Pseudostatic (Undrained)

Horizontal Seismic Coefficient = 0.153g

Name: Upper Clay (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Upper Clay (Undrained)
Name: Embankment Fill (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Embankment Fill (Undrained)
Name: Lower Clay (Undrained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 5,000 psf Phi': 0 °
Name: Ash (Undrained) Model: S=f(overburden) Unit Weight: 90 pcf Tau/Sigma Ratio: 0.05 Minimum Strength: 0 psf



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Project Name: Newton Primary Ash Pond Stability Analysis-Section B

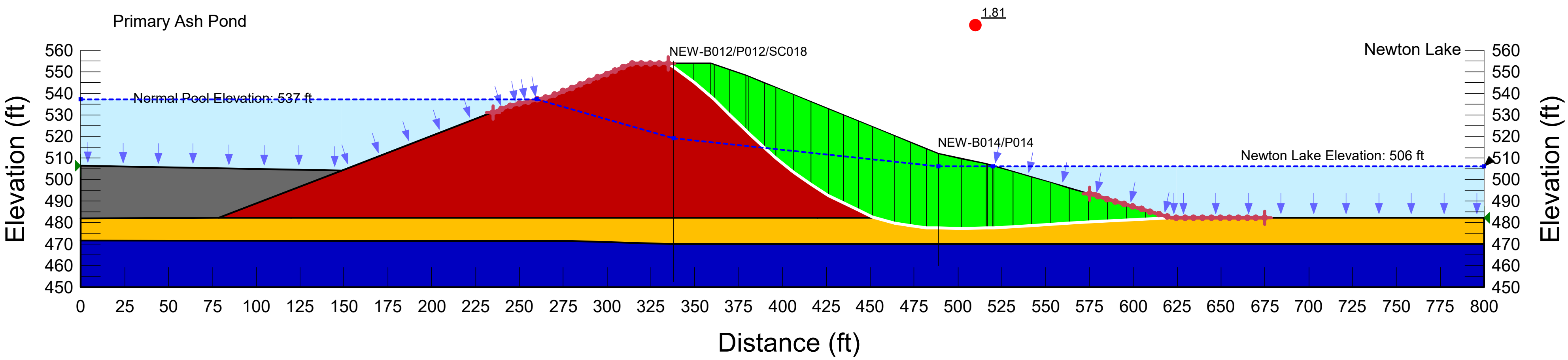
Analysis: Long Term (Drained)

Calculated By: MJN   Date: 6/17/2016
Checked By: VMCh   Date: 6/20/2016
Modified By: PK   Date: 9/01/2021
Checked By:ZJF   Date: 9/08/2021

Name: Upper Clay (Drained)   Model: Mohr-Coulomb   Unit Weight: 130 pcf   Cohesion': 0 psf   Phi': 29 °
Name: Ash (Drained)   Model: Mohr-Coulomb   Unit Weight: 90 pcf   Cohesion': 0 psf   Phi': 30 °
Name: Lower Clay (Drained)   Model: Mohr-Coulomb   Unit Weight: 130 pcf   Cohesion': 3,700 psf   Phi': 33 °
Name: Embankment Fill (Drained)   Model: Mohr-Coulomb   Unit Weight: 130 pcf   Cohesion': 0 psf   Phi': 31 °

Materials

- Upper Clay (Drained)
- Ash (Drained)
- Lower Clay (Drained)
- Embankment Fill (Drained)



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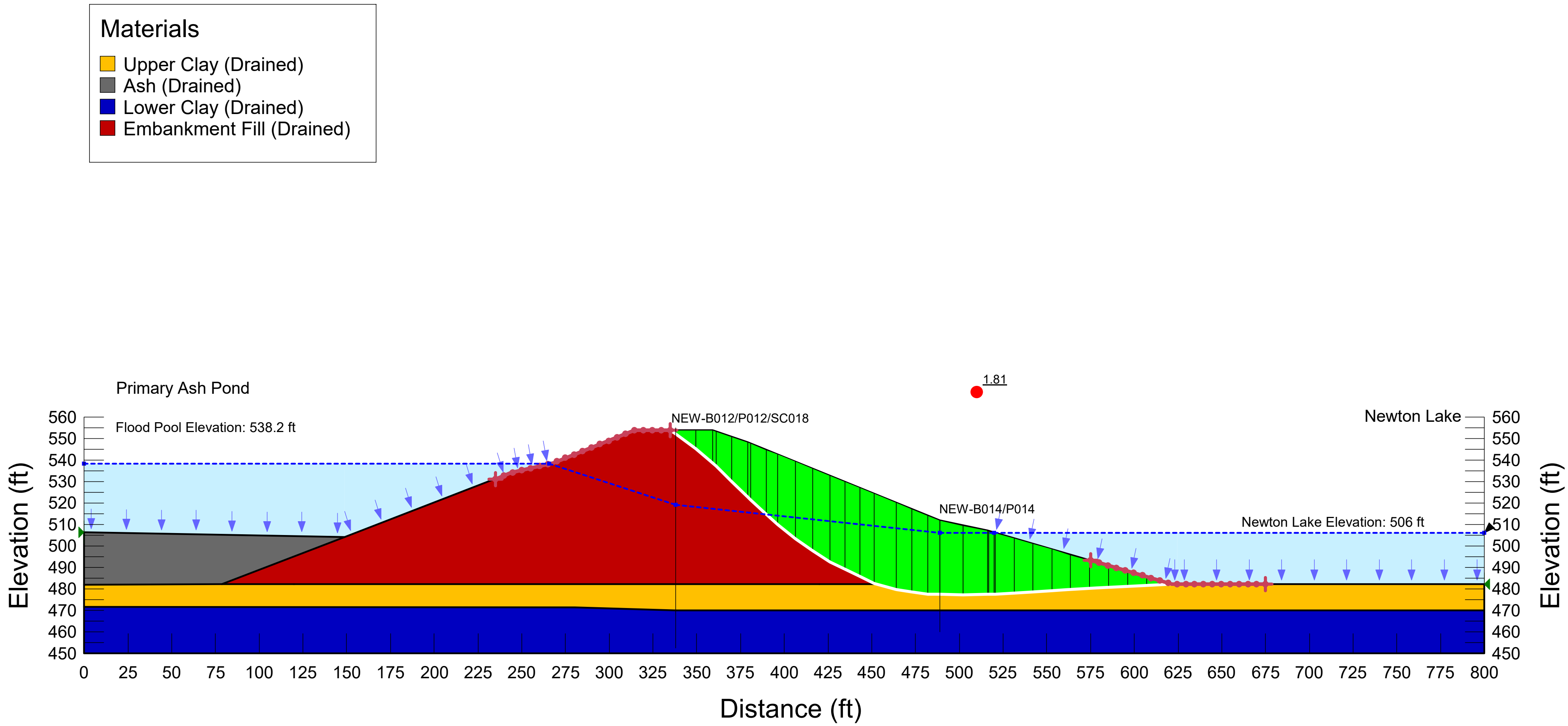
Project Name: Newton Primary Ash Pond Stability Analysis-Section B

Analysis: Surcharge (Drained)

Calculated By: MJN Date: 6/17/2016
Checked By: VMCh Date: 6/20/2016
Modified By: PK Date: 9/01/2021
Checked By:ZJF Date: 9/08/2021

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Ash (Drained) Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 0 psf Phi': 30 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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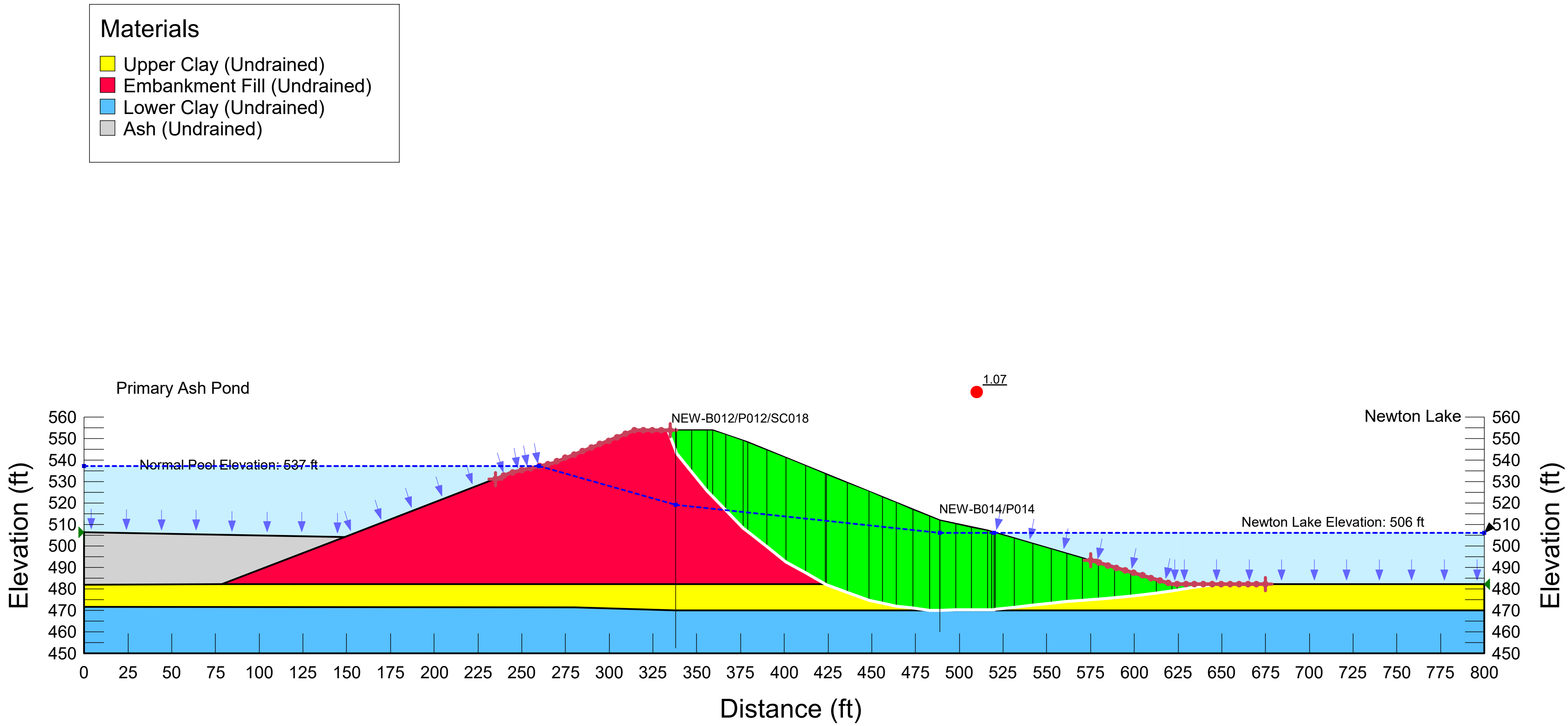
Project Name: Newton Primary Ash Pond Stability Analysis-Section B

Analysis: Pseudostatic (Undrained)

Horizontal Seismic Coefficient = 0.153g

Calculated By: MJN Date: 6/17/2016
Checked By: VMCh Date: 6/20/2016
Modified By: PK Date: 9/01/2021
Checked By:ZJF Date: 9/08/2021

Name: Upper Clay (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Upper Clay (Undrained)
Name: Embankment Fill (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Embankment Fill (Undrained)
Name: Lower Clay (Undrained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 5,000 psf Phi': 0 °
Name: Ash (Undrained) Model: S=f(overburden) Unit Weight: 90 pcf Tau/Sigma Ratio: 0.05 Minimum Strength: 0 psf



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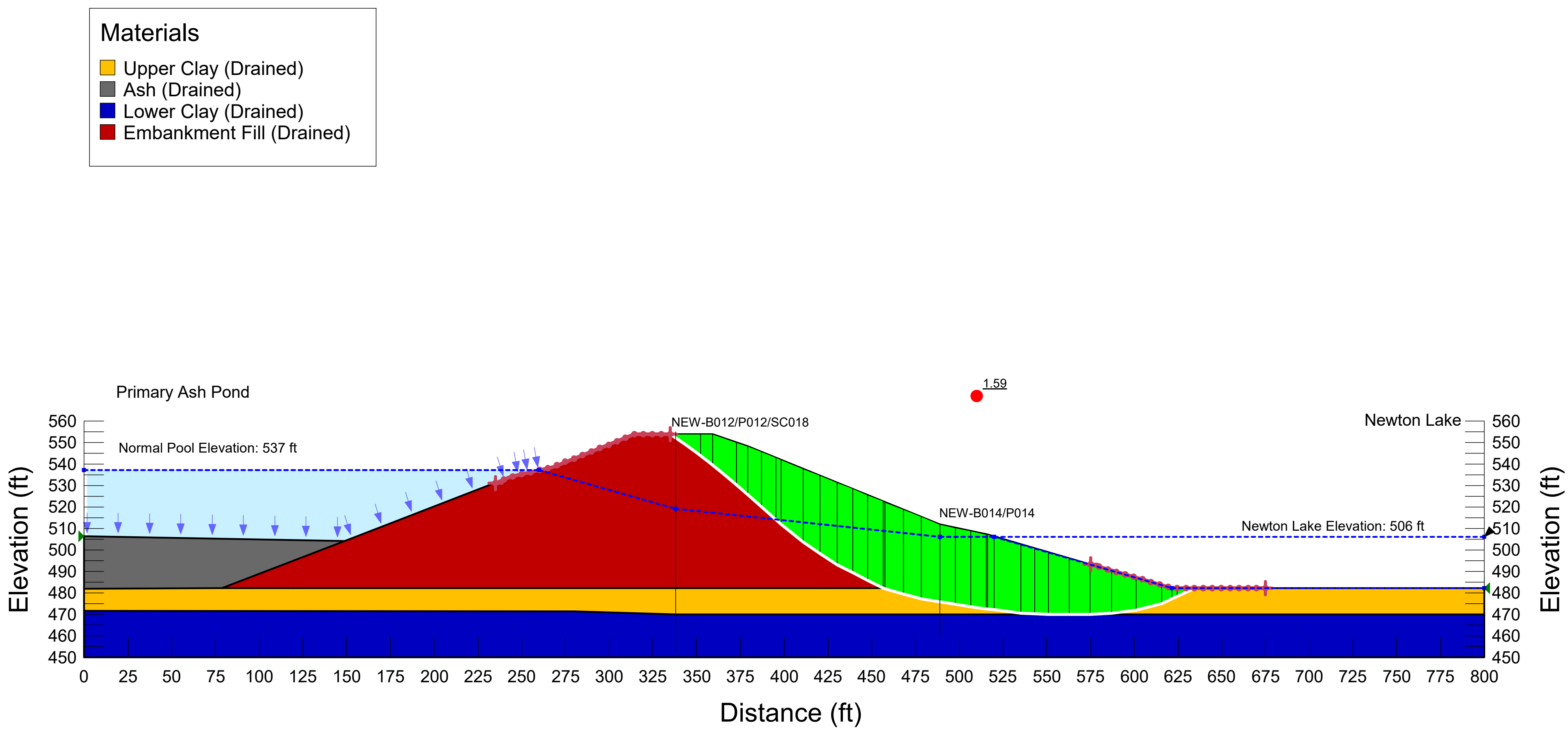
Project Name: Newton Primary Ash Pond Stability Analysis-Section B

Analysis: Sudden Drawdown

Calculated By: MJN Date: 6/17/2016
Checked By: VMCh Date: 6/20/2016
Modified By: PK Date: 9/01/2021
Checked By:ZJF Date: 9/08/2021

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 ° Cohesion R: 470 psf Phi R: 22 ° Piezometric Line After Drawdown: 2
Name: Ash (Drained) Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 0 psf Phi': 30 ° Cohesion R: 0 psf Phi R: 0 ° Piezometric Line After Drawdown: 2
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 ° Cohesion R: 0 psf Phi R: 0 ° Piezometric Line After Drawdown: 2
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 ° Cohesion R: 500 psf Phi R: 22 ° Piezometric Line After Drawdown: 2



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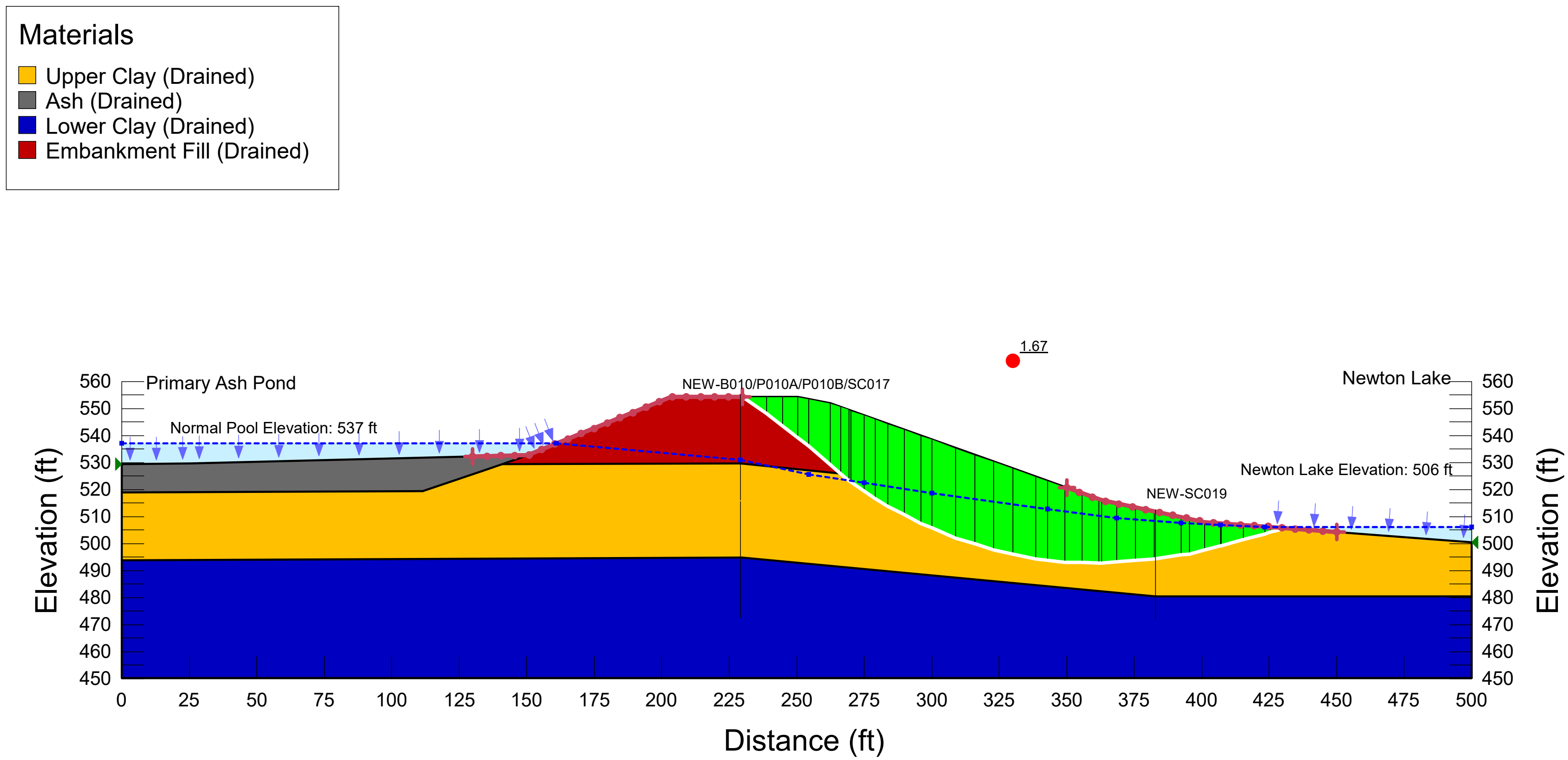
Project Name: **Newton Primary Ash Pond Stability Analysis-Section C**

Analysis: Long Term (Drained)

Calculated By: MJN Date: 6/20/2016
Checked By: VMCh Date: 6/20/2016
Modified By: PK Date:9/01/2021
Checked By:ZJF Date: 9/08/2021

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Ash (Drained) Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 0 psf Phi': 30 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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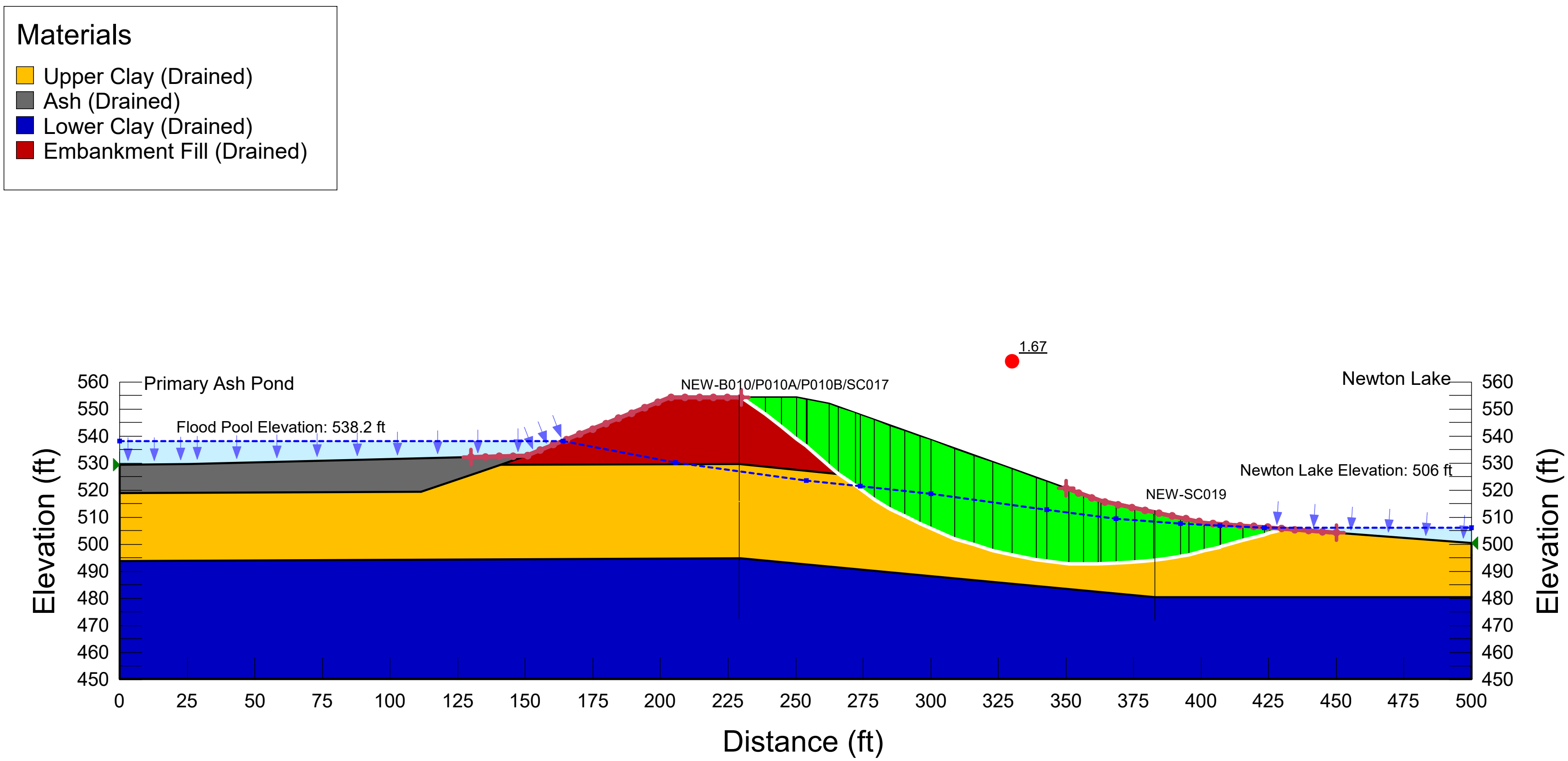
Project Name: Newton Primary Ash Pond Stability Analysis-Section C

Analysis: Surcharge (Drained)

Calculated By: MJN Date: 6/20/2016
Checked By: VMCh Date: 6/20/2016
Modified By: PK Date:9/01/2021
Checked By:ZJF Date: 9/08/2021

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Ash (Drained) Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 0 psf Phi': 30 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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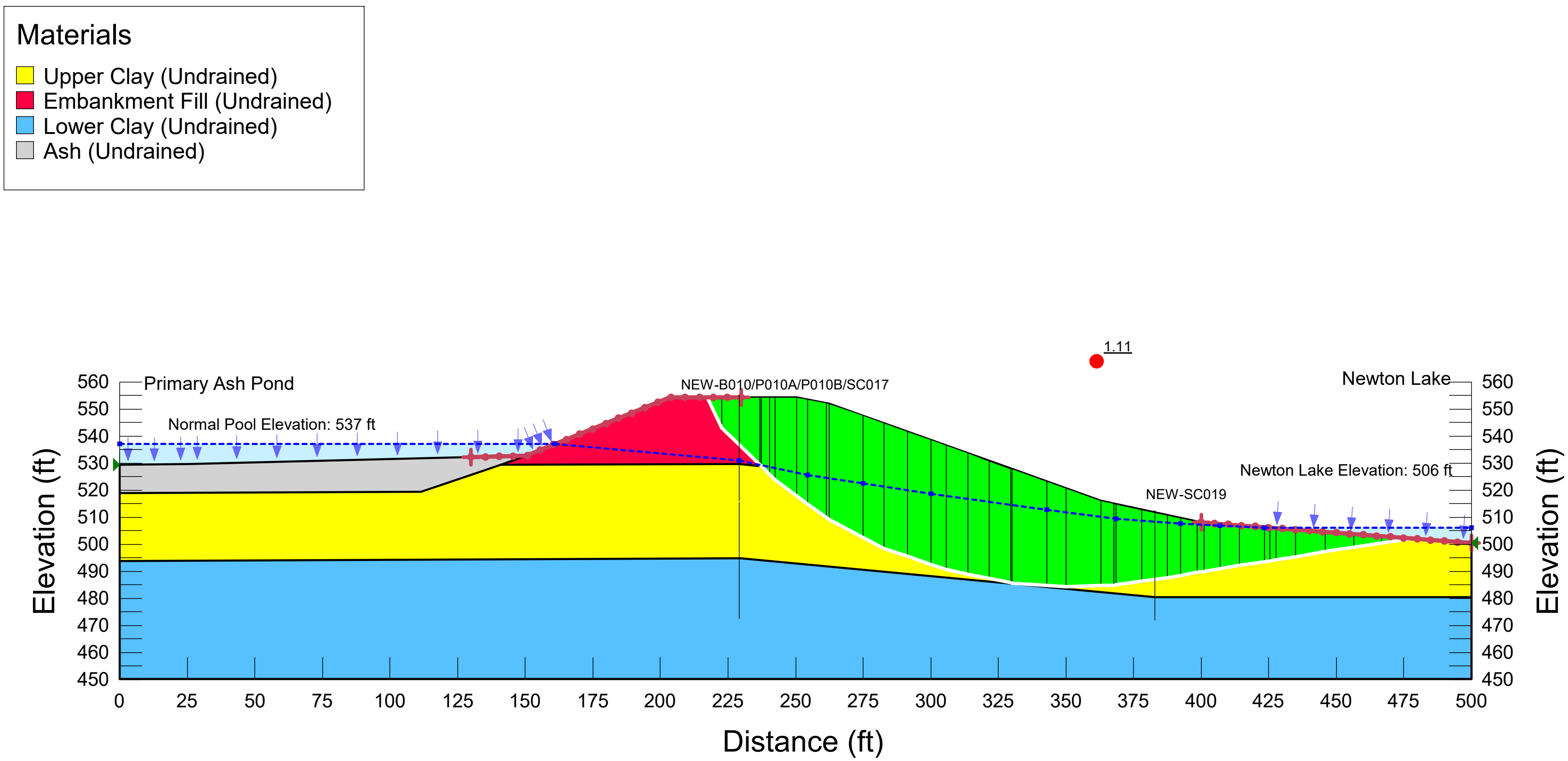
Project Name: Newton Primary Ash Pond Stability Analysis-Section C

Calculated By: MJN Date: 6/20/2016
Checked By: VMCh Date: 6/20/2016
Modified By: PK Date:9/01/2021
Checked By:ZJF Date: 9/08/2021

Analysis: Pseudostatic (Undrained)

Horizontal Seismic Coefficient = 0.153g

Name: Upper Clay (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Upper Clay (Undrained)
Name: Embankment Fill (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Embankment Fill (Undrained)
Name: Lower Clay (Undrained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 5,000 psf Phi': 0 °
Name: Ash (Undrained) Model: S=f(overburden) Unit Weight: 90 pcf Tau/Sigma Ratio: 0.05 Minimum Strength: 0 psf



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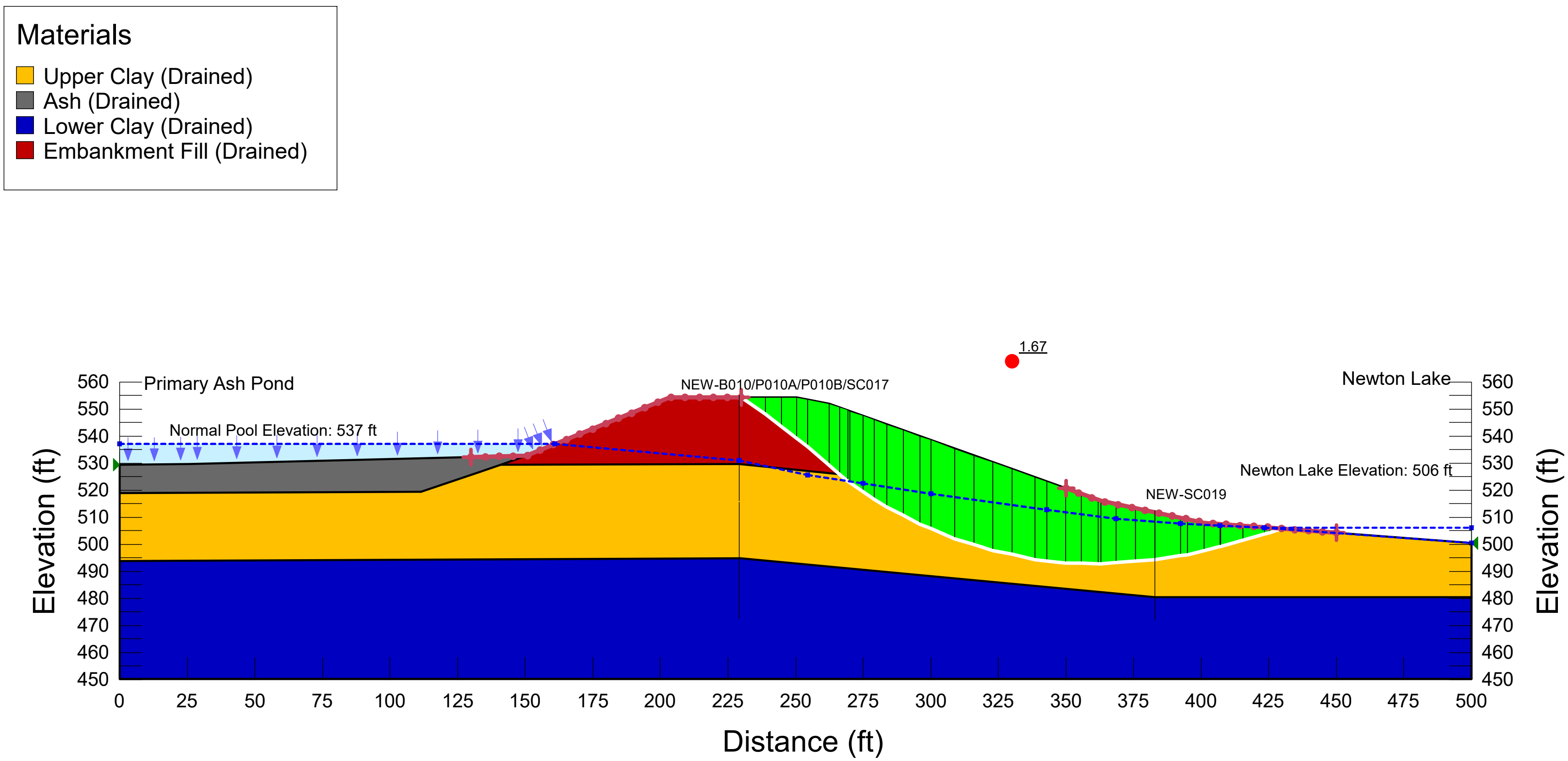
Project Name: Newton Primary Ash Pond Stability Analysis-Section C

Analysis: Sudden Drawdown

Calculated By: MJN Date: 6/20/2016
Checked By: VMCh Date: 6/20/2016
Modified By: PK Date:9/01/2021
Checked By:ZJF Date: 9/08/2021

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 ° Cohesion R: 470 psf Phi R: 22 ° Piezometric Line After Drawdown: 2
Name: Ash (Drained) Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 0 psf Phi': 30 ° Cohesion R: 0 psf Phi R: 0 ° Piezometric Line After Drawdown: 2
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 ° Cohesion R: 0 psf Phi R: 0 ° Piezometric Line After Drawdown: 2
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 ° Cohesion R: 500 psf Phi R: 22 ° Piezometric Line After Drawdown: 2



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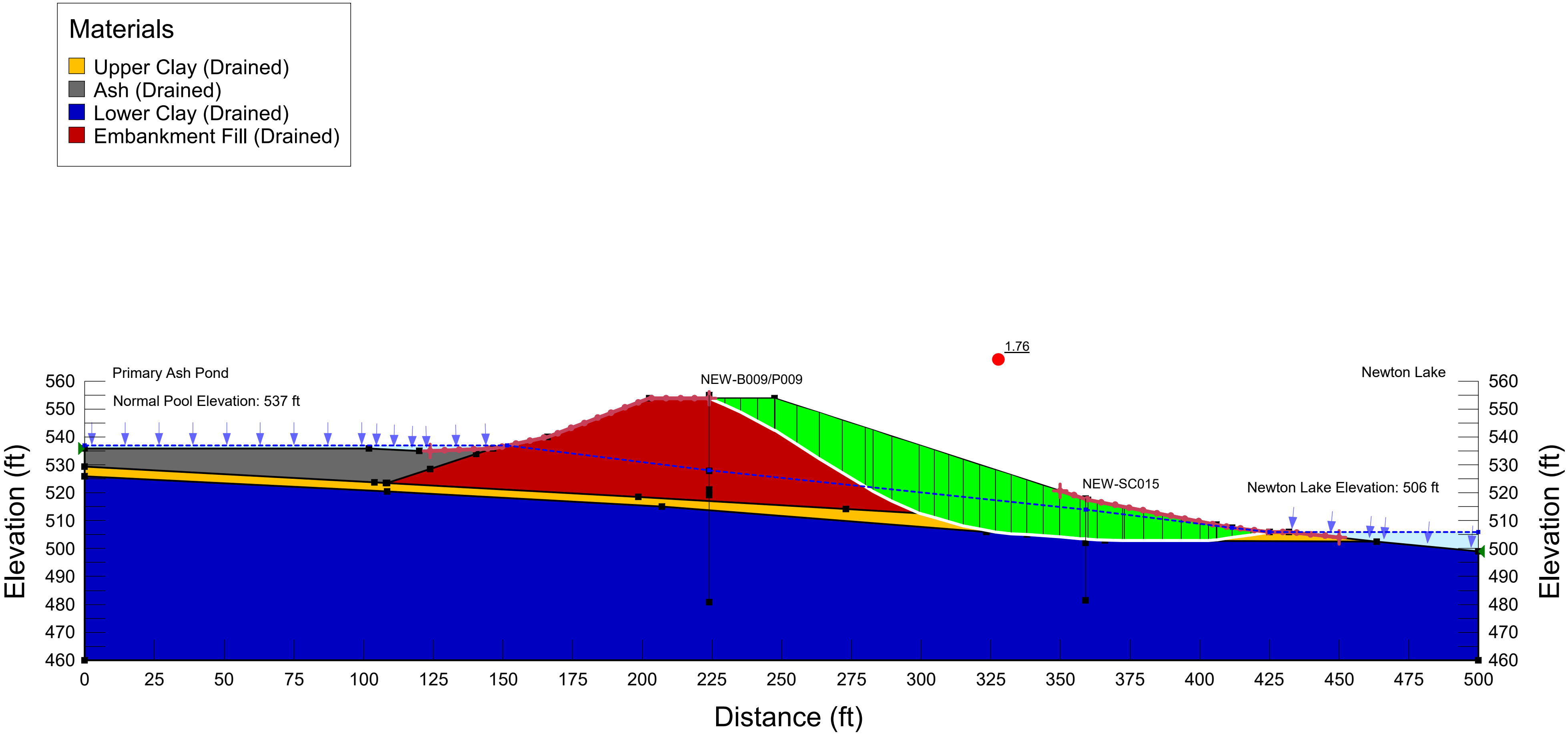
Project Name: Newton Primary Ash Pond Stability Analysis-Section D

Analysis: Long Term (Drained)

Calculated By: MJN Date: 6/20/2016
Checked By: VMCh Date: 6/20/2016
Modified By: PK Date:9/01/2021
Checked By:ZJF Date: 9/08/2021

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Ash (Drained) Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 0 psf Phi': 30 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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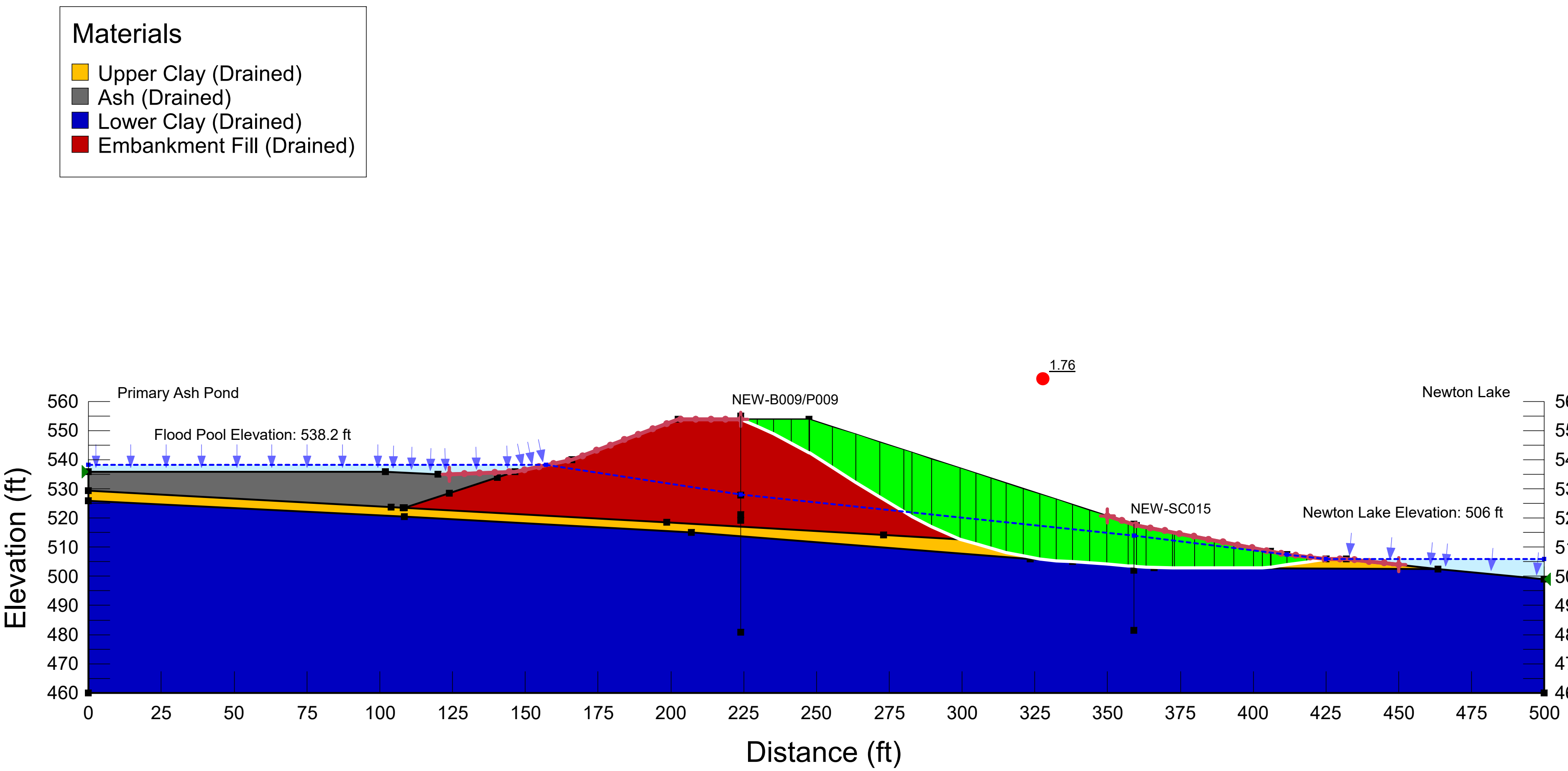
Project Name: Newton Primary Ash Pond Stability Analysis-Section D

Analysis: Surcharge (Drained)

Calculated By: MJN Date: 6/20/2016
Checked By: VMCh Date: 6/20/2016
Modified By: PK Date:9/01/2021
Checked By:ZJF Date: 9/08/2021

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Ash (Drained) Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 0 psf Phi': 30 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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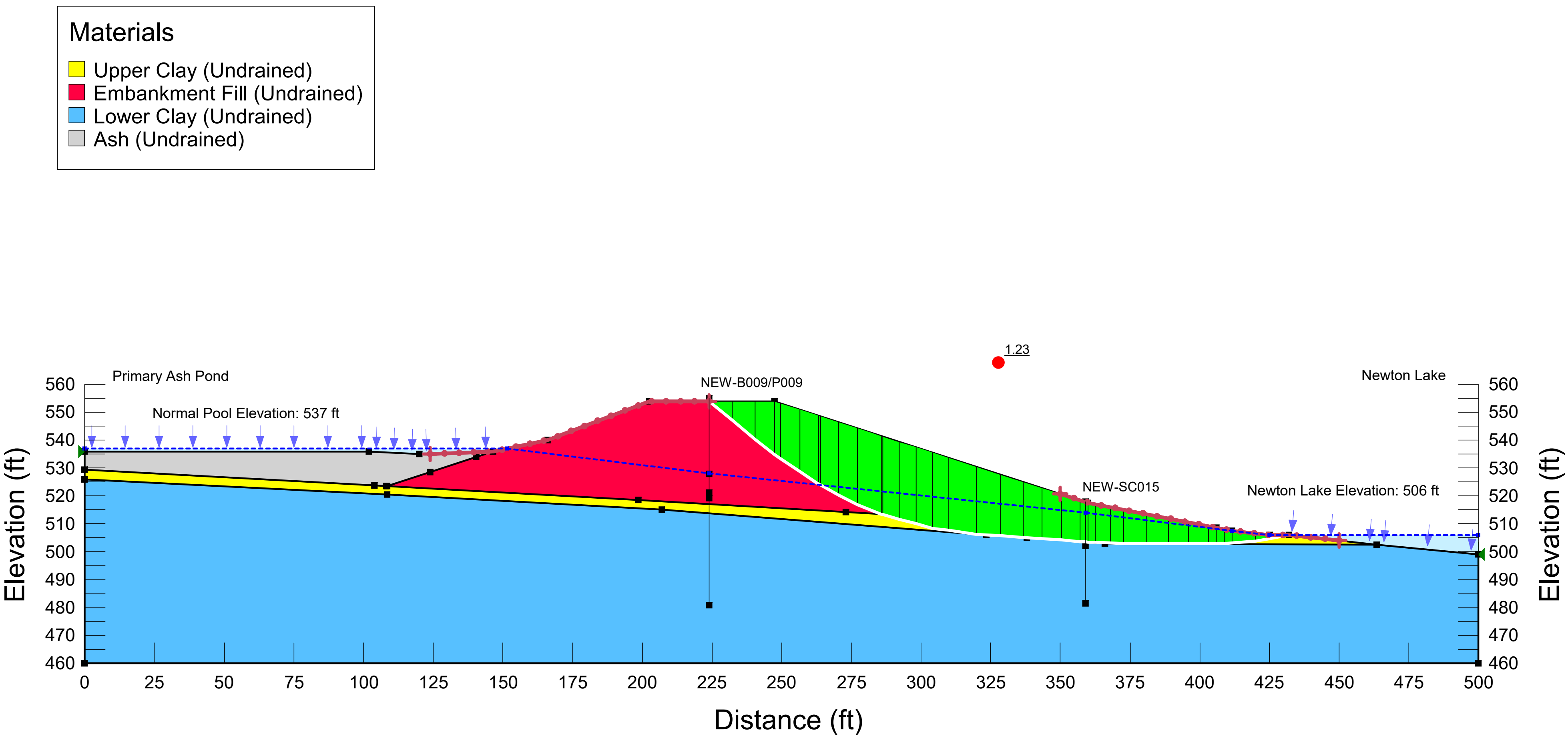
Project Name: Newton Primary Ash Pond Stability Analysis-Section D

Analysis: Pseudostatic (Undrained)

Calculated By: MJN Date: 6/20/2016
Checked By: VMCh Date: 6/20/2016
Modified By: PK Date:9/01/2021
Checked By:ZJF Date: 9/08/2021

Horizontal Seismic Coefficient = 0.153g

Name: Upper Clay (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Upper Clay (Undrained)
Name: Embankment Fill (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Embankment Fill (Undrained)
Name: Lower Clay (Undrained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 5,000 psf Phi': 0 °
Name: Ash (Undrained) Model: S=f(overburden) Unit Weight: 90 pcf Tau/Sigma Ratio: 0.05 Minimum Strength: 0 psf



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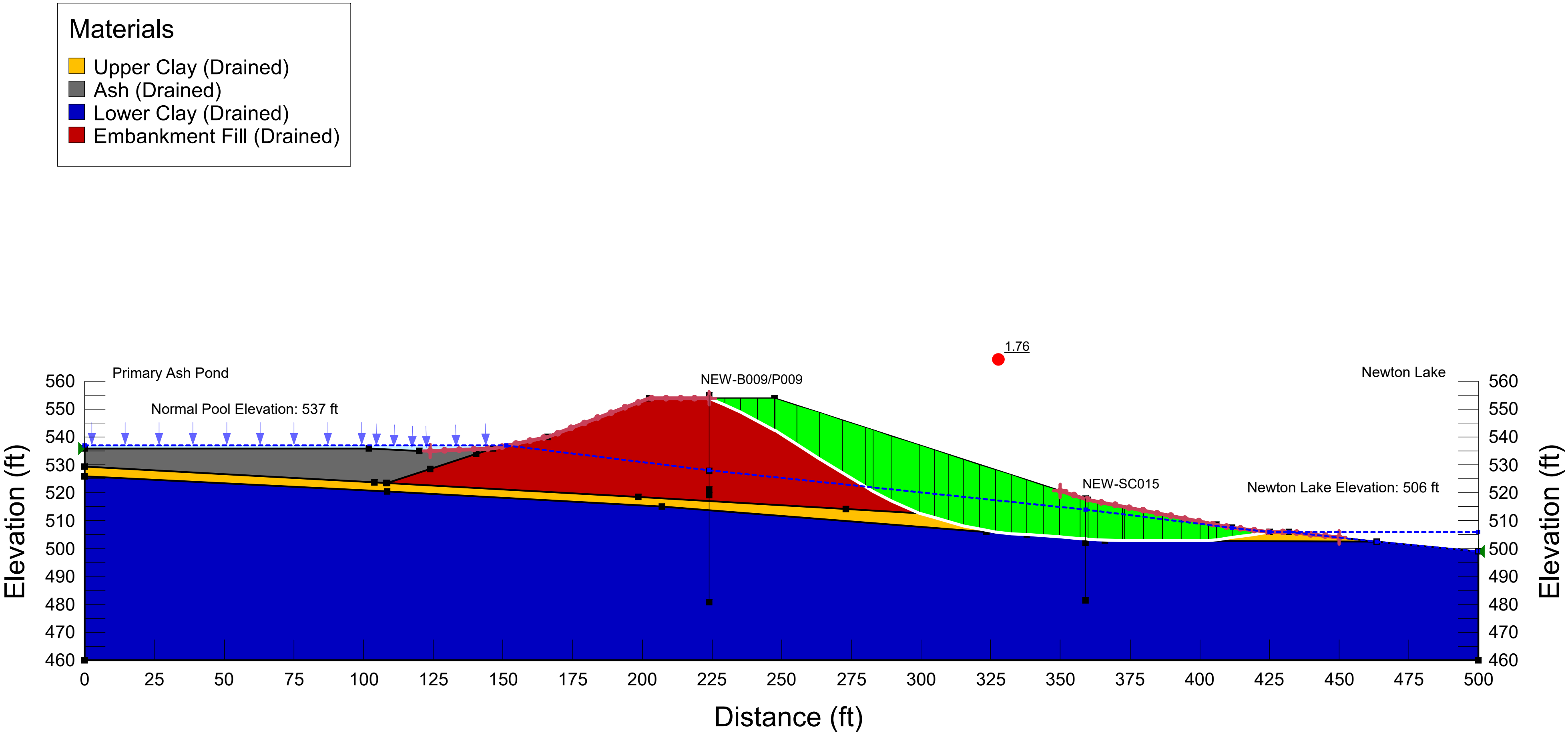
Project Name: Newton Primary Ash Pond Stability Analysis-Section D

Analysis: Sudden Drawdown

Calculated By: MJN Date: 6/20/2016
Checked By: VMCh Date: 6/20/2016
Modified By: PK Date:9/01/2021
Checked By:ZJF Date: 9/08/2021

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 ° Cohesion R: 470 psf Phi R: 22 ° Piezometric Line After Drawdown: 2
Name: Ash (Drained) Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 0 psf Phi': 30 ° Cohesion R: 0 psf Phi R: 0 ° Piezometric Line After Drawdown: 2
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 ° Cohesion R: 0 psf Phi R: 0 ° Piezometric Line After Drawdown: 2
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 ° Cohesion R: 500 psf Phi R: 22 ° Piezometric Line After Drawdown: 2



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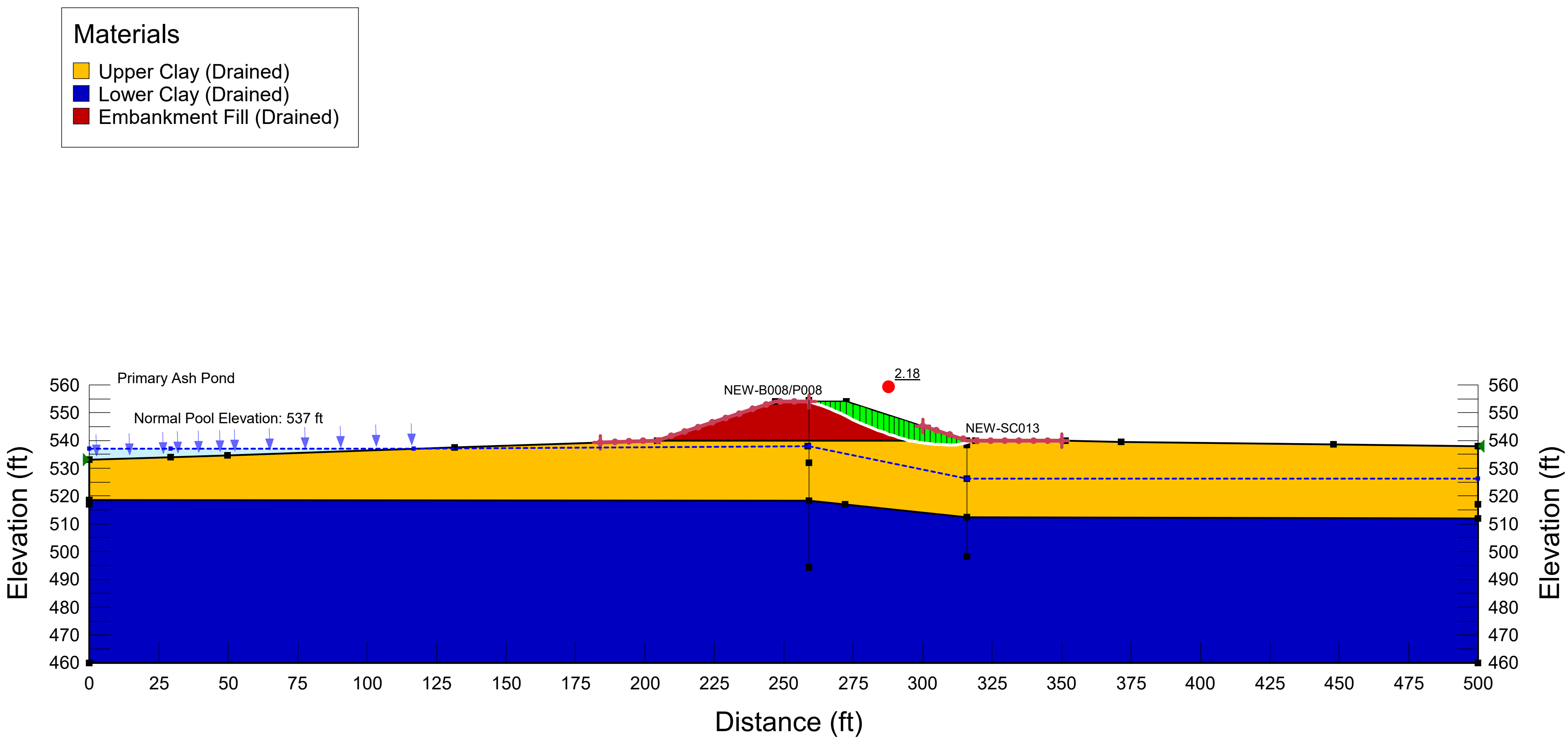
Project Name: **Newton Primary Ash Pond Stability Analysis-Section E**

Analysis: Long Term (Drained)

Calculated By: MJN Date: 6/20/2016
Checked By: VMCh Date: 6/20/2016
Modified By: PK Date:9/01/2021
Checked By:ZJF Date: 9/08/2021

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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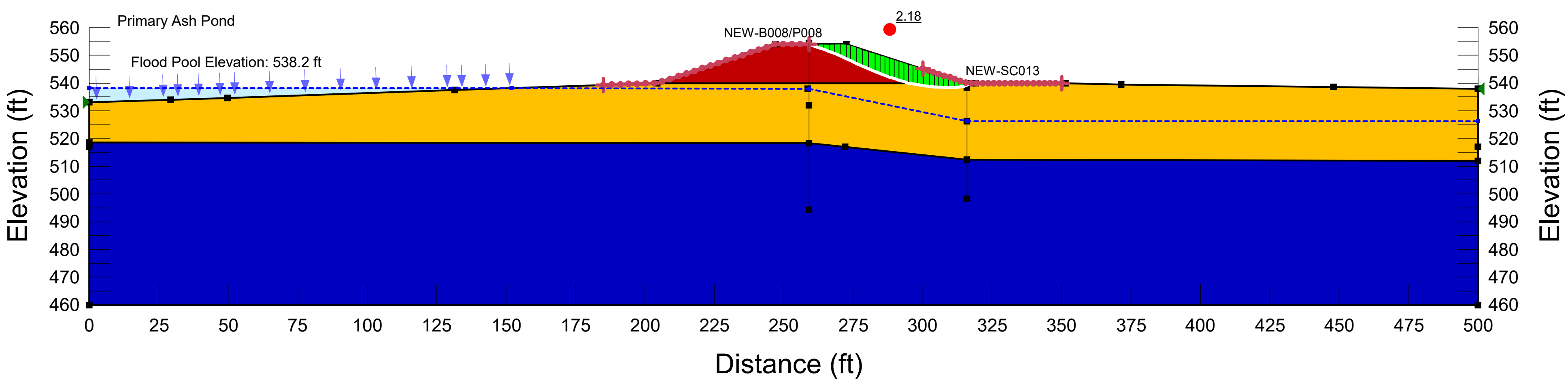
Project Name: **Newton Primary Ash Pond Stability Analysis-Section E**

Analysis: Surcharge (Drained)

Calculated By: MJN Date: 6/20/2016
Checked By: VMCh Date: 6/20/2016
Modified By: PK Date:9/01/2021
Checked By:ZJF Date: 9/08/2021

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °

Materials
- Upper Clay (Drained)
- Lower Clay (Drained)
- Embankment Fill (Drained)



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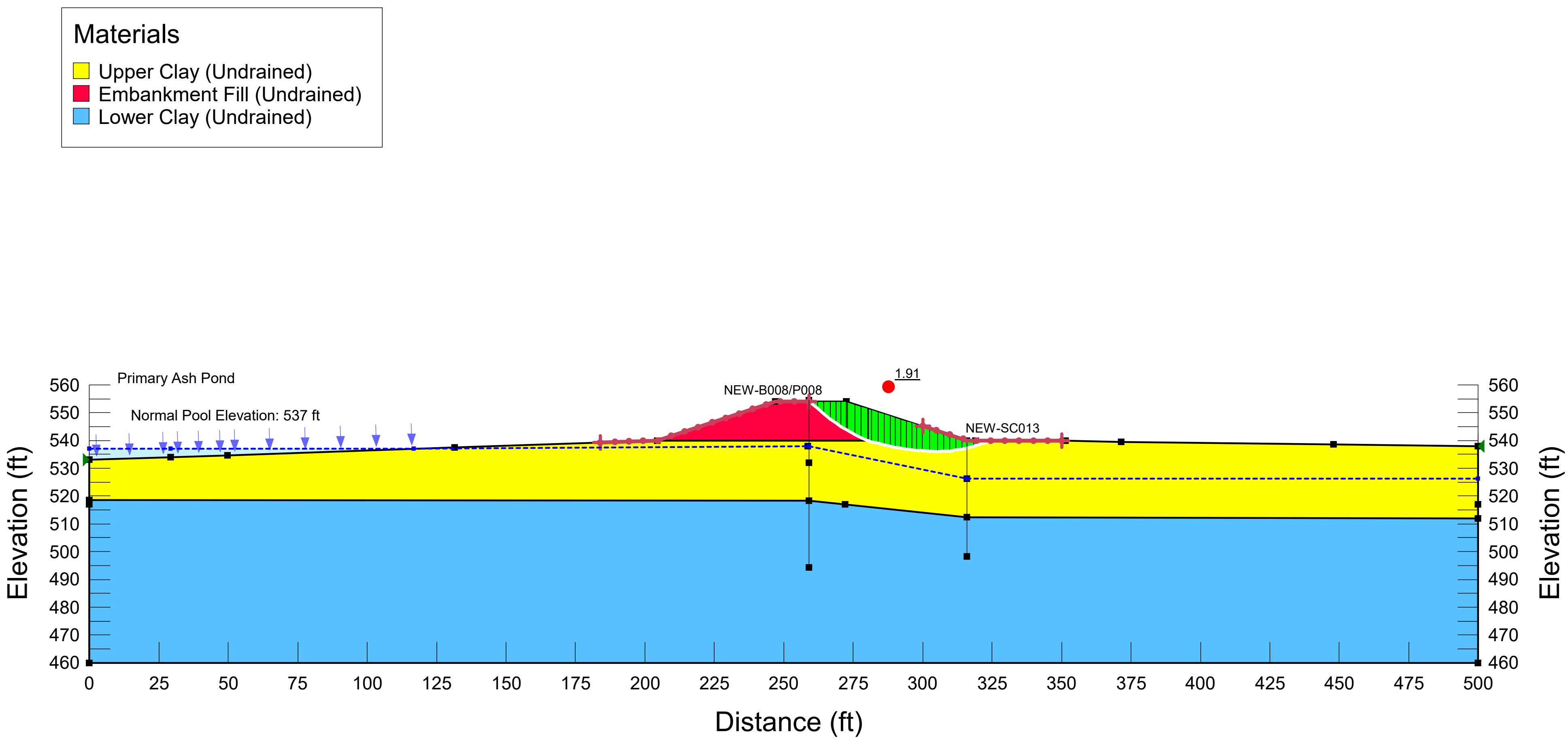
Project Name: **Newton Primary Ash Pond Stability Analysis-Section E**

Analysis: Pseudostatic (Undrained)

Calculated By: MJN Date: 6/20/2016
Checked By: VMCh Date: 6/20/2016
Modified By: PK Date:9/01/2021
Checked By:ZJF Date: 9/08/2021

Horizontal Seismic Coefficient = 0.153g

Name: Upper Clay (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Upper Clay (Undrained)
Name: Embankment Fill (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Embankment Fill (Undrained)
Name: Lower Clay (Undrained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 5,000 psf Phi': 0 °



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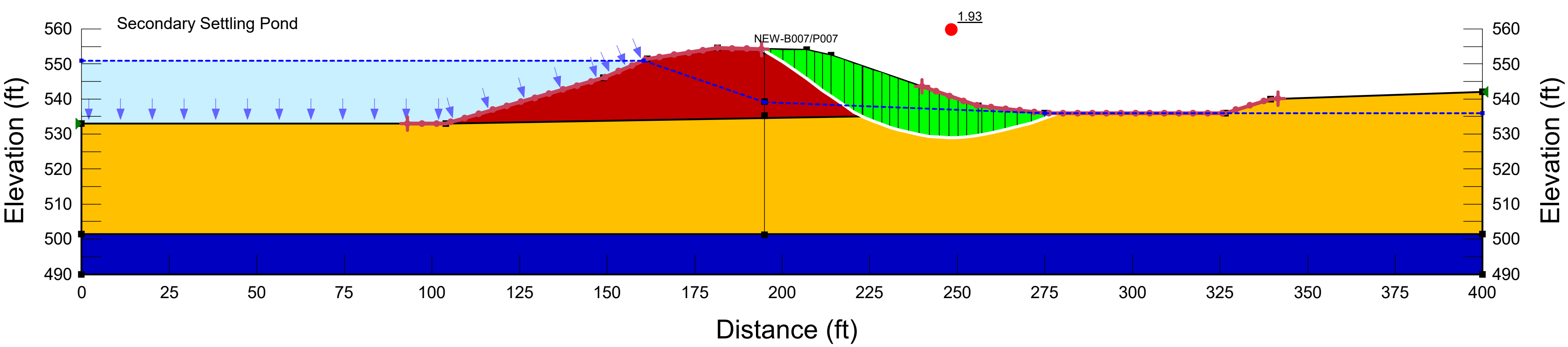
Project Name: **Newton Primary Ash Pond Stability Analysis-Section F**

Analysis: Long Term (Drained)

Calculated By: ZJF Date: 5/23/2016
Checked By: VMCh Date: 6/16/2016
Modified By: PK Date:9/01/2021
Checked By:ZJF Date: 9/08/2021

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °

Materials
Upper Clay (Drained)
Lower Clay (Drained)
Embankment Fill (Drained)



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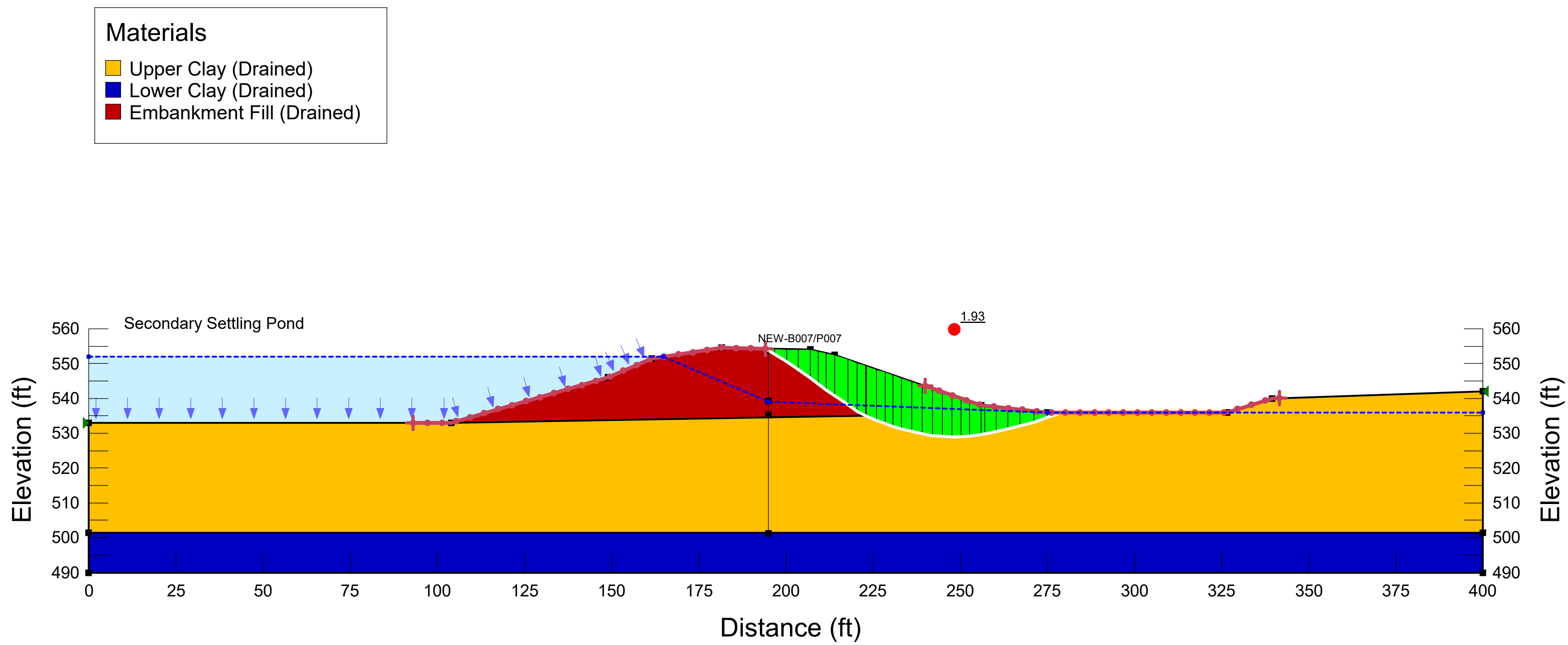
Project Name: Newton Primary Ash Pond Stability Analysis-Section F

Analysis: Surcharge (Drained)

Calculated By: ZJF Date: 5/23/2016
Checked By: VMCh Date: 6/16/2016
Modified By: PK Date:9/01/2021
Checked By:ZJF Date: 9/08/2021

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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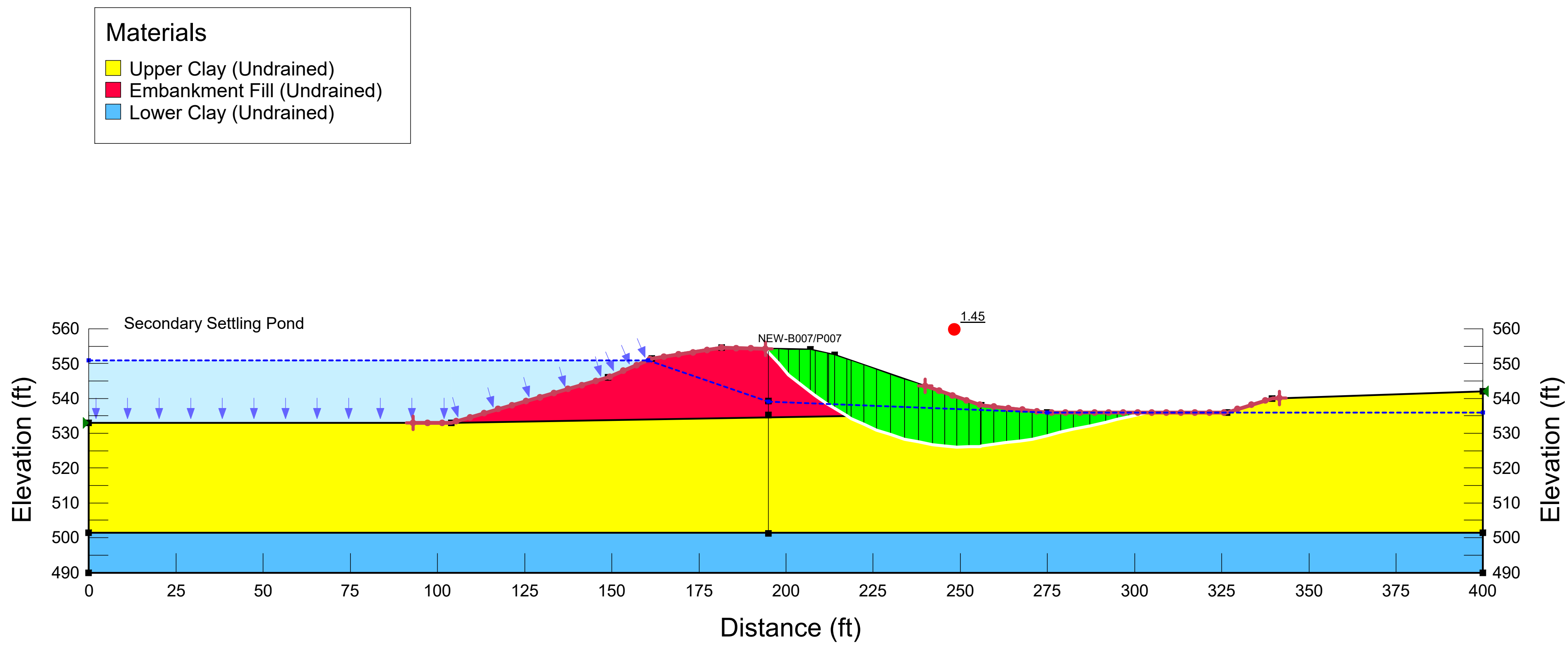
Project Name: **Newton Primary Ash Pond Stability Analysis-Section F**

Analysis: Pseudostatic (Undrained)

Calculated By: ZJF Date: 5/23/2016
Checked By: VMCh Date: 6/16/2016
Modified By: PK Date:9/01/2021
Checked By:ZJF Date: 9/08/2021

Horizontal Seismic Coefficient = 0.153 g

Name: Upper Clay (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Upper Clay (Undrained)
Name: Embankment Fill (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Embankment Fill (Undrained)
Name: Lower Clay (Undrained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 5,000 psf Phi': 0 °



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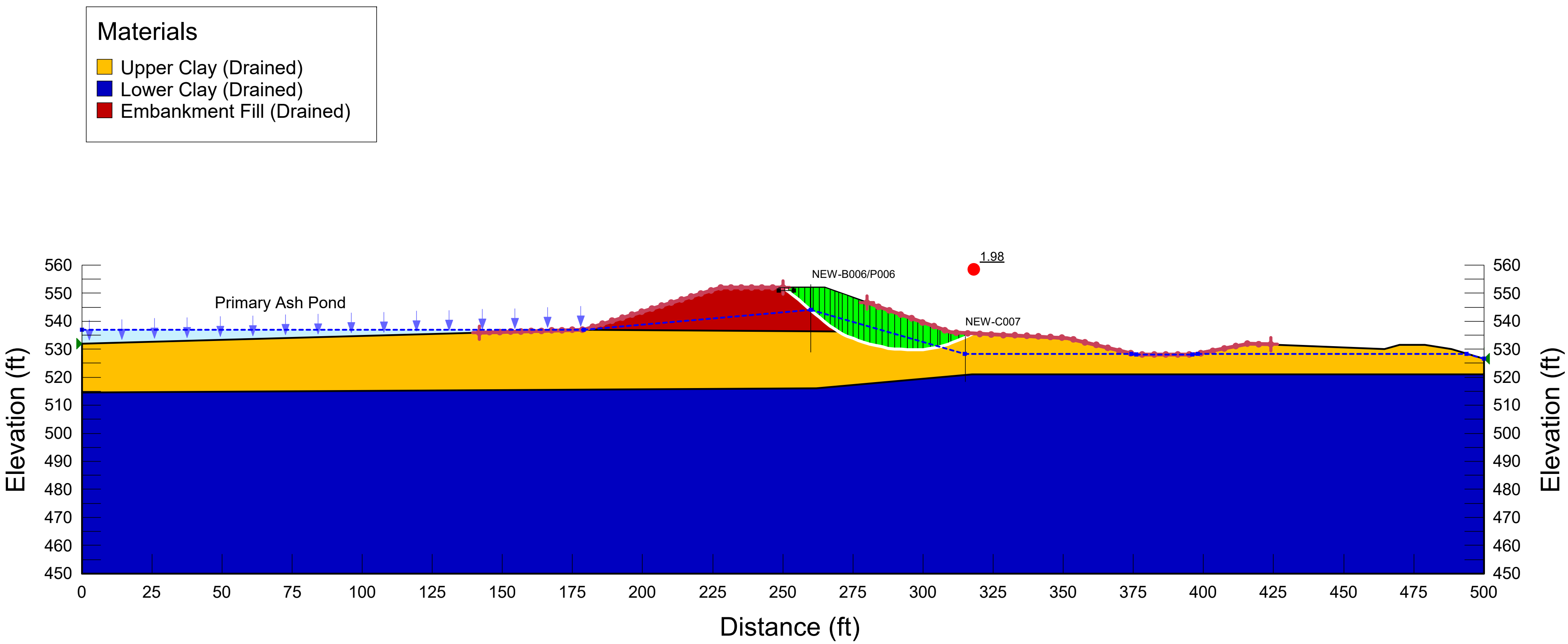
Project Name: Newton Primary Ash Pond Stability Analysis-Section G

Analysis: Long Term (Drained)

Calculated By: ZJF Date: 5/23/16
Checked By: VMCh Date: 06/20/16
Modified By: PK Date:9/01/21
Checked By:ZJF Date: 9/08/21

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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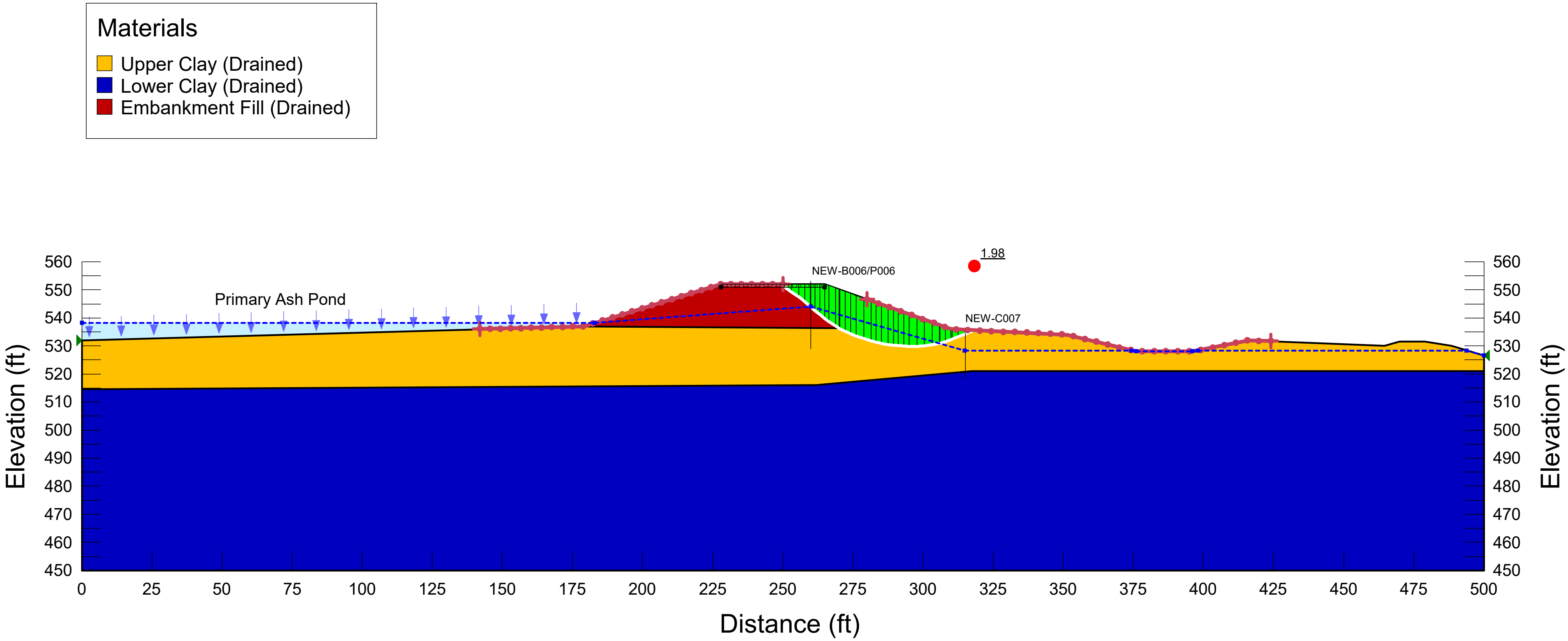
Project Name: Newton Primary Ash Pond Stability Analysis-Section G

Analysis: Surcharge (Drained)

Calculated By: ZJF Date: 5/23/16
Checked By: VMCh Date: 06/20/16
Modified By: PK Date:9/01/21
Checked By:ZJF Date: 9/08/21

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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Project Name: Newton Primary Ash Pond Stability Analysis-Section G

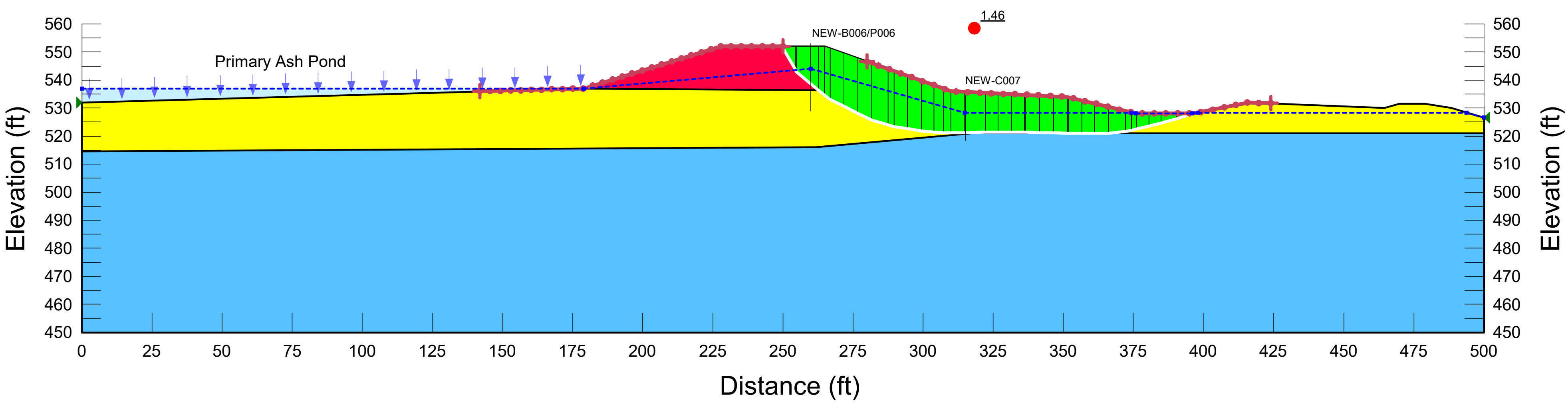
Analysis: Pseudostatic (Undrained)

Calculated By: ZJF	Date: 5/23/16
Checked By: VMCh	Date: 06/20/16
Modified By: PK	Date:9/01/21
Checked By:ZJF	Date: 9/08/21

Horizontal Seismic Coefficient = 0.153 g

Name: Upper Clay (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Upper Clay (Undrained)
Name: Embankment Fill (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Embankment Fill (Undrained)
Name: Lower Clay (Undrained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 5,000 psf Phi': 0 °

Materials
- Upper Clay (Undrained)
- Embankment Fill (Undrained)
- Lower Clay (Undrained)



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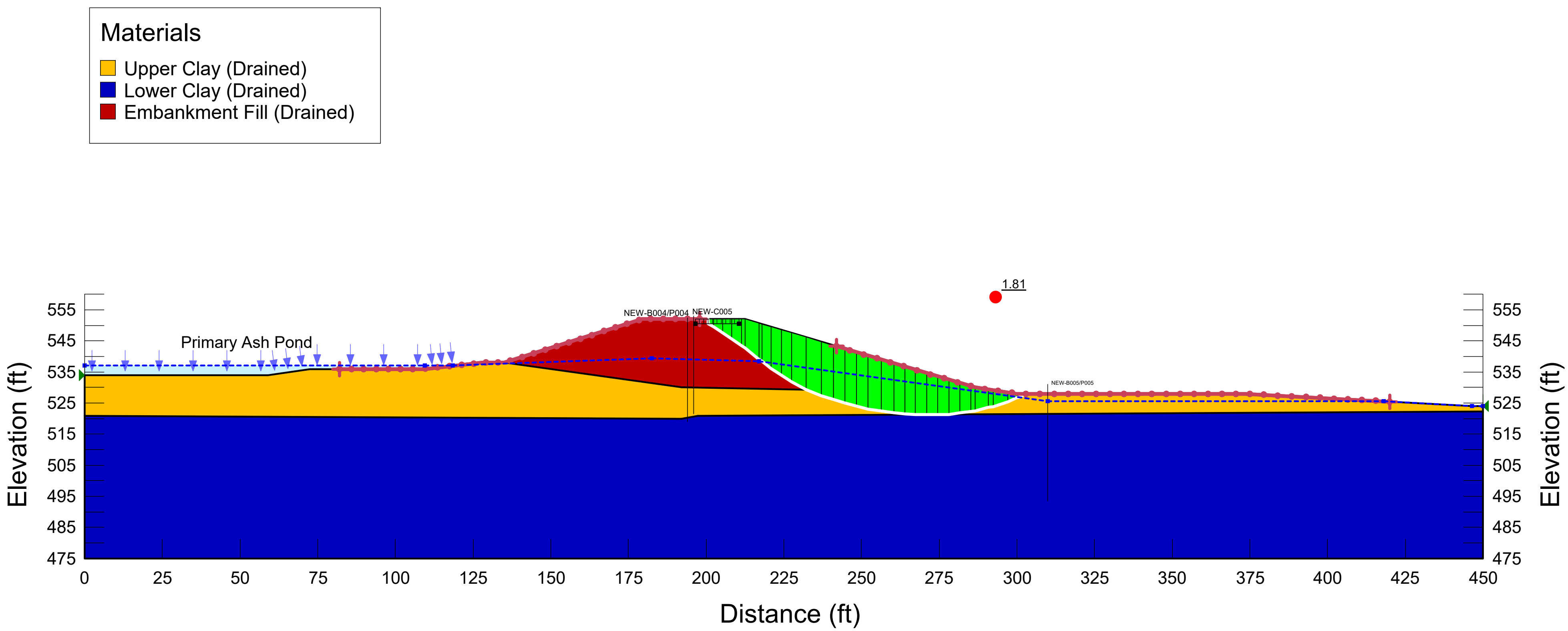
Project Name: Newton Primary Ash Pond Stability Analysis-Section H

Analysis: Long Term (Drained)

Calculated By: ZJF Date: 5/23/16
Checked By: VMCh Date: 6/20/16
Modified By: PK Date:9/01/21
Checked By:ZJF Date: 9/08/21

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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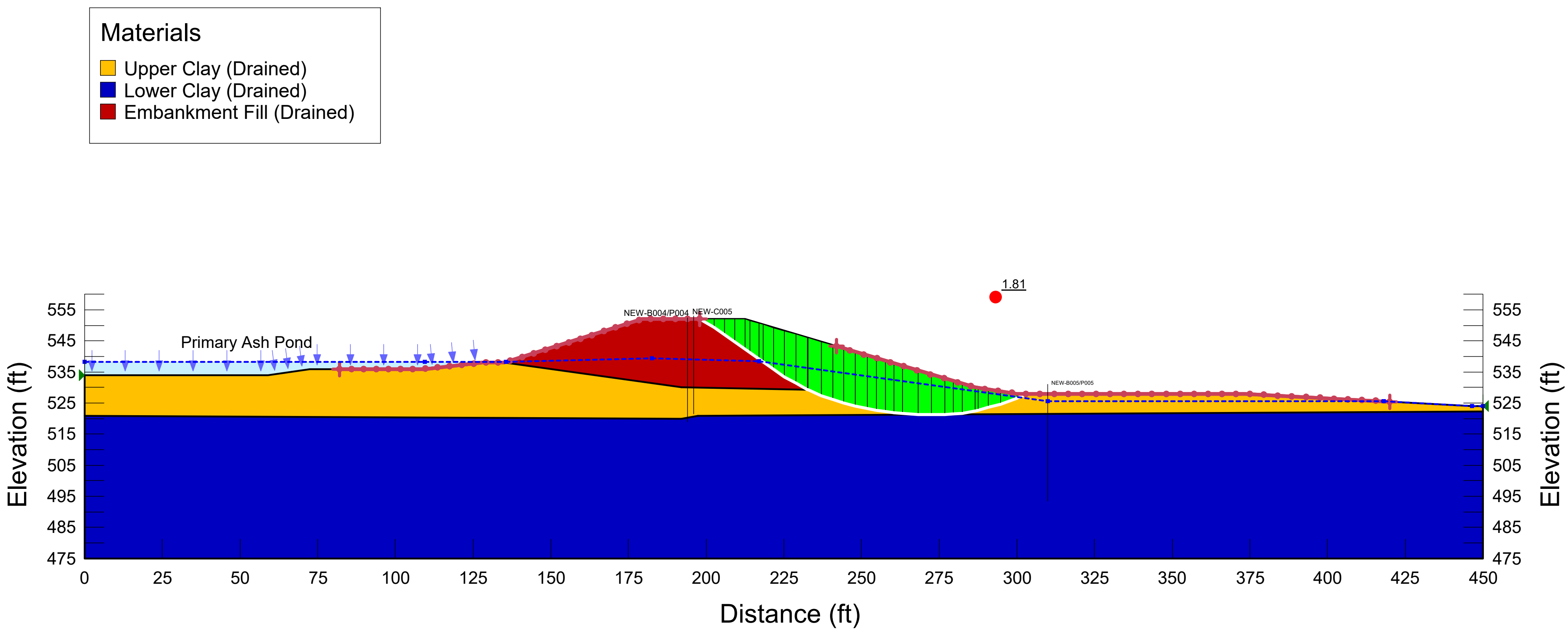
Project Name: Newton Primary Ash Pond Stability Analysis-Section H

Analysis: Surcharge (Drained)

Calculated By: ZJF Date: 5/23/16
Checked By: VMCh Date: 6/20/16
Modified By: PK Date:9/01/21
Checked By:ZJF Date: 9/08/21

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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Project Name: Newton Primary Ash Pond Stability Analysis-Section H

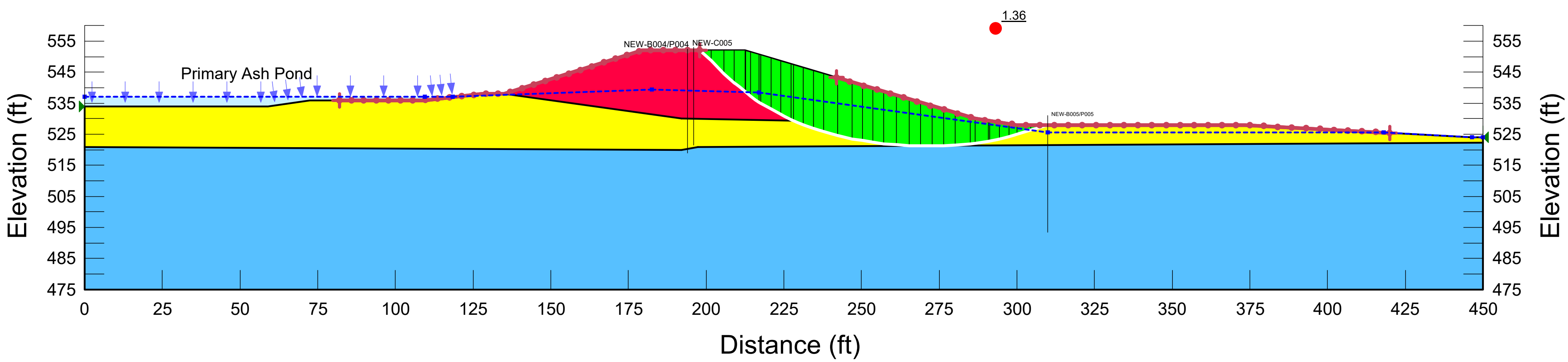
Analysis: Pseudostatic (Undrained)

Calculated By: ZJF Date: 5/23/16
Checked By: VMCh Date: 6/20/16
Modified By: PK Date:9/01/21
Checked By:ZJF Date: 9/08/21

Horizontal Seismic Coefficient = 0.153 g

Name: Upper Clay (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Upper Clay (Undrained)
Name: Embankment Fill (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Embankment Fill (Undrained)
Name: Lower Clay (Undrained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 5,000 psf Phi': 0 °

Materials
- Upper Clay (Undrained)
- Embankment Fill (Undrained)
- Lower Clay (Undrained)



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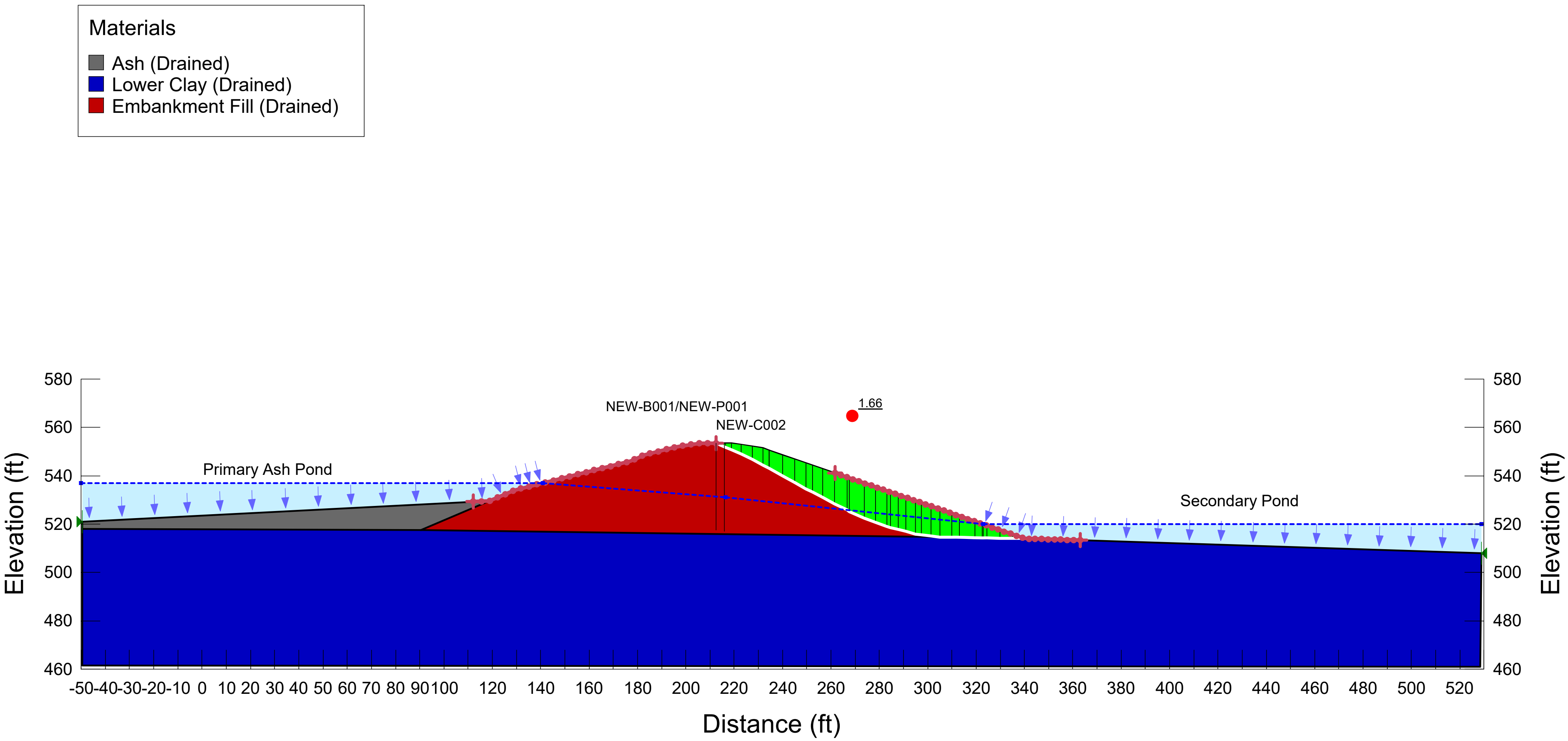
Project Name: Newton Primary Ash Pond Stability Analysis-Section I

Analysis: Long Term (Drained)

Calculated By: NDS Date: 5/25/16
Checked By: VMCh Date: 6/20/16
Modified By: PK Date:9/01/21
Checked By:ZJF Date: 9/08/21

Name: Ash (Drained) Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 0 psf Phi': 30 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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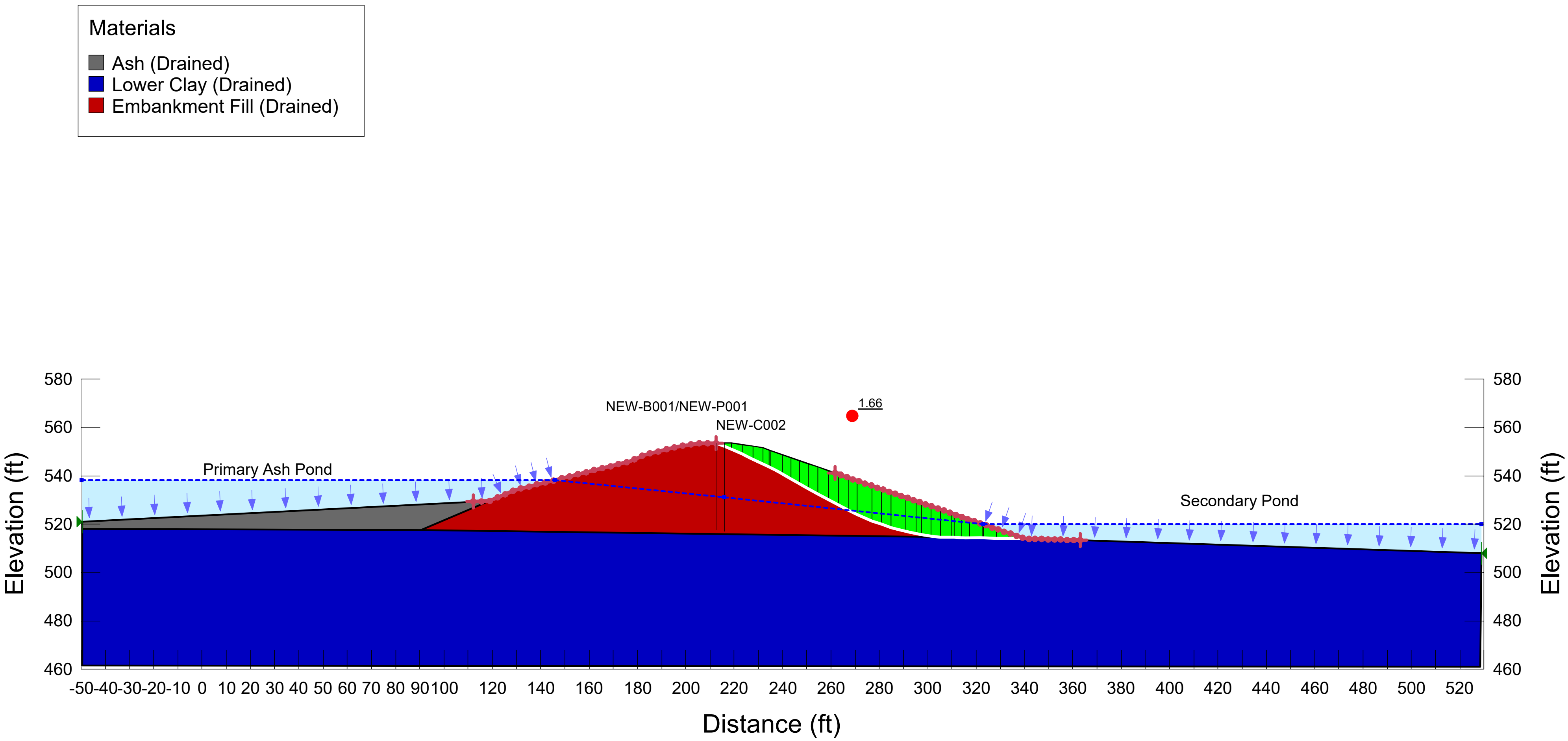
Project Name: Newton Primary Ash Pond Stability Analysis-Section I

Analysis: Surcharge (Drained)

Calculated By: NDS Date: 5/25/16
Checked By: VMCh Date: 6/20/16
Modified By: PK Date:9/01/21
Checked By:ZJF Date: 9/08/21

Name: Ash (Drained) Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 0 psf Phi': 30 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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Project Name: Newton Primary Ash Pond Stability Analysis-Section I

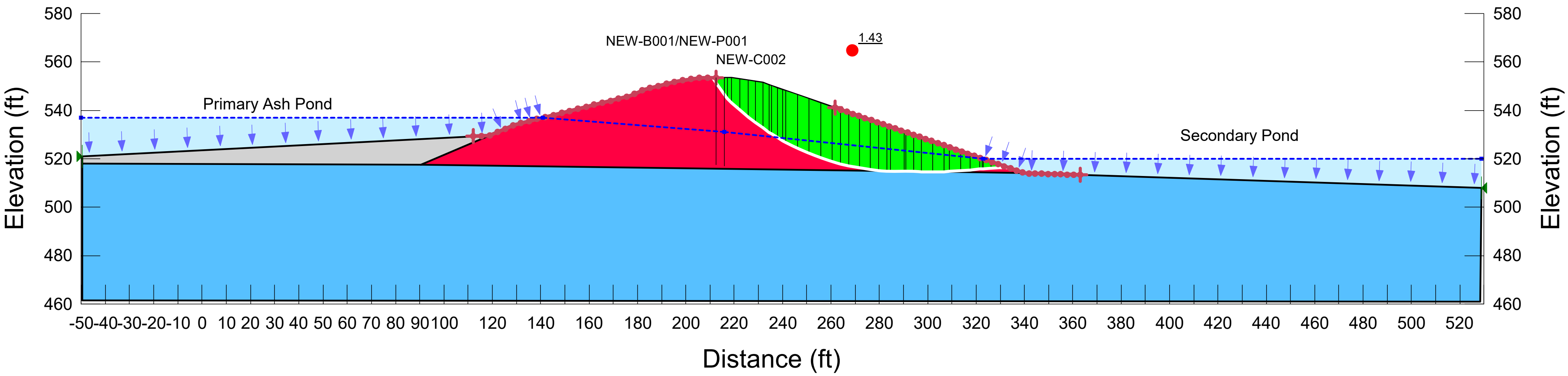
Analysis: Pseudostatic (Undrained)

Calculated By: NDS Date: 5/25/16
Checked By: VMCh Date: 6/20/16
Modified By: PK Date:9/01/21
Checked By:ZJF Date: 9/08/21

Horizontal Seismic Coefficient = 0.153 g

Name: Embankment Fill (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Embankment Fill (Undrained)
Name: Lower Clay (Undrained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 5,000 psf Phi': 0 °
Name: Ash (Undrained) Model: S=f(overburden) Unit Weight: 90 pcf Tau/Sigma Ratio: 0.05 Minimum Strength: 0 psf

Materials
- Embankment Fill (Undrained)
- Lower Clay (Undrained)
- Ash (Undrained)



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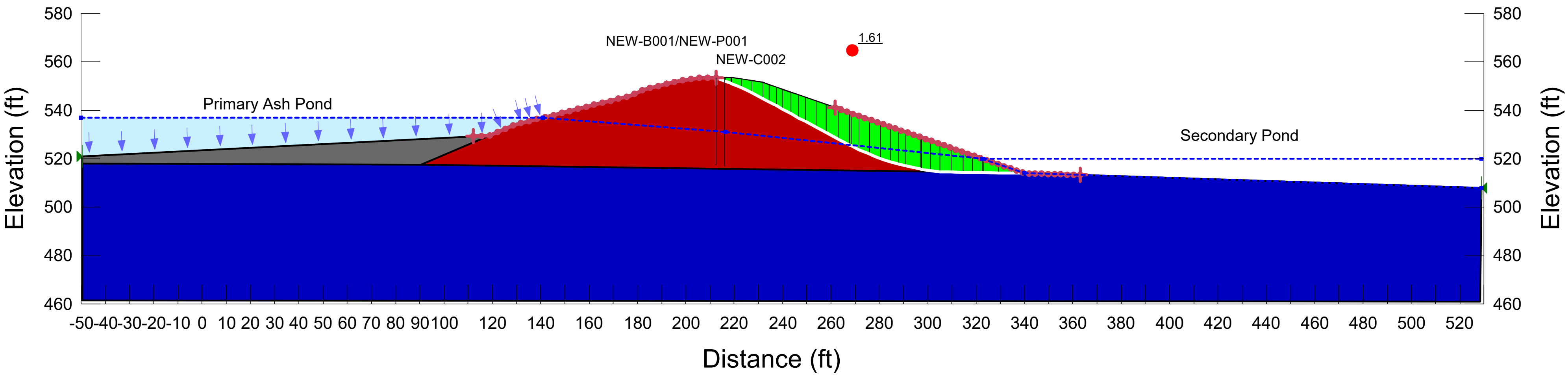
Project Name: Newton Primary Ash Pond Stability Analysis-Section I

Analysis: Sudden Drawdown

Calculated By: NDS Date: 5/25/16
Checked By: VMCh Date: 6/20/16
Modified By: PK Date:9/01/21
Checked By:ZJF Date: 9/08/21

Name: Ash (Drained) Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 0 psf Phi': 30 ° Cohesion R: 0 psf Phi R: 0 ° Piezometric Line After Drawdown: 2
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 ° Cohesion R: 0 psf Phi R: 0 ° Piezometric Line After Drawdown: 2
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 ° Cohesion R: 500 psf Phi R: 22 ° Piezometric Line After Drawdown: 2

Materials
- Ash (Drained)
- Lower Clay (Drained)
- Embankment Fill (Drained)



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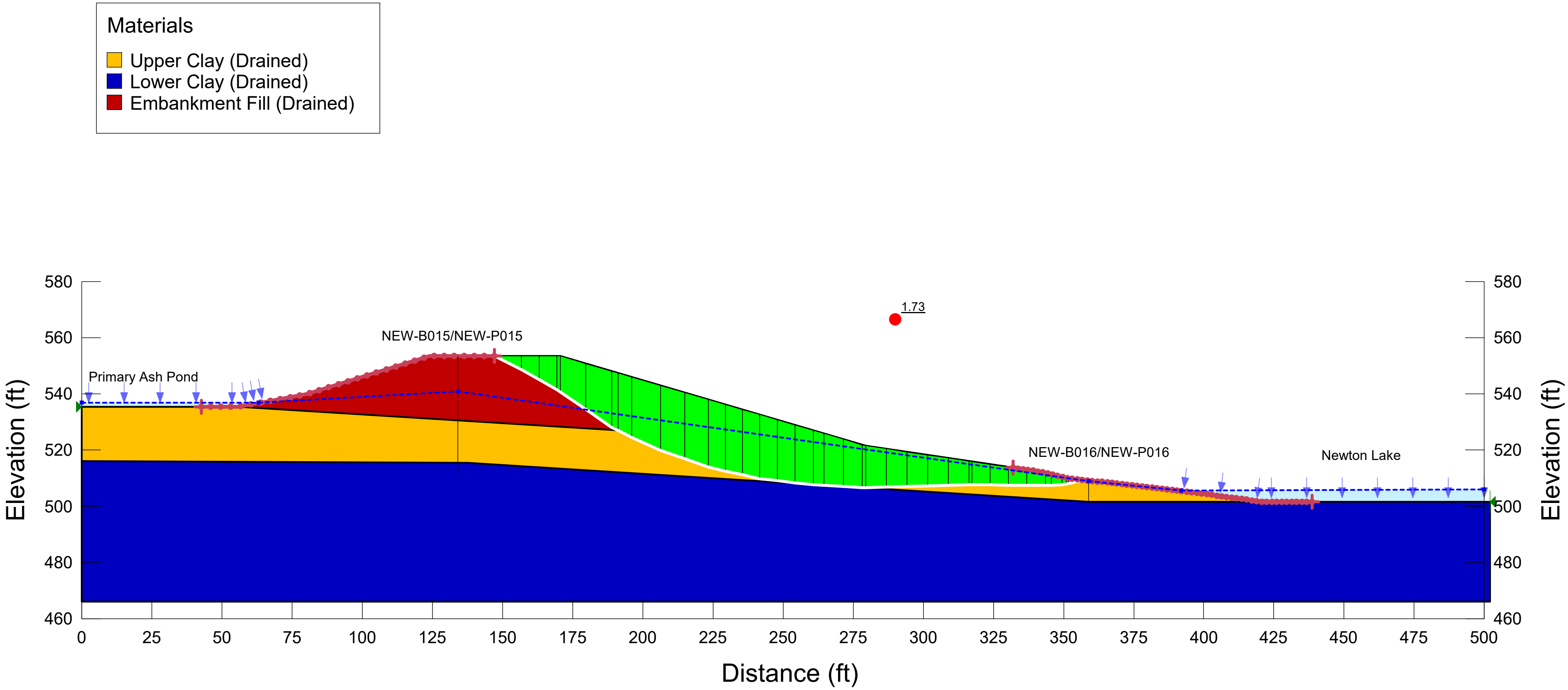
Project Name: **Newton Primary Ash Pond Stability Analysis-Section K**

Analysis: Long Term (Drained)

Calculated By: NDS Date: 5/31/16
Checked By: VMCh Date: 6/20/16
Modified By: PK Date:9/01/21
Checked By:ZJF Date: 9/08/21

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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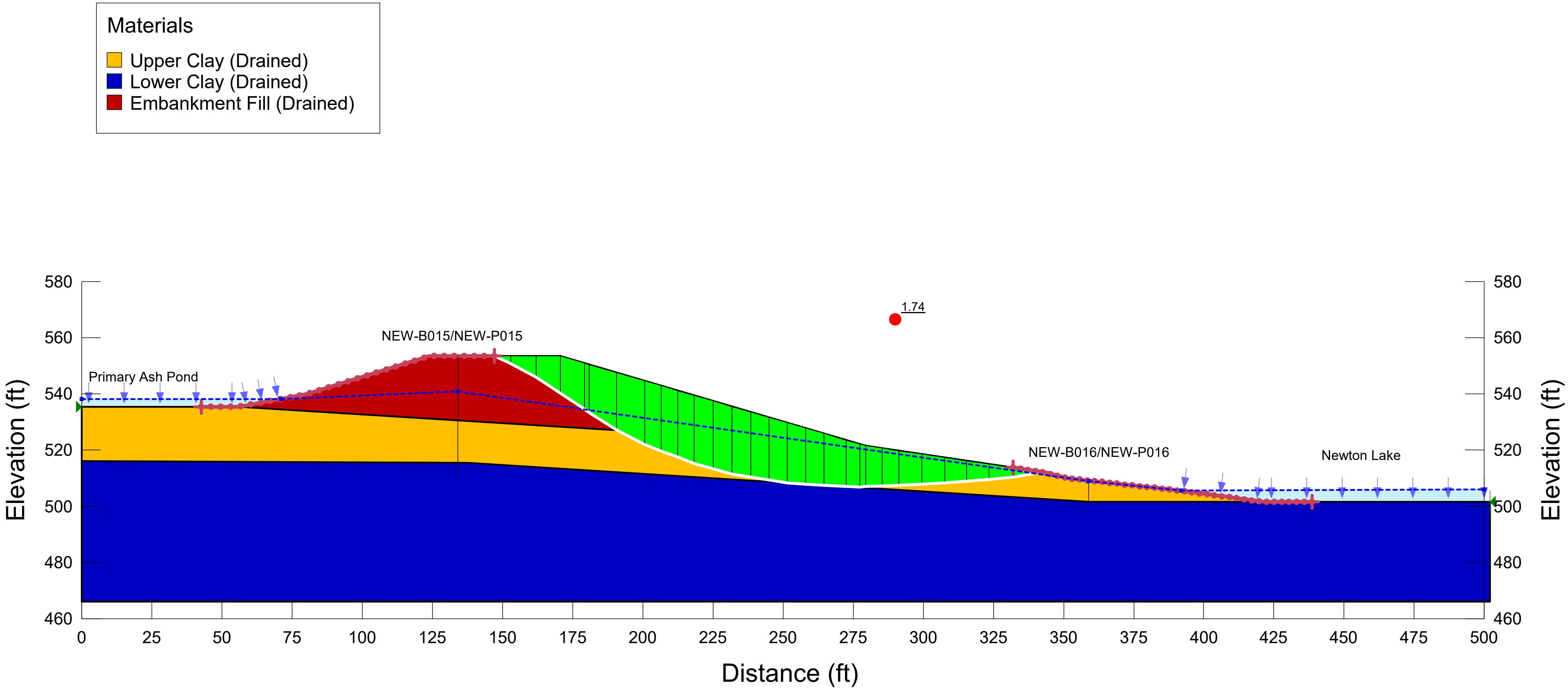
Project Name: **Newton Primary Ash Pond Stability Analysis-Section K**

Analysis: Surcharge (Drained)

Calculated By: NDS Date: 5/31/16
Checked By: VMCh Date: 6/20/16
Modified By: PK Date:9/01/21
Checked By:ZJF Date: 9/08/21

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 °
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 °
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 °



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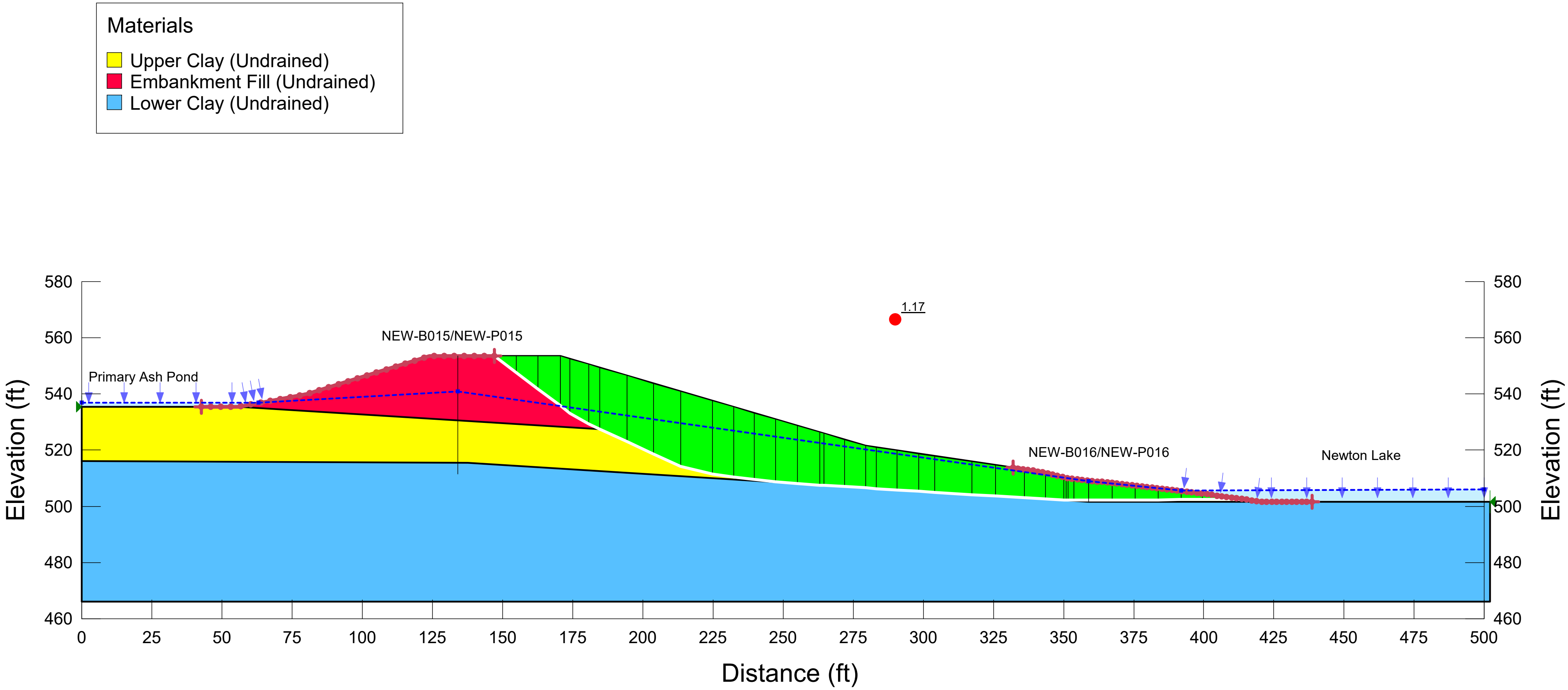
Project Name: Newton Primary Ash Pond Stability Analysis-Section K

Analysis: Pseudostatic (Undrained)

Calculated By: NDS Date: 5/31/16
Checked By: VMCh Date: 6/20/16
Modified By: PK Date:9/01/21
Checked By:ZJF Date: 9/08/21

Horizontal Seismic Coefficient = 0.153 g

Name: Upper Clay (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Upper Clay (Undrained)
Name: Embankment Fill (Undrained) Model: Shear/Normal Fn. Unit Weight: 130 pcf Strength Function: Embankment Fill (Undrained)
Name: Lower Clay (Undrained) Model: Undrained (Phi=0) Unit Weight: 130 pcf Cohesion': 5,000 psf



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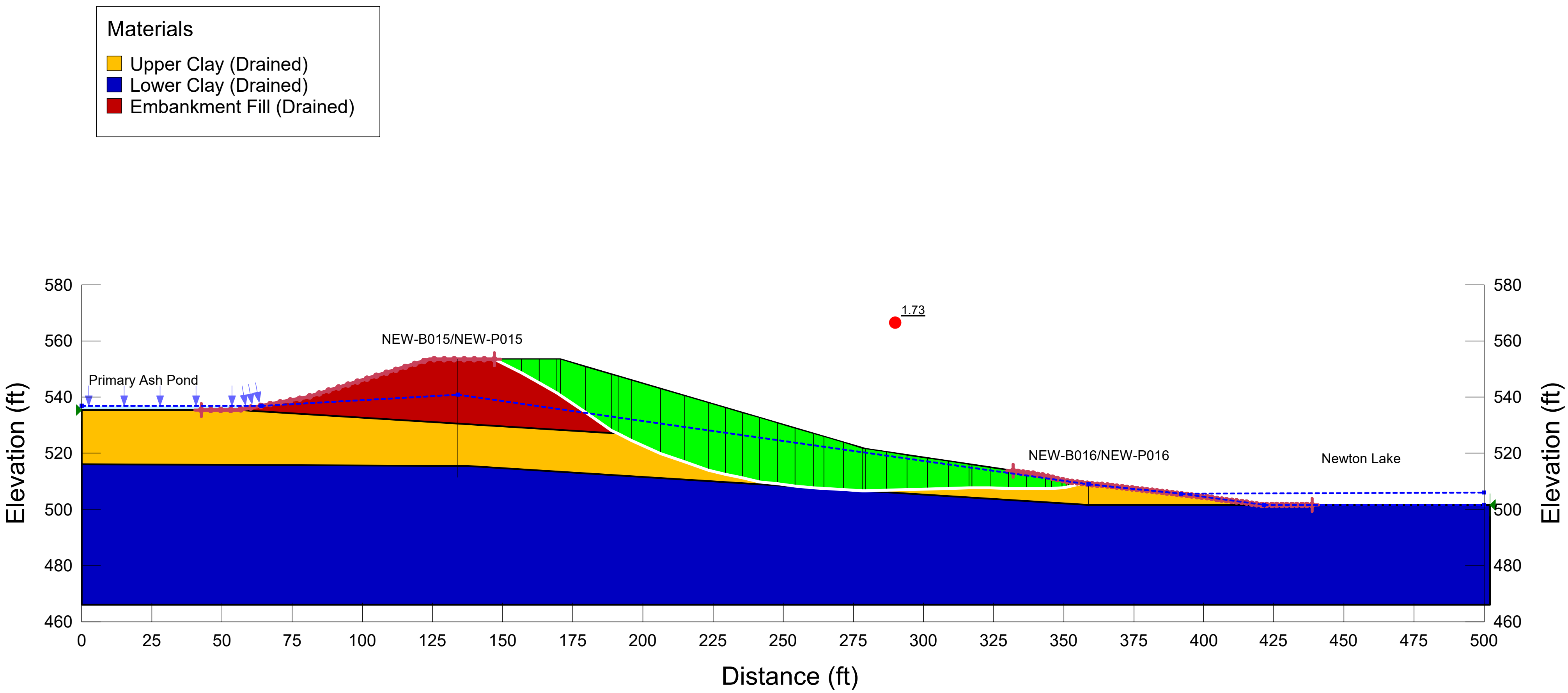
Project Name: Newton Primary Ash Pond Stability Analysis-Section K

Analysis: Sudden Drawdown

Calculated By: NDS Date: 5/31/16
Checked By: VMCh Date: 6/20/16
Modified By: PK Date:9/01/21
Checked By:ZJF Date: 9/08/21

Name: Upper Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 29 ° Cohesion R: 470 psf Phi R: 22 ° Piezometric Line After Drawdown: 2
Name: Lower Clay (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 3,700 psf Phi': 33 ° Cohesion R: 0 psf Phi R: 0 ° Piezometric Line After Drawdown: 2
Name: Embankment Fill (Drained) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 31 ° Cohesion R: 500 psf Phi R: 22 ° Piezometric Line After Drawdown: 2



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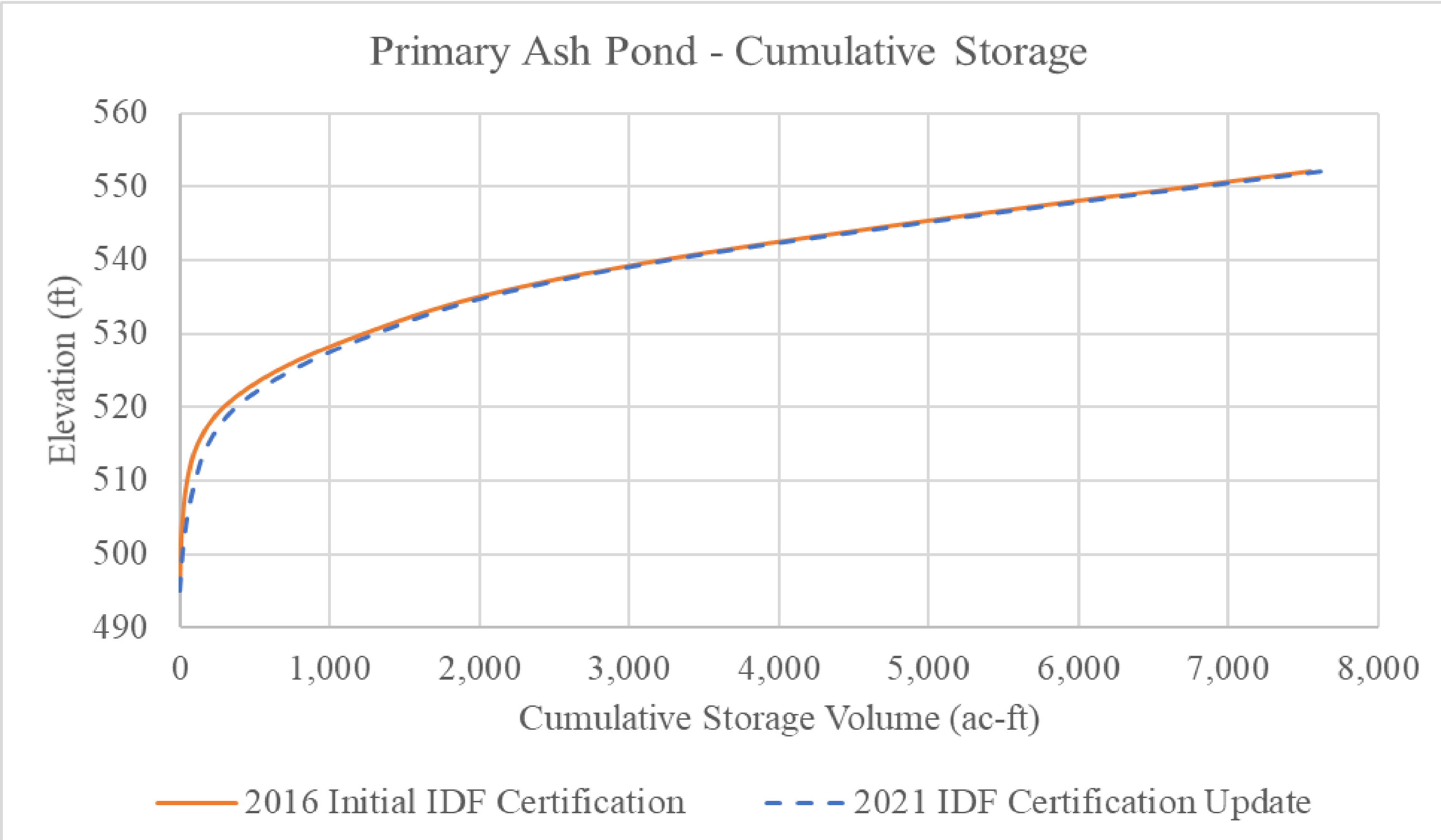
Attachment E

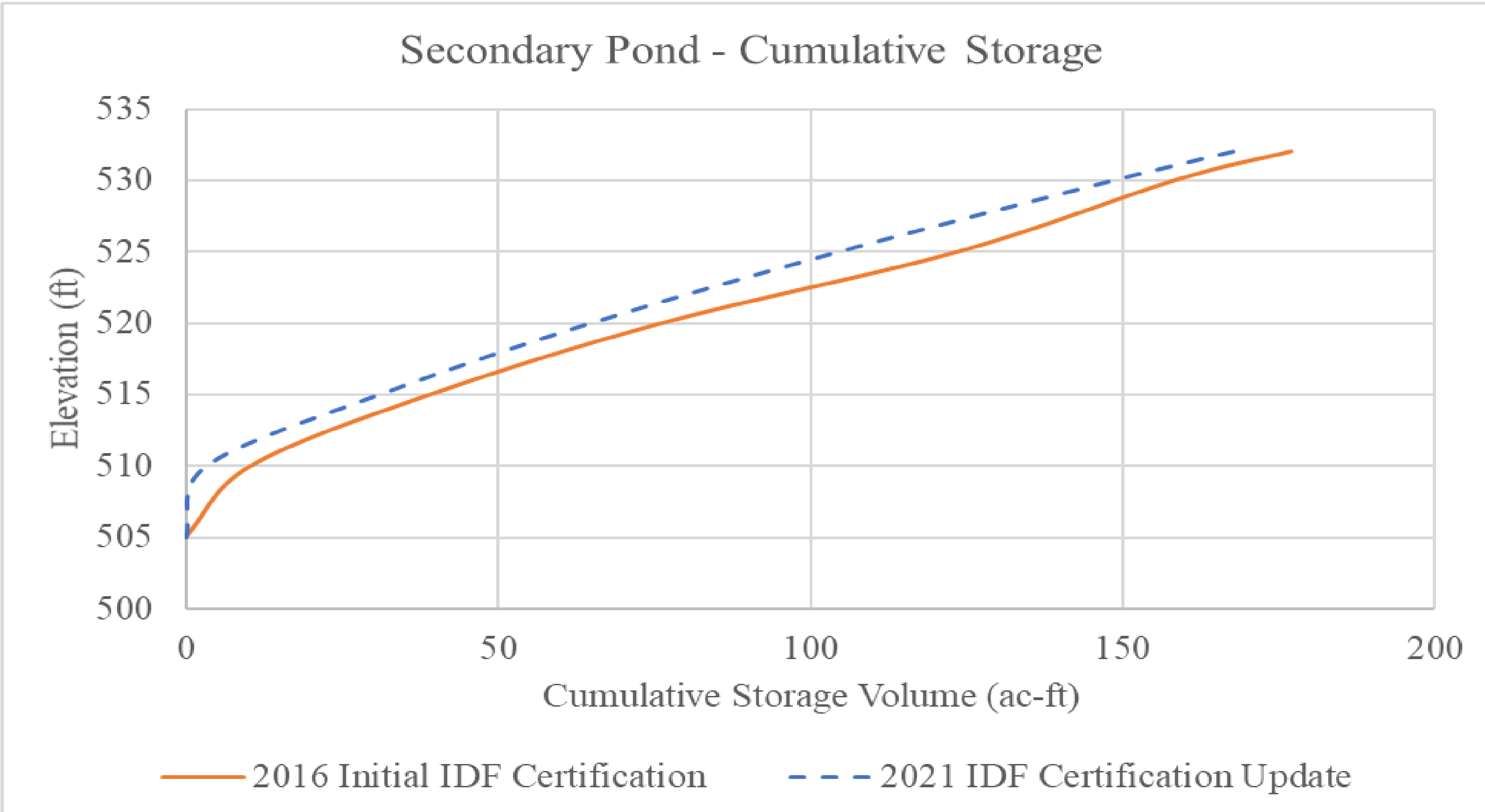
Periodic Inflow Design Flood Control System Plan Analyses



PRIMARY ASH POND CUMULATIVE STORAGE
PERIODIC CERTIFICATION
NEWTON POWER PLANT
NEWTON, ILLINOIS

Geosyntec consultants

GLP8027	9/10/2021	Figure E-1

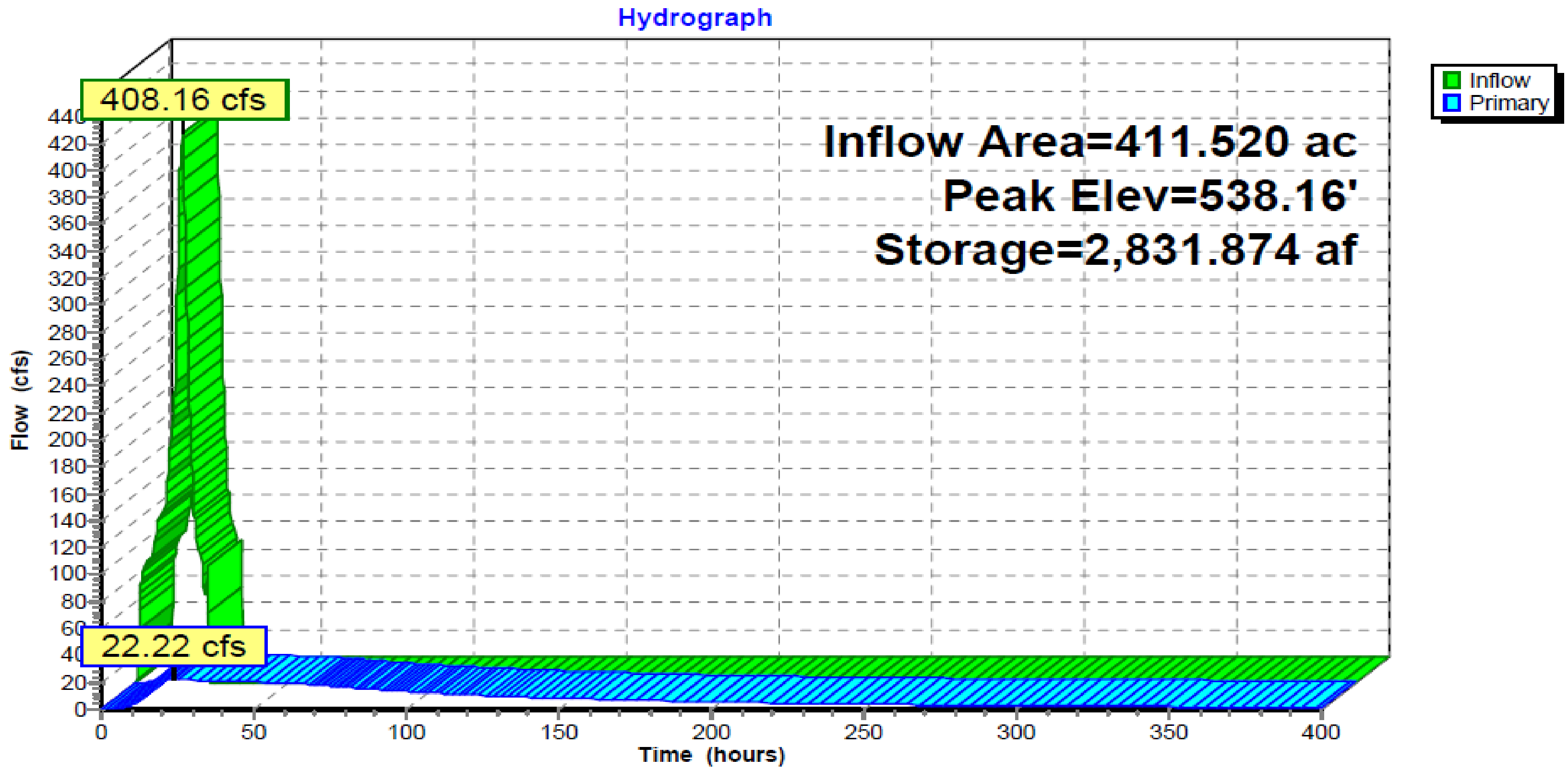


SECONDARY POND CUMULATIVE STORAGE
PERIODIC CERTIFICATION
NEWTON POWER PLANT
NEWTON, ILLINOIS

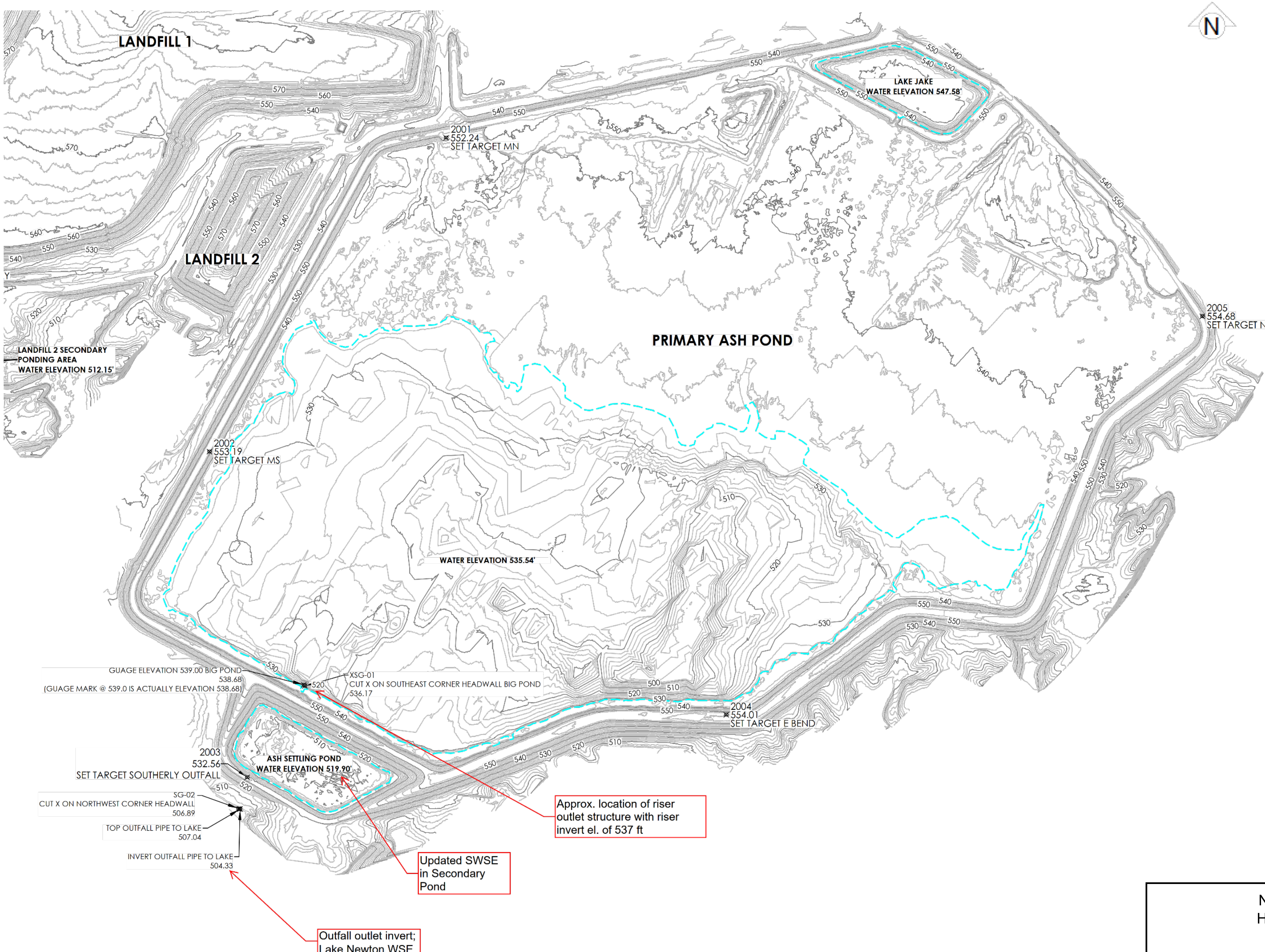
Geosyntec consultants

GLP8027	9/10/2021	Figure E-2

Pond 1P: Primary Ash Pond



AP1 IDF HYDROGRAPH PERIODIC CERTIFICATION NEWTON POWER PLANT NEWTON, ILLINOIS		
Geosyntec consultants		Figure E-3
GLP8027	9/10/2021	



Newton Power Plant
Hydrologic Workmap

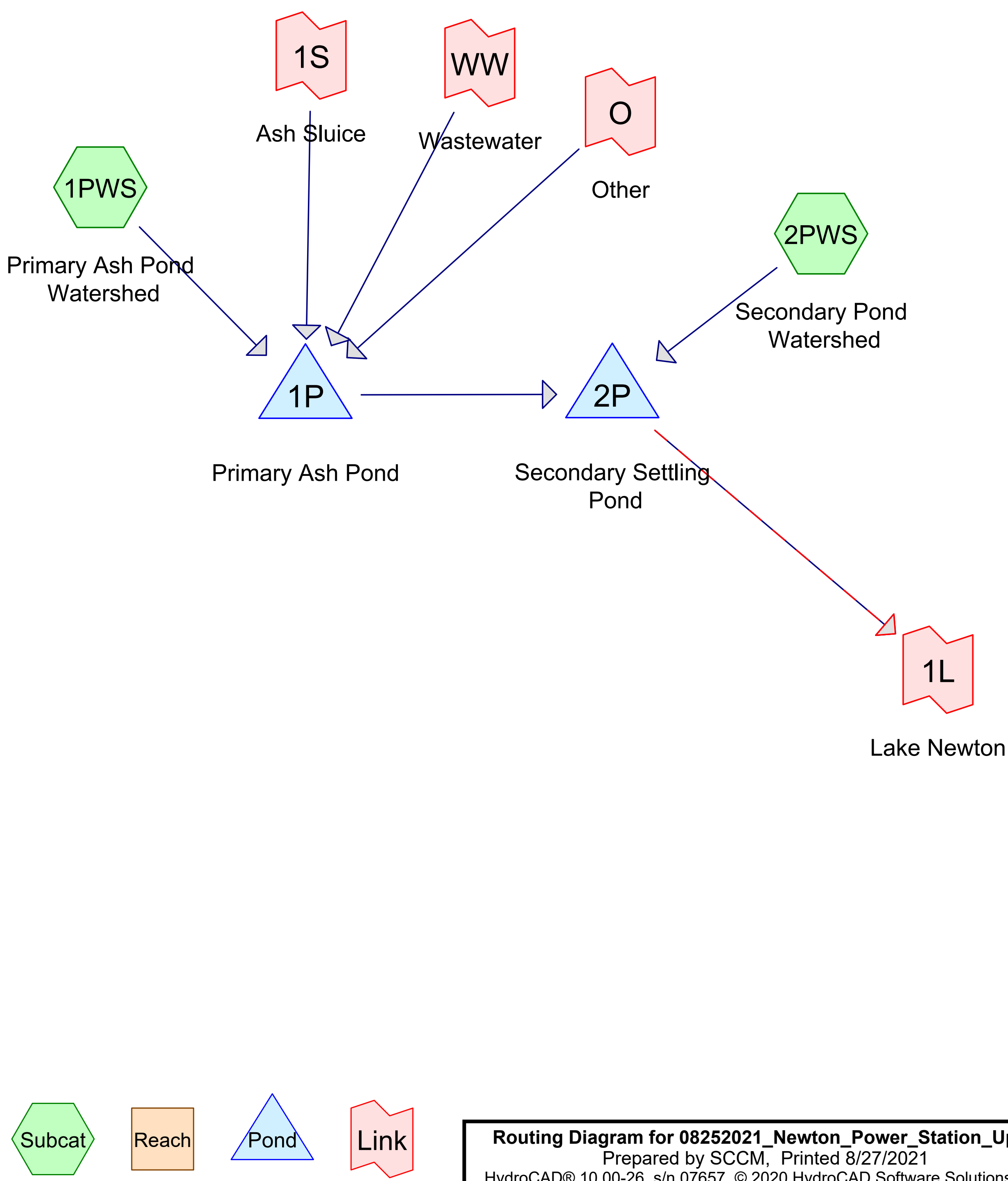
Geosyntec consultants

Figure E-4

GLP8027 | September 2021

Figure based on IngenAE 2020 Site Topo

DRAFT - NOT FOR CONSTRUCTION - NOT TO SCALE - ATTORNEY-CLIENT PRIVILEGED & CONFIDENTIAL



Routing Diagram for 08252021_Newton_Power_Station_Update
Prepared by SCCM, Printed 8/27/2021
HydroCAD® 10.00-26 s/n 07657 © 2020 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
423.520	98	(1PWS, 2PWS)
423.520	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
423.520	Other	1PWS, 2PWS
423.520		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	423.520	423.520		1PWS, 2PWS
0.000	**0.000**	**0.000**	**0.000**	**423.520**	**423.520**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1P	512.18	508.00	220.0	0.0190	0.013	28.0	0.0	0.0
2	2P	505.00	504.33	226.0	0.0030	0.013	28.0	0.0	0.0

Time span=0.00-400.00 hrs, dt=0.15 hrs, 2668 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1PWS: Primary Ash Runoff Area=411.520 ac 100.00% Impervious Runoff Depth=8.77"
Tc=6.0 min CN=98 Runoff=408.16 cfs 300.740 af

Subcatchment 2PWS: Secondary Pond Runoff Area=12.000 ac 100.00% Impervious Runoff Depth=8.77"
Tc=6.0 min CN=98 Runoff=11.90 cfs 8.770 af

Pond 1P: Primary Ash Pond Peak Elev=538.16' Storage=2,831.874 af Inflow=408.16 cfs 300.740 af
Outflow=22.22 cfs 260.432 af

Pond 2P: Secondary Settling Pond Peak Elev=519.90' Storage=64.320 af Inflow=28.79 cfs 269.202 af
Primary=61.56 cfs 333.516 af Secondary=0.00 cfs 0.000 af Outflow=61.56 cfs 333.516 af

Link 1L: Lake Newton Inflow=61.56 cfs 333.516 af
Primary=61.56 cfs 333.516 af

Link 1S: Ash Sluice Manual Hydrograph above 13.37 cfs below 13.37 cfs Inflow=13.37 cfs 171.338 af
Primary=0.00 cfs 0.000 af Secondary=13.37 cfs 171.338 af

Link O: Other Manual Hydrograph above 1.54 cfs below 1.54 cfs Inflow=1.54 cfs 50.935 af
Primary=0.00 cfs 0.000 af Secondary=1.54 cfs 50.935 af

Link WW: Wastewater Manual Hydrograph above 23.39 cfs below 23.39 cfs Inflow=23.39 cfs 201.231 af
Primary=0.00 cfs 0.000 af Secondary=23.39 cfs 201.231 af

Total Runoff Area = 423.520 ac Runoff Volume = 309.510 af Average Runoff Depth = 8.77"
0.00% Pervious = 0.000 ac 100.00% Impervious = 423.520 ac

Summary for Subcatchment 1PWS: Primary Ash Pond Watershed

[49] Hint: Tc<2dt may require smaller dt

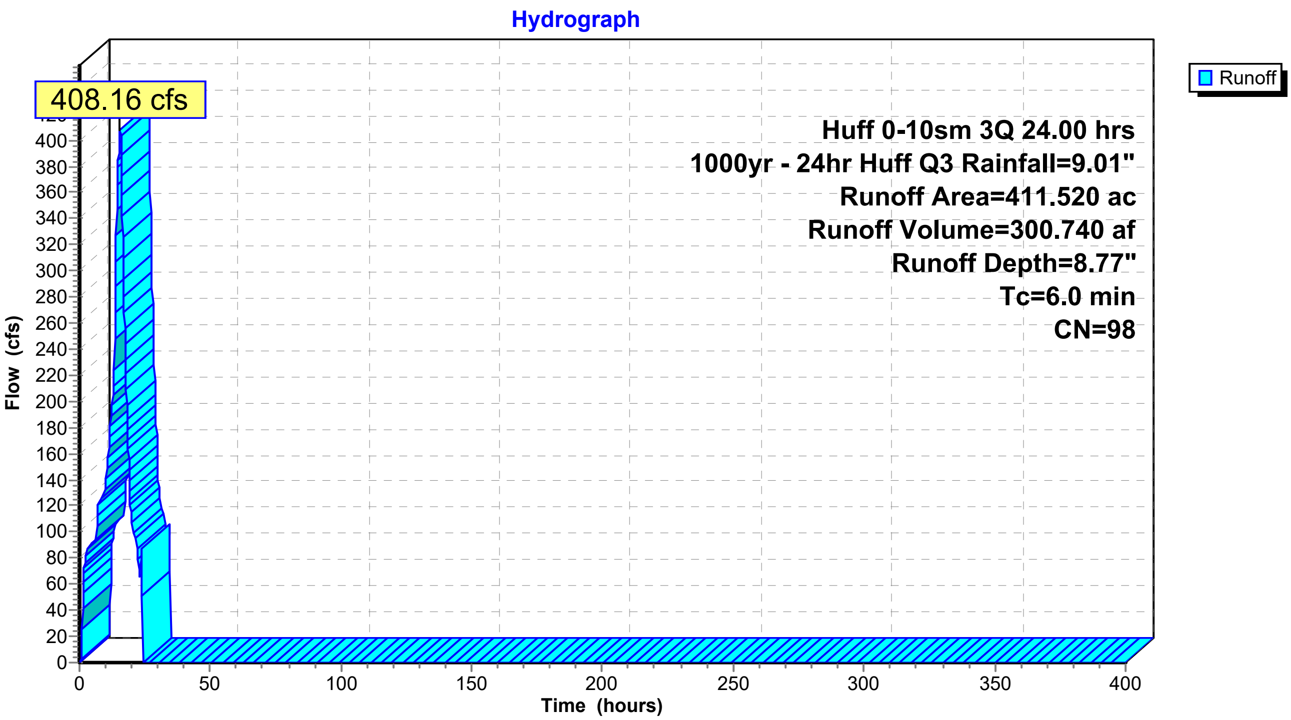
Runoff = 408.16 cfs @ 15.60 hrs, Volume= 300.740 af, Depth= 8.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.05 hrs, dt= 0.15 hrs
Huff 0-10sm 3Q 24.00 hrs 1000yr - 24hr Huff Q3 Rainfall=9.01"

	Area (ac)	CN	Description
*	411.520	98	
	411.520		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1PWS: Primary Ash Pond Watershed



Summary for Subcatchment 2PWS: Secondary Pond Watershed

[49] Hint: Tc<2dt may require smaller dt

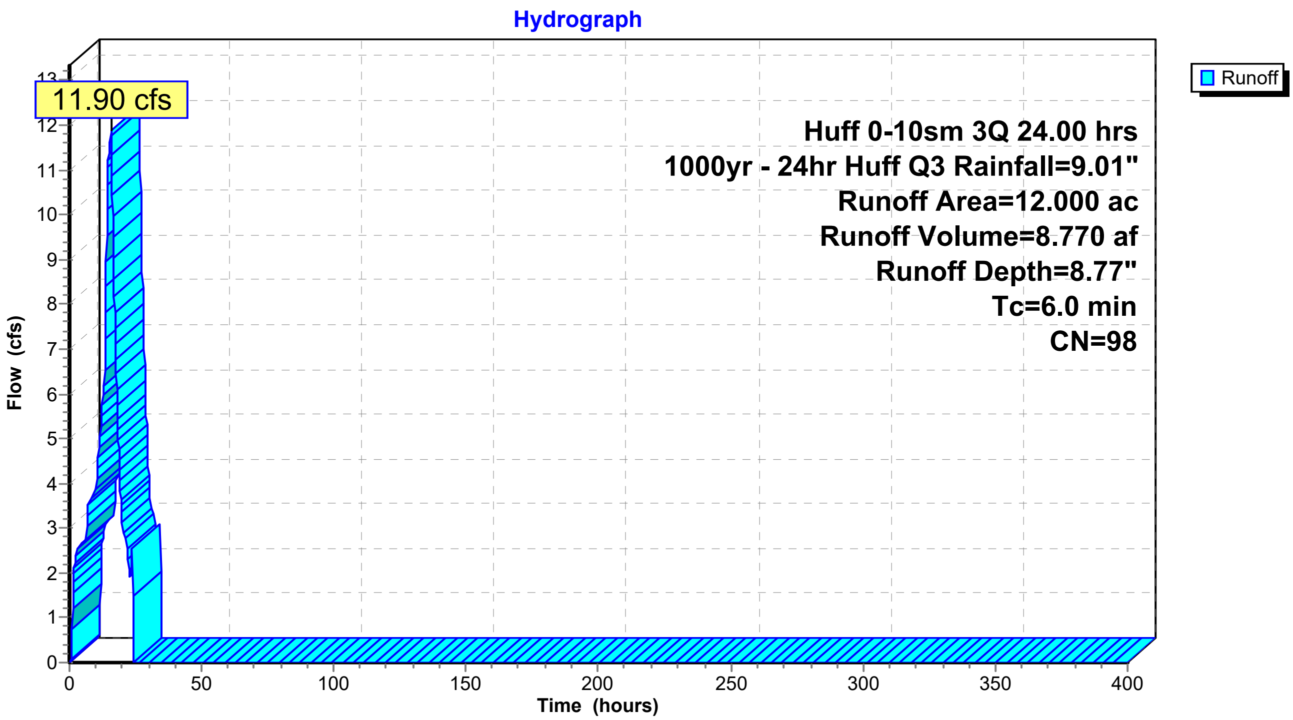
Runoff = 11.90 cfs @ 15.60 hrs, Volume= 8.770 af, Depth= 8.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.05 hrs, dt= 0.15 hrs
Huff 0-10sm 3Q 24.00 hrs 1000yr - 24hr Huff Q3 Rainfall=9.01"

	Area (ac)	CN	Description
*	12.000	98	
	12.000		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2PWS: Secondary Pond Watershed



Summary for Pond 1P: Primary Ash Pond

Inflow Area = 411.520 ac,100.00% Impervious, Inflow Depth = 8.77" for 1000yr - 24hr Huff Q3 event
Inflow = 408.16 cfs @ 15.60 hrs, Volume= 300.740 af
Outflow = 22.22 cfs @ 24.18 hrs, Volume= 260.432 af, Atten= 95%, Lag= 514.8 min
Primary = 22.22 cfs @ 24.18 hrs, Volume= 260.432 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-400.05 hrs, dt= 0.15 hrs
Starting Elev= 537.00' Surf.Area= 0.000 ac Storage= 2,550.800 af
Peak Elev= 538.16' @ 24.18 hrs Surf.Area= 0.000 ac Storage= 2,831.874 af (281.074 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 6,560.9 min (7,370.8 - 809.8)

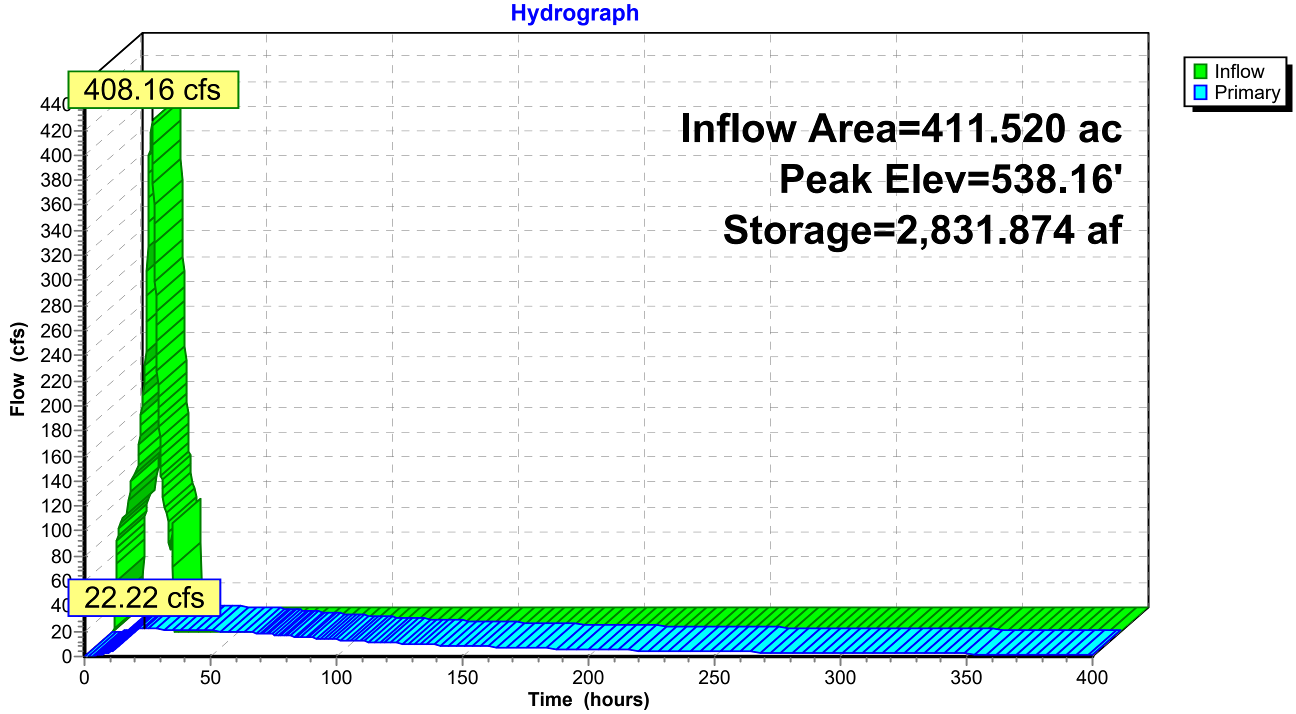
Volume	Invert	Avail.Storage	Storage Description
#1	495.00'	7,623.000 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
495.00	0.000
500.00	18.000
505.00	51.000
510.00	104.000
515.00	192.000
520.00	377.000
525.00	752.000
530.00	1,312.000
535.00	2,068.000
540.00	3,275.000
545.00	4,965.000
550.00	6,842.000
551.00	7,231.000
552.00	7,623.000

Device	Routing	Invert	Outlet Devices
#1	Primary	512.18'	**28.0" Round Culvert** L= 220.0' Ke= 0.820 Inlet / Outlet Invert= 512.18' / 508.00' S= 0.0190 '/' Cc= 0.900 n= 0.013, Flow Area= 4.28 sf
#2	Device 1	537.00'	**28.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=22.22 cfs @ 24.18 hrs HW=538.16' TW=510.37' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 22.22 cfs of 84.54 cfs potential flow)
  ↑—**2=Orifice/Grate** (Orifice Controls 22.22 cfs @ 5.20 fps)

Pond 1P: Primary Ash Pond



Summary for Pond 2P: Secondary Settling Pond

Inflow Area = 423.520 ac,100.00% Impervious, Inflow Depth > 7.63" for 1000yr - 24hr Huff Q3 event
Inflow = 28.79 cfs @ 16.35 hrs, Volume= 269.202 af
Outflow = 61.56 cfs @ 0.00 hrs, Volume= 333.516 af, Atten= 0%, Lag= 0.0 min
Primary = 61.56 cfs @ 0.00 hrs, Volume= 333.516 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-400.05 hrs, dt= 0.15 hrs
Starting Elev= 519.90' Surf.Area= 0.000 ac Storage= 64.320 af
Peak Elev= 519.90' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 64.320 af

Plug-Flow detention time= 67.0 min calculated for 269.095 af (100% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	505.00'	168.000 af	**Custom Stage Data** Listed below

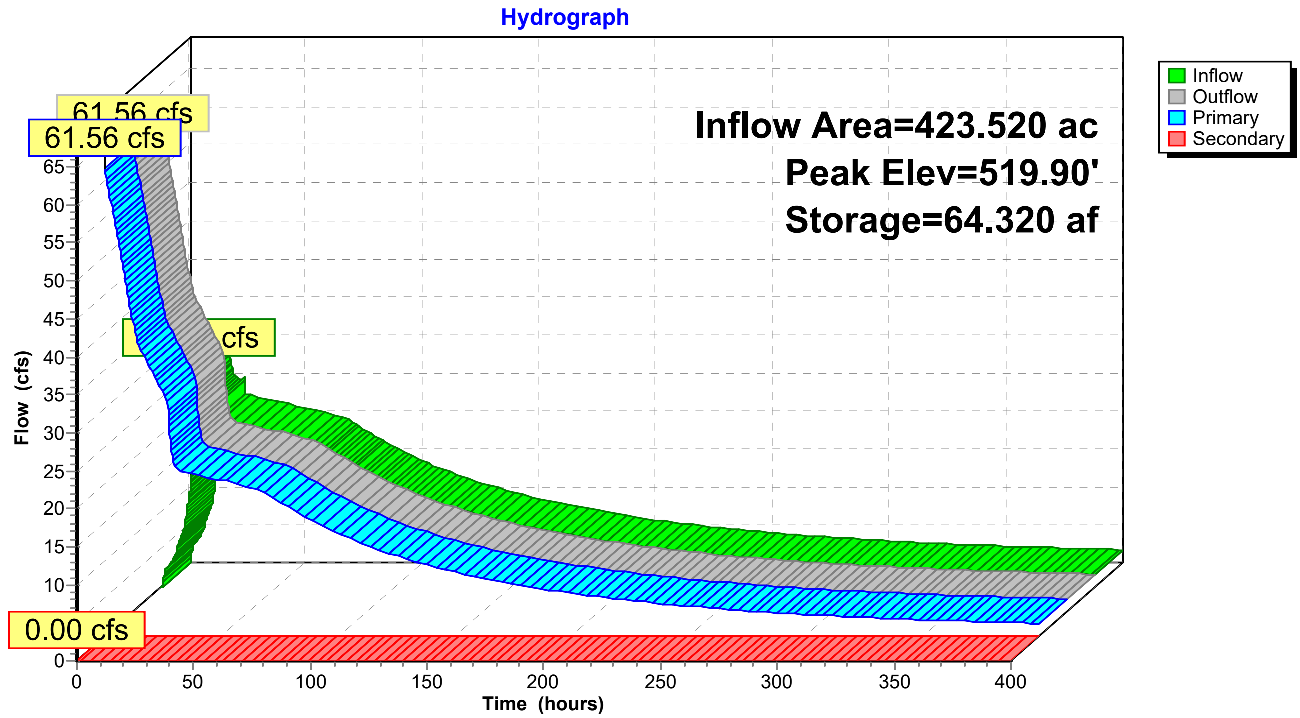
Elevation (feet)	Cum.Store (acre-feet)
505.00	0.000
510.00	3.000
515.00	31.000
520.00	65.000
525.00	105.000
530.00	149.000
531.00	158.000
532.00	168.000

Device	Routing	Invert	Outlet Devices
#1	Primary	505.00'	**28.0" Round Culvert** L= 226.0' Ke= 0.820 Inlet / Outlet Invert= 505.00' / 504.33' S= 0.0030 '/' Cc= 0.900 n= 0.013, Flow Area= 4.28 sf
#2	Secondary	528.50'	**5.0' long Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 Coef. (English) 2.65 2.65 2.65 2.65 2.65 2.65 2.65 2.65 2.65

Primary OutFlow Max=61.56 cfs @ 0.00 hrs HW=519.90' TW=504.33' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 61.56 cfs @ 14.40 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=519.90' TW=504.33' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: Secondary Settling Pond



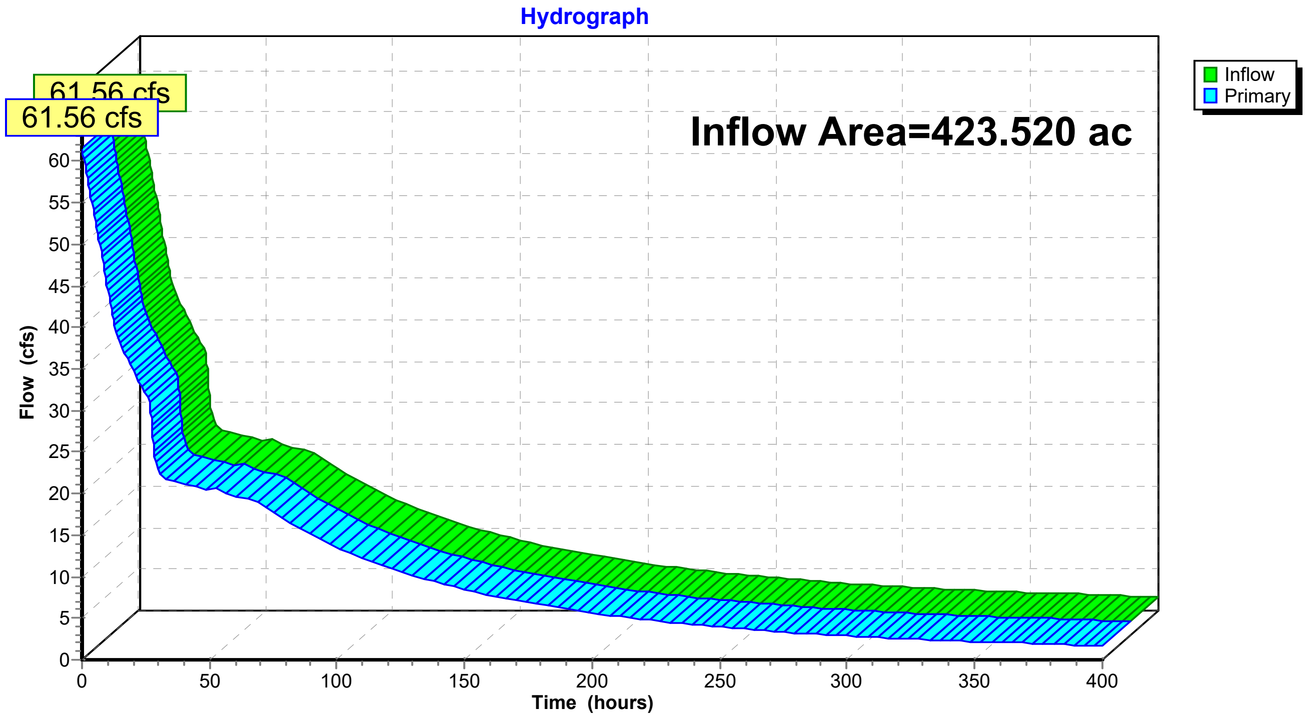
Summary for Link 1L: Lake Newton

Inflow Area = 423.520 ac,100.00% Impervious, Inflow Depth > 9.45" for 1000yr - 24hr Huff Q3 event
Inflow = 61.56 cfs @ 0.00 hrs, Volume= 333.516 af
Primary = 61.56 cfs @ 0.00 hrs, Volume= 333.516 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-400.05 hrs, dt= 0.15 hrs

Fixed water surface Elevation= 504.33'

Link 1L: Lake Newton



Summary for Link 1S: Ash Sluice

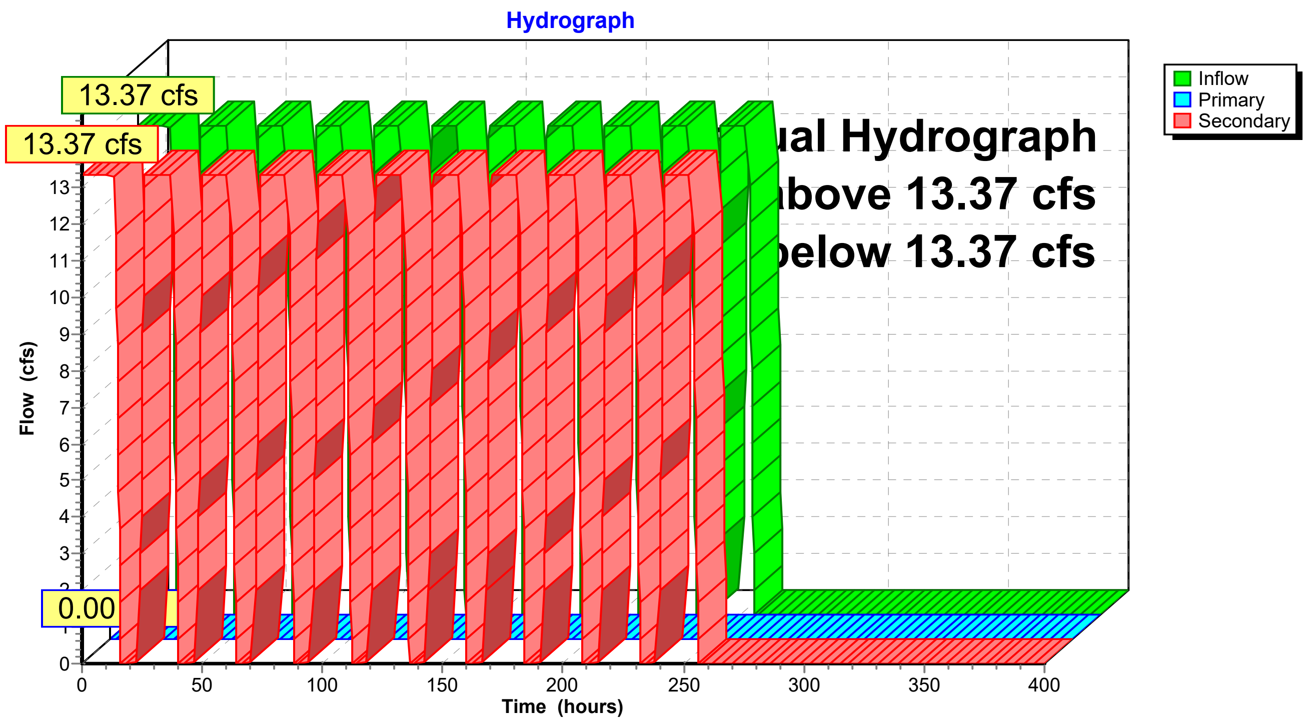
Inflow = 13.37 cfs @ 0.00 hrs, Volume= 171.338 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Secondary = 13.37 cfs @ 0.00 hrs, Volume= 171.338 af

Primary outflow = Inflow above 13.37 cfs below 13.37 cfs, Time Span= 0.00-400.05 hrs, dt= 0.15 hrs

132 Point manual hydrograph, To= 0.00 hrs, dt= 2.00 hrs, cfs =

13.37	13.37	13.37	13.37	13.37	13.37	13.37	13.37	0.00	0.00
0.00	0.00	0.00	13.37	13.37	13.37	13.37	13.37	13.37	13.37
0.00	0.00	0.00	0.00	0.00	13.37	13.37	13.37	13.37	13.37
13.37	13.37	0.00	0.00	0.00	0.00	0.00	13.37	13.37	13.37
13.37	13.37	13.37	13.37	0.00	0.00	0.00	0.00	0.00	13.37
13.37	13.37	13.37	13.37	13.37	13.37	0.00	0.00	0.00	0.00
0.00	13.37	13.37	13.37	13.37	13.37	13.37	13.37	0.00	0.00
0.00	0.00	0.00	13.37	13.37	13.37	13.37	13.37	13.37	13.37
0.00	0.00	0.00	0.00	0.00	13.37	13.37	13.37	13.37	13.37
13.37	13.37	0.00	0.00	0.00	0.00	0.00	13.37	13.37	13.37
13.37	13.37	13.37	13.37	0.00	0.00	0.00	0.00	0.00	13.37
13.37	13.37	13.37	13.37	13.37	13.37	0.00	0.00	0.00	0.00
0.00	13.37	13.37	13.37	13.37	13.37	13.37	13.37	0.00	0.00
0.00	0.00								

Link 1S: Ash Sluice



Summary for Link O: Other

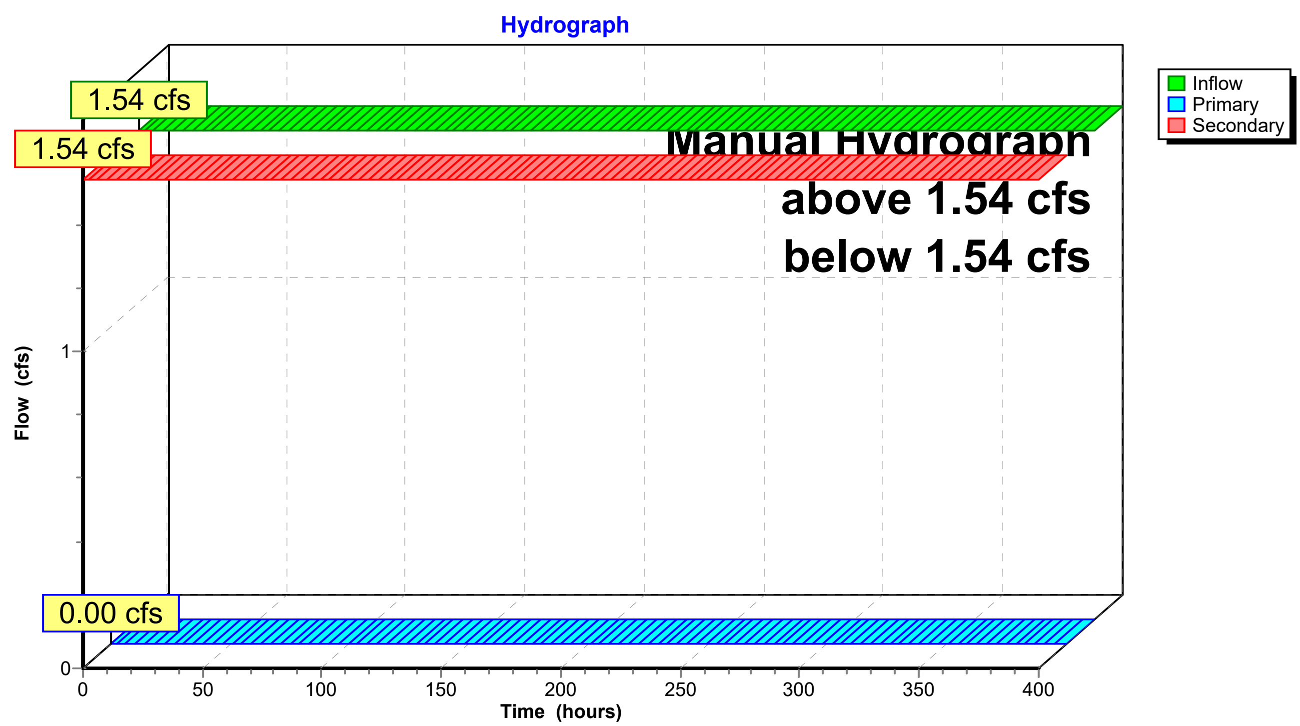
Inflow = 1.54 cfs @ 0.00 hrs, Volume= 50.935 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Secondary = 1.54 cfs @ 0.00 hrs, Volume= 50.935 af

Primary outflow = Inflow above 1.54 cfs below 1.54 cfs, Time Span= 0.00-400.05 hrs, dt= 0.15 hrs

126 Point manual hydrograph, To= 0.00 hrs, dt= 5.00 hrs, cfs =

1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54
1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54
1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54
1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54
1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54
1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54
1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54
1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54
1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54
1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54
1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54
1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54
1.54	1.54	1.54	1.54	1.54	1.54				

Link O: Other



Summary for Link WW: Wastewater

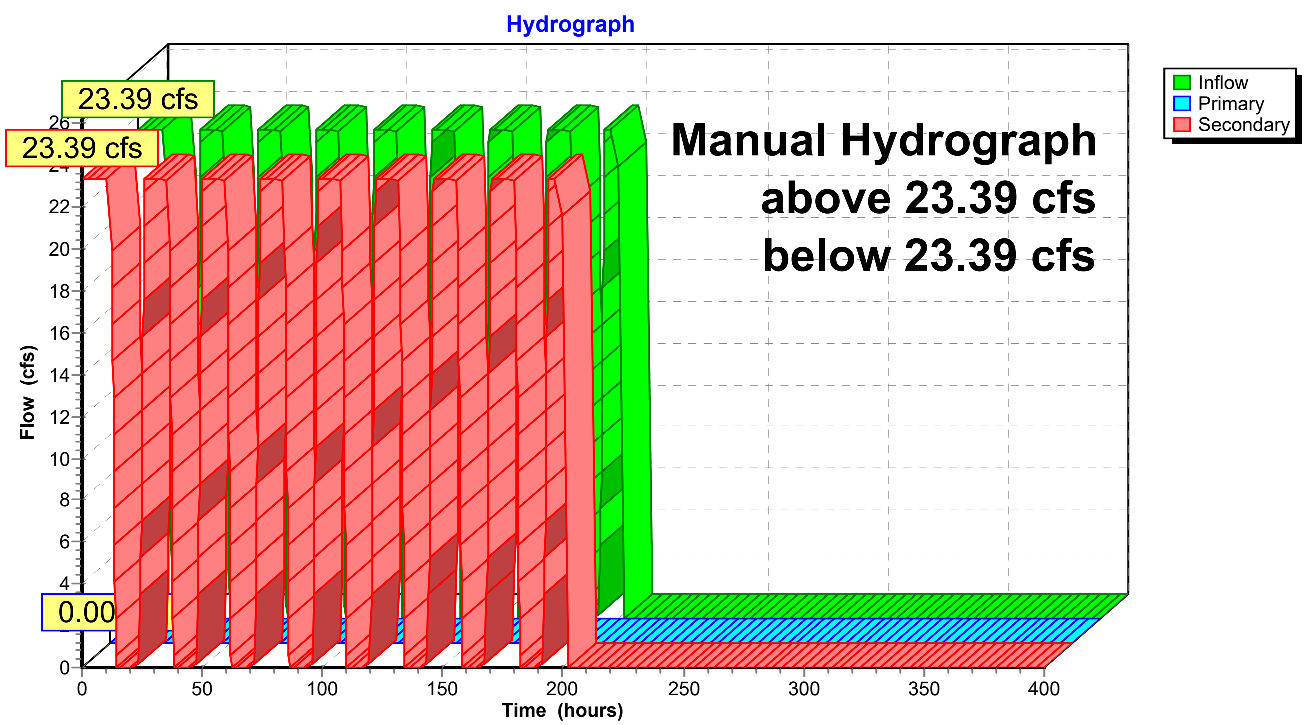
Inflow =	23.39 cfs @	0.00 hrs,	Volume=	201.231 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af,	Atten= 100%, Lag= 0.0 min
Secondary =	23.39 cfs @	0.00 hrs,	Volume=	201.231 af	

Primary outflow = Inflow above 23.39 cfs below 23.39 cfs, Time Span= 0.00-400.05 hrs, dt= 0.15 hrs

101 Point manual hydrograph, To= 0.00 hrs, dt= 2.00 hrs, cfs =

23.39	23.39	23.39	23.39	23.39	23.39	23.39	0.00	0.00	0.00
0.00	0.00	0.00	23.39	23.39	23.39	23.39	23.39	23.39	0.00
0.00	0.00	0.00	0.00	0.00	23.39	23.39	23.39	23.39	23.39
23.39	0.00	0.00	0.00	0.00	0.00	0.00	23.39	23.39	23.39
23.39	23.39	23.39	0.00	0.00	0.00	0.00	0.00	0.00	23.39
23.39	23.39	23.39	23.39	23.39	0.00	0.00	0.00	0.00	0.00
0.00	23.39	23.39	23.39	23.39	23.39	23.39	0.00	0.00	0.00
0.00	0.00	0.00	23.39	23.39	23.39	23.39	23.39	23.39	0.00
0.00	0.00	0.00	0.00	0.00	23.39	23.39	23.39	23.39	23.39
23.39	0.00	0.00	0.00	0.00	0.00	0.00	23.39	23.39	23.39
23.39									

Link WW: Wastewater



Attachment D

Types of CCR and Chemical Constituents

Newton Power Plant - Ash Pond's Chemical Constituents

In accordance with 35 I.A.C. 845.230(d)(2)(C), IPGC is submitting available/existing analyses of "the chemical constituents of all waste streams, chemical additives and sorbent materials entering or contained in" the CCR impoundment, Ash Pond.

A list of the chemical constituents' analyses contained in the 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. IPGC 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 Ash Pond

Pollutant	Units	Surface Free Liquids Average Concentration	Subsurface Free Liquids Average Concentration
Acidity (total)	mg/L	< 20.0	< 20.0
Alkalinity (total)	mg/L	98.3	327
Ammonia Nitrogen	mg/L	< 0.10	3.0
Antimony (dissolved)	mg/L	< 0.00031	0.00105
Antimony (total)	mg/L	< 0.00034	0.0079
Arsenic (dissolved)	mg/L	0.0021	0.0275
Arsenic (total)	mg/L	0.0023	0.0297
Barium (dissolved)	mg/L	0.246	0.191
Barium (total)	mg/L	0.27	0.62
Beryllium (dissolved)	mg/L	< 0.00050	< 0.001
Beryllium (total)	mg/L	< 0.00050	< 0.0011
Boron (dissolved)	mg/L	0.421	4.2
Boron (total)	mg/L	0.416	4.7
Cadmium (dissolved)	mg/L	< 0.00050	0.0007
Cadmium (total)	mg/L	< 0.00050	0.0008
Calcium (total recoverable)	mg/L	19.1	57.9
Chemical Oxygen Demand	mg/L	34.9	46.9
Chloride (total)	mg/L	10.9	19.2
Chromium (dissolved)	mg/L	0.0018	0.00070
Chromium (hexavalent)	mg/L	0.0016	0.0013
Chromium (total)	mg/L	0.002	0.007
Cobalt (dissolved)	mg/L	< 0.00011	0.001
Cobalt (total)	mg/L	< 0.00020	0.016
Copper (dissolved)	mg/L	0.0020	0.001
Copper (total)	mg/L	0.0026	0.0156
Cyanide (dissociable)	mg/L	< 0.010	0.4
Cyanide	mg/L	< 0.010	0.3
Fluoride	mg/L	0.65	0.44
Iron (dissolved)	mg/L	0.055	0.069
Iron (Ferric)	mg/L	0.08	2.89
Iron (Ferrous)	mg/L	< 0.12	< 0.4
Iron (total)	mg/L	0.142	3.1
Kjeldahl Nitrogen (total)	mg/L	1.1	4
Lead (dissolved)	mg/L	< 0.001	0.001
Lead (total)	mg/L	< 0.001	0.005
Lithium (total recoverable)	mg/L	< 0.010	0.028
Magnesium (total recoverable)	mg/L	5.46	2.8
Manganese (dissolved)	mg/L	0.0020	0.003
Manganese (total)	mg/L	0.0083	0.019
Mercury (dissolved)	mg/L	0.000044	0.0023
Mercury (total)	mg/L	0.000095	0.0033

Pollutant	Units	Surface Free Liquids Average Concentration	Subsurface Free Liquids Average Concentration
Molybdenum (dissolved)	mg/L	0.0145	0.267
Molybdenum (total)	mg/L	0.015	0.263
Nickel (dissolved) 200.8 WD	mg/L	< 0.00055	0.007
Nickel (dissolved) 6020 WD	mg/L	< 0.00057	0.007
Nickel (total)	mg/L	< 0.00077	0.0115
Nitrate as N	mg/L	< 0.10	0.09
Nitrite as N	mg/L	< 0.10	0.08
Oil & grease	mg/L	< 5.4	5.1
Oxidation/Reduction Potential	mg/L	-100	-276.7
pH*	SU	9.3	10.0
Phenols	mg/L	< 0.050	0.06
Phosphorus	mg/L	< 0.31	1.8
Potassium (dissolved)	mg/L	7.71	50.9
Potassium (total recoverable)	mg/L	7.7	52.8
Radium - 226	mg/L	0.99	0.63
Radium - 228	mg/L	0.87	1.03
Radium (total)	mg/L	1.87	1.66
Selenium (total)	mg/L	0.0042	0.038
Silica	mg/L	1.75	50.0
Silver (dissolved)	mg/L	< 0.00050	< 0.0009
Silver (total)	mg/L	< 0.00050	0.0009
Sodium (total recoverable)	mg/L	64.6	1365
Specific Conductance	mg/L	430.5	5827
Sulfate	mg/L	117	2554
Sulfide (total)	mg/L	0.051	1.5
Thallium (dissolved)	mg/L	< 0.001	< 0.002
Thallium (total)	mg/L	< 0.001	0.002
Total dissolved solids	mg/L	272	4700
Total Organic Carbon	mg/L	6.5	7.6
Total suspended solids	mg/L	37.9	92.6
Zinc (dissolved)	mg/L	< 0.010	0.013
Zinc (total)	mg/L	< 0.010	0.032

*Used https://calstormcompliance.com/ph-averaging-tool

Appendix B: List of Chemical Additives, Waste Streams and Sorbent Materials

Chemical Additives
Nalco PC-191 or equivalent (Anti-scalant)
Nalco PC-56 or equivalent (Biocide)
Ondeo-Nalco CA-250 or equivalent (Cationic Polymer)
General Chemical Hyper+Ion-1090 or equivalent (Aluminum Chlorohydrate)
Aluminum Chlorohydrate
Sodium Hydroxide (50%)
Sulfuric Acid (93%)
GE Betz Spectrus OX1200 or equivalent (Granular Bromine)
Anhydrous Ammonia
Dust suppression agents for coal
Hydrated Lime
Sodium Bicarbonate
Coal Dust Suppression Products*
Calcium Bromide for mercury control*

* Only a very small percentage of these chemicals would enter the ash pond. A high majority of the product would be consumed in the combustion process. Varying products may be used.

Waste Streams and Sorbent Materials*
Bottom & fly ash sluice water
Wastewater sumps
Water treatment filter backwash
Reverse osmosis reject water
Mixed bed waste water
Air heater wash water
Boiler blowdown
Sewage treatment plant #2 discharge
Coal pile runoff
Stormwater runoff
SCR module wastewater
Non-Chemical Metal Cleaning Wastewater

*No sorbent materials

DYNEGY

Safety Data Sheet

Section 1
Identification of the Substance and of the Supplier

1.1 Product Identifier

Product Name/Identification:	ASTM 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:****	

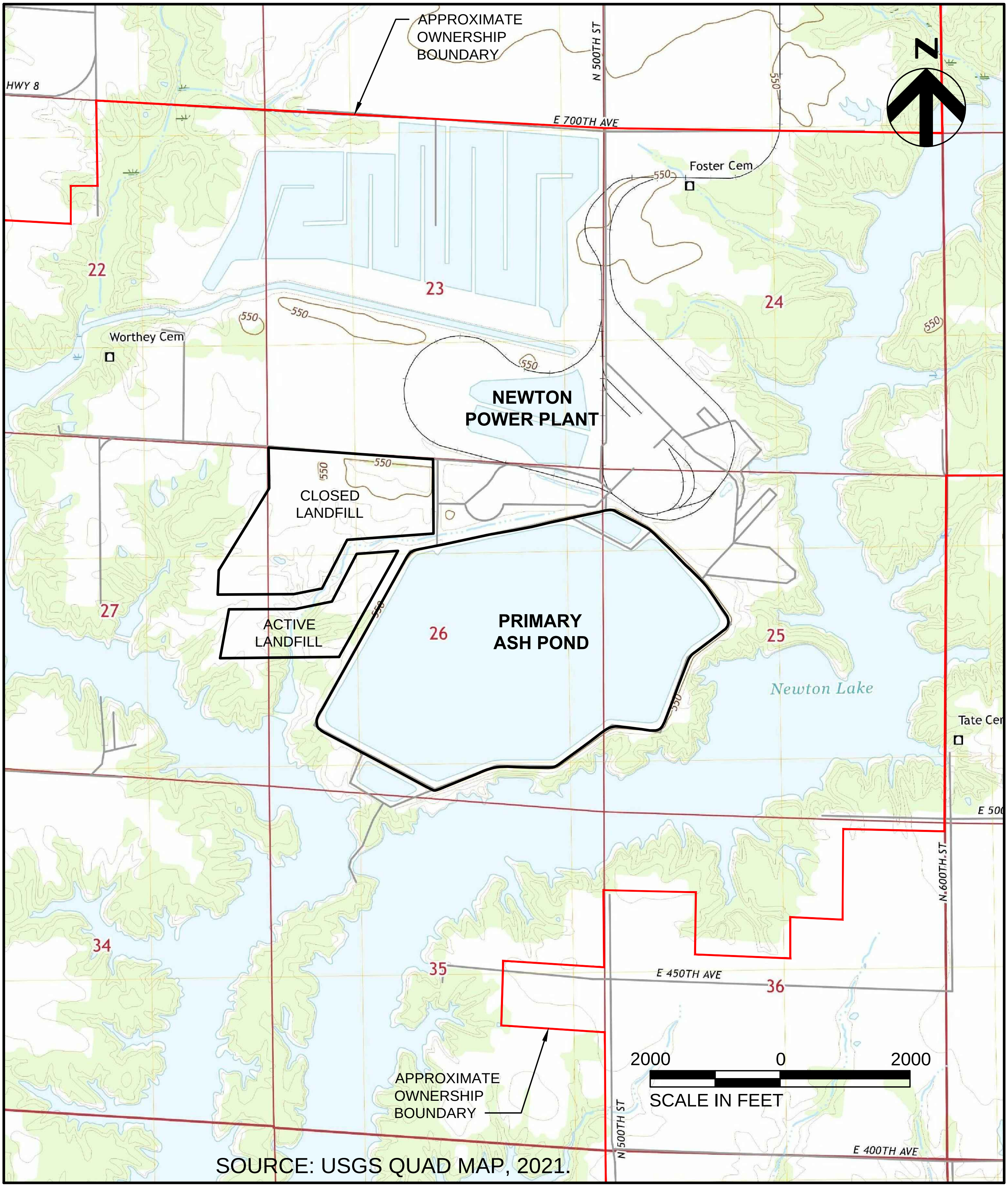
** Chronic Health Effects*
****** *Appropriate personal protection is defined by the activity to be performed.*
See Section 8 for additional information.

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.

Attachment E

Site Location Maps



HDR

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

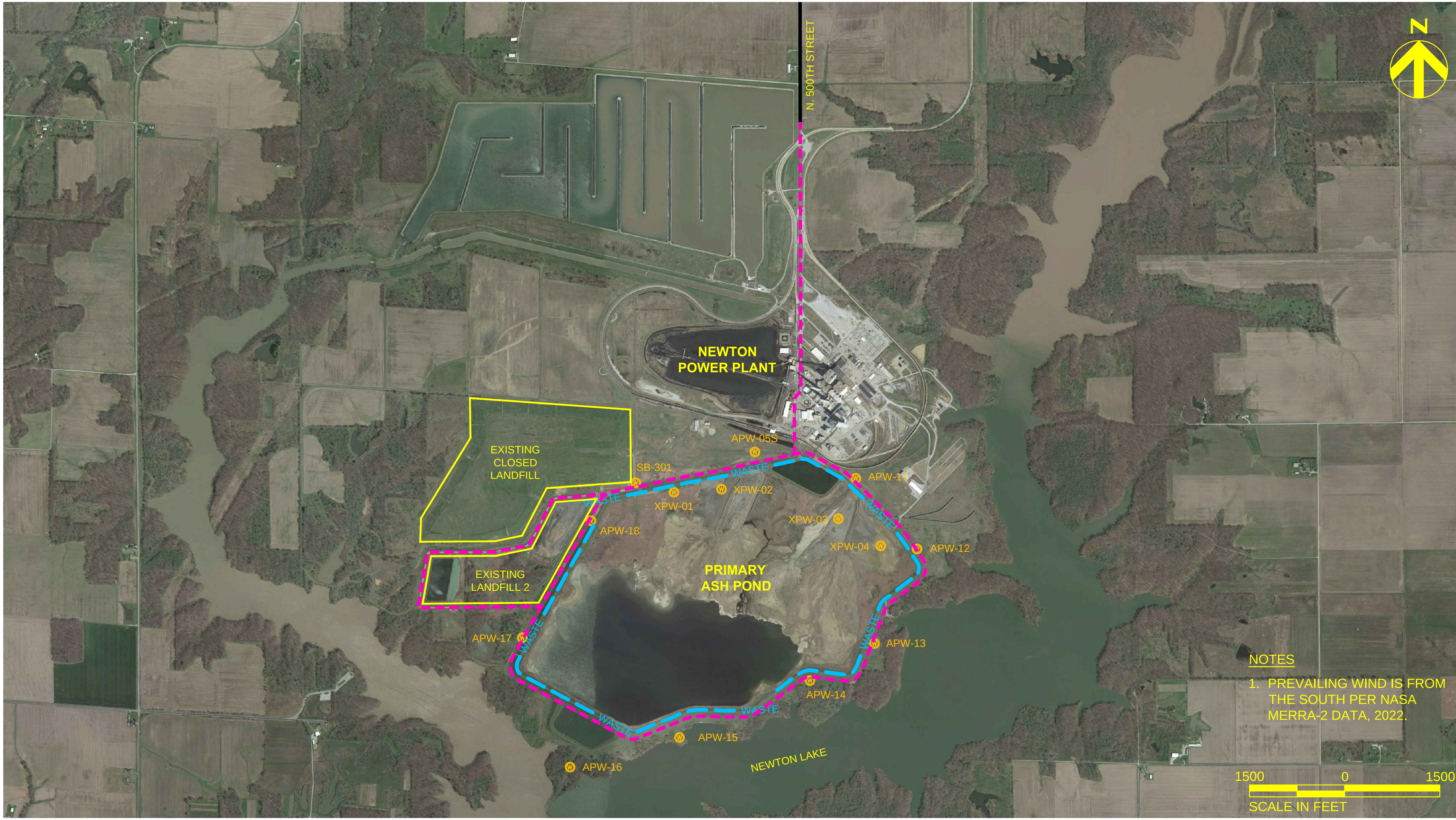
SITE LOCATION MAP

DATE
JULY 2022

FIGURE
3

Attachment F

Site Plan Map and On-Site Transportation Plan



LEGEND

WASTE (blue dashed line)	CCR UNIT LIMITS
(magenta dashed line)	ON-SITE TRAFFIC ROUTES FOR CLOSURE
(black line)	PUBLIC ROADWAY TO ACCESS SITE
(yellow line)	EXISTING LANDFILL LIMITS
(W symbol)	EXISTING GROUNDWATER WELL

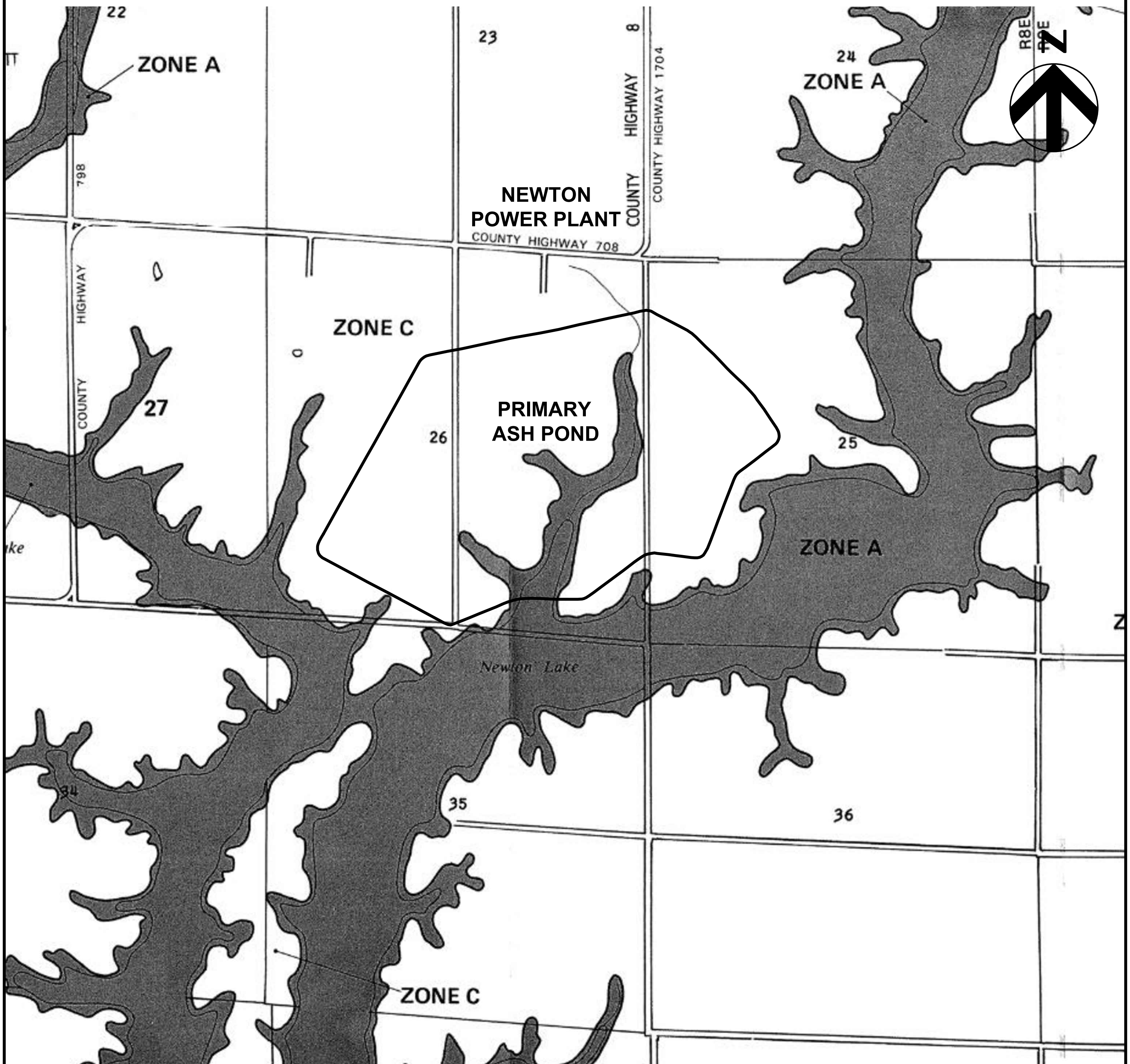
HDR

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

SITE MAP AND TRANSPORTATION PLAN

DATE
JULY 2022

FIGURE
1



NOTES

1. SOURCE IMAGERY FROM FIRM PANEL 170990 025 B DATED JANUARY 17, 1985 DOES NOT INCORPORATE POND CONSTRUCTION TOPOGRAPHY FROM 1977.

2000 0 2000

SCALE IN FEET

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

FLOODPLAIN MAP

DATE: JULY 2022

FIGURE: 2

Attachment G

Final Closure Plan and Proposed Closure Schedule

Illinois Power Generating Company

Primary Ash Pond
FINAL CLOSURE PLAN

July 2022

Table of Contents

TABLES

ATTACHMENTS

1. INTRODUCTION

Illinois Power Generating Company (IPGC) is the owner of the coal-fired Newton Power Plant (NPP), also referred to as Newton Power Station (NPS), in Jasper County, Illinois.

This facility has a CCR unit called the Primary Ash Pond (PAP). This Closure Plan is for the PAP only. The PAP has an Illinois Environmental Protection Agency (IEPA) identification number of W0798070001-01. As part of the proposed closure, a new photovoltaic (PV) solar power facility will be installed on top of the closed ash pond area with an installed power of approximately 106.4 megawatts DC (MWdc) and a rated power of approximately 81.9 megawatts AC (MWac). Interconnection of the solar facility will occur at the NPP substation.

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.

Based on the Closure Alternatives Analysis, a hybrid 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). An alternatives analysis, provided in **Attachment A**, was prepared 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 PAP. All CCR in the southern portion of the impoundment will be removed and relocated to the northern portion of the impoundment which will be closed via CIP in accordance with Section 845.750. CCR from approximately 38% of the current footprint of the impoundment will be removed and consolidated to the north.

1.2. Organization of Final Closure Plan

This Final Closure Plan is organized in the following manner:

- **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;
- **Section 5** includes additional information regarding the closure;
- **Section 6** includes a Certification from a Qualified Professional Engineer; and
- **Section 7** includes referenced 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 PAP, 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 Description of Closure

Section 845.720(a)(1)(A): A narrative description of how the CCR surface impoundment will be closed in accordance with this Part.

The PAP will be closed in place and covered with a final cover compliant with 40 C.F.R. § 257.102(d)(3) and Section 845.720(a)(1)(C). The PAP is an unlined CCR surface impoundment. Therefore, closing the PAP with a final cover system will result in a cap with lower permeability than the bottom of the pond.

Closure of the PAP with a final cover system will include the following tasks:

- Preparing the site for closure by establishing perimeter stormwater Best Management Practices (BMPs), as needed, at the construction limits of disturbance.

- Removing free liquids by solidifying waste, as needed, and removing liquid waste by removing liquids and pumping them to the adjacent Settling Pond for ultimate discharge at National Pollutant Discharge Elimination System (NPDES) Outfall 001.

- Removing existing outflow structures and culverts connecting the PAP to the adjacent Settling Pond.
    - Existing piping will be cut and capped below grade and the area backfilled and graded.
    - Aboveground pipes will be removed.

- Abandoning existing geotechnical piezometers that will not be utilized as post-closure instrumentation. Abandonment will be performed in accordance with Illinois monitoring well regulations.

- Establishing a temporary dewatering and water management system within the PAP consisting of ditches and sumps to support passive (i.e., gravity) dewatering of CCR for stabilization and to collect contact stormwater during closure and maintain the PAP in an unwatered state. Contact stormwater, during construction, will be pumped to the Settling Pond for discharge at NDPES Outfall 001.

- Consolidating the PAP by excavating all CCR from the south and west side of the PAP and using it as fill within the north and east side of the PAP to establish minimum slopes as practical. Based on topography, it is estimated limited waste is located to the south that can be moved to the north side of the site. CCR will be placed in lifts and compacted to provide a subgrade suitable for construction of a final cover system.

- A new soil dike will be constructed along the southern boundary of the CIP portion of the PAP in accordance with Illinois Department of Natural Resources Part 3702 Rules. To alleviate stability concerns for the new dike construction, any saturated soils underlying the proposed location of the new dike will be overexcavated and replaced with compacted, low permeability soils.

- Dewatering will be performed as needed to support construction activity and fill placement, using the water management system. Free liquids will be eliminated by removing liquid wastes.

    - Approximately 1,917,000-cy (2,600,000-tons) of CCR will be consolidated from within the PAP. Material from Area 3 of the Newton Landfill 2, and coal pile material may also be moved from those areas and utilized as subgrade fill in the Ash Pond closure area.
    - Landfill 2 will be closed in place under its existing Permit No. 1997-233-LF.

- Removing the berm between the PAP and adjacent Settling Pond by lowering the grades to be consistent with the closure by removal grades. The Settling Pond will be removed, and the borrow area in the south side of the PAP will be used as a post-closure, non-CCR, stormwater management pond.

- As needed, clean fill material will be placed and graded within the southern portion of the PAP to promote positive stormwater drainage away from the CIP footprint and towards Newton Lake.

- Constructing a final cover system extending over the consolidated footprint of the PAP that contains CCR, and includes, from bottom to top:

    - A 40-mil linear low-density polyethylene (LLDPE) textured geomembrane, placed on a prepared subgrade with rocks no larger than one inch in diameter and other sharp objects removed prior to placement;

    - A geocomposite drainage layer, to convey stormwater that has percolated through the final cover soils to the perimeter stormwater drainage system;

        - Alternatively, the site may use a 50-mil LLDPE geomembrane material called “Microdrain” or “Supergrip” instead of a typical textured 40-mil

LLDPE, that has built in drainage studs on the top side, allowing for use of an 8-oz. geotextile instead of the geocomposite listed above.

- Based on a demonstration to be submitted to IEPA for approval pursuant to Section 845.750(c)(2), the proposed final cover system will be installed including an alternative 1.5 ft thick protective layer (e.g., cover soil) to protect the geomembrane and 0.5 ft of topsoil capable of supporting vegetation, for a total cover soil thickness of 2 ft, equivalent to the minimum regulatory requirement.

- The final cover system grades will be approximately 2% over the majority of the PAP, although 25% (4 horizontal to 1 vertical [4H:1V]) grades will be used in limited areas, where needed to tie the final cover system into existing grades.

- The final cover system will include an anchor trench for the geosynthetic materials along the entire perimeter of the consolidated material to secure the final cover system into existing grades. The anchor trench will be placed beyond the proposed limits of the waste to provide a continuous containment system and encapsulation for the retained CCR.

- Existing groundwater monitoring wells in the closure area 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 completion on top of the final cover.

- Constructing a post-closure non-contact stormwater management system consisting of:
  - Stormwater channels leading from northeast to southwest to convey stormwater into the new stormwater pond; and
  - Drainage pipes, channels and downchutes where channels flow from the PAP final cover and lead into the stormwater pond, to reduce erosion.

- Establishing vegetation on the final cover system by:
  - Fertilizing the topsoil, as needed to support vegetation, based on agronomical soil tests;
  - Seeding the topsoil with a suitable grass seed for local climatic and soil conditions;
  - Providing temporary BMP measures such as mulch, erosion control blankets, silt fences, and/or straw wattles, as necessary to reduce the potential for soil erosion until vegetation is established; and
  - Restoring the site, after vegetation is established and the site is stabilized, by removing stormwater BMPs and temporary stabilization measures that are no longer needed.

Permit-level 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 PAP will be closed-in-place and will not be closed by removal of CCR. However, the southwest portion of the pond is proposed to be consolidated to the northeast as part of this closure event (i.e. partial closure by removal or 'hybrid' closure). This portion will be completed in accordance with Section 845.740 as applicable to a 'partial CBR'.

In this southern area, all CCR will be removed. The subsoils will be visually observed for signs of CCR. If subsoils with CCR or staining are observed, they will be removed and consolidated to the north. It is anticipated that up to 1-ft of subsoils may be removed beyond pre-pond grades; however, visual inspection will be conducted to confirm all CCR is removed from the southern portion of the PAP.

Section 845.740(b) does not apply to this project, as groundwater monitoring will continue per the groundwater monitoring plan for the site, which is primarily closed in place with a final cover system. Decontamination of areas outside the south consolidation area of the PAP will not be required because there have been no releases of CCR from the PAP and there is no containment system within the PAP.

Section 845.740(c)(1) does not apply to this project, as material is not being transported off site.

Onsite dust controls, a public notice at the property entrance, and temporary control measures to prevent contamination of surface water, groundwater, soil and sediments shall be used throughout construction per Section 845.740. General housekeeping procedures shall be implemented to minimize the amount of time the CCR is exposed to precipitation and wind, and stormwater shall be managed under an NPDES permit and SWPPP.

A modification application to revise the current site NPDES permit will be submitted to include the new flows from unwatering and dewatering. This will be submitted prior to the Closure Construction Permit Application submittal. An NOI will be submitted as needed for coverage under the general NDPES permit for construction activities prior to commencing closure activities.

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 PAP is approximately 5,000,000 cubic yards. This inventory will increase by approximately 700,000 CY to approximately 5,700,000 CY through the closure process and consolidation of currently in place CCR and soils on the south portion of the pond and utilizing it in the PAP as compacted subgrade fill.

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 PAP, in plan view, is approximately 404 acres, as shown in the attached drawings. Final cover will be placed over an area of approximately 260.6 acres to extend completely across the surface area of the consolidated PAP waste and beyond the limits of CCR in plan view.

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**. Key sequential phases and sub-tasks that will be completed as part of the closure will include:

- Agency Coordinating, Approvals, and Permitting
    - Approval of the closure Construction Permit Application by IEPA.

- Obtaining a modification to the existing NPDES permit to allow the disposal of water generated from unwatering and dewatering operations to Newton Lake via the existing NPDES-permitted Outfall 001 for the Site;
- Obtaining a construction permit from the Illinois Department of Natural Resources (IDNR), Office of Water Resources (OWR), Dam Safety Program (DSP) to allow the embankment and spillways of the PAP to be modified as part of closure;
- A coverage under the general NPDES permit for construction activities 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).

- Final Design and Bidding
    - Completion of final design documents, including drawings and specifications.
    - Bidding and selection of a closure construction contractor.
- Dewater and Stabilize CCR, Install Final Cover System
    - Closure contractor mobilization and material procurement.
    - Installing stormwater BMPs around the construction area, per the Land Disturbance Permit.
    - Unwatering the PAP by pumping impounded water to the Polishing Pond.
    - Abandoning existing outfall structures and culverts.
    - Stabilizing the subgrade through dewatering and the placement of compacted CCR fill.
    - Constructing design final cover subgrades, including stormwater channel subgrades and modifications to the PAP perimeter berm.
    - Installing the final cover system geosynthetics and anchor trench.
    - Placing cover soil and topsoil over the geosynthetics.
- Site Restoration
    - Constructing riprap-lined letdown structures.

- Seeding and stabilizing the surface of the final cover system and other disturbed areas and allowing the vegetation to become established.
- Removing temporary stormwater BMPs and other temporary stabilization measures, after vegetation is established.
- Closure contractor demobilization from the site.

The closure construction project is expected to be completed by October 2028. Full vegetation will be established as soon as practical in the fall of 2028, with reseeding occurring as needed the following spring for establishment of a full stand of grass.

Table 1 – Closure Completion Milestone Schedule

Milestone	Timeframe (Preliminary Estimates)
Final Closure Plan Submittal	July 2022
Agency Coordination, Approvals, and Permitting • Obtain state permits, as needed, for dewatering, water discharge, land disturbance, and dam modifications.	16 to 24 months after Final Closure Plan Approval July 2022 to July 2024
Final Design and Bid Process • Complete final design of the closure and select a construction contractor.	6 to 12 months during Agency Coordination, Approvals, and Permitting July 2023 to July 2024
Dewater and Stabilize CCR, Install Final Cover System • Complete contractor mobilization, installation of stormwater BMPs, and unwatering of the PAP • Abandon outfall structures, stabilize the PAP, and complete grading and consolidation. • Install the final cover system and stormwater downchutes.	36 to 48 months after necessary permits are issued 12 months after final power plant shut down scheduled for September 17, 2027 July 2024 to July 2028
Site Restoration • Seed and stabilize the PAP. • Complete contractor demobilization.	2 to 3 months after the final cover system is complete May 2028 to September 2028
Timeframe to Complete Closure	Prior to October 17, 2028

Section 845.720(a)(1)(F) (Continued): 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).

The time required to complete closure construction is not currently expected to exceed the timeframe specified in Section 845.760(a). Therefore, closure extensions for the PAP are not being sought at this time.

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 PAP surface impoundment, including principal design and construction features, material specifications, and a discussion of how each feature is in accordance with the requirements of Section 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 Illinois EPA in the Part 845 rulemaking.

4.1. Minimization of Post-Closure Infiltration and Releases

Section 845.750(a)(1): 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: 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.

The closure design will result in a reduction of infiltration into the PAP by 94% compared to pre-closure conditions as shown in the Groundwater Modelling Report (Ramboll, 2022). The Groundwater Modelling Report shows that the closure design will result in a reduction of hydraulic flux out of the PAP by 94% compared to pre-closure conditions (Figure 6-5). Due to the reduction in the hydraulic flux out of the PAP, the mass flux out of the PAP will also be controlled or minimized as much as feasible as a result of closure design. This is achieved through the installation of a final cover system with the following design features and specifications:

- An LLDPE geomembrane low-permeability layer will placed on the prepared subgrade to control and minimize vertical infiltration 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 geocomposite drainage/cushion layer and a total of two feet of cover soil and topsoil over the top of the geomembrane. Alternatively, the geocomposite may be replaced with a geotextile filtration layer if used in conjunction with a microdrain style geomembrane for stormwater infiltration drainage.

- Surface stormwater will be routed from the top of the final cover by the construction of a free-draining post-closure stormwater management system including channels and letdown structures. The stormwater management system and sloped grade of the material will drain by gravity and preclude water impoundment on top of the final cover system, thereby minimizing post-closure infiltration into the CCR.

Releases of CCR leachate and/or contaminated run-off into the groundwater, surface waters, and/or atmosphere will be minimized, to the maximum extent feasible, as:

- The PAP is located on a relatively thick layer of clay estimated to be a low permeability material.
    - The final cover system will tie into the surrounding grades, by constructing a final cover anchor trench at or beyond the horizontal limits of the CCR material.
    - This barrier will result in the CCR being physically isolated from the surrounding environment including stormwater, surface water, and atmosphere and therefore minimizing the releases of CCR, leachate, or contaminated run-off into the ground, surface waters, and atmosphere.
- CCR leachate (e.g., pore water within the CCR) volumes will be minimized via the installation of the final cover system including a low-permeability geomembrane layer. The final cover system will minimize infiltration and therefore the amount of leachate within the CCR.
    - The PAP does not have a base liner or leachate collection system, however, its general location over the site's in-situ clays has shown through its groundwater monitoring system that leachate has not historically been migrating from the site.
    - Efforts for removal of liquid waste to eliminate free liquids during construction are anticipated to remove pore water from within the CCR, followed by capping which will prevent 'recharge' of pore water from stormwater.

4.2. Preclusion of Future Impoundment

Section 845.750(a)(2): Preclude the probability of future impoundment of water, sediment, or slurry.

A final cover system will be installed on top of the PAP. All areas of the final cover system will be sloped to positively drain to the exterior of the PAP and preclude future impoundment of water, sediment, or slurry. This will include installing top deck slopes at approximately 2% grades, sideslopes at up to 25% (e.g., 4 horizontal to 1 vertical [4H:1V]) grades at the tie-in between the final cover system and existing grades, and stormwater channel grades at about 0.5% slopes. Stormwater channels will flow by gravity into the adjacent new stormwater pond via riprap-lined downchutes. Hydrologic and hydraulic calculations used to design the stormwater channels and other control features to preclude impoundment are provided in **Attachment C**.

4.3. Provisions for Preventing Instability, Sloughing and Movement

Section 845.750(a)(3): 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 berms of the PAP are constructed out of compacted fill materials and have been in place for over 40-years. The southwest berm of the PAP will be removed during closure for use as final cover soils and subgrade fill as needed. The northeast berm of the PAP will also be mostly removed, and the final cover system will terminate into the remainder of the berm. The effects of these modifications have been evaluated by performing global slope stability analyses considering post- closure conditions. The resulting factors of safety exceed typical regulatory minimum values for static and seismic loading conditions. Slope stability analyses are provided in **Attachment D**.

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% (4H:1V) at the edges of the final cover, as necessary to tie into existing grades. The potential for sloughing and movement of the final cover system 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 D**.

4.4. Minimize the Need for Further Maintenance

Section 845.750(a)(4): Minimize the need for further maintenance of the CCR surface impoundment.

Future maintenance needs will be minimized using the following design features:

- The final cover system will be installed at gentle 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.
  - These relatively flat slopes will minimize erosion of the final cover soils and thereby minimize maintenance needs by reducing stormwater flow velocities relative to steeper slopes.
  - The relatively flat slopes will also promote 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 channels, will be stabilized by placing topsoil, fertilizing the topsoil, establishing vegetation using suitable grass species.
    - The vegetation will minimize erosion of the final cover system by stabilizing the topsoil.
    - The use of fertilizer and selection of a suitable grass species will minimize maintenance required to repair areas of poor vegetation establishment.
- Stormwater channels will be stabilized with erosion control blankets and straw wattles. Erosion control blankets and riprap will be placed as needed to minimize post-closure erosion and associated maintenance for stormwater channels.
    - Calculations used to design the stormwater channel stabilization and riprap armoring were based on the 100-year, 24-hour, and 25-year, 24-hour storms. These calculations are provided in **Attachment C**.

4.5. Be Completed in Shortest Amount of Time

Section 845.750(a)(5): 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, with a consideration of other permits from multiple 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)(1): Free liquids must be eliminated by removing liquid wastes or solidifying the remaining wastes and waste residues.

Section 845.750(b)(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 PAP. Engineering measures necessary to remove liquid waste that is readily separable under ambient temperature and pressure are being evaluated.

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> 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 construction technique or material provides equivalent or superior performance to the requirements of this subsection (c) 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.

A 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. HDR completed a Hydrologic Evaluation of Landfill Performance (HELP) [1] model to compare flux through the geosynthetic cover to the regulatory minimum equivalent cover system of a 3-ft layer of soil with hydraulic conductivity of 1 x 10-7 cm/sec in order to demonstrate that the geomembrane cover system is anticipated to be superior to a soil only cover. The HELP modeling estimated a total infiltration of 0.58-inches of waterper year (in/yr) for the geomembrane cover system, compared to 1.35-in/yr for the soil cover. Therefore, the geomembrane final cover system is calculated to be superior to clay in terms of hydraulic flux, as infiltration is reduced by a factor of 2.32.

Alternatively, a 50-mil LLDPE Microdrain geomembrane material may be selected for this project. This material would be expected to meet or exceed the above discussed infiltration reduction factor of 2.32.

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. Final Protective Layer

<u>Section 845.750(c)(2):</u> *The final protective layer must meet the following requirements*

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 to be submitted to IEPA for approval pursuant to Section 845.750(c)(2), the protective layer will include, from bottom to top, a nonwoven geotextile or geocomposite based on the geomembrane manufacturer selection, 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 (or geocomposite) and 1.5-ft thick cover soil layer will protect the geomembrane from root penetration. Geomembranes are not susceptible to freeze damage. The cushion layer 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.

4.8. Certification

<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.

Printed Name: Mark Roberts, P.E.

7/28/2022

Signature *Date*

Registration Number: 062062011
Expiration Date: 11.30.2023

Seal applies to Closure Plan and appendices prepared by HDR. This report relies upon data, analyses, and reports prepared by others.

LICENSED PROFESSIONAL ENGINEER
MARK GLYN ROBERTS
062.062011
STATE OF ILLINOIS

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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.

Approximately 700,000 cubic yards of material are located within the pond, in the current landfill open cell, and coal pile that is anticipated to be moved and consolidated to the closure area. This material shall be used to reach slopes needed. Final grades may vary slightly based on field conditions in the pond, however minimum slopes shall be maintained. This waste material was generated onsite.

All CCR will be excavated from the south portion of the PAP and transported to the north portion of the PAP to be beneficially used as compacted subgrade fill below the final cover system. The CCR will be placed on top of the existing subgrade (i.e., existing elevation of CCR in the surface impoundment) after dewatering of the PAP and used as a free-draining subgrade stabilization layer. CCR placement will only occur completely beneath the limits of the PAP final cover system. This is in accordance with the Section 845.750(d) criteria.

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 and 0.5% stormwater flowline slopes within the limits of final cover, which are generally less than 5%.

However, short lengths of 25% final cover slopes will be used in limited areas 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**. Twenty five percent slopes will be utilized to allow most of the final cover, in area, to ultimately drain towards the southeast, and route stormwater into the new stormwater pond.

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 D**. Resulting factors of safety exceed typical minimum factors of safety for both global and veneer stability.

4.11. Proposed PV Solar Power Facility

As part of the closure effort, a new photovoltaic (PV) solar power facility will be installed on top of the closed PAP with an installed power of approximately 106.4 megawatts DC (MWdc) and a rated power of approximately 81.9 megawatts AC (MWac). Interconnection of the solar facility will occur at the existing NPP substation.

The solar facility layout is proposed to include a 2V fixed tilt ballasted system using FirstSolar Series 6 CuRe PV modules rated at 480 W and 25 Sungrow 3600 kVA inverters. The layout includes PV modules, inverters and MV transformers, access roads, and entrances. Alternate PV module and inverter models may be installed, as approved by the Engineer, to incorporate the most efficient technology available at the time of installation. The layout includes various access roads to be installed within the site. Transmission line easements intersecting the PAP will be clear of the pond surface and the panels. The facility layout is shown on the Drawings included in Appendix B.

The PV racking system and electrical equipment will be placed on concrete foundations placed directly on the protective soil layer. A thin layer of select aggregate may be placed beneath some of the concrete foundations for leveling purposes. The racks and equipment will be placed to avoid interference with existing monitoring devices or the storm water management system. Final layout of the panel rows and access road may vary with Engineer approval to accommodate stormwater features.

The ballast blocks will be designed to minimize the additional load on the protective soil layer so it will not adversely impact the final cover system. All electric components will be installed above grade or within the protective soil layer; the geomembrane will not be penetrated. If changes are proposed to the closure design, a revised closure plan will be submitted to the Illinois EPA for approval.

5. ADDITIONAL INFORMATION

Both the lateral migration of groundwater and vertical infiltration of liquids, and releases of CCR, leachate, and contaminated run-off into and out of the PAP will be controlled, minimized or eliminated, to the maximum extent feasible, under post-closure conditions.

- The PAP is unlined with underlying soils that are generally clays, as discussed in **Section 2.1**.

- Closure of the PAP will include constructing a final cover system that ties into the perimeter of the waste boundary, as discussed in **Section 4.**

- CCR within the PAP is separated from the uppermost aquifer by an estimated minimum of 14-ft of low permeability glacial tills [Ramboll, 2022].

- Groundwater levels beneath the PAP have been monitored using about 14 piezometers since 2015. During a review of data collected between 2015, and 2021 (a period of over five years), the normal groundwater elevation was typically El. 530 ft or lower, while Lake Newton surface water elevations were approximately El. 504.

- The lowest elevation of CCR within the PAP after closure will be approximately El. 485 ft, as shown in Sheet C-302 in **Attachment B**.

HDR

6. CERTIFICATION FROM A QUALIFIED PROFESSIONAL ENGINEER

Section 845.720(b)(S): 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, Mark Roberts, 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.

Printed Name: Mark Roberts, P.E.

7/28/2022

Signature Date

Registration Number: 062062011
Expiration Date: 11.30.2023

Seal applies to Closure Plan and appendices prepared by HDR. This report relies upon data, analyses, and reports prepared by others.

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7. REFERENCES

[1] United States Environmental Protection Agency, "Walkthrough to Install and Operate the Hydrologic Evaluation of Landfill Performance (HELP) Model, Version 3.07," 2017.

[2] Ramboll, "Groundwater Modeling Report, Primary Ash Pond, Newton Power Plant, Newton, Illinois," July 2022.

Attachment A

Closure Alternatives Analysis

Closure Alternatives Analysis for the Primary Ash Pond at the Newton Power Plant Newton, Illinois

July 28, 2022

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Abbreviations

AACE	Association for the Advancement of Cost Engineering
BMP	Best Management Practice
BCU	Bedrock Confining Unit
CAA	Closure Alternatives Analysis
CBR-Onsite	Closure-by-Removal with On-Site CCR Disposal
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
EJ	Environmental Justice
GHG	Greenhouse Gas
GWPS	Groundwater Protection Standards
HUC	Hydrologic Unit Code
IAC	Illinois Administrative Code
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
IPGC	Illinois Power Generating Company
LCU	Lower Confining Unit
LLDPE	Linear Low-Density Polyethylene
N_2O	Nitrous Oxide
NID	National Inventory of Dams
NO_x	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
PAP	Primary Ash Pond
PM	Particulate Matter
PMP	Potential Migration Pathway
SFWA	State Fish and Wildlife Area
TMDL	Tr3TTotal Maximum Daily Load
TVA	Tennessee Valley Authority
UA	Uppermost Aquifer
UCU	Upper Confining Unit
UD	Upper Drift
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 Primary Ash Pond (PAP) located on Illinois Power Generating Company's (IPGC) Newton Power Plant property near the City of Newton, 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 three specific closure scenarios for the PAP: Closure-in-Place (CIP) with excavation and consolidation, Closure-by-Removal with On-Site CCR Disposal (CBR-Onsite), and Closure-by-Removal with Off-Site CCR Disposal (CBR-Offsite). The CIP scenario would entail excavating CCR from the southern and western portions of the PAP and consolidating it into the northern and eastern portions, followed by capping with a new cover system consisting of a 40-mil linear low-density polyethylene (LLDPE) geomembrane layer, a geocomposite drainage layer, and 24 inches of low-permeability soil with a vegetated surface.[1] The CBR-Onsite scenario would entail excavating the CCR from the PAP and transporting it to an on-Site landfill for disposal. The CBR-Offsite scenario would entail excavating the CCR from the PAP and transporting it to an off-Site landfill for disposal. Even though capping the entire PAP (without any excavation or consolidation) would be an acceptable closure approach based on IAC Section 845.710 (IEPA, 2021a), it was not evaluated in this CAA. IPGC will also continue to evaluate potential opportunities for beneficial re-use of CCR excavated from the PAP 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 an existing, permitted CCR landfill (Newton CCR Landfill Phase II) located immediately west of the PAP at the Newton Power Plant Site. However, this landfill is not actively being used to store waste and does not have sufficient capacity to contain all of the CCR that would be excavated from the PAP under the CBR-Onsite scenario. Additional landfill capacity would be required for the CBR-Onsite scenario and could be accomplished by reconstructing the current landfill cell, constructing additional sections of the landfill that have already been permitted, and either constructing an additional permitted expansion of the landfill or constructing a separate, additional on-Site landfill (Attachment B). A 25-acre area immediately adjacent to and east of the existing landfill is the most practical location for a potential landfill expansion.

Table S.1 summarizes the expected impacts of the CIP, CBR-Onsite, 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 PAP. Key benefits of the CIP scenario relative to the CBR-Onsite and CBR-Offsite scenarios include the more rapid re-development of the Site for installation of solar panels on the capped impoundment and reduced impacts to workers, community members, and the environment during construction (*e.g.*, fewer construction-related accidents, lower energy demands, less

[1] Alternatively, the final cover system for the PAP may use a 50-mil LLDPE geomembrane material called "Microspike" or "Supergrip," which has built-in drainage studs on the top (HDR, 2022).

air pollution and greenhouse gas [GHG] emissions, reduced duration of traffic-related impacts, and potentially lower impacts to environmental justice [EJ] communities). Moreover, the CIP scenario will meet the requred closure schedule (*i.e.*, closure completed by October 2028) defined in IAC Section 845.700(d)(2)(C)(ii) (IEPA, 2021a), whereas the CBR-Onsite and CBR-Offsite scenarios will 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-Onsite**	**CBR-Offsite**
Closure Alternative Descriptions (Section 2.1, IAC Section 845.710(c))	The CIP scenario would entail excavation of CCR from the southern and western portions of the PAP and consolidation of it into the northern and eastern portions, followed by capping with a new cover system. 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.	All CCR would be excavated from the PAP and transported *via* truck to the existing on-Site landfill for disposal. The on-Site landfill does not have sufficient capacity at present and would require expansion. This scenario meets the requirements of IAC Section 845.710(c)(2) (IEPA, 2021), which requires an assessment be included in the CAA of whether the Site has an on-Site landfill with available capacity or whether an on-Site landfill can be constructed.	All CCR would be excavated from the PAP 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 PAP.
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 PAP 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.	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 PAP. 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 PAP. 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 PAP. 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 PAP (*e.g.*, due to 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 PAP (*e.g.*, due to 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 of some constituents in groundwater.	During closure, there would be minimal risk of dike failure occurring at the PAP (*e.g.*, due to 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 of some constituents in groundwater.
Worker Risks (Section 2.2.4.1, IAC Sections 845.710(b)(1)(D) and 845.710(b)(1)(F))	An estimated 0.018 worker fatalities and 2.8 worker injuries would be expected to occur due to on-Site activities under this closure scenario. An additional 0.019 worker fatalities and 1.4 worker injuries would be expected to occur off-Site due to vehicle accidents during hauling, labor and equipment mobilization and demobilization, and material deliveries. In total, 0.037 worker fatalities and 4.3 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.	An estimated 0.032 worker fatalities and 5.0 worker injuries would be expected to occur due to on-Site activities under this closure scenario. An additional 0.032 worker fatalities and 2.5 worker injuries would be expected to occur off-Site due to vehicle accidents during hauling, labor and equipment mobilization and demobilization, and material deliveries. In total, 0.064 worker fatalities and 7.4 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.	An estimated 0.0097 worker fatalities and 1.5 worker injuries would be expected to occur due to on-Site activities under this closure scenario. An additional 0.29 worker fatalities and 18 worker injuries would be expected to occur off-Site due to vehicle accidents during hauling, labor and equipment mobilization and demobilization, and material deliveries. In total, 0.30 worker fatalities and 19 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.
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 far less under this closure scenario than under the CBR-Offsite scenario because it does not require off-Site hauling (*i.e.*, off-Site transport of CCR or borrow soil). In total, an estimated 0.012 fatalities and 0.70 injuries would be expected to occur among community members due to off-Site activities under this scenario. No impacts to nearby EJ communities are anticipated under this closure scenario.	Off-Site impacts on nearby residents would be far less under this closure scenario than under the CBR-Offsite scenario because it does not require off-Site hauling (*i.e.*, off-Site transport of CCR or borrow soil). In total, an estimated 0.016 fatalities and 1.1 injuries would be expected to occur among community members due to off-Site activities under this scenario. No impacts to nearby EJ communities are anticipated under this closure scenario.	Off-Site impacts on nearby residents would be far greater under this scenario than under the CIP and CBR-Onsite scenarios, because this scenario requires significantly more off-Site vehicle and equipment travel miles. In total, an estimated 0.76 fatalities and 24 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 3.4 minutes on average during working hours for approximately 3,960 working days under this scenario. In addition, the transport of CCR to the off-Site landfill could potentially result in impacts to several EJ communities located along haul routes, including the EJ communities near Lawrenceville, IL, Vincennes, IN, and Terre Haute, IN.

Evaluation Factor (Report Section; IAC Part 845 Section)	Closure Scenario		
	CIP	**CBR-Onsite**	**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 Newton Lake and the greater Newton Lake State Fish and Wildlife Area. Because the expected duration of construction activities is shorter under the CIP scenario than under the CBR-Onsite and CBR-Offsite scenarios, short-term impacts on the scenic and recreational value of natural areas near the Site would be less under this closure scenario than under the two CBR scenarios. There are no historical sites in the vicinity of the impoundment or the on-Site landfill. Thus, no impacts on historical sites would be expected under any closure scenario.	Due to (*e.g.*) noise and visual disturbances, construction activities may have short-term negative impacts on the recreational use of Newton Lake and the greater Newton Lake State Fish and Wildlife Area. Because the expected duration of construction activities is longer under the CBR-Onsite and CBR-Offsite scenarios than under the CIP scenario, short-term impacts on the scenic and recreational value of natural areas near the Site would be greater under these two closure scenarios than under the CIP scenario. There are no historical sites in the vicinity of the impoundment or the on-Site landfill. Thus, no impacts on historical sites would be expected under any closure scenario.	Due to (*e.g.*) noise and visual disturbances, construction activities may have short-term negative impacts on the recreational use of Newton Lake and the greater Newton Lake State Fish and Wildlife Area. Because the expected duration of construction activities is longer under the CBR-Onsite and CBR-Offsite scenarios than under the CIP scenario, short-term impacts on the scenic and recreational value of natural areas near the Site would be greater under these two closure scenarios than under the CIP scenario. There are no historical sites in the vicinity of the impoundment or the on-Site landfill. Thus, no impacts on historical sites would be expected under any closure 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 far smaller under the CIP and CBR-Onsite scenarios than under the CBR-Offsite scenario, because the total on-Site and off-Site vehicle and equipment travel miles required under the CIP scenario (3,550,000 miles) and CBR-Onsite scenario (6,150,000 miles) are far smaller than those required under the CBR-Offsite scenario (75,300,000 miles). 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 and installation of solar panels on the capped impoundment would put energy back on the grid and reduce reliance on non-renewable energy sources. Re-development of the capped impoundment for solar facility installation would occur more rapidly under the CIP scenario than under the two CBR scenarios.	Total energy demands and GHG emissions would be far smaller under the CIP and CBR-Onsite scenarios than under the CBR-Offsite scenario, because the total on-Site and off-Site vehicle and equipment travel miles required under the CIP scenario (3,550,000 miles) and CBR-Onsite scenario (6,150,000 miles) are far smaller than those required under the CBR-Offsite scenario (75,300,000 miles). Because expansion of the existing on-Site landfill would be necessary in order to accept all of the CCR from the PAP, the CBR-Onsite 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.	Total energy demands and GHG emissions would be far greater under the CBR-Offsite scenario than under the CIP and CBR-Onsite scenarios, because the total on-Site and off-Site vehicle and equipment travel miles required under the CBR-Offsite scenario (75,300,000 miles) are far greater than those required under the CIP scenario (3,550,000 miles) and the CBR-Onsite scenario (6,150,000 miles). If expansion of the off-Site landfill became necessary in order to accept all of the CCR from the PAP, 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 terrestrial and aquatic species located in the vicinity of the PAP, the borrow area, the on-Site landfill, and the off-Site landfill. Short-term impacts on natural resources and habitat would be smaller under the CIP scenario than under the CBR-Onsite and CBR-Offsite scenarios, because the overall duration of construction would be shorter under the CIP scenario than under the two CBR scenarios.	Construction activities may have short-term negative impacts on terrestrial and aquatic species located in the vicinity of the PAP, the borrow area, the on-Site landfill, and the off-Site landfill. Short-term impacts on natural resources and habitat would be greater under the CBR-Onsite and CBR-Offsite scenarios than under the CIP scenario, because the overall duration of construction would be longer under the two CBR scenarios than under the CIP scenario.	Construction activities may have short-term negative impacts on terrestrial and aquatic species located in the vicinity of the PAP, the borrow area, the on-Site landfill, and the off-Site landfill. Short-term impacts on natural resources and habitat would be greater under the CBR-Onsite and CBR-Offsite scenarios than under the CIP scenario, because the overall duration of construction would be longer under the two CBR scenarios than under the CIP scenario.

Evaluation Factor (Report Section; IAC Part 845 Section)	Closure Scenario		
	CIP	**CBR-Onsite**	**CBR-Offsite**
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 PAP under each of the proposed closure scenarios (Ramboll, 2022). Model predictions indicate that groundwater concentrations in monitoring wells within the UD/PMP and UA will achieve the GWPS in 20 years under the CIP scenario and 16 years under the CBR closure scenario (Ramboll, 2022). Model predictions also indicate that groundwater concentrations will remain above the GWPSs in the UCU for a period of more than 100 years for both the CIP and CBR scenarios. However, in both the CIP and CBR scenarios, the plume footprint continues to recede over time and remains within the property boundaries, indicating that both closure scenarios perform equivalently with regard to achieving the GWPSs (Ramboll, 2022).	Groundwater modeling was performed to evaluate future groundwater quality in the vicinity of the PAP under each of the proposed closure scenarios (Ramboll, 2022). Model predictions indicate that groundwater concentrations in monitoring wells within the UD/PMP and UA will achieve the GWPS in 20 years under the CIP scenario and 16 years under the CBR closure scenario (Ramboll, 2022). Model predictions also indicate that groundwater concentrations will remain above the GWPSs in the UCU for a period of more than 100 years for both the CIP and CBR scenarios. However, in both the CIP and CBR scenarios, the plume footprint continues to recede over time and remains within the property boundaries, indicating that both closure scenarios perform equivalently with regard to achieving the GWPSs (Ramboll, 2022). Additionally, changing geochemical conditions during an extended excavation can be a mechanism that results in the mobilization and increased transport of some constituents in groundwater. This may result in GWPS exceedance durations in excess of the model predictions.	Groundwater modeling was performed to evaluate future groundwater quality in the vicinity of the PAP under each of the proposed closure scenarios (Ramboll, 2022). Model predictions indicate that groundwater concentrations in monitoring wells within the UD/PMP and UA will achieve the GWPS in 20 years under the CIP scenario and 16 years under the CBR closure scenario (Ramboll, 2022). Model predictions also indicate that groundwater concentrations will remain above the GWPSs in the UCU for a period of more than 100 years for both the CIP and CBR scenarios. However, in both the CIP and CBR scenarios, the plume footprint continues to recede over time and remains within the property boundaries, indicating that both closure scenarios perform equivalently with regard to achieving the GWPSs (Ramboll, 2022). Additionally, changing geochemical conditions during an extended excavation can be a mechanism that results in the mobilization and increased transport of some constituents in groundwater. This may result in GWPS exceedance durations in excess of the model predictions.
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-Onsite 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.	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 PAP. 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 PAP. 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.	There are no current or future risks to any human or ecological receptors associated with the PAP. 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.
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-Onsite and CBR-Offsite pose additional implementation difficulties due to higher earthwork volumes and higher dewatering volumes, and longer construction schedules. The construction schedule for excavation may also be negatively impacted under the CBR-Onsite scenario, because the on-Site landfill would need to be expanded in order to receive all of the materials excavated from the impoundment.	Relative to CIP, CBR-Onsite and CBR-Offsite pose additional implementation difficulties due to higher earthwork volumes and higher dewatering volumes, and longer construction schedules. Hauling would be more difficult to implement under the CBR-Offsite scenario than under the CBR-Onsite scenario, due to the much longer haul distance required (75 miles *versus* 1 mile) and the need to use public roads for hauling. Because the CCR would be hauled on public roads, it would require haul trucks with a smaller capacity (16.5 cubic yards *versus* 34 cubic yards) and would also need to be dewatered to a greater extent than would be necessary under the CBR-Onsite 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 need to be expanded to receive all of the CCR generated during excavation.

Evaluation Factor (Report Section; IAC Part 845 Section)	Closure Scenario		
	CIP	**CBR-Onsite**	**CBR-Offsite**
▪ *Expected Operational Reliability*	Operational reliability would be expected under all closure scenarios.	Operational reliability would be expected under all closure scenarios.	Operational reliability would be expected under all closure scenarios.
▪ *Need for Permits and Approvals*	Permits required under all closure scenarios would include a modification to the existing NPDES permit; a construction permit from the IDNR Dam Safety Program to allow the embankment and spillways of the PAP 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).	Permits required under all closure scenarios would include a modification to the existing NPDES permit; a construction permit from the IDNR Dam Safety Program to allow the embankment and spillways of the PAP 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). On-site landfill expansion would require permitting from IEPA Bureau of Land under Title 35 Sections 811 and 812 as well as local government approval.	Permits required under all closure scenarios would include a modification to the existing NPDES permit; a construction permit from the IDNR Dam Safety Program to allow the embankment and spillways of the PAP to be modified as part of closure; a construction stormwater permit through IEPA; and a WPC permit. 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 PAP.
▪ *Availability of Equipment and Specialists*	CIP and CBR 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 all 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 scenarios, shortages may cause fewer challenges under the CIP scenario than under the CBR scenarios.	CIP and CBR 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 all scenarios if supply chain resilience does not improve by the time of construction. Due to higher earthwork volumes and a greater need for construction equipment under the CBR scenarios than under the CIP scenario, shortages may cause greater challenges under the CBR scenarios than under the CIP scenario.	CIP and CBR 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 all scenarios if supply chain resilience does not improve by the time of construction. Due to higher earthwork volumes and a greater need for construction equipment under the CBR scenarios than under the CIP scenario, shortages may cause greater challenges under the CBR scenarios than under the CIP scenario. The current shortage of truck drivers may be particularly impactful under the CBR-Offsite scenario, due to the large volumes of CCR to be hauled from the Site.
▪ *Available Capacity and Location of Treatment, Storage, and Disposal Services*	Under the CIP scenario, all of the CCR currently within the PAP would be stored within the existing footprint of the impoundment. Treatment would consist of unwatering the PAP at the start of construction, performing limited dewatering to stabilize the CCR subgrade, and managing stormwater inflow. Water from unwatering and dewatering of the PAP would be discharged in accordance with the NPDES permit for the facility.	The existing on-Site landfill at the Newton Power Plant Site does not have sufficient capacity to receive all of the CCR that is currently slated for landfilling under the CBR-Onsite scenario. Expansion of the on-Site landfill capacity would thus be necessary. The potential impacts of landfill expansion are included in the analysis as one aspect of the overall closure scenario. Water from unwatering and dewatering of the PAP would be discharged in accordance with the NPDES permit for the facility.	The capacity remaining at the preferred off-Site landfill (the Sycamore Ridge Landfill in Pimento, Indiana) is sufficient to receive all of the CCR in the PAP. 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. Water from unwatering and dewatering of the PAP 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 any closure scenario.	No current or future exceedances of any screening benchmarks for surface water would be expected under any closure scenario.	No current or future exceedances of any screening benchmarks for surface water would be expected under any closure scenario.
Potential Modes of Transportation Associated with CBR (Section 2.1; IAC Section 845.710(c)(1)	This factor is not relevant for CIP.	This factor is not relevant for CBR-Onsite.	IAC Section 845.710(c)(1) requires CBR alternatives to consider multiple methods for transporting CCR off-Site, including rail, barge, and trucks. HDR evaluated the feasibility of transporting CCR to the off-Site landfill *via* rail or barge and found that neither option is 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.

Evaluation Factor (Report Section; IAC Part 845 Section)	Closure Scenario CIP	 CBR-Onsite	 CBR-Offsite
Concerns of Residents Associated with Alternatives (Section 2.6, IAC Section 845.710(b)(4))	Despite the preference for CBR that has been expressed by nonprofits representing community interests near the Site, CIP would effectively address residents' concerns regarding potential impacts to groundwater and surface water quality at the Site. Relative to CBR-Offsite, CIP and CBR-Onsite (which do not require any off-Site hauling) present far fewer risks to nearby residents and potentially EJ communities in the form of off-Site accidents, traffic-related impacts, noise, and air pollution. Moreover, under the CIP scenario, the Site could be more rapidly re-developed for the installation of a solar facility on the capped impoundment. A public meeting was held on May 24, 2022, pursuant to requirements under IAC Section 845.710(e). Questions raised by attendees were addressed at the meeting; subsequently, a written summary of the questions and responses was prepared.	Relative to CBR-Offsite, CIP and CBR-Onsite (which do not require any off-Site hauling) present far fewer risks to nearby residents and potentially EJ communities in the form of off-Site accidents, traffic-related impacts, noise, and air pollution. A public meeting was held on May 24, 2022, pursuant to requirements under IAC Section 845.710(e). Questions raised by attendees were addressed at the meeting; subsequently, a written summary of the questions and responses was prepared.	Relative to CIP and CBR-Onsite, CBR-Offsite (which requires substantial off-Site hauling) presents far greater risks to nearby residents and potentially EJ communities in the form of off-Site accidents, traffic-related impacts, noise, and air pollution. A public meeting was held on May 24, 2022, pursuant to requirements under IAC Section 845.710(e). Questions raised by attendees were addressed at the meeting; subsequently, a written summary of the questions and responses was prepared.

Notes:

AACE = Association for the Advancement of Cost Engineering; CBR = Closure-by-Removal; CBR-Offsite = Closure-by-Removal with Off-Site CCR Disposal; CBR-Onsite = Closure-by-Removal with On-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; PAP = Primary Ash Pond.

1 Introduction

1.1 Site Description and History

1.1.1 Site Location and History

Illinois Power Generating Company's (IPGC) Newton Power Plant is an electric power generating facility with coal-fired units located approximately seven miles southwest of the City of Newton, Illinois. The facility began operating in approximately 1977 and will be retired by the end of 2027 (Meeker, 2020; Ramboll, 2021).

1.1.2 CCR Impoundment

The Newton Power Plant produces and stores coal combustion residuals (CCRs) as part of its operations. The Primary Ash Pond (PAP; Vistra ID No. CCR Unit 501, Illinois Environmental Protection Agency [IEPA] ID No. W0798070001-01, and National Inventory of Dams [NID] ID No. IL50719), which is the only CCR-containing impoundment at this Site, is the subject of this report.

The PAP (Figure 1.1) is a 404-acre unlined surface impoundment constructed in 1977 for the management of bottom ash, fly ash, and other non-CCR waste generated by the facility (Ramboll, 2021). Decanted water from the PAP discharges into the Secondary Pond, a 9.3-acre non-CCR impoundment located immediately south of the PAP (Ramboll, 2021). The Secondary Pond, which is used to clarify process water, discharges to Newton Lake *via* a National Pollutant Discharge Elimination System (NPDES)-permitted outfall (AECOM, 2016a; Ramboll, 2021). After the Newton Power Plant is retired in 2027, the PAP will no longer receive sluiced ash. Final closure of the PAP is expected to be completed by the end of 2028 (HDR, 2022).

Figure 1.1 Site Location Map. Adapted from Ramboll (2021).

1.1.3 Surface Water Hydrology

The Secondary Pond, which receives decanted water from the PAP, is permitted to discharge to Newton Lake, the approximately 1,650-acre cooling pond for the facility (Figure 1.1, Ramboll, 2021). Newton Lake is a long water body that surrounds the PAP to the east, south, and west. It is located within the Weather Creek and Newton Lake Watersheds (Hydrologic Unit Codes [HUCs] 051201140504 and 051201140503, respectively), which lie within the larger Little Wabash River watershed (HUCs 05120114 and 05120115; Tetra Tech, 2008; US EPA, 2018). The southern boundary of the PAP is approximately 250 to 700 feet (ft) from the northern shore of Newton Lake (Ramboll, 2021).

Newton Lake (Assessment Unit ID IL_RCR) is listed on the 2018 Illinois Section 303(d) List as being impaired for fish consumption due to mercury. In addition, it is listed as being impaired for aesthetic quality due to Total Suspended Solids (IEPA, 2019a; US EPA, 2018). As of 2008, there is a Total Maximum Daily Load (TMDL) in place to address aesthetic quality impairments in Newton Lake due to an excess of Total Phosphorus (Tetra Tech, 2008).

In addition to Newton Lake, another unnamed 13.7-acre lake is located within 1,000 meters (3,281 feet) of the PAP. There are also several unnamed freshwater ponds located within 1,000 meters of the PAP that range in size from 0.3 acres to 6.2 acres (Figure 1.2; Ramboll, 2021).

Golder collected a total of 28 surface water samples from Newton Lake in the vicinity of the PAP in April and May of 2021 (Golder, 2021). These data are summarized in Gradient's Human Health and Ecological Risk Assessment for the Site, which is provided as Attachment A of this report.

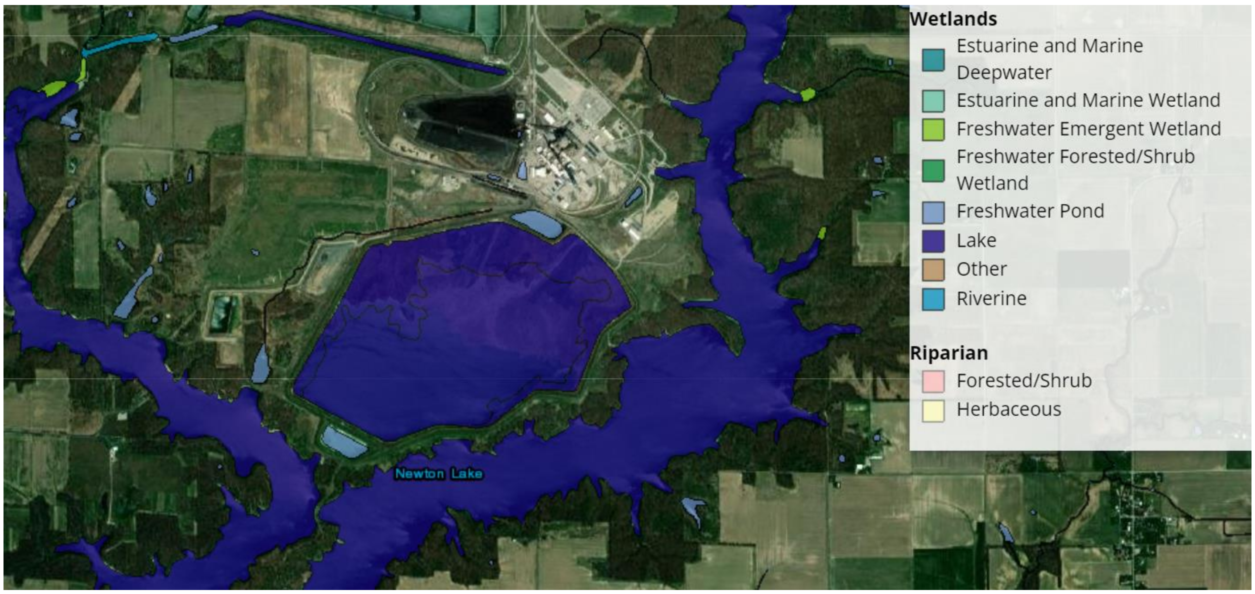

Figure 1.2 Wetlands and Surface Water Bodies in the Vicinity of the Newton Primary Ash Pond. Adapted from US FWS (2021).

1.1.4 Hydrogeology

The geology underlying the Site in the vicinity of the PAP primarily consists of unlithified deposits overlying a shale bedrock unit. The principal types of unlithified materials include the Peoria Silt /Sangman Soil, the Hagarstown Member, the Vandalia Till, the Mulberry Grove Member, and the Smithboro Till/Banner Formation (Ramboll, 2021). These unlithified deposits are underlain by a Pennsylvanian Age shale bedrock of the Mattoon Formation (Ramboll, 2021). Five distinct hydrostratigraphic units in the area are (listed from ground surface down): the Upper Drift (UD)/Potential Migration Pathway (PMP), the Upper Confining Unit (UCU), the Uppermost Aquifer (UA), the Lower Confining Unit (LCU), and the Bedrock Confining Unit (BCU) (Ramboll, 2021).The UD is composed of low permeability silts and clays of the Peoria Silt and Sangamon Soil and the sandier soils of the Hagarstown Member (*i.e.*, PMP). The Peoria Silt and Sangamon Soil range in thickness from 3 to 46 ft (Ramboll, 2021). The Hagarstown Member is generally 2 feet (ft) thick but is encountered at thicknesses up to about 6.9 ft in the vicinity of the Ash Pond (Ramboll, 2021). The UA is composed of a 3 to 17 ft thick Mulberry Grove Member, which consists of sand, silty- and clayey- sand, and gravel. The UA is sandwiched between two low-permeability confining units: (i) the UCU on top consisting of clay and silt of the Vandalia Till and (ii) the LCU on bottom consisting of silt and clay of the Smithboro Till Member and the Banner Formation (Ramboll, 2021). No wells are screened within the UCU, the LCU, or the underlying shale BCU.

Groundwater within the UA flows generally from the north towards the south and southwest. In the southern area of the PAP, groundwater flows toward a former drainage feature located west of the PAP (Ramboll, 2021). In the northern area of the PAP, groundwater from the UA may interact with surface water in Newton Lake, as evidenced by relatively higher groundwater head elevations compared to the Newton Lake water level. Groundwater within the UD/PMP may also interact with surface water in Newton Lake (Ramboll, 2021).

The "Hydrogeologic Site Characterization Report" prepared by Ramboll as part of the operating permit for the PAP includes an evaluation of groundwater data collected from PAP monitoring wells between 2015 and 2021 (Ramboll, 2021).

1.1.5 Site Vicinity

The Newton Power Plant Site is located in a predominantly agricultural area. The PAP is located south of the power plant and is bordered by Newton Lake to the west, south, and east (Ramboll, 2021. Scenic and recreational areas within a few miles of the Site include the Newton Lake State Fish and Wildlife Area (SFWA) and the Prairie Ridge State Natural Area / Jasper County Prairie Chicken Sanctuary (Ramboll, 2021. The Newton Lake SFWA, which includes Newton Lake and an additional 5,800 surrounding acres of timber, cropland, and open/non-cultivated land, is preserved by IDNR for fishing, hunting, and wildlife management. Approximately 540 acres of the western shoreline are also used for picnicking, hiking, biking, and horseback riding. The northeastern portion of the Newton Lake SFWA is dedicated to the preservation of the prairie chicken, a state-endangered species (IDNR, 2022). The Prairie Ridge State Natural Area / Jasper County Prairie Chicken Sanctuary, which is located east of Newton Lake, consists of several discontinuous tracts of land that are similarly dedicated to the preservation of the prairie chicken (IDNR, 2022).

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 PAP (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 PAP 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 PAP pursuant to requirements under IAC Section 845.710 (IEPA, 2021). The three closure scenarios evaluated in this CAA are Closure-in-Place with consolidation (CIP), Closure-by-Removal with On-Site CCR Disposal (CBR-Onsite), and Closure-by-Removal with Off-Site CCR Disposal (CBR-Offsite). The CIP scenario would entail consolidation of CCR in the northern portion of the PAP, followed by capping with a new cover system. Under the CBR-Onsite scenario, the CCR would be excavated from the impoundment and hauled to an on-Site landfill. Under the CBR-Offsite scenario, the CCR would be excavated from the impoundment and hauled to an off-Site landfill. IPGC will also continue to evaluate potential opportunities for beneficial re-use of CCR excavated from the PAP as an alternative to disposal. In addition to the primary closure activities to be undertaken at the PAP, all three closure scenarios account for the eventual closure of the existing off-Site landfill (which currently contains uncapped waste) *via* capping.

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 an existing, permitted CCR landfill (Newton CCR Landfill Phase II) located immediately west of the PAP at the Newton Power Plant Site. However, this landfill is not actively being used to store waste and does not have sufficient capacity to contain all of the CCR that would be excavated from the PAP under the CBR-Onsite scenario. Additional landfill capacity would be required for the CBR-Onsite scenario and could be accomplished by reconstructing the current landfill cell, constructing additional sections of the landfill that have already been permitted, and either constructing an additional permitted expansion of the landfill or constructing a separate, additional on-Site landfill (Attachment B). A 25-acre area immediately adjacent to and east of the existing landfill is the most practical location for a potential landfill expansion.

Sections 2.1.1, 2.1.2, and 2.1.3 provide detailed descriptions of the CIP, CBR-Onsite, and CBR-Offsite closure scenarios. These scenarios are based on the Closure Plan for the PAP (HDR, 2022) and additional closure documents and analyses provided to Gradient by HDR, which are attached to this report as Attachment B.

2.1.1 Closure-in-Place

Under the CIP scenario, the CCR in the PAP would be excavated from the southern and western portions of the PAP and consolidated into the northern and eastern portions, then capped in place with a final cover system. This scenario includes the following work elements (HDR, 2022):

- Unwatering and dewatering of the impoundment *via* pumping and the construction of drilled sumps, engineered trenches, and/or horizontal wells. Water from unwatering and dewatering would be pumped to the adjacent Secondary Pond, which discharges to Newton Lake *via* a NPDES-permitted outfall. Dewatering and unwatering would begin as soon as practical with the completion of permitting and continue throughout the construction period.

- Consolidation of the CCR in the PAP by excavating CCR and approximately 1 foot of underlying soils from the southern and western portions of the PAP and using it as fill within the northern and eastern portions of the PAP in order to establish minimum slopes. CCR will be placed in lifts and compacted to provide a subgrade suitable for construction of a final cover system. In addition to CCR, materials within the existing on-Site landfill and/or coal pile may also be relocated and utilized as subgrade fill within the impoundment closure area.
- Removal of existing outflow structures and culverts connecting the PAP to the adjacent Secondary Pond.
- Removal of the berm between the PAP and the Secondary Pond, followed by removal of the Secondary Pond. Post-closure, an area in the southern portion of the PAP will be used as a stormwater management pond.
- Construction of an alternative cover system over the consolidated ash consisting of a 40-mil LLDPE geomembrane layer, a geocomposite drainage layer, and 24 inches of protective soil cover suitable for supporting vegetative growth.[2] An alternative cover performance demonstration has been submitted to IEPA for approval pursuant to Section 845.750(c)(2) (Geosyntec, 2022). A solar facility atop the cover system is currently being designed. Components of the vegetative cover may change as details of the solar facility are finalized. However, any changes to the cover are expected to be protective of human health and the environment and meet the requirements of Section 845.750(c).
- Installation of stormwater control structures, including: (i) stormwater channels designed to convey stormwater into the new stormwater pond post-closure, and (ii) drainage pipes, channels, and downchutes designed to reduce erosion in places where channels flow from the PAP final cover and lead into the stormwater pond.
- 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.

Under this scenario, the existing on-Site landfill would also be closed *via* capping. The existing on-Site landfill is approximately 12 acres in size.

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 (HDR, 2022).

- An alternative cover system would be installed over the CCR that remains in the PAP. The cover, consisting of an LLDPE geomembrane layer and 24 inches of soil, as described above, would minimize vertical infiltration of precipitation into the basin [Part 845.750(a)(1)] (Geosyntec, 2022). A solar facility atop the cover system is currently being designed. Components of the vegetative cover may change as details of the solar facility are finalized. However, any changes are expected to be protective of human health and the environment and meet the requirements of Section 845.750(c).
- 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 PAP to existing site drainages [Part 845.750(a)(2)].

[2] Alternatively, the final cover system for the PAP may use a 50-mil LLDPE geomembrane material called “Microspike” or “Supergrip," which has built-in drainage studs on the top (HDR, 2022).

- Free liquids in the CCR would be eliminated by removing liquid wastes or solidifying the remaining wastes. Engineered trenches would facilitate gravity drainage of liquid wastes in the CCR and direct the liquid wastes to sumps. Other engineering measures, such as drilled sumps and/or horizontal wells, may also be considered to facilitate removal of liquid wastes and stabilization of wastes. Liquid wastes 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 PAP by 94% compared to pre-closure conditions (Ramboll, 2022). Additionally, CIP will result in a reduction of hydraulic flux out of the PAP by 94% compared to pre-closure conditions (Ramboll, 2022). Due to the reduction in the hydraulic flux out of the PAP, the mass flux out of the PAP will also be controlled or minimized as much as feasible as a result of CIP.

As an additional consideration, the PAP is located on a relatively thick layer of low-permeability clay, and the final cover system will tie into the surrounding grades. Post-closure, the CCR remaining in the PAP will therefore be physically isolated from the surrounding environment, including stormwater, surface water, and the atmosphere (HDR, 2022). Moreover, the CCR within the PAP will be located above the uppermost aquifer under normal conditions, and is also expected to be perennially above the uppermost aquifer level during higher-water conditions in Newton Lake. Post-closure, there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations, including the seasonal high-water table (HDR, 2022). 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 offsite beneficial use, may result in a smaller footprint for purposes of our ultimate cap design along with a reduced construction schedule.

Under this scenario, approximately 1,920,000 CY of CCR will be relocated to the northern and eastern portions of the PAP (an assumed average travel distance of approximately 1 mile; Attachment B). Construction of the final cover systems for the impoundment and the on-Site landfill would require an additional 976,000 CY of clean soil, which would be sourced from within the footprint of the PAP, existing berms, and if needed, elsewhere on Site (an assumed average travel distance of approximately 1 mile; Attachment B). Borrow soil would be hauled around the Site using haul trucks with an assumed capacity of 34 CY.

Under the CIP scenario, the overall expected duration of construction and earthwork activities (including closure of the impoundment and site restoration) is approximately 38 to 51 months (3.2 to 4.3 years). The total expected number of on-Site working days (excluding, *e.g.*, winter weather delays and weekends) is 720 days (Attachment B). The CIP scenario will meet the requred closure schedule (*i.e.*, closure completed by October 2028) defined in IAC Section 845.700(d)(2)(C)(ii) (IEPA, 2021a). Key parameters for the CIP scenario are shown in Table 2.1.

Table 2.1 Key Parameters for the Closure-in-Place Scenario

Parameter	Value
Surface Area of PAP	404 acres
Surface Area of Final Cover System	268 acres
Surface Area of On-Site Landfill	12 acres
Volume of CCR to be Relocated	1,920,000 CY
Average Travel Distance for Relocation of CCR	1 mile
Required Volume of Borrow Soil	976,000 CY
Average Distance to On-Site Borrow Soil Location	1 mile
Duration of Construction Activities	3.2 to 4.3 years
Labor Hours	
Total On-Site Labor	245,000 hours
Total Off-Site Labor	4,000 hours
30% Contingency	74,600 hours
Total Labor Hours:	323,000 hours
Vehicle and Equipment Travel Miles	
Vehicles On-Site	79,000 miles
Equipment On-Site	720,000 miles
On-Site Haul Trucks (Unloaded + Loaded)	113,000 miles
Labor Mobilization	2,260,000 miles
Equipment Mobilization (Unloaded + Loaded)	66,200 miles
Off-Site Haul Trucks (Unloaded + Loaded)	0 miles
Material Deliveries (Unloaded + Loaded)	308,000 miles
Total On-Site Vehicle and Equipment Travel Miles:	912,000 miles
Total Off-Site Vehicle and Equipment Travel Miles:	2,640,000 miles
Total Vehicle and Equipment Travel Miles:	3,550,000 miles

Notes:
PAP = Primary Ash Pond.
Due to rounding, totals may not match the sum of the values.
Source: Attachment B, HDR (2022).

2.1.2 Closure-by-Removal with On-Site CCR Disposal

Under the CBR-Onsite scenario, all CCR would be excavated from the PAP and transported to an on-Site landfill for disposal. There is an existing, permitted CCR landfill at the Newton Power Plant Site, which is located approximately 1 mile from the PAP along Site roads (Attachment B). However, this landfill does not currently have sufficient capacity to contain all of the CCR that would be excavated from the PAP under the CBR-Onsite scenario (approximately 5,700,000 CY). The existing on-Site landfill would therefore need to be expanded under this scenario.

This scenario includes the following work elements (Attachment B):

- Expansion of the existing on-Site landfill. Landfill expansion would include the reconstruction of the current landfill cell, construction of the remaining permitted capacity for the landfill, and further expansion of the landfill into a 25-acre area located immediately to the east.
    - The landfill expansion area overlaps the footprint of the PAP, requiring phased closure of the PAP. CCR located within the landfill expansion area would be relocated to the existing permitted landfill prior to construction of the expansion.

- The landfill expansion would also require relocation of an access road, a major drainageway, and possibly a monitoring well.

- Unwatering and dewatering of the impoundment by pumping water to the adjacent Secondary Pond, which discharges to Newton Lake *via* a NPDES-permitted outfall.
- Construction of stormwater control structures, including ditches and sumps, to convey runoff away from the impoundment.
- Excavation of CCR and approximately one foot of underlying soils from the impoundment and transport of these materials to the on-Site landfill.
- Backfilling of the impoundment as needed in order to promote positive drainage and prevent the impoundment of non-contact stormwater within the PAP post-closure.
- Site restoration, including the placement of six inches of topsoil along the side slopes and bottom of the PAP and revegetation with native grasses.
- Monitoring for 3 years post-closure or until such time as GWPSs are achieved, whichever is longer.

Under this scenario, the existing on-Site landfill would be closed *via* capping following the disposal of CCR from the impoundment. After expansion, the existing on-Site landfill would be approximately 66 acres in size.

Soil for expansion of the on-Site landfill, backfilling of the impoundment, site restoration, and on-Site landfill closure would be sourced from within the footprint of the PAP, existing berms, and if needed, elsewhere on Site (an assumed average travel distance of approximately 1 mile; Attachment B). In total, 562,000 CY of clean borrow soil would be required under this scenario. A haul truck capacity of 34 CY is assumed for the on-Site transport of borrow soil and CCR (Attachment B).

The overall expected duration of construction and earthwork activities under this scenario (including closure of the impoundment, backfilling to maintain positive drainage, and site restoration) is approximately 94 to 110 months (7.8 to 9.2 years). The total expected number of on-Site working days (excluding, *e.g.*, winter weather delays and weekends) is 1,440 days (Attachment B). The CBR-Onsite 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, 2021a). Key parameters for the CBR-Onsite scenario are shown in Table 2.2.

Table 2.2 Key Parameters for the Closure-by-Removal with On-Site CCR Disposal Scenario

Parameter	Value
Surface Area of PAP	404 acres
Surface Area of On-Site Landfill (After Expansion)	66 acres
Average Travel Distance to On-Site Landfill	1 mile
Hauled Volume of CCR	5,700,000 CY
Average Distance to On-Site Borrow Soil Location	1 mile
Hauled Volume of Borrow Soil	562,000 CY
Duration of Construction Activities	7.8 to 9.2 years
Labor Hours	
Total On-Site Labor	429,000 hours
Total Off-Site Labor	4,000 hours
30% Contingency	130,000 hours
Total Labor Hours:	563,000 hours
Vehicle and Equipment Travel Miles	
Vehicles On-Site	140,000 miles
Equipment On-Site	1,440,000 miles
On-Site Haul Trucks (Unloaded + Loaded)	335,000 miles
Labor Mobilization	3,940,000 miles
Equipment Mobilization (Unloaded + Loaded)	128,000 miles
Off-Site Haul Trucks (Unloaded + Loaded)	0 miles
Material Deliveries (Unloaded + Loaded)	164,000 miles
Total On-Site Vehicle and Equipment Travel:	1,910,000 miles
Total Off-Site Vehicle and Equipment Travel:	4,230,000 miles
Total Vehicle and Equipment Travel:	6,150,000 miles

Notes:
CCR = Coal Combustion Residual; PAP = Primary Ash Pond.
Due to rounding, totals may not match the sum of the values.
Source: Attachment B.

2.1.3 Closure-by-Removal with Off-Site CCR Disposal

Under the CBR-Offsite scenario, all CCR would be excavated from the PAP 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 Sycamore Ridge Landfill in Pimento, Indiana (5621 East Cottom Drive), which is located approximately 75 miles from the Site (Attachment B). The Sycamore Ridge Landfill is the closest landfill to the Site with sufficient capacity to receive all of the material excavated from the PAP. Nonetheless, as described below in Section 2.4.5, it is possible that the Sycamore Ridge Landfill would have to be expanded during closure in order to accommodate the large amount of CCR to be received at the landfill and the relatively short time frame over which receipt of the CCR would occur.

IAC Section 845.710(c)(1) requires CBR alternatives to consider multiple methods for transporting CCR off-Site, including rail, barges, and trucks. HDR evaluated the feasibility of transporting CCR to the off-Site landfill *via* rail or barges and found that neither option is likely to be viable at this Site (Attachment B). Transporting CCR by rail would require modifications to the existing rail terminal on the Newton Power Plant property and the construction of a new rail terminal near the off-Site landfill. Modification of the existing on-Site rail terminal and construction of a new off-Site rail terminal would require coordination with the railroad and additional design and 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. Moreover, because there is no direct rail route from the Site to the off-Site landfill, the transport of CCR to the off-Site landfill would require approximately 75 miles of rail transport (one-way) on tracks owned by 3 separate rail lines.

Barge transport is not a viable option for transporting CCR offsite, because the Newton Power Plant property is not located near a river that can accommodate barge traffic. In fact, the nearest terminal for barge traffic is approximately 125 miles away in St. Louis, Missouri. For these reasons, 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 (Attachment 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 (Attachment B):

- Unwatering and dewatering of the impoundment by pumping water to the adjacent Secondary Pond, which discharges to Newton Lake *via* a NPDES-permitted outfall.
- Construction of stormwater control structures, including ditches and sumps, to convey runoff away from the impoundment.
- Excavation of CCR and approximately one foot of underlying soils from the impoundment and transport of these materials to the off-Site landfill.
- Backfilling of the impoundment as needed in order to promote positive drainage and prevent the impoundment of non-contact stormwater within the PAP post-closure.
- Site restoration, including the placement of six inches of topsoil along the side slopes and bottom of the PAP and revegetation with native grasses.
- Monitoring for 3 years post-closure or until such time as GWPSs are achieved, whichever is longer.

Under this scenario, the existing on-Site landfill would also be closed *via* capping. The existing on-Site landfill is approximately 12 acres in size.

Soil for backfilling of the impoundment, site restoration, and on-Site landfill closure would be sourced from within the footprint of the PAP, existing berms, and if needed, elsewhere on Site (an assumed average travel distance of approximately 1 mile; Attachment B). In total, 68,000 CY of clean borrow soil would be required under this scenario. A haul truck capacity of 34 CY is assumed for the on-Site transport of borrow soil (Attachment B). CCR would be hauled to the off-Site landfill using haul trucks with a capacity of 16.5 CY, a smaller capacity than that of the haul trucks that would haul CCR to the on-

Site landfill under the CBR-Onsite scenario (34 CY) due to restrictions placed on the size of trucks that can be used on public roadways.

The overall expected duration of construction and earthwork activities under this scenario (including closure of the impoundment, backfilling to maintain positive drainage, and site restoration) is approximately 262 to 266 months (22 years). The total expected number of on-Site working days (excluding, *e.g.*, winter weather delays and weekends) is 3,960 days (Attachment B). The CBR-Offsite scenario will not meet the requred closure schedule (*i.e.*, closure completed by October 2028) defined in IAC Section 845.700(d)(2)(C)(ii) (IEPA, 2021a). Key parameters for the CBR-Offsite scenario are shown in Table 2.3.

Table 2.3 Key Parameters for the Closure-by-Removal with Off-Site CCR Disposal Scenario

Parameter	Value
Surface Area of PAP	404 acres
Surface Area of On-Site Landfill	12 acres
Average Travel Distance to Off-Site Landfill	75 miles
Hauled Volume of CCR	5,700,000 CY
Average Distance to On-Site Borrow Soil Location	1 mile
Hauled Volume of Borrow Soil	68,000 CY
Duration of Construction Activities	22 years
Labor Hours	
Total On-Site Labor	129,000 hours
Total Off-Site Labor	1,850,000 hours
30% Contingency	595,000 hours
Total Labor Hours:	2,580,000hours
Vehicle and Equipment Travel Miles	
Vehicles On-Site	611,000miles
Equipment On-Site	3,960,000 miles
On-Site Haul Trucks (Unloaded + Loaded)	0 miles
Labor Mobilization	18,000,000 miles
Equipment Mobilization (Unloaded + Loaded)	738,000 miles
Off-Site Haul Trucks (Unloaded + Loaded)	51,800,000 miles
Material Deliveries (Unloaded + Loaded)	128,000 miles
Total On-Site Vehicle and Equipment Travel:	4,570,000 miles
Total Off-Site Vehicle and Equipment Travel:	70,700,000 miles
Total Vehicle and Equipment Travel:	75,300,000 miles

Notes:
CCR = Coal Combustion Residual; PAP = Primary Ash Pond.
Due to rounding, totals may not match the sum of the values.
Source: Attachment 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 (Attachment A of this report), which provides a detailed evaluation of the magnitude of existing risks to human and ecological receptors associated with the PAP. This report concluded that there are no current unacceptable risks to any human or ecological receptors associated with the PAP. 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 any closure scenario. Thus, there would be no current risk or future risk under any closure scenario, and the magnitude of reduction of existing risks would be the same under every 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, the PAP is located partially within the 100-year flood zone for Newton Lake (FEMA, 1985; Modeer, 2021). However, as required by IAC Section 845.340(c), "recognized and generally accepted engineering practices have been incorporated into the design of the CCR surface impoundment to ensure that the CCR surface impoundment will not restrict the flow of the base flood, reduce the temporary water storage capacity of a floodplain, or result in washout of CCR." In addition, AECOM and Geosyntec evaluated the risk of flood overtopping occurring at the PAP and found that the impoundment can adequately manage flow during peak discharge from even a 1,000-year storm event, thus preventing overtopping (AECOM, 2016b; Geosyntec, 2021). Engineering analyses similarly show that the PAP dikes are expected to remain stable under static, seismic, and flood conditions (AECOM, 2016c; Geosyntec, 2021). Prior to closure (*i.e.*, under current conditions), the risk of floods or other storm-related events leading to dike failure or overtopping is therefore minimal. Post-closure, the risks of overtopping or dike failure occurring due to floods or other storm-related events would be even smaller than they are currently. 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-Onsite and CBR-Offsite scenarios, all of the CCR in the PAP 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 any closure scenario either during or following closure.

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 Newton Power Plant property lies within approximately 40 miles of the Wabash Valley Fault System, and is therefore located within a seismic impact zone (Ramboll, 2021; Haley & Aldrich, Inc., 2018a). However, all structural components of the PAP have been designed to resist the maximum horizontal acceleration in lithified earth material for the Site. The PAP therefore meets the seismic safety requirements of 40 CFR Section 257.63(a) and IAC Section 845.330(a), and the overall risk of dike failure due to seismicity is expected to be low (Burns & McDonnell, 2021; Haley & Aldrich, Inc., 2018a). Additionally, the PAP 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; Haley & Aldrich, Inc., 2018b). The nearest known faults are the Albion-Ridgeway and Mt. Carmel-New Harmony faults, which are located about 42 miles southeast of the PAP. These faults do not have known recent activity (Haley & Aldrich, Inc., 2018b). Overall, the risk of dike failure occurring during or following closure activities due to seismic activity is therefore expected to be low.

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 PAP and the on-Site landfill under each closure scenario are described in Section 2.1 (Closure Alternatives Descriptions). In summary, under the CIP scenario, the PAP would undergo monitoring for 30 years post-closure, or until such time as GWPSs are achieved. Under the CBR-Onsite and CBR-Offsite scenarios, the PAP 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 CCR hauling.

As shown in Tables 2.1 through 2.3, HDR estimates that the CIP scenario would require 245,000 on-Site labor hours (Attachment B). The CBR-Onsite scenario would require approximately 429,000 on-Site labor hours, and the CBR-Offsite scenario would require approximately 129,000 on-Site labor hours. 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 Attachment B, we estimate that approximately 2.8 worker injuries and 0.018 worker fatalities would occur on-Site under the CIP scenario; approximately 5.0 worker injuries and 0.032 worker fatalities would occur on-Site under the CBR-Onsite scenario; and approximately 1.5 worker injuries and 0.0097 worker fatalities would occur on-Site under the CBR-Offsite scenario (Table 2.4).

Table 2.4 Expected Number of On-Site Worker Accidents Under Each Closure Scenario

Closure Scenario	Injuries	Fatalities
CIP	2.8	0.018
CBR-Onsite	5.0	0.032
CBR-Offsite	1.5	0.0097

Notes:
CBR-Offsite = Closure-by-Removal with Off-Site CCR Disposal; CBR-Onsite = Closure-by-Removal with On-Site CCR Disposal; CIP = Closure-in-Place.

Off-Site, a far greater number of total vehicle and equipment travel miles would be required under the CBR-Offsite scenario than would be required under the CIP and CBR-Onsite scenarios (Tables 2.1 through 2.3). Under the CIP scenario, only 2,640,000 total off-Site vehicle and equipment travel miles would be required; under the CBR-Onsite scenario, 4,230,000 total off-Site vehicle and equipment travel miles would be required; and, under the CBR-Offsite scenario, 70,700,000 total off-Site vehicle and equipment travel miles would be required (Attachment B). The United States Department of

Transportation (US DOT, 2020) 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 2.5 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 upon passenger vehicles (cars or light trucks, including pickups, vans, and sport utility vehicles) and that hauling, equipment mobilization/demobilization, and material deliveries would rely upon large trucks. Based on US DOT's accident statistics and the mileage estimates in Attachment B, an estimated 1.4 worker injuries and 0.019 worker fatalities would be expected to occur due to off-Site activities under the CIP scenario; an estimated 2.5 worker injuries and 0.032 worker fatalities would be expected to occur due to off-Site activities under the CBR-Onsite scenario; and an estimated 18 worker injuries and 0.29 worker fatalities would be expected to occur due to off-Site activities under the CBR-Offsite scenario.

Table 2.5 Expected Number of Off-Site Worker Accidents Under Each Closure Scenario

Off-Site Vehicle Use Category	CIP		CBR-Onsite		CBR-Offsite	
	Injuries	Fatalities	Injuries	Fatalities	Injuries	Fatalities
Hauling	0	0	0	0	6.6	0.15
Labor Mobilization/Demobilization	1.4	0.018	2.4	0.031	11	0.14
Equipment Mobilization/Demobilization	0.0085	0.00019	0.016	0.00037	0.094	0.0021
Material Deliveries	0.039	0.00089	0.021	0.00048	0.016	0.00037
Total:	1.4	0.019	2.5	0.032	18	0.29

Notes:
CBR-Offsite = Closure-by-Removal with Off-Site CCR Disposal; CBR-Onsite = Closure-by-Removal with On-Site CCR Disposal; CIP = Closure-in-Place.

Overall, taking into account accidents occurring both on- and off-Site, 4.3 worker injuries and 0.037 worker fatalities would be expected under the CIP scenario; 7.4 worker injuries and 0.064 worker fatalities would be expected under the CBR-Onsite scenario; and 19 worker injuries and 0.030 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. Differences in worker risks between the three 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 (2020) and the off-Site travel mileages reported in Attachment B, off-Site vehicle accidents could result in an estimated 0.70 injuries and 0.012 fatalities among community members (*i.e.*, people involved in haul truck accidents that are neither haul truck drivers nor passengers, including pedestrians, drivers of other vehicles, *etc*.) under the CIP scenario (Table 2.6). Under the CBR-Onsite scenario, off-Site vehicle accidents could result in an estimated 1.1 community injuries and 0.016 community fatalities. Under the CBR-Offsite scenario, off-Site vehicle accidents could result in an estimated 24 community injuries and 0.76 community fatalities. Risks to community members arising from vehicle accidents are therefore much higher under the CBR-Offsite scenario than under the other two scenarios.

Table 2.6 Expected Number of Community Accidents Under Each Closure Scenario

Off-Site Vehicle Use Category	CIP		CBR-Onsite		CBR-Offsite	
	Injuries	Fatalities	Injuries	Fatalities	Injuries	Fatalities
Hauling	0	0	0	0	19	0.69
Labor Mobilization/Demobilization	0.56	0.0071	0.98	0.012	4.5	0.057
Equipment Mobilization/Demobilization	0.024	0.00088	0.047	0.0017	0.27	0.0098
Material Deliveries	0.11	0.0041	0.060	0.0022	0.047	0.0017
Total:	0.70	0.012	1.1	0.016	24	0.76

Notes:
CBR-Offsite = Closure-by-Removal with Off-Site CCR Disposal; CBR-Onsite = Closure-by-Removal with On-Site CCR Disposal; 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 traffic near the Site and the off-Site landfill. Traffic could potentially cause travel delays on local roads and cause damage to local roadways. It could also cause delays in the re-development of the Site for installation of a solar facility on the capped impoundment.

Traffic may increase temporarily around the Site under all 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.

Off-Site CCR hauling would only be required under the CBR-Offsite scenario. Under this scenario, hauling-related construction activities would be expected to span approximately 3,960 working days and require approximately 345,000 truckloads (Attachment B). Assuming 10-hour working days, a haul truck would need to pass a given location near the Site once every 3.4 minutes on average for the duration of hauling-related activities under this closure scenario.

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." Because there are no residences or businesses within 1,500 feet of any of the construction areas on the Site (the impoundment, the on-Site borrow soil location, and the on-Site landfill), we do not anticipate that any residences or businesses would be adversely impacted by noise pollution at the Site under any closure scenario. However, recreators and wildlife on Newton Lake or within the greater Newton Lake SFWA, which lie within 1,500 feet of the PAP, could be temporarily impacted by construction noise under all scenarios. Noise impacts in the vicinity of the Site would likely be smaller under the CIP scenario than under the CBR-Onsite and CBR-Offsite scenarios, because the overall duration of construction would be shorter under the CIP scenario than under the two CBR scenarios (3.2 to 4.3 years for CIP *vs.* 7.8 to 9.2 years for CBR-Onsite *vs.* 22 years for CBR-Offsite).

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 under the CBR-Offsite scenario due to high volumes of haul truck traffic. As described above (Traffic), the construction schedule for the CBR-Offsite scenario requires haul trucks to pass by a given location every 3.4 minutes on average for 10 hours each day over the course of approximately 3,960 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 all closure scenarios due to 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. As such, off-Site noise impacts are likely to be greatest under the CBR-Offsite scenario (for which substantial off-Site hauling is required) and least under the CIP and CBR-Onsite scenarios (for which no off-Site hauling is required).

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 numerous 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 the use of 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-Onsite and CBR-Offsite scenarios than under the CIP scenario, due to the greater amount of on-Site vehicle and equipment travel miles required under these scenarios (912,000 total on-Site travel miles under the CIP scenario *versus* 1,910,000 total on-Site travel miles under the CBR-Onsite scenario *versus* 4,570,000 total on-Site travel miles under the CBR-Offsite scenario; Tables 2.1 through 2.3). Off-Site, emissions would be substantially higher under the CBR-Offsite scenario than under the CIP and CBR-Onsite scenarios, due to the demands of off-Site hauling (2,640,000 total off-Site travel miles under the CIP scenario *versus* 4,230,000 total off-Site travel miles under the CBR-Onsite scenario *versus* 70,700,000 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, 2019b).

IEPA's EJ Start mapper (IEPA, 2019b) uses income and demographics data collected by the U.S. Census Bureau to map all of the EJ communities throughout the state. In order to extend the boundaries of the EJ Start mapper into the neighboring state of Indiana (the location of the preferred off-Site landfill), Gradient used U.S. Census Bureau data reported in the national-level EJScreen tool (US EPA, 2020) to create a new EJ community mapping tool that was identical to EJ Start for communities in Illinois but also included EJ communities located in Indiana.

Gradient's analysis demonstrated that the outer perimeters of the 1-mile buffer zones for the two EJ communities located closest to the Site (the EJ community near Effingham, IL and the EJ community near Olney, IL) are both located approximately 15.5 miles from the Site (Figure 2.1). As described above (Noise), significant noise impacts due to construction are expected to be limited to potential receptors located within 1,500 ft (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 ft (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). Thus, the EJ communities near Effingham and Olney are unlikely to be directly impacted by on-Site air emissions, noise pollution, or other negative impacts arising at the Site. However, they may be impacted by off-Site impacts, 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 that would be in continuous use 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.

Under the CBR-Offsite scenario, EJ communities located along the haul route to the off-Site landfill or near the off-Site landfill itself could potentially be negatively impacted throughout the excavation period by the air pollution, noise, traffic, and accidents generated by CCR-hauling activities. Figure 2.1 demonstrates that the off-Site landfill is not located within one mile of any EJ communities. However, based on the three major haul routes suggested by Google Maps (Google, 2022), transport of CCR to the off-Site landfill could potentially entail hauling CCR through the EJ communities near Lawrenceville, IL, Vincennes, IN, or Terre Haute, IN (Figure 2.1; IEPA, 2019b; US EPA, 2020).

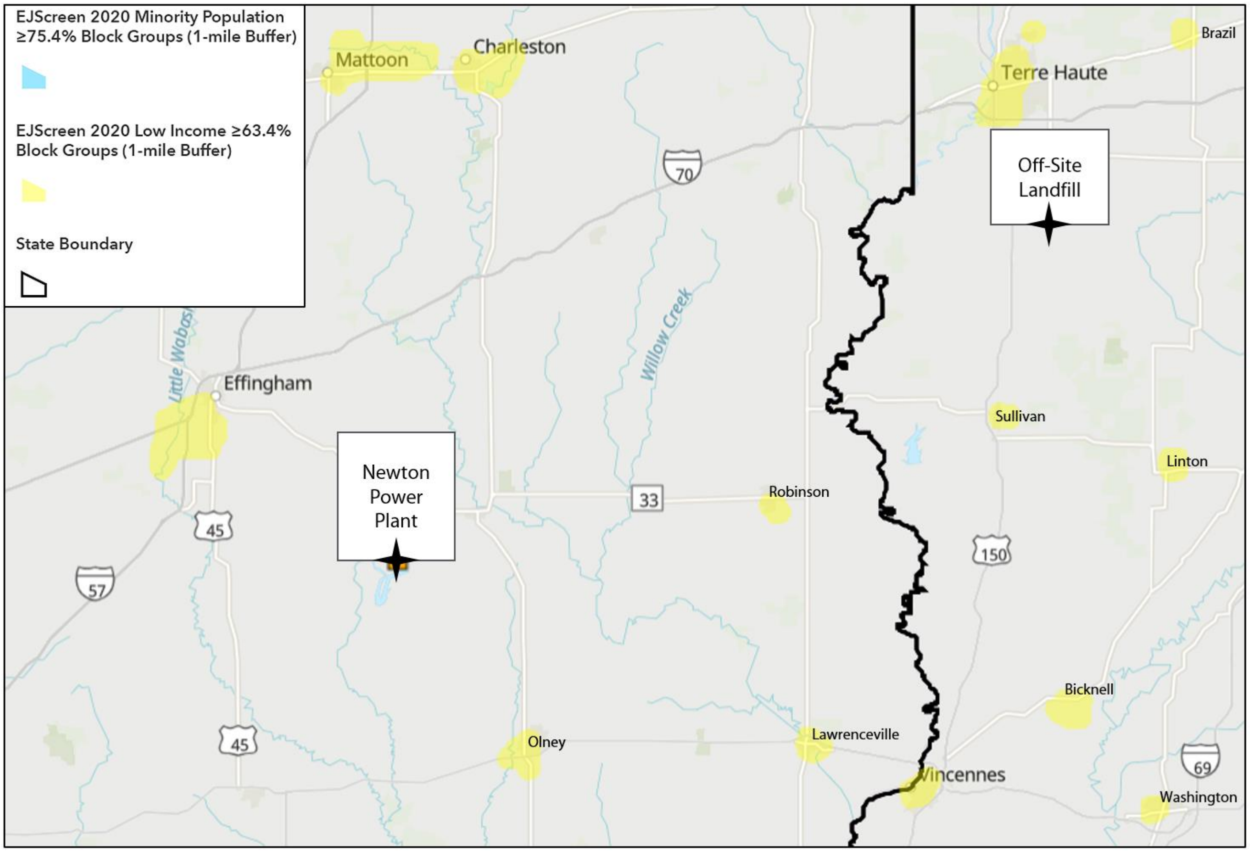

Figure 2.1 Environmental Justice Communities in the Vicinity of the Site and the Off-Site Landfill. Sources: IEPA (2019b) and US EPA (2020).

Scenic, Historical, and Recreational Value

During construction activities, negative impacts on scenic and recreational value may occur on Newton Lake and within the greater Newton Lake SFWA. Noise impacts were described above. In addition, construction activities at the PAP may be visible to recreators using Newton Lake and the Newton Lake SFWA, potentially interfering with enjoyment of the view. Negative impacts would not be expected to occur within any scenic, recreational, or conservation areas located further away from the Site, including the Prairie Ridge State Natural Area and Jasper County Prairie Chicken Sanctuary. Because the expected duration of construction activities is longer under the CBR-Onsite and CBR-Offsite scenarios than under the CIP scenario (3.2 to 4.3 years for CIP *vs*. 7.8 to 9.2 years for CBR-Onsite *vs*. 22 years for CBR-Offsite), short-term impacts on the scenic and recreational value of natural areas near the Site would be greater under these two closure scenarios 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 PAP or the on-Site landfill (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 far greater under the CBR-Offsite scenario than under the CIP and CBR-Onsite scenarios, because the total on-Site and off-Site vehicle and equipment travel miles required under the CBR-Offsite scenario (75,300,000 miles) is greater than those required under the CIP scenario (3,550,000 miles) and the CBR-Onsite scenario (6,150,000 miles; Tables 2.1 through 2.3).

We did not quantify the carbon footprint of the approximately 268 acres of geomembrane liner material required for the final PAP 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. Expansion of the on-Site landfill under the CBR-Onsite scenario and 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 liners.

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 far greater under the CBR-Offsite scenario than under the CIP or CBR-Onsite scenarios. We did not quantify the energy demands of the geomembranes required for the construction of the final cover system under the CIP scenario, the geomembranes required for the expansion of the on-Site landfill under the CBR-Onsite scenario, or, potentially, the geomembranes required for expansion of the off-Site landfill under the CBR-Offsite scenario.

The Newton Power Plant Site is slated for re-development as a utility-scale solar power generating facility and a 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, create jobs, benefit the reliability of the electrical grid, and support Illinois' path toward 100 percent clean energy by 2050. The CIP scenario would result in more rapid re-development of a solar facility on the capped impoundment– and, hence, the more rapid realization of grid-scale solar energy benefits – than the two CBR scenarios.

Natural Resources and Habitat

During closure, major construction activities such as the excavation of the impoundment, the excavation of the borrow area, the expansion of the on-Site landfill, and, potentially, the expansion of the off-Site landfill 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 all closure scenarios, it is possible that limited negative short-term impacts could occur to sensitive aquatic species in Newton Lake and the other minor surface water bodies located near the PAP (see Section 1.1.3) due to sediment runoff during construction. Short-term impacts on natural resources and habitat would be greater under the CBR-Onsite and CBR-Offsite scenarios than under the CIP scenario, because the overall duration of construction would be longer under the two CBR scenarios than under the CIP scenario (3.2 to 4.3 years for CIP *vs*. 7.8 to 9.2 years for CBR-Onsite *vs*. 22 years for CBR-Offsite).

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 various closure scenarios.

According to the IDNR Natural Heritage Database, there are 18 endangered species and 7 threatened species within Jasper 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). Nonetheless, pursuant to requirements under IAC Section 845.710, this section of the text describes the time required to achieve GWPSs at the Site.

As described above in Section 1.1.4 (Hydrogeology), water and CCR-associated constituents from the PAP may migrate vertically downward until they reach the UD/PMP and the UA. Beneath the PAP, groundwater within the UA generally flows from the north towards the south/southwest, converging near a former drainage feature located along the western edge of the PAP (Ramboll, 2021). In the northern area of the PAP, groundwater from the UA may interact with surface water in Newton Lake, as evidenced by groundwater head elevations in this area that are higher than the surface water level in Newton Lake. Groundwater within the UD/PMP may also interact with surface water in Newton Lake.

At the Newton Site, seasonal variation in groundwater levels generally results in groundwater elevation fluctuations of less than one foot. Surface water elevations in Newton Lake similarly do not fluctuate significantly over time, since the lake elevation is controlled by a dam. As a result, groundwater flow directions at the Site are not generally affected by seasonal variabilities (Ramboll, 2021).

Groundwater modeling was performed to evaluate future groundwater quality in the vicinity of the PAP under each of the proposed closure alternatives (Ramboll, 2022). Model predictions indicate that groundwater concentrations in monitoring wells within the UD/PMP and UA will achieve the GWPS within 20 years after closure under the CIP scenario and within 16 years after closure under both CBR closure scenarios (Ramboll, 2022). The model predicted a four-year time difference when GWPSs are achieved for CIP (20 years post-closure) and CBR (16 years post-closure) is not significant. Furthermore, because the estimated duration of construction activities for CBR is at least about four years longer than the duration of construction activities for CIP (3.2-4.3 years for CIP compared to 7.8-9.2 years for CBR-Onsite and 22 years for CBR-Offsite; Section 2.1), CIP may actually achieve the GWPSs faster than either the CBR-Onsite or CBR-Offsite scenarios.

Model predictions also indicate that groundwater concentrations will remain above the GWPSs in the UCU for a period of more than 100 years for both the CIP and CBR scenarios. This is due to the retention of constituent mass within the thick, low conductivity layer which underlies the PAP. However, in both the CIP and CBR scenarios, the plume footprint continues to recede over time and remains within the property boundaries, indicating that both closure scenarios perform equivalently with regard to achieving the GWPSs (Ramboll, 2022).

Additionally, changing geochemical conditions during the extended excavation associated with the CBR-Offsite and CBR-Onsite scenarios can be a mechanism that results in the mobilization and increased transport of some constituents in groundwater. This may result in GWPS exceedance durations in excess of the model predictions for the CBR-Offsite and CBR-Onsite scenarios.

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 PAP. 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 PAP. 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 and EJ communities related to accidents, traffic-related impacts, 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 two CBR scenarios (see Section 2.2.2 above). Additionally, there are no current or future unacceptable risks to any human or ecological receptors under any 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 on-Site and off-Site landfills under the CBR-Onsite and CBR-Offsite scenarios. All 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 PAP 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 any closure scenario.

2.3.2 Extent to Which Treatment Technologies May Be Used (IAC Section 845.710(b)(2)(B))

Under all three 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 Newton Lake 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-Onsite and CBR-Offsite pose additional implementation difficulties due to higher earthwork volumes and higher dewatering volumes, and longer construction schedules. Relative to the CBR-Onsite scenario, hauling would be far more difficult to implement under the CBR-Offsite scenario due to the longer haul distance required for off-Site disposal than for on-Site disposal (approximately 75 miles *versus* 1 mile) and the need to haul the CCR over public roads. Hauling over public roads rather than private roads would require the use of lower-volume haul trucks (16.5 CY *versus* 34 CY), which would increase the number of trucks and trips required for CCR excavation and transport. Additionally, because the CBR-Offsite scenario would involve hauling CCR off-Site (*i.e.*, intrastate travel), a higher level of dewatering would be required under this scenario compared to the CBR-Onsite scenario. As described in Section 2.2.4.2 ("Community Risks"), off-Site hauling may also have detrimental community impacts due to 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 IPGC 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 and may require additional permitting. 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 PAP.

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 two CBR scenarios. 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 on-Site and off-Site landfills under the CBR-Onsite and CBR-Offsite scenarios. As such, operational reliability would be expected under all 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 all closure scenarios. Components of the three closure scenarios that would be expected to require a permit include:

- A modification to the existing NPDES permit through IEPA to allow the disposal of water generated from unwatering and dewatering operations to Newton Lake *via* the existing NPDES-permitted outfall for the Site;
- A construction permit from the Illinois Department of Natural Resources, Office of Water Resources, Dam Safety Program to allow the embankment and spillways of the PAP 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, the existing on-Site landfill would require expansion under the CBR-Onsite scenario in order to accommodate all of the material excavated from the PAP. Expansion of the onsite landfill would require permitting from the IEPA Bureau of Land, under Title 35 Section 811 and 812, and approval from local government. Under the CBR-Offsite scenario, it may similarly be necessary to expand the off-Site landfill. 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, CBR-Onsite, 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 all 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 higher earthwork volumes and a longer construction schedule under the CBR-Onsite and CBR-Offsite scenarios than under the CIP scenario, shortages in construction equipment may cause greater challenges under these scenarios than under the CIP scenario. The current shortage of truck drivers may be particularly impactful under the CBR-Offsite scenario, due to the large volume of CCR to be hauled from the Site. 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 PAP would be stored within the existing footprint of the PAP. Treatment would consist of unwatering the PAP at the start of construction, performing limited dewatering to stabilize the CCR subgrade, and managing stormwater inflow. Water from unwatering and dewatering of the PAP would be discharged in accordance with the NPDES permit for the facility. Under the two CBR scenarios, water treatment would similarly consist of unwatering and dewatering the PAP 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 two CBR scenarios than under the CIP scenario.

Under the CBR-Onsite and CBR-Offsite scenarios, 5.7 million CY of CCR would be excavated from the PAP and require disposal. The existing landfill on the Newton Power Plant property does not have sufficient capacity to receive all of the CCR that is currently slated for landfilling under the CBR-Onsite scenario. Expansion of the on-Site landfill would thus be necessary. The steps required for on-Site landfill expansion were described above in Section 2.1.2. Under the CBR-Offsite scenario, CCR would be sent to the Sycamore Ridge Landfill in Pimento, Indiana, which is located approximately 75 miles from the Site (Attachment B). The Sycamore Ridge Landfill has approximately 10 million CY of remaining capacity, and should therefore be able to accept all of the material excavated from the PAP without expansion (Attachment B). However, closure of the PAP 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.

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 (Attachment A), both modeled and measured surface water concentrations in Newton Lake are below relevant human health and ecological screening benchmarks. Surface water concentrations of CCR-associated constituents would be expected to decline over time under all closure scenarios. Thus, no current or future exceedances of any human health or ecological screening benchmarks would be anticipated under any closure scenario.

The lined landfills that would receive the CCR excavated from the impoundment under the CBR-Onsite and CBR-Offsite scenarios 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 any closure scenario.

2.6 Concerns of Residents Associated with Closure Alternatives (IAC Section 845.710(b)(4))

Several nonprofits representing community interests near the Site have raised concerns regarding the potential impacts of the PAP on groundwater and surface water quality, including Earthjustice, the Prairie Rivers Network, and the Sierra Club (Earthjustice *et al*., 2018; Sierra Club and CIHCA, 2014). These parties generally prefer CBR to CIP, citing fears that allowing CCR to remain in place "allows the widespread groundwater contamination to continue indefinitely" (Earthjustice *et al*., 2018). However, it is not the case that closing the PAP *via* CIP rather than CBR 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 PAP under any scenario. There is also minimal risk of future CCR releases occurring under any scenario. Furthermore, groundwater modeling conducted at the Site demonstrated that both closure scenarios perform equivalently with regard to achieving the GWPSs (Ramboll, 2022). All three closure scenarios are therefore responsive to residents' concerns regarding impacts to groundwater and surface water quality. Additionally, the CIP and CBR-Onsite scenarios have several advantages over the CBR-Offsite scenario with regard to likely community concerns. Specifically, because the CIP and CBR-Onsite scenarios do not require any off-Site hauling, they present fewer risks to workers, nearby residents, and potentially EJ communities than the CBR-Offsite scenario during construction in the form of off-Site 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-Onsite and CBR-Offsite scenarios, due to the shorter duration of construction activities. Finally, the Site can be more rapidly re-developed for installation of solar panels on the capped impoundment under the CIP scenario than under the CBR-Onsite and CBR-Offsite scenarios. Re-development of the Site for use in solar generation and battery energy storage would bring new jobs to the community and contribute positively to Illinois's growing renewable energy portfolio.

A public meeting was held on May 24, 2022, pursuant to requirements under IAC Section 845.710(e). Questions raised by 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, 2021a).

2.8 Summary

Table S.1 (Summary of Findings) summarizes the expected impacts of the CIP, CBR-Onsite, 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 PAP. Key benefits of the CIP scenario relative to the CBR-Onsite and CBR-Offsite scenarios include more rapid re-development of the Site for installation of solar panels on the capped impoundment and reduced impacts to workers, community members, and the environment during construction (*e.g.*, fewer constructed-related accidents, lower energy demands, less air pollution and GHG emissions, reduced duration of traffic-related impacts, and potentially lower impacts to EJ communities). Moreover, the CIP scenario will meet the requred closure schedule (*i.e.*, closure completed by October 2028) defined in IAC Section 845.700(d)(2)(C)(ii) (IEPA, 2021a), whereas the CBR-Onsite and CBR-Offsite scenarios will be unable to meet this required schedule.

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Attachment A

Human Health and Ecological Risk Assessment

Human Health and Ecological Risk Assessment
Primary Ash Pond
Newton Power Plant
Newton, Illinois

July 28, 2022

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Abbreviations

ADI	Acceptable Daily Intake
BCF	Bioconcentration Factor
BCG	Biota Concentration Guide
BCU	Bedrock Confining Unit
CAA	Closure Alternatives Assessment
CCR	Coal Combustion Residual
CEM	Conceptual Exposure Model
COI	Constituent of Interest
COPC	Constituent of Potential Concern
CSF	Cancer Slope Factor
CSM	Conceptual Site Model
ESV	Ecological Screening Value
GWPS	Groundwater Protection Standard
GWQS	Groundwater Quality Standards
HTC	Human Threshold Criteria
IAC	Illinois Administrative Code
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
ILWATER	Illinois Water and Related Wells
IPGC	Illinois Power Generating Company
ISGS	Illinois State Geological Survey
LCU	Lower Confining Unit
LF 1	Phase 1 Landfill
LF 2	Phase 2 Landfill
MCL	Maximum Contaminant Level
NPDES	National Pollutant Discharge Elimination System
NPP	Newton Power Plant
NRWQC	National Recommended Water Quality Criteria
ORNL RAIS	Oak Ridge National Laboratory's Risk Assessment Information System
PAP	Primary Ash Pond
PMP	Potential Migration Pathway
PRG	Preliminary Remediation Goal
RfD	Reference Dose
RME	Reasonable Maximum Exposure
RSL	Regional Screening Level
SWQS	Surface Water Quality Standards
TEC	Threshold Effect Concentration
TSS	Total Suspended Solids
UA	Uppermost Aquifer
UCU	Upper Confining Unit
UD	Upper Drift
US DOE	United States Department of Energy
US EPA	United States Environmental Protection Agency

1 Introduction

Illinois Power Generating Company's (IPGC) Newton Power Plant (NPP, or "the Site") is an electric power generating facility with coal-fired units located approximately seven miles southwest of the city of Newton, Illinois. The facility began operating in approximately 1977 and will be retired by the end of 2027 (Meeker, 2020; Ramboll, 2021). The NPP has one surface impoundment for storage of coal combustion residuals (CCR), known as the Primary Ash Pond (PAP), that was constructed in 1977 and covers approximately 404 acres (Ramboll, 2021). Closure of the PAP (Illinois Environmental Protection Agency [IEPA] ID No. W0798070001-01), which is the subject of this report, is planned to commence by the end of 2022.

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 PAP. This risk evaluation was performed to support the Closure Alternatives Assessment (CAA) for the PAP 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 adjacent Newton Lake 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 (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 PAP 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 unacceptable risks were identified for recreators boating in Newton Lake adjacent to the Site.
- No unacceptable risks were identified for recreators exposed to sediment in Newton Lake adjacent to the Site.
- No unacceptable risks were identified for anglers consuming locally caught fish.
- No unacceptable risks were identified for ecological receptors exposed to surface water or sediment.
- No bioaccumulative ecological risks were identified.

It should be noted that this evaluation incorporates a number of conservative assumptions that tend to overestimate exposure and risk. Moreover, it should be noted that because current conditions do not present a risk to human health or the environment, there will also be no unacceptable risk to human health or the environment for future conditions when the PAP 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 NPP is located in Jasper County Illinois, approximately seven miles southwest of the city of Newton. The PAP is located south of the power plant in a predominantly agricultural area. The PAP is surrounded by Newton Lake on the west, south, and east (Figure 2.1) (Ramboll, 2021). Three CCR units are present on the NPP property, including the PAP and two landfills; the Phase 1 Landfill (LF 1) is located northwest and west of the PAP, and the Phase 2 Landfill (LF 2) is located west of the PAP. The PAP is the subject of this report (Ramboll, 2021). The PAP discharges into a secondary pond located immediately south of the PAP, which then discharges to Newton Lake under a National Pollutant Discharge Elimination System (NPDES) permit (No. IL0049191) (Ramboll, 2021).

Newton Lake was formed by the construction of a dam in 1975 (US National Dams, 2022), and is used as a cooling water supply for the NPP (IDNR, 2019). Water is drawn from the eastern arm near the power plant and thermal effluent is released at two locations in the western arm via NPDES permitted outfalls (IEPA, 2016).

Figure 2.1 Site Location Map. Source: Ramboll, 2021.

2.2 Geology/Hydrogeology

The geology underlying the Site in the vicinity of the PAP primarily consists of unlithified deposits overlying a shale bedrock unit. The principal types of unlithified materials include the Peoria Silt /Sangman Soil, the Hagarstown Member, the Vandalia Till, the Mulberry Grove Member, and the Smithboro Till/Banner Formation (Ramboll, 2021). These unlithified deposits are underlain by a Pennsylvanian Age shale bedrock of the Mattoon Formation (Ramboll, 2021). Five distinct hydrostratigraphic units in the area are (listed from ground surface down): the Upper Drift (UD)/Potential Migration Pathway (PMP), the Upper Confining Unit (UCU), the Uppermost Aquifer (UA), the Lower Confining Unit (LCU), and the Bedrock Confining Unit (BCU) (Ramboll, 2021).

The UD is composed of low permeability silts and clays of the Peoria Silt and Sangamon Soil and the sandier soils of the Hagarstown Member (*i.e.*, PMP). The Hagarstown Member is generally 2 feet (ft) thick but is encountered at thicknesses up to about 6.9 ft in the vicinity of the Ash Pond (Ramboll, 2021). The UD/PMP has a geometric mean horizontal hydraulic conductivity of 3.1×10^{-3} cm/s (Ramboll, 2021). The UA is composed of a 3 to 17 ft thick Mulberry Grove Member, which consists of sand, silty- and clayey-sand, and gravel. The UA has a geometric mean horizontal hydraulic conductivity of 6.8×10^{-3} cm/s (Ramboll, 2021). The UA is sandwiched between two low-permeability confining units: (i) the UCU on top consisting of clay and silt of the Vandalia Till and (ii) the LCU on bottom consisting of silt and clay of the Smithboro Till Member and the Banner Formation (Ramboll, 2021). No wells are screened within the UCU, the LCU, or the underlying shale BCU. Field hydraulic conductivity tests were not performed in any of these confining units (Ramboll, 2021).

Groundwater within the UA flows generally from the north towards the south and southwest. In the southern area of the PAP, groundwater flows toward a former drainage feature located west of the PAP (Ramboll, 2021). In the northern area of the PAP, groundwater from the UA may interact with surface water in Newton Lake, as evidenced by relatively higher groundwater head elevations compared to the Newton Lake water level. Groundwater velocities in the UA range from 0.04 to 1.9 ft/day. Horizontal hydraulic gradients calculated for the UA range from 0.0025 to 0.0071 ft/ft (Ramboll, 2021). Groundwater within the UD/PMP may also flow into Newton Lake; however, flow velocity or hydraulic gradient have not been calculated or measured within the PMP (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 PAP migrates and interacts with surface water and sediment in the adjacent Newton Lake. The CSM was developed using available hydrogeologic data specific to the PAP (Ramboll, 2021), including information on groundwater flow and surface water characteristics.

CCR-related constituents may migrate vertically downward beneath the PAP and into groundwater; these constituents may subsequently migrate with groundwater in the UA and the PMP and flow into the eastern arm of Newton Lake. CCR-related constituents from the PAP may migrate vertically downward through the UD/PMP and the UCU into the UA (Ramboll, 2021). The north to south groundwater flow within the UA is mostly in the horizontal direction because the UA is underlain by two low-permeability confining units (*i.e.*, LCU and BCU) that inhibit vertical flow (Ramboll, 2021). A component of the CCR-related constituents from the PMP may also flow into Newton Lake, particularly on the eastern portion of the PAP where groundwater and surface water interact. After groundwater flows into the lake, dissolved constituents in groundwater may partition between sediments and surface water.

2.4 Groundwater Monitoring

A total of 29 wells have been used to monitor the groundwater quality near and downgradient of the PAP. Of these, 23 wells are screened in the UA, and 6 wells are screened in the UD (Table 2.1). The analyses presented in this report relied on all available data from the 29 wells collected between 2015 and 2021, which is the period subsequent to the promulgation of the Federal CCR Rule. Groundwater samples were analyzed for a suite of total metals, specified in Illinois CCR Rule Part 845.600 (IEPA, 2021).[1] A summary of the groundwater data used in this risk evaluation is presented in Table 2.2. The PAP well locations are shown in Figure 2.2. Note that there are additional wells in the vicinity of the PAP (shown in Figure 2.1) that were not used in this risk analysis, because they were screened in the CCR and are not reflective of groundwater conditions. The use of groundwater data in this risk evaluation does not imply that detected constituents are associated with the PAP or that they have been identified as potential groundwater exceedances.

[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.

Figure 2.2 Monitoring Well Locations. Source: Ramboll, 2021, Figure 3-1.

Table 2.1 Groundwater Monitoring Wells Related to Newton Primary Ash Pond

Well	Hydrogeologic Unit	Date Constructed	Screen Top Depth (ft bgs)	Screen Bottom Depth (ft bgs)	Well Depth (ft bgs)
APW02	UD	06/19/2010	9.70	19.70	20.00
APW03	UD	06/18/2010	9.70	19.70	20.00
APW04	UD	06/19/2010	7.70	17.70	18.00
APW05	UA	10/22/2015	62.64	67.44	67.84
APW05S	UD	01/19/2021	10.00	20.00	20.00
APW06	UA	10/21/2015	67.67	72.48	72.88
APW07	UA	11/05/2015	77.89	82.70	83.10
APW08	UA	10/28/2015	71.40	81.06	81.53
APW09	UA	11/03/2015	56.66	61.46	61.85
APW10	UA	11/06/2015	40.74	45.54	45.94
APW11	UA	01/23/2021	60.00	65.00	65.00
APW12	UD	02/21/2021	20.00	30.00	30.00
APW13	UA	01/22/2021	58.50	63.50	63.50
APW14	UA	01/23/2021	50.00	55.00	55.00
APW15	UA	01/22/2021	98.00	103.00	103.00
APW16	UA	01/20/2021	80.50	85.50	85.50
APW17	UA	01/22/2021	87.00	92.00	92.00
APW18	UA	01/21/2021	75.00	80.00	80.00
G48MG	UA	10/20/2015	71.80	76.65	77.06
G202	UA	10/16/1996	64.00	74.00	74.00
G203	UA	11/15/1996	62.50	72.50	72.50
G208	UA	10/13/2011	74.93	94.71	94.80
G217S	UD	08/26/1997	9.00	19.00	19.00
G217D	UA	12/09/2014	--	--	69.30
G222	UA	10/25/2011	64.57	79.24	79.30
G223	UA	10/11/2011	79.09	88.75	89.10
G224	UA	10/05/2011	63.51	73.17	73.50
R202	UA	--	--	--	--
R217D	UA	09/26/2017	60.10	65.03	65.24

Notes:
-- = Data Unavailable.
bgs = Below Ground Surface; ft = Feet; UA = Uppermost Aquifer; UD = Upper Drift.
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	2	225	0.0035	0.0036	0.003
Arsenic	204	225	0.001	0.13	0.001
Barium	225	225	0.0075	1.5	0.001
Beryllium	3	225	0.0025	0.0033	0.001
Boron	358	358	0.023	0.66	0.02
Cadmium	4	225	0.0012	0.0034	0.001
Chromium	39	225	0.004	0.09	0.004
Cobalt	37	225	0.002	0.036	0.002
Lead	59	225	0.001	0.065	0.001
Lithium	106	225	0.01	0.3	0.02
Mercury	14	225	0.0002	0.002	0.0002
Molybdenum	195	225	0.0011	0.045	0.001
Selenium	9	225	0.001	0.006	0.001
Thallium	5	225	0.0011	0.0036	0.001
Radionuclides (pCi/L)					
Radium-226+228	225	225	0.0127	15.2	1.85
Other (mg/L, unless otherwise noted)					
Chloride	372	372	8	550	500
Fluoride	316	360	0.258	8.16	6.25
Sulfate	331	370	1	3200	500
Total Dissolved Solids	482	482	300	5500	34

Notes:
pCi/L = PicoCuries Per Liter.

2.5 Surface Water Monitoring

Golder collected a total of 28 surface water samples from Newton Lake in the vicinity of the PAP in April and May, 2021 (Golder Associates Inc., 2021). The sample locations are shown in Figure 2.3, and the sampling results are summarized in Table 2.3.

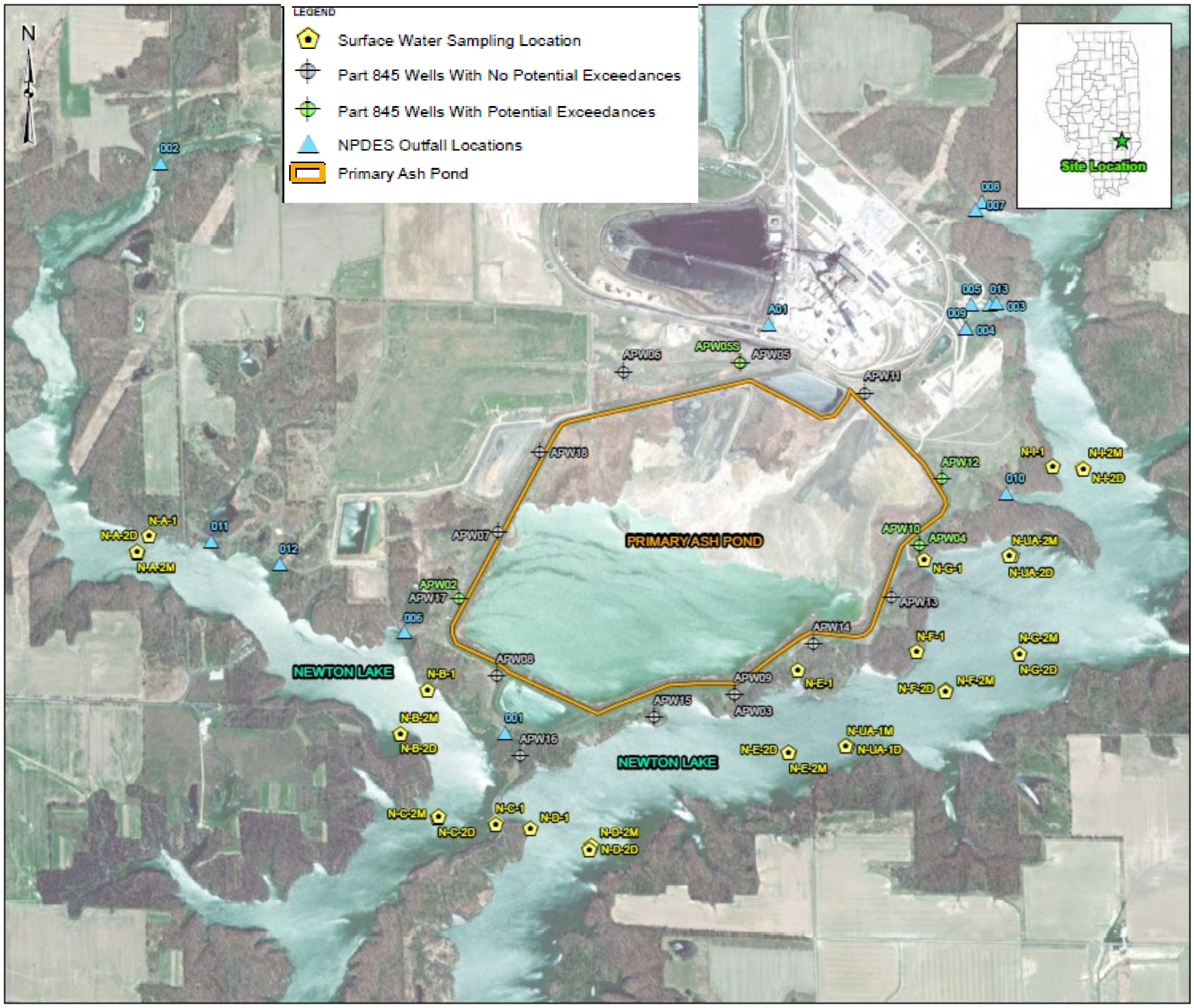

Figure 2.3 Surface Water Sampling Locations. Source: Golder Associates Inc., 2021.

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)					
Antimony	0	28			0.003
Arsenic	28	28	0.0018	0.0042	0.001
Barium	28	28	0.052	0.64	0.001
Beryllium	0	28			0.001
Boron	28	28	0.11	0.14	0.01
Cadmium	0	28			0.001
Calcium	28	28	19	22	0.2
Chromium	1	28	0.0067	0.0067	0.004
Cobalt	0	28			0.002
Iron	28	28	0.027	1.2	0.01
Lead	0	28			0.001
Lithium	0	28			0.02
Magnesium	28	28	5.0	5.8	0.1
Manganese	28	28	0.044	0.69	0.001
Mercury	0	28			0.0002
Molybdenum	28	28	0.0046	0.0062	0.001
Potassium	28	28	5.6	10	0.1
Selenium	0	28			0.001
Sodium	28	28	19	22	0.1
Thallium	0	28			0.001
Radionuclides (pCi/L)					
Radium-226+228	28	28	0.012	2.1	1.09
Other (mg/L)					
Chloride	28	28	8.5	9.6	1
Fluoride	28	28	0.35	0.51	0.25
Sulfate	28	28	35	95	25
Total Dissolved Solids	28	28	170	240	34

Notes:
COI = Constituent of Interest; pCi/L = PicoCuries Per Liter.
Surface water was analyzed for both total and dissolved metals; only total metals are reported here because they generally have higher concentrations than dissolved metals. However, the maximum dissolved concentrations for boron, manganese, and molybdenum are slightly higher (up to a factor of two) than the maximum total concentrations, but boron, manganese, and molybdenum have not been identified as COIs.

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 PAP 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.

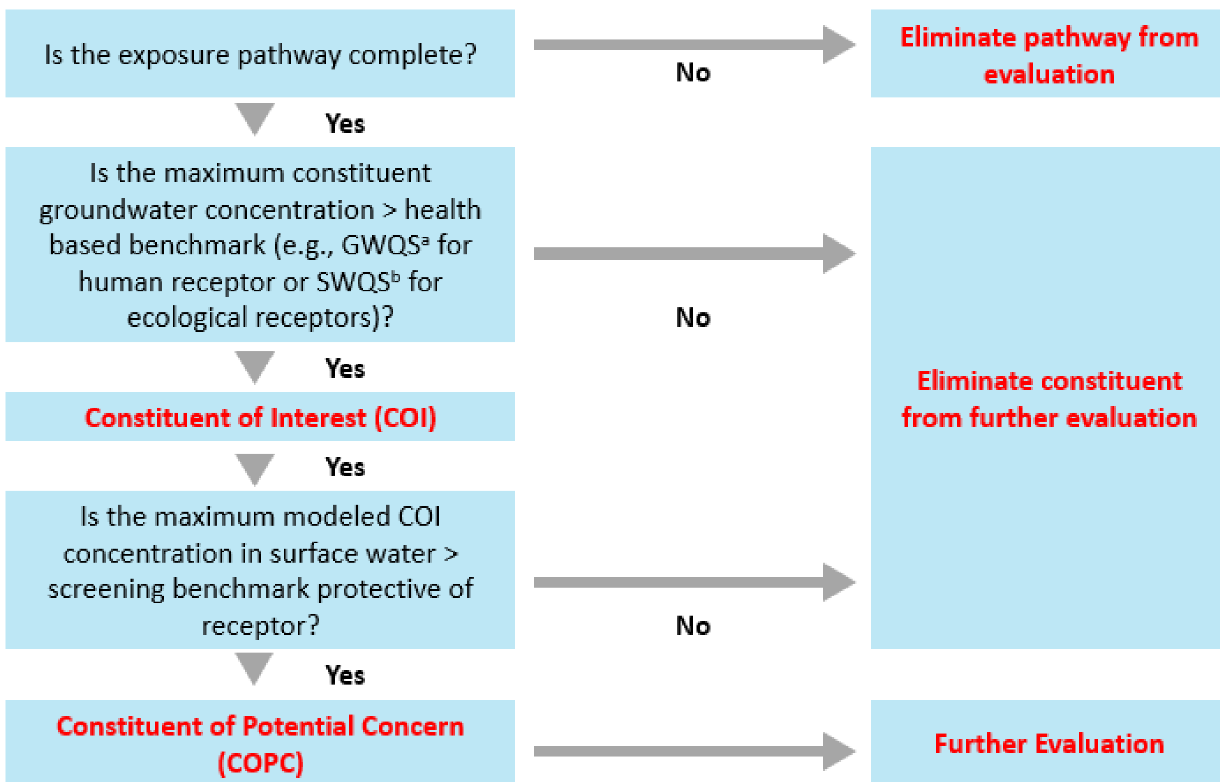

Figure 3.1 Overview of Risk Evaluation Methodology. IEPA = Illinois Environmental Protection Agency; GWQS = IEPA Groundwater Quality Standards; SWQS = IEPA Surface Water Quality Standards. (a) The IEPA Part 845 Groundwater Protection Standards (GWPS) were used to identify COIs. (b) IEPA SWQS protective 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 surface water quality standards (SWQS) for ecological receptors. Based on the CSM (Section 2.2), some groundwater underlying the PAP has the potential to interact with surface water in Newton Lake. Therefore, potential PAP-related constituents in groundwater may potentially flow toward and into surface water in Newton Lake.

Surface water samples have been collected from Newton Lake adjacent to the Site; however, sediment samples have not been collected from the lake. 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 PAP-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 PAP 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 PAP 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 lake 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, and swimming. Section 3.2.1.1 explains why the residential drinking water and irrigation pathways are incomplete, and Section 3.2.1.2 provides additional description of the recreational exposures. While a recreator's potential exposure to surface water in Newton Lake was evaluated, swimming does not occur in Newton Lake, because it is owned by IPGC and used as a cooling reservoir (IDNR, 2022).

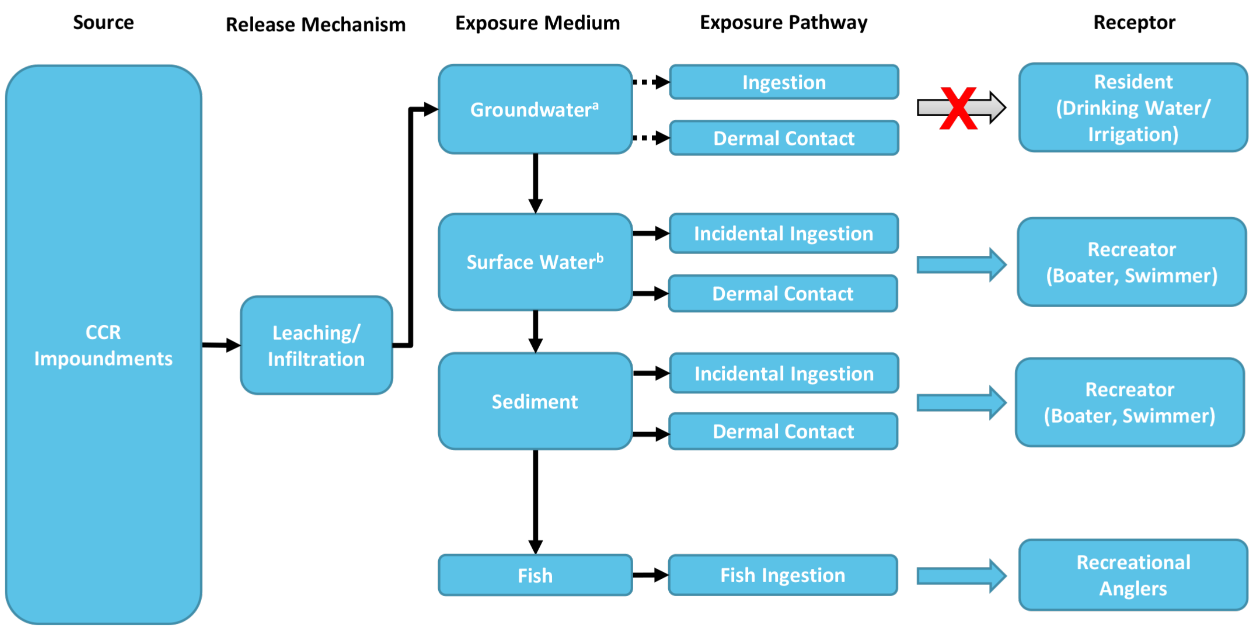

Figure 3.2 Human Conceptual Exposure Model. CCR = Coal Combustion Residual. Dashed line/Red X = Incomplete or insignificant exposure pathway. (a) Groundwater in the vicinity of the Site is not used as a drinking water or irrigation source. (b) Surface water is not used as a drinking water source.

3.2.1.1 Groundwater or Surface Water as a Drinking Water/Irrigation Source

Groundwater as a source of drinking water and/or irrigation water is not a complete exposure pathway for CCR-related constituents originating from the PAP. Specifically, shallow groundwater from the UA and the PMP in the vicinity of the PAP is not used as a source of drinking water, and no potable wells were identified downgradient of the PAP. A summary of the evidence supporting the conclusion that there are no residential uses of the shallow groundwater and Newton Lake surface water as a source of drinking water is presented below:

- **No potential groundwater receptors are in the vicinity of the PAP**. Relying on state databases, Ramboll completed a potable water well survey in 2021 (Ramboll, 2021). Two wells[3] were identified within a 1,000-meter radius of the PAP boundary during a comprehensive search of the Illinois State Geological Survey's (ISGS) Illinois Water and Related Wells (ILWATER) Map (ISGS, 2020) (Figure 3.3). Both wells are listed as dry/abandoned and are not currently in use as a source of drinking water (Ramboll, 2021).
- **There is no off-Site migration of CCR-related constituents in groundwater**. Newton Lake is intersected by both the UA and the PMP; thus, groundwater from the UA and the PMP may interact with surface water in the lake in some areas. The two water wells that are identified within a 1,000 m radius of the PAP are located on the southeast side of Newton Lake, *i.e.*, the opposite side of the lake from the PAP. Thus, Newton Lake separates the wells from the PAP (Figure 3.3). CCR-constituents in groundwater within the UA and the PMP are not expected to flow underneath or bypass Newton Lake.
- **Newton Lake adjacent to the PAP is not used as a public water supply.** Newton Lake is a cooling water pond owned and maintained by IPGC. IPGC restricts the use of the pond as a source of drinking water. Therefore, the human exposure pathway of surface water ingestion (as potable water) adjacent to the PAP was not evaluated further.
- **The PAP has a limited hydraulic connection to underlying groundwater**. The LCU and the shale BCU underlying the shallow aquifers (*i.e.*, the UA and the PMP) form a hydraulic barrier between the PAP and deeper groundwater resources. Due to the very low hydraulic conductivity of these confining units, downward migration of shallow groundwater is expected to be limited. Therefore, the likelihood of PAP-related impacts to deep groundwater is minimal.

[3] These are well numbers 120790038600 and 120790043600 (Ramboll, 2021).

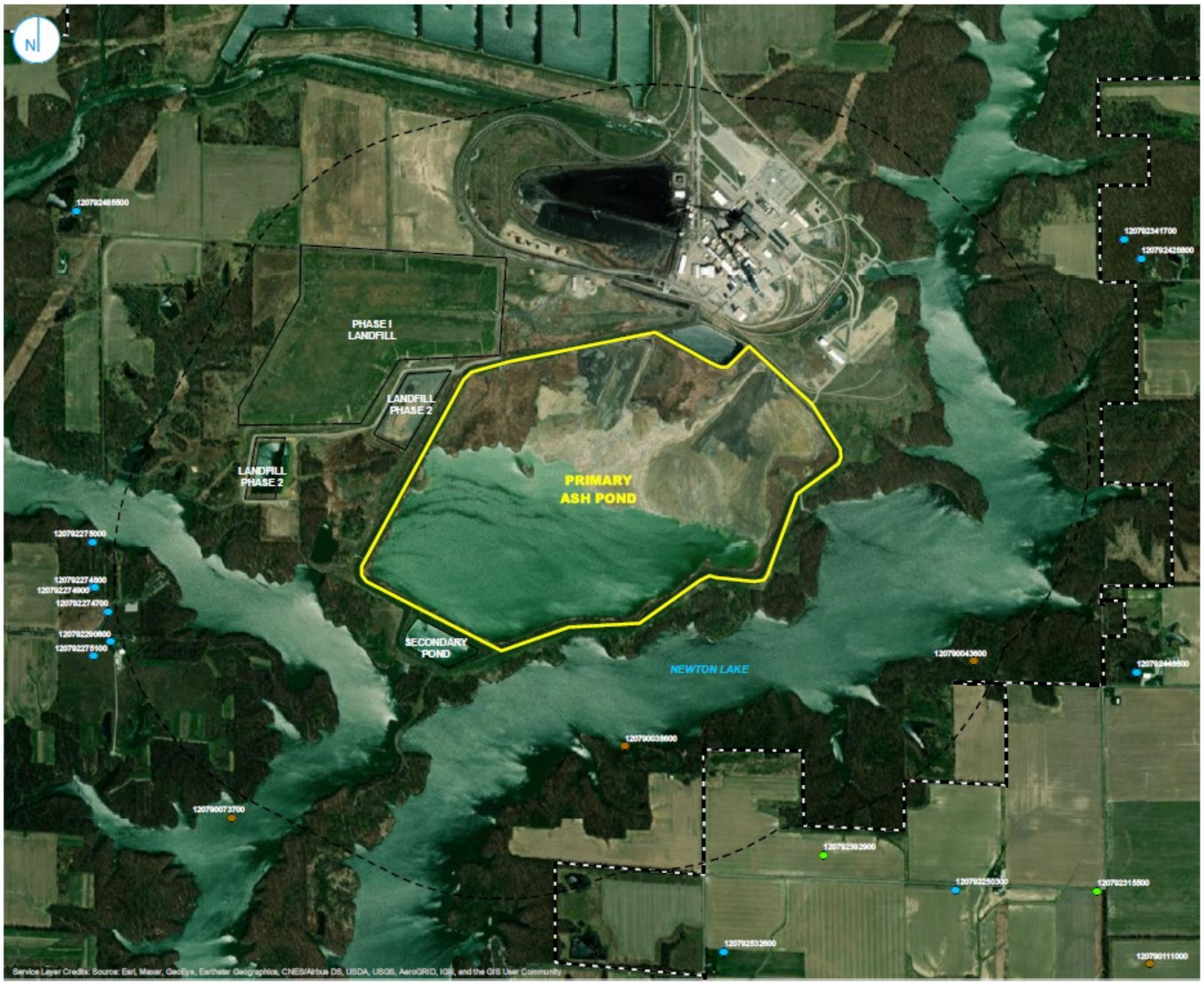

Figure 3.3 Water Wells Within 1,000 meters of the Primary Ash Pond. Source: Ramboll, 2021, Figure B-1.

3.2.1.2 Recreational Exposures

Newton Lake is located adjacent to the Site and is owned by IPGC. A portion of the NPP property along the lake has been leased to the Illinois Department of Natural Resources (IDNR) for use as a State Fish and Wildlife Area; thus, the lake is used for recreational fishing (IDNR, 2019). Recreational exposure to surface water and sediment may occur during activities such as boating or fishing in the lake. Recreational anglers may also consume locally caught fish from Newton Lake. Swimming does not occur in Newton Lake because it is owned by IPGC and used as a cooling reservoir (IDNR, 2022).

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 3.4 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).

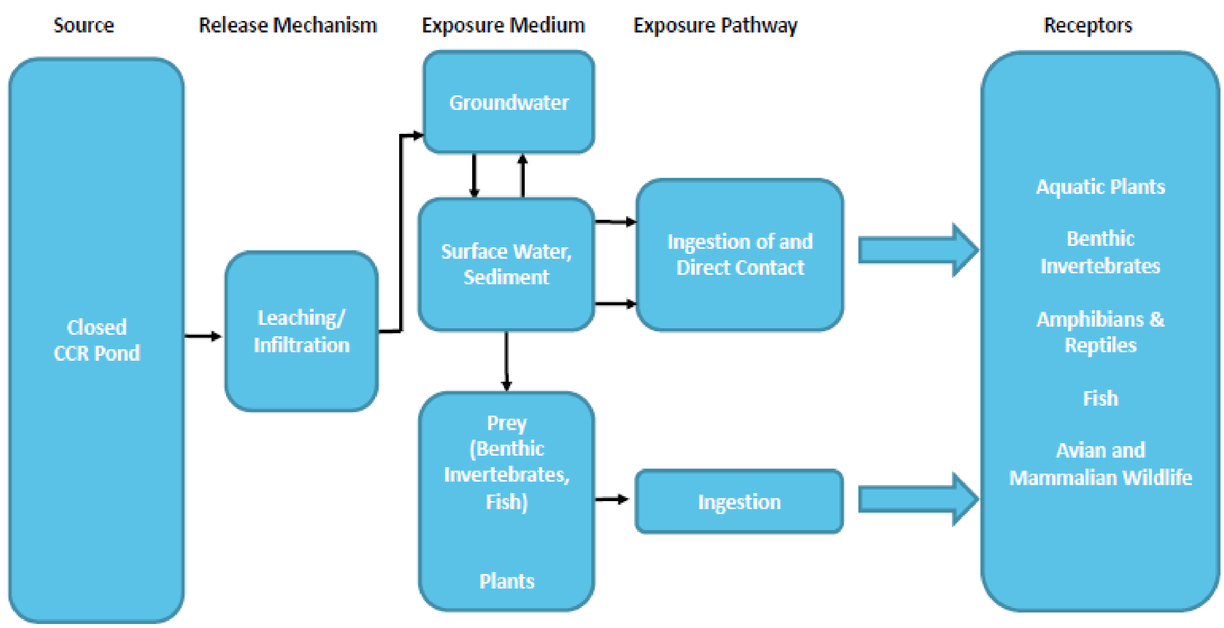

Figure 3.4 Ecological Conceptual Exposure Model. CCR = Coal Combustion Residual.

3.3 Identification of Constituents of Interest

Risks were evaluated for COIs. A constituent was considered a COI if the maximum detected constituent concentration in groundwater exceeded a health-based benchmark. According to US EPA risk assessment guidance (US EPA, 1989), this screening step is designed to reduce the number of constituents carried through the risk evaluation that are anticipated to have a minimal contribution to the overall risk. Identified COIs are the constituents that are most likely to pose a risk concern in the surface water adjacent to the Site.

3.3.1 Human Health Constituents of Interest

For the human health risk evaluation, COIs were conservatively identified as constituents with maximum concentrations in groundwater above the GWPS listed in the Illinois CCR Rule Part 845.600 (IEPA, 2021). Gradient used the maximum detected concentrations from groundwater samples collected from all of the PAP-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 PAP or that they have been identified as potential groundwater exceedances. Using this approach, 7 COIs (arsenic, cobalt, lead, lithium, thallium, radium-226+228, and fluoride) were identified for the human health risk evaluation *via* the surface water pathway (Table 3.1).

The water quality parameters that exceeded the GWPS included chloride, sulfate, and total dissolved solids; however, these constituents were not included in the risk evaluation because the GWPS 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, 2021a). The secondary MCL for total dissolved solids (500 mg/L) is based on hardness, deposits, colored water, staining, and salty taste (US EPA, 2021a). Given that these parameters are not likely to pose a human health risk concern in the event of exposure, they were not considered to be human health COIs.

Table 3.1 Human Health Constituents of Interest

Constituents[a]	Maximum Concentration	GWPS[b]	Human Health COI[c]
Total Metals (mg/L)			
Antimony	0.0036	0.0060	No
Arsenic	0.13	0.010	Yes
Barium	1.5	2.0	No
Beryllium	0.0033	0.0040	No
Boron	0.66	2.0	No
Cadmium	0.0034	0.0050	No
Chromium	0.090	0.10	No
Cobalt	0.036	0.0060	Yes
Lead	0.065	0.0075	Yes
Lithium	0.30	0.040	Yes
Mercury	0.0020	0.0020	No
Molybdenum	0.045	0.10	No
Selenium	0.0060	0.050	No
Thallium	0.0036	0.0020	Yes
Radionuclides (pCi/L)			
Radium-226+228	15	5.0	Yes
Other (mg/L)			
Chloride	550	200	No[d]
Fluoride	8.2	4.0	Yes
Sulfate	3,200	400	No[d]
Total Dissolved Solids	5,500	1,200	No[e]

Notes:
COI = Constituent of Interest; GWPS = Groundwater Protection Standard; MCL = Maximum Contaminant Level; pCi/L = PicoCuries Per Liter.
Shaded = Compound identified as a COI.
(a) The constituents are those listed in the IL Part 845.600 GWPS (IEPA, 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, 2022).[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 PAP-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. Cadmium, cobalt, lead, mercury, radium-226+228, chloride, and fluoride were identified as COIs for ecological receptors (Table 3.2).

[4] Hardness data are not available for Newton Lake adjacent to the Site, therefore, the US EPA (2022) default hardness of 100 mg/L was used. Use of a higher hardness value would result in less stringent screening values, thus, use of the US EPA default hardness is conservative.

Table 3.2 Ecological Constituents of Interest

Constituents[a]	Maximum Groundwater Concentration	Ecological Benchmark[b]	Basis	Ecological COI[c]
Total Metals (mg/L)				
Antimony	0.0036	0.19	US EPA R4 ESV	No
Arsenic	0.13	0.19	IEPA SWQC	No
Barium	1.5	5.0	IEPA SWQC	No
Beryllium	0.0033	0.064	US EPA R4 ESV	No
Boron	0.66	7.6	IEPA SWQC	No
Cadmium	0.0034	0.0011	IEPA SWQC	Yes
Chromium	0.09	0.21	IEPA SWQC	No
Cobalt	0.036	0.019	US EPA R4 ESV	Yes
Lead	0.065	0.020	IEPA SWQC	Yes
Lithium	0.3	0.44	US EPA R4 ESV	No
Mercury	0.002	0.0011	IEPA SWQC	Yes
Molybdenum	0.045	7.2	US EPA R4 ESV	No
Selenium	0.006	1.0	IEPA SWQC	No
Thallium	0.0036	0.0060	US EPA R4 ESV	No
Radionuclides (pCi/L)				
Radium-226+228	15.2	3.0	US DOE	Yes
Other (mg/L, unless otherwise noted)				
Chloride	550	500	IEPA SWQC	Yes
Fluoride	8.16	4.0	IEPA SWQC	Yes
Sulfate	3200	NA	NA	No
Total Dissolved Solids	5500	NA	NA	No

Notes:

COI = Constituent of Interest; DOE = Department of Energy; GWPS = Groundwater Protection Standard; IEPA SWQS = Illinois Environmental Protection Agency Surface Water Quality Standards; NA = Not Available; PAP = Primary Ash Pond; pCi/L = PicoCuries Per Liter; US EPA R4 ESV = US 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 Newton PAP.

(b) Ecological benchmarks are from the hierarchy of sources discussed in Section 3.3.2: IEPA SWQS (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

Surface water sampling has been conducted in Newton Lake adjacent to the Site. To estimate the potential contribution to surface water (and sediment) from groundwater specifically associated with the PAP, Gradient modeled concentrations in Newton Lake surface water and sediment from groundwater flowing into the lake 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 2015 to 2021 were conservatively used to model COI concentrations in surface water and sediment. The groundwater data were measured as total metals. Use of the total metal concentration for these COIs may overestimate surface water concentrations because dissolved concentrations, which are lower than total concentrations, represent the mobile fractions of constituents that could likely flow 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 PAP-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 and surface water properties used to estimate the volume of groundwater flowing into Newton Lake and surface water concentrations are presented in Table 3.3. The COI concentrations in sediment were modeled using the COI-specific sediment-to-water partitioning coefficients and the sediment properties presented in Table 3.4. In the absence of Site-specific information for Newton Lake, Gradient used default assumptions (*e.g.*, depth of the upper benthic layer and bed sediment porosity) to model sediment concentrations. The modeled surface water and sediment concentrations are presented in Table 3.5. These modeled concentrations reflect conservative contributions from groundwater. A description of the modeling and the detailed results are presented in Appendix A.

Table 3.3 Groundwater and Surface Water Properties Used in Modeling

Parameter	Unit	Values	Notes/Source
Groundwater			
COI Concentration	mg/L	Constituent specific	Maximum detected concentration in groundwater.
Cross Section Area for the Uppermost Aquifer[a]	m^2	18,330	The sum of the maximum thicknesses of the PMP and the UA (*i.e.*, approximately 7.3 m) multiplied by the length of the ash pond intersecting Newton Lake (*i.e.*, about 2,500 m) (Ramboll, 2021).
Hydraulic Gradient	m/m	0.0048	The average hydraulic gradient determined for the UA was used (Ramboll, 2021).
Hydraulic Conductivity of the Uppermost Aquifer	cm/s	0.00495	Average of the geometric mean horizontal hydraulic conductivities measured for the PMP (3×10^{-3} cm/s) and the UA (6.8×10^{-3} cm/s).
Surface Water			
Surface Water Flow Rate	L/yr	3.37×10^{13}	An overflow dam located in the south portion of the lake (between the two lake arms) regulates water discharge out of the lake. The total discharge rate through the dam is 59,450 cubic feet per second [cfs] (US National Dams, 2022). This flow is assumed to be representative of the sum of discharges from the eastern and western arms of the Lake. A flow rate of 37,701 cfs was determined for the eastern arm adjacent to the PAP based on watershed ratio analysis (Archfield & Vogel, 2010; Gianfagna *et al*., 2015) using the USGS StreamStats application (USGS, 2022).
Total Suspended Solids	mg/L	9.2	Average of TSS concentrations measured at four monitoring locations in Newton Lake (USGS *et al*., 2022).
Depth of the Water Column	m	5.08	Depth of Newton Lake near the power plant (Ramboll, 2021).
Suspended Sediment to Water Partition Coefficient	mg/L	Constituent specific	Values based on US EPA (2014).

Notes:

cfs = Cubic Feet per Second; COI = Constituent of Interest; L/yr = Liter Per Year; m^2 = Square Meter; PAP = Primary Ash Pond; PMP = Primary Migration Pathway; TSS = Total Suspended Solids; UA = Uppermost Aquifer; US EPA = United States Environmental Protection Agency.

(a) Cross-sectional area represents the area through which groundwater flows from the UA into Newton Lake (*i.e.*, the area where groundwater intersects Newton Lake).

Table 3.4 Sediment Properties Used in Modeling

Parameter	Unit	Value	Notes/Source
Sediment			
Depth of Upper Benthic Layer	m	0.03	Default (US EPA, 2014)
Depth of Water Body	m	5.11	Depth of water column (5.08 m, depth of Newton Lake near the power plant (Ramboll, 2021) plus depth of upper benthic layer (0.03 m) (US EPA, 2014)
Bed Sediment Particle Concentration	g/cm^3	1	Default (US EPA, 2014)
Bed Sediment Porosity	-	0.6	Default (US EPA, 2014)
TSS Mass per Unit Area	kg/m^2	0.047	Depth of water column × TSS × conversion factors (10^{-6} kg/mg and 1,000 L/m^3)
Sediment Mass per Unit Area	kg/m^2	30	Depth of upper benthic layer × bed sediment particulate concentration × conversion factors (0.001 kg/g, 10^6 cm^3/m^3)
Sediment to Water Partition Coefficients	mg/L	Constituent specific	Values based on US EPA (2014)

Notes:
TSS = Total Suspended Solids; US EPA = United States Environmental Protection Agency.

Table 3.5 Surface Water and Sediment Modeling Results

COI	Groundwater Concentration (mg/L or pCi/L)	Mass Discharge Rate (mg/year or pCi/year)	Total Water Column Concentration (mg/L or pCi/L)	Concentration Sorbed to Bottom Sediments (mg/kg or pCi/kg)
Total Metals				
Arsenic	0.13	1.8E+07	5.3E-07	1.2E-04
Cadmium	0.0034	4.7E+05	1.4E-08	1.6E-05
Cobalt	0.036	4.9E+06	1.5E-07	1.2E-04
Lead	0.065	8.9E+06	2.7E-07	1.9E-03
Lithium	0.30	4.1E+07	1.2E-06	(a)
Mercury	0.0020	2.7E+05	8.2E-09	2.3E-04
Thallium	0.0036	4.9E+05	1.5E-08	2.6E-07
Radionuclides				
Radium-226+228	15	2.1E+09	6.2E-05	4.3E-01
Other				
Chloride	550	7.6E+10	2.3E-03	(a)
Fluoride	8.2	1.1E+09	3.4E-05	5.3E-03
Sulfate	3,200	4.4E+11	1.3E-02	(a)

Notes:
COI = Constituent of Concern; K_d = Equilibrium Partition Coefficient; pCi/L = PicoCuries Per Liter; pCi/kg = PicoCuries Per Kilogram.
(a) Lithium, chloride, and sulfate do not readily sorb to soil or sediment particles; a K_d value of 0 was used for the modeling.

3.4 Human Health Risk Evaluation

The section below presents the results of the human health risk evaluation for recreators (boaters and anglers) in Newton Lake 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 Newton Lake. 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, 2021b) as a conservative estimate of the ADI. The RfDs are given in mg/kg-day, while the ADIs are given in mg/day; thus, Gradient multiplied the RfD by a standard body weight of 70 kg to obtain the ADI in mg/day. The calculation of the HTC values is shown in Appendix B, Table B.1.

Gradient used bioconcentration factors (BCFs) from a hierarchy of sources. The primary BCFs were those that US EPA used to calculate the National Recommended Water Quality Criteria (NRWQC) for human health (US EPA, 2002). Other sources included BCFs used in the US EPA coal combustion ash risk assessment (US EPA, 2014) and BCFs reported by Oak Ridge National Laboratory's Risk Assessment

Information System (ORNL RAIS) (ORNL, 2020).[5] Lithium did not have a BCF value available from any authoritative source; therefore, the water quality criterion for lithium was calculated assuming a BCF of 1. This is a conservative assumption, as lithium does not readily bioaccumulate in the aquatic environment (ECHA, 2020a,b; ATSDR, 2010).

Illinois recommends a fish consumption rate of 0.020 kg/day (20 g/day) for an adult weighing 70 kg (IEPA, 2019). Illinois recommends a water consumption rate of 0.01 L/day for "incidental exposure through contact or ingestion of small volumes of water while swimming or during other recreational activities" (IEPA, 2019). Appendix B, Table B.1 presents the calculated HTC for fish and water and for fish consumption only.

The HTC for fish consumption for radium-226+228 was calculated as follows:

$$\mathrm{HTC} = \frac{\mathrm{TCR}}{(\mathrm{SF} \times \mathrm{BAF} \times \mathrm{F})}$$

where:

HTC	=	Human health protection criterion in picoCuries per liter (pCi/L)
TCR	=	Target cancer risk ($1\text{x}10^{-5}$)
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 3.6). All surface water concentrations were below their respective benchmarks. The HTC values are protective of recreational exposure *via* water and/or fish ingestion and do not account for dermal exposures to COIs in surface water while 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 Newton Lake.

[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 3.6 Risk Evaluation for Recreators (Boaters and Anglers)

COI	Maximum SW Concentration		HTC for Water and Fish	HTC for Water Only	HTC for Fish Only	COPC	
	Modeled	Measured[a]				Based on Modeled Concentrations	Based on Measured Concentrations
Total Metals (mg/L)							
Arsenic	5.3E-07	4.2E-03	0.022	2.0	0.023	No	No
Cobalt	1.5E-07	ND	0.0035	2.1	0.0035	No	NA
Lead	2.7E-07	ND	0.015	0.015	0.015	No	NA
Lithium	1.2E-06	ND	4.7	14	7.0	No	NA
Thallium	1.5E-08	ND	0.0017	0.40	0.0017	No	NA
Radionuclides (pCi/L)							
Radium-226+228	6.2E-05	2.1E+00	1,000	1,000	87,413	No	No
Other (mg/L)							
Fluoride	3.4E-05	5.1E-01	143	800	174	No	No

Notes:
COI = Constituent of Interest; COPC = Constituent of Potential Concern; HTC = Human Threshold Criteria; NA = Not Applicable; ND = Not Determined; pCi/L = PicoCuries Per Liter; SW = Surface Water.
(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 Newton Lake; 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, 2021c). 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, 2021c). 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, 2021c). The sediment screening benchmarks were calculated based on a target hazard quotient of 1, or a target cancer risk of $1x10^{-5}$. Appendix B, Table B.2 presents the calculation of screening benchmarks protective of recreational exposures to sediment. A recreator sediment screening benchmark for radium-226+228 was based on soil Preliminary Remediation Goals (PRGs) calculated for radium-226 and radium-228 using US EPA's PRG calculator (US EPA, 2020). The lower of the two values was used as the recreator sediment screening benchmark for radium-226+228 (Appendix B, Table B.3).

Screening Risk Evaluation: The modeled sediment concentrations were well below the recreational sediment screening benchmarks (Table 3.7). Therefore, exposure to sediment is not expected to pose an unacceptable risk to recreators while boating.

Table 3.7 Risk Evaluation for Recreators Exposed to Sediment

COI	Modeled Sediment Concentration (mg/kg)	Recreator Sediment Screening Benchmark (mg/kg)	COPC
Total Metals (mg/kg)			
Arsenic	1.2E-04	6.8E+01	No
Cobalt	1.2E-04	4.1E+02	No
Lead	1.9E-03	4.0E+02	No
Lithium	(a)	2.7E+03	NA
Thallium	2.6E-07	1.4E+01	No
Radionuclides (pCi/kg)			
Radium-226+228	4.3E-01	7.9E+03	No
Other (mg/kg)			
Fluoride	5.3E-03	5.5E+04	No

Notes:
COI = Constituent of Interest; COPC = Constituent of Potential Concern; K_d = Equilibrium Partition Coefficient; NA = Not Applicable; pCi/kg = PicoCuries Per Kilogram.
(a) Lithium does not readily sorb to soil or sediment particles; a K_d value of 0 was used for the modeling.

3.5 Ecological Risk Evaluation

Based on the ecological CEM (Figure 3.4), ecological receptors could be exposed to surface water and dietary items (*i.e.*, prey and plants) potentially impacted by identified COIs (cadmium, cobalt, lead, mercury, radium-226+228, chloride, and fluoride).

3.5.1 Ecological Receptors Exposed to Surface Water

Screening Exposures: The ecological evaluation considered aquatic communities in Newton Lake potentially impacted by identified ecological COIs. Measured and modeled surface water concentrations were compared to risk-based ecological screening benchmarks.

Screening Benchmarks: Surface water screening benchmarks protective of aquatic life were obtained from the following hierarchy of sources:

- IEPA SWQS (IEPA, 2019), regulatory standards that are intended to protect aquatic life exposed to surface water on a long-term basis (*i.e.*, chronic exposure). For cadmium, the surface water benchmark is hardness dependent and calculated using a default hardness of 100 mg/L (US EPA, 2022)[6];

- US EPA Region IV (2018) surface water ESVs for hazardous waste sites; 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 3.8). 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 Newton Lake.

Table 3.8 Risk Evaluation of Ecological Receptors Exposed to Surface Water

COI	Maximum Surface Water Concentration		Ecological Freshwater Benchmark	Basis	COPC	
	Modeled	Measured			Based on Modeled Concentrations	Based on Measured Concentrations
Total Metals (mg/L)						
Cadmium	1.4E-08	ND	0.0011	IEPA SWQC	No	NA
Cobalt	1.5E-07	ND	0.019	US EPA R4 ESV	No	NA
Lead	2.7E-07	ND	0.020	IEPA SWQC	No	NA
Mercury	8.2E-09	ND	0.0011	IEPA SWQC	No	NA
Radionuclides (pCi/L)						
Radium-226+228	6.2E-05	2.1	3.0	US DOE	No	No
Other (mg/L)						
Chloride	2.3E-03	9.6	500	IEPA SWQC	No	No
Fluoride	3.4E-05	0.51	4.0	IEPA SWQC	No	No

Notes:
COI = Constituent of Interest; COPC = Constituent of Potential Concern; IEPA SWQC = Illinois Environmental Protection Agency Surface Water Quality Standard; NA = Not Applicable; ND = Not Detected; 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.

3.5.2 Ecological Receptors Exposed to Sediment

Screening Exposures: COIs in impacted groundwater discharging into Newton Lake 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

[6] Conservatisms associated with using a default hardness value are discussed in Section 3.6.
[7] The biota concentration guide (BCG) for sediment is 90 pCi/g for Ra-228 and 100 pCi/g for Ra-226; the lower of the two values was used for Ra-226+228, and converted to pCi/kg (US DOE, 2019).

to ecological receptors exposed to sediment was not evaluated for these constituents. The benchmarks used in this evaluation are listed in Table 3.9.

Screening Risk Results: The maximum modeled COI sediment concentrations were below their respective sediment screening benchmarks (Table 3.9). The modeled sediment concentrations attributed to potential contributions from Site groundwater for all COIs were less than 1% of the sediment screening benchmark. Therefore, the modeled sediment concentrations attributed to potential contributions from Site groundwater are not expected to significantly contribute to ecological exposures in Newton Lake adjacent to the Site.

Table 3.9 Risk Evaluation of Ecological Receptors Exposed to Sediment

COI	Modeled Sediment Concentration	ESV[a]	COPC	% of Benchmark
Total Metals (mg/kg)				
Cadmium	1.6E-05	0.99	No	0.0016%
Cobalt	1.2E-04	50	No	0.00024%
Lead	1.9E-03	35.8	No	0.0053%
Mercury	2.3E-04	0.18	No	0.13%
Radionuclides (pCi/kg)				
Radium-226+228	4.3E-01	90,000[b]	No	0.00048%
Other (mg/kg)				
Chloride	-	-	-	-
Fluoride	5.3E-03	NA	-	-

Notes:
COI = Constituent of Interest; COPC = Constituent of Potential Concern; ESV = Ecological Screening Value; 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 EPA Region IV (2018).
(b) ESV from US DOE (2019); value converted from 90 pCi/g to 90,000 pCi/kg.

3.5.3 Ecological Receptors Exposed to Bioaccumulative Constituents of Interest

Screening Exposures: COIs with bioaccumulative properties can impact higher-trophic-level wildlife exposed to these COIs *via* direct exposures (surface water and sediment exposure) and secondary exposures through the consumption of dietary items (*e.g.*, plants, invertebrates, small mammals, and fish).

Screening Benchmark: US EPA Region IV (2018) guidance and IEPA SWQS (IEPA, 2019) guidance were used to identify constituents with potential bioaccumulative effects.

Risk Evaluation: With the exception of mercury, the ecological COIs (cadmium, cobalt, lead, radium-226+228, chloride, and fluoride) were not identified as having potential bioaccumulative effects. Therefore, these COIs are not considered to pose an ecological risk *via* bioaccumulation. IEPA (2019) identifies mercury as the only metal with bioaccumulative properties. US EPA Region IV (2018) also identifies mercury (including methyl mercury) as having potential bioaccumulative effects.[8]

The modeled mercury concentration in surface water (8.2×10^{-9} mg/L) was below the mercury surface water ESV for wildlife (1.3×10^{-6} mg/L), and the modeled mercury concentration in sediment (2.3×10^{-4} mg/kg) was below the sediment ESV for wildlife (0.18 mg/kg) (US EPA Region IV, 2018). Both the

[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.

modeled surface water and sediment concentrations were below benchmarks protective of receptors accounting for bioacccumulative properties. Therefore, in addition to not posing an ecological risk from direct toxicity, mercury does not pose a risk from bioaccumulation exposures.

3.6 Uncertainties and Conservatisms

A number of uncertainties and their potential impact on the risk evaluation are discussed below. Wherever possible, conservative assumptions were used in an effort to minimize uncertainties and overestimate rather than underestimate risks.

Exposure Estimates:

- The risk evaluation included the IL Part 845.600 constituents detected in groundwater samples (above GWPS) collected from wells associated with the PAP. However, it is possible that not all of the detected constituents are related specifically to the PAP.
- The human health and ecological risk characterizations were based on the maximum measured or modeled COI concentrations, rather than on averages. Thus, the variability in exposure concentrations was not considered. Assuming continuous exposure to the maximum concentration overestimates human and ecological exposures, given that receptors are mobile and concentrations change over time. For example, US EPA guidance states that risks should be estimated using average exposure concentrations as represented by the 95% upper confidence limit on the mean (US EPA, 1992). Given that exposure estimates based on the maximum concentrations did not exceed risk benchmarks, Gradient has greater confidence that there is no risk concern.
- Only constituents detected in groundwater were used to identify COIs and model COI concentrations in surface water and sediment. For the constituents that were not detected in PAP 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 PAP-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 90^{th} 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. However, hardness data are not available for Newton Lake; therefore, 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 NPP in Newton, Illinois. The CSM developed for the Site indicates that groundwater beneath the PAP flows into Newton Lake 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 Newton Lake 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 2021 were used to estimate exposures. Surface water data collected from Newton Lake 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 PAP 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 Newton Lake 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 Newton Lake 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 Newton Lake.
- 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 PAP 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 in river surface water and sediment based on available groundwater data. First, Gradient estimated the flow rate of constituents of interest (COIs) that may flow into Newton Lake *via* groundwater. Then, Gradient adapted United States Environmental Protection Agency's (US EPA's) indirect exposure assessment methodology (US EPA, 1998) in order to model surface water and sediment water concentrations in Newton Lake.

Model Overview

Groundwater flow into Newton Lake is represented by a one-dimensional steady-state model. In this model, the groundwater plume migrates horizontally in the Uppermost Aquifer (UA) and the potential migration pathway (PMP) prior to discharging into Newton Lake. The groundwater flow entering the lake is the flow going through a cross-sectional area with a length equal to the length of the lake adjacent to the Primary Ash Pond (PAP) with potential CCR-related impacts and a height equal to the maximum saturated thicknesses of the UA and the PMP. This is a conservative assumption because groundwater elevation data indicate that only groundwater on the eastern side of the PAP has potential to interact with surface water in the lake. It was assumed that groundwater flowing through the shallow water bearing zones (*i.e.*, the UA and the PMP) may flow into Newton Lake. The length of the groundwater discharge zone was estimated using Google Earth Pro (Google LLC, 2022).

Groundwater flow into Newton Lake mixes with the surface water in the lake. The COIs entering the lake *via* groundwater can dissolve into the water column, sorb to suspended sediments, or sorb to benthic sediments. Using US EPA's indirect exposure assessment methodology (US EPA, 1998), the model evaluates the surface water and sediment concentrations at a location downstream of the groundwater discharge, assuming a well-mixed water column.

Groundwater Discharge Rate

The groundwater discharge rate was evaluated using conservative assumptions. Gradient conservatively assumed that the groundwater concentrations were uniformly equal to the maximum detected concentration for each individual COI. Gradient ignored adsorption by subsurface soil and assumed that groundwater flowing through the shallow aquifers was discharged into the lake.

For each groundwater unit, the groundwater flow rate into the river was derived using Darcy's Law:

$$Q = KiA$$

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 lake was then calculated by:

$$m_c = C_c \times Q \times CF$$

where:

m_c = Mass discharge rate of the COI (mg/year)
C_c = Maximum groundwater concentration of the COI (mg/L)
Q = Groundwater flow rate (m^3/s)

CF = Conversion factors: 1,000 L/m^3; 31,557,600 s/year

The values of the aquifer parameters used for these calculations are provided in Table A.1. The calculated mass discharge rates were then used as inputs for the surface water and sediment partitioning model.

The cross-sectional area for the shallow aquifers was 18,330 m^2. The length of the discharge zone was estimated to be approximately 2,500 m. The height of the discharge zone was assumed to be the sum of the maximum thicknesses of the PMP and the UA (*i.e.*, approximately 7.3 m) (Ramboll, 2021).

The hydraulic gradient was 0.0048 m/m, based on the average horizontal hydraulic gradient determined for the UA (Ramboll, 2021). Hydraulic gradient was not measured in the PMP.

The hydraulic conductivity was 0.00495 cm/s, based on the average of the geometric mean horizontal hydraulic conductivities measured for the PMP (3 x 10^{-3} cm/s) and the UA (6.8 x 10^{-3} cm/s) (Ramboll, 2021).

Surface Water and Sediment Concentration

Groundwater that flows into the lake 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" (US EPA, 2014). This model describes the partitioning of constituents between surface water, suspended sediments, and benthic sediments based on equilibrium partition coefficients. 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 the analysis, Gradient used the partitioning coefficients given in Table J-1 of the US EPA CCR Risk Assessment for all COIs (US EPA, 2014). These coefficients are presented in Table A.2.

To be conservative, Gradient assumed that the constituents were not affected by dissipation or degradation once they entered the water body. The total water body concentration of the COI was calculated as (US EPA, 1998):

$$C_{wtot} = \frac{m_c}{V_f \times f_{water}}$$

where:

C_{wtot} = Total water body concentration of the constituent (mg/L)
m_c = Mass discharge rate of the COI (mg/year)
V_f = Water body annual flow (L/year)
f_{water} = Fraction of COI in the water column (unitless)

Newton Lake was formed by damming and is used as a cooling water supply for Newton Power Plant (NPP) (US National Dams, 2022). Water is drawn from the eastern arm near the power plant and thermal effluent is released at two locations in the western arm *via* NPDES permitted outfalls (IEPA, 2016). A small overflow dam located in the south portion of the lake (between the two lake arms) regulates water discharge out of the lake. The total discharge rate of 59,450 cubic feet per second (cfs) through the overflow dam (US National Dams. 2022) is assumed to be representative of the sum of discharges from the eastern and western arms of the Newton Lake. A flow rate of 37,701 cfs was determined for the eastern arm based on watershed ratio analysis (Archfield & Vogel, 2010; Gianfagna *et al.*, 2015) using the USGS StreamStats application (USGS, 2022). The surface water parameters are presented in Table A.3.

The fraction of COIs in the water column was calculated for each COI using the sediment/water and suspended solids/water partition coefficients (US EPA, 2014, Table J-1). The fraction of COIs in the water column is defined as (US EPA, 2014):

$$f_{water} = \frac{(1 + [K_{dsw} \times TSS \times 0.000001]) \times \frac{d_w}{d_z}}{\left([1 + (K_{dsw} \times TSS \times 0.000001)] \times \frac{d_w}{d_z}\right) + ([bsp + K_{dbs} \times bsc] \times \frac{d_b}{d_z})}$$

where:

K_{dsw}	=	Suspended sediment-water partition coefficient (mL/g)
K_{dbs}	=	Sediment-water partition coefficient (mL/g)
TSS	=	Total suspended solids in the surface water body (mg/L), set equal to 9.2 mg/L, which is the average of TSS concentrations measured at four monitoring locations at Newton Lake (*i.e.*, IL_EPA_WQX-RCR-1, IL_EPA_WQX-RCR-2, IL_EPA_WQX-RCR-3, and IL_EPA_WQX-RCR-4) (USGS *et al.*, 2022)
0.000001	=	Units conversion factor
d_w	=	Depth of the water column (m). The depth of the water column was estimated as 5.08 m, based on the geologic cross-section in Ramboll (2021 Figure 2-7). .
d_b	=	Depth of the upper benthic layer (m), set equal to 0.03 m (US EPA, 2014)
$d_z = d_w + d_b$	=	Depth of the water body (m) = 5.11 m
bsp	=	Bed sediment porosity (unitless), set equal to 0.6 (US EPA, 2014)
bsc	=	Bed sediment particle concentration (g/cm^3), set equal to 1.0 g/cm^3 (US EPA, 2014)

The fraction of COIs dissolved in the water column (f_d) is calculated as (US EPA 2014):

$$f_d = \frac{1}{1 + K_{dsw} \times TSS \times 0.000001}$$

The values of the fraction of COIs in the water column and other calculated parameters are presented in Table A.4.

The total water column concentration (C_{wcTot}) of the COIs, comprising both the dissolved and suspended sediment phases, is then calculated as (US EPA, 2014):

$$C_{wcTot} = C_{wtot} \times f_{water} \times \frac{d_z}{d_w}$$

Finally, the dissolved water column concentration (C_{dw}) for the COIs is calculated as (US EPA, 2014):

$$C_{dw} = f_d \times C_{wcTot}$$

The dissolved water column concentration was then used to calculate the concentration of COIs sorbed to suspended solids in the water column (US EPA, 1998):

$$C_{sw} = C_{dw} \times K_{dsw}$$

where:

C_{sw}	=	Concentration sorbed to suspended solids (mg/kg)
C_{dw}	=	Concentration dissolved in the water column (mg/L)
K_{dsw}	=	Suspended solids/water partition coefficient (mL/g)

In the same way, using the total water body concentration and the fraction of COIs in the benthic sediments, the model derives the total concentration in benthic sediments (US EPA, 2014, Table J-1-12):

$$C_{bstot} = f_{benth} \times C_{wtot} \times \frac{d_z}{d_b}$$

where:

C_{bstot}	=	Total concentration in bed sediment (mg/L or g/m^3)
C_{wtot}	=	Total water body concentration of the constituent (mg/L)
f_{benth}	=	Fraction of contaminant in benthic sediments (unitless)
d_b	=	Depth of the upper benthic layer (m)
$d_z = d_w + d_b$	=	Depth of the water body (m)

This value can be used to calculate dry weight sediment concentration as follows:

$$C_{sed-dw} = \frac{C_{bstot}}{bsc}$$

where:

C_{sed-dw}	=	Dry weight sediment concentration (mg/kg)
C_{bstot}	=	Total sediment concentration (mg/L)
bsc	=	Bed sediment bulk density (default value of 1 g/cm^3 from US EPA, 2014)

The total sediment concentration is composed of the concentration dissolved in the bed sediment pore water (equal to the concentration dissolved in the water column) and the concentration sorbed to benthic sediments (US EPA, 1998).

The concentration sorbed to benthic sediments was calculated from (US EPA, 1998):

$$C_{sb} = C_{dbs} \times K_{dbs}$$

where:

C_{sb}	=	Concentration sorbed to bottom sediments (mg/kg)
C_{dbs}	=	Concentration dissolved in the sediment pore water (mg/L)
K_{dbs}	=	Sediments/water partition coefficient (mL/kg)

For each COI, the modeled total water column concentration, the modeled dry weight sediment concentration, and the modeled concentration sorbed to sediment are presented in Table A.5.

Table A.1 Parameters Used to Estimate Groundwater Discharge to Surface Water

Groundwater Unit	Parameter	Name	Value	Unit
Uppermost Aquifer and Potential Migration Pathway	A	Cross-Sectional Area[a]	18,330	m^2
Uppermost Aquifer and Potential Migration Pathway	i	Hydraulic Gradient[b]	0.0048	m/m
Uppermost Aquifer and Potential Migration Pathway	K	Hydraulic Conductivity[c]	0.00495	cm/s

Notes:
Source: Hydraulic gradient and hydraulic conductivity values from Ramboll (2021).
Cross-sectional area was estimated from Ramboll (2021).
(a) The sum of the maximum thicknesses of the PMP and the UA (i.e., approximately 7.3 m) multiplied by the length of the ash pond intersecting Newton lake (*i.e.*, about 2,500 m).
(b) Hydraulic gradient measurements are not available for the PMP. The average hydraulic gradient determined for the UA was used.
(c) Average of the geometric mean horizontal hydraulic conductivities measured for the PMP (3×10^{-3} cm/s) and the UA (6.8×10^{-3} cm/s).

Table A.2 Partition Coefficients

Constituent	Sediment-Water, Mean, K_{dbs}		Suspended Sediment-Water, Mean, K_{dsw}	
	Value (log_{10}) (mL/g)	Value (mL/g)	Value (log_{10}) (mL/g)	Value (mL/g)
Metals				
Arsenic	2.4	2.51E+02	3.9	7.94E+03
Cadmium	3.3	2.00E+03	4.9	7.94E+04
Cobalt	3.1	1.26E+03	4.8	6.31E+04
Lead	4.6	3.98E+04	5.7	5.01E+05
Lithium	-	-	-	-
Mercury	4.9	7.94E+04	5.3	2.00E+05
Thallium	1.3	2.00E+01	4.1	1.26E+04
Radionuclides				
Radium-226+228	-	7.40E+03	-	7.40E+03
Other				
Chloride	-	-	-	-
Fluoride	2.2	1.58E+02	2.2	1.58E+02
Sulfate	-	-	-	-

Notes:
Source: US EPA (2014).
Lithium, chloride, and sulfate do not readily sorb to soils and sediments. Consequently, sediment concentrations were not modeled for these constituents (K_d was assumed to be 0).

Table A.3 Surface Water Parameters

Parameter	Name	Value	Unit
TSS	Total Suspended Solids	9.2	mg/L
V_{fx}	Surface Water Flow Rate	3.37 x 10^{13}	L/yr
d_b	Depth of Upper Benthic Layer (default)	0.03	m
d_w	Depth of Water Column	5.08	m
d_z	Depth of Water Body	5.11	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]	0.047	kg/m^2
M_S	Sediment Mass per Unit Area[b]	30	kg/m^2

Notes:
Source of default values: US EPA (2014).
Source of TSS data: USGS *et al*., 2022.
(a) Determined by multiplying total suspended solids, TSS by the depth of water column, d_w.
(b) Determined by multiplying depth of upper benthic layer, d_b, with sediment bed particle concentration of 1 g/cc.

Table A.4 Calculated Parameters

COI	Fraction of Constituent in the Water Column f_{water}	Fraction of Constituent in the Benthic Sediments $f_{benthic}$	Fraction of Constituent Dissolved in the Water Column $f_{dissolved}$
Arsenic	0.419	0.581	0.932
Cadmium	0.1280	0.8720	0.5778
Cobalt	0.175	0.825	0.633
Lead	0.023	0.977	0.178
Lithium	0.996	0.004	
Mercury	0.006	0.994	0.353
Thallium	0.902	0.098	0.896
Radionuclides			
Radium-226+228	0.024	0.976	0.936
Other			
Fluoride	0.516	0.484	0.999

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)
Total Metals				
Arsenic	0.13	1.8E+07	5.3E-07	1.2E-04
Cadmium	0.0034	4.7E+05	1.4E-08	1.6E-05
Cobalt	0.036	4.9E+06	1.5E-07	1.2E-04
Lead	0.065	8.9E+06	2.7E-07	1.9E-03
Lithium	0.30	4.1E+07	1.2E-06	(a)
Mercury	0.0020	2.7E+05	8.2E-09	2.3E-04
Thallium	0.0036	4.9E+05	1.5E-08	2.6E-07
Radionuclides				
Radium-226+228	15	2.1E+09	6.2E-05	4.3E-01
Other				
Chloride	550	7.6E+10	2.3E-03	(a)
Fluoride	8.2	1.1E+09	3.4E-05	5.3E-03
Sulfate	3,200	4.4E+11	1.3E-02	(a)

Notes:
COI = Constituent of Interest; pCi/kg = PicoCuries Per Kilogram; pCi/L = PicoCuries Per Liter.
(a) Lithium, chloride, and sulfate do not readily sorb to soil or sediment particles; a K_d value of 0 was used for the modeling.

Appendix B

Screening Benchmarks

Table B.1 Calculated Water Quality Standards Protective of Incidental Ingestion and Fish Consumption

Human Health COI	BCF[a] (L/kg-tissue)	Basis	MCL (mg/L)	RfD (mg/kg-day)	ADI[b] (mg/day)	Human Threshold Criteria		
						Water & Fish (mg/L)	Water Only (mg/L)	Fish Only (mg/L)
Arsenic	44	NRWQC (2002)	0.010	0.00030	0.020	0.022	2.0	0.023
Cobalt	300	ORNL (2020)	NC	0.00030	0.021	0.0035	2.1	0.0035
Fluoride	2.3	US EPA (2014)	4.0	0.040	8.0	143	800	174
Lead	46	US EPA (2014)	0.015	NC	0.030	0.015	0.015	0.015
Lithium	1	(c)	NC	0.002	0.14	4.7	14	7.0
Thallium	116	NRWQC (2002)	0.0020	0.000010	0.0040	0.0017	0.40	0.0017
Human Health COI	**BAF (L/kg-tissue)**		**MCL (pCi/L)**	**ADI (pCi/day)**	**Food Ingestion Slope Factor[d] (risk/pCi)**	**Human Threshold Criteria**		
	SW-Fish	**Basis**				**Water & Fish (pCi/L)**	**Water Only (pCi/L)**	**Fish Only (pCi/L)**
Radium-226 + 228	4.0	ORNL (2020)	5	10	1.43E-09	1,000	1,000	87,413

Notes:

ADI = Acceptable Daily Intake; BAF = Bioaccumulation Factor; BCF = Bioconcentration Factor; MCL = Maximum Contaminant Level; NC = No Criterion Available; NRWQC = National Recommended Water Quality Criteria; ORNL = Oak Ridge National Laboratory; pCi = picocurie; Ra = Radium; RAIS = Risk Assessment Information System; RfD = Reference Dose; US EPA = United States Environmental Protection Agency.

(a) BCFs from the following hierarchy of sources:

NRWQC (US EPA, 2002). National Recommended Water Quality Criteria: 2002. Human Health Criteria Calculation Matrix.

US EPA (2014). Human and Ecological Risk Assessment of Coal Combustion Residuals.

ORNL RAIS (ORNL, 2020). Risk Assessment Information System (RAIS) Toxicity Values and Chemical Parameters.

(b) ADI based on the MCL is calculated as the MCL (mg/L) multiplied by a water ingestion rate of 2 L/day. In the absence of an MCL, the ADI was calculated as the RfD (mg/kg-day) multiplied by the body weight (70 kg).

(c) BCF of 1 was used as a conservative assumption, due to lack of published BCF.

(d) Food ingestion slope factors for Ra-226+D and Ra-228+D were compared and the higher factor (Ra-228+D) was selected. The "+D" indicates that the risks from "associated short-lived radioactive decay products are also included" (US EPA, 2001).

Equations from IEPA (2019):

Consumption of Water and Fish

$$HTC = \frac{ADI}{W + (F \times BCF)}$$

Incidental Consumption of Water Only

$$HTC = \frac{ADI}{W}$$

Consumption of Fish Only

$$HTC = \frac{ADI}{F \times BCF}$$

Radium-226+228

$$HTC = \frac{TCR}{(SF \times BAF \times F)}$$

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: TRV: CSF (mg/kg-day)$^{-1}$	Cancer: TRV: Dermal CSF (mg/kg-day)$^{-1}$	Cancer: Child + Adult: Incidental Ingestion SL (mg/kg)	Cancer: Child + Adult: Dermal Contact SL (mg/kg)	Cancer SL (mg/kg)	Non-Cancer: TRV: RfD (mg/kg-day)	Non-Cancer: TRV: Dermal RfD (mg/kg-day)	Non-Cancer: Child: Incidental Ingestion SL (mg/kg)	Non-Cancer: Child: Dermal Contact SL (mg/kg)	Non-Cancer: Adult: Incidental Ingestion SL (mg/kg)	Non-Cancer: Adult: Dermal Contact SL (mg/kg)	Non-Cancer SL (mg/kg): Child	Non-Cancer SL (mg/kg): Adult	Recreator RSL Sediment (mg/kg)	Basis[a]
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
Cobalt	1	NA	NC	NC	NC	NC	NC	3.0E-04	3.0E-04	4.1E+02	NA	4.4E+03	NA	4.1E+02	4.4E+03	4.1E+02	nc
Lead	1	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	4.0E+02	L
Lithium	1	NA	NC	NC	NC	NC	NC	2.0E-03	2.0E-03	2.7E+03	NA	2.9E+04	NA	2.7E+03	2.9E+04	2.7E+03	nc
Thallium	1	NA	NC	NC	NC	NC	NC	1.0E-05	1.0E-05	1.4E+01	NA	1.5E+02	NA	1.4E+01	1.5E+02	1.4E+01	nc
Other																	
Fluoride	1	NA	NC	NC	NC	NC	NC	4.0E-02	4.0E-02	5.5E+04	NA	5.8E+05	NA	5.5E+04	5.8E+05	5.48E+04	nc
Radionuclides																**Total Soil PRG (pCi/kg)**	
Radium-226 + 228																7.9E+03	

Notes:

ABS = Dermal Absorption Fraction; COI = Constituent of Interest; CSF = Cancer Slope Factor; NC = No Criterion Available; pCi = PicoCurie; PRG = Preliminary Remediation Goal; RfD = Reference Dose; RSL = Regional Screening Level; SL = Screening Level; TRV = Toxicity Reference Value; US EPA = United States Environmental Protection Agency.

(a) Screening benchmark defined as the lower of the Screening Levels for cancer and non-cancer. The basis of the benchmark presented as c = based on cancer endpoint, nc = based on non-cancer endpoint, or L = based on blood lead levels.

Equations for Screening Benchmark and Screening Levels:

$$\text{Screening Benchmark} = \frac{1}{\frac{1}{SL_{ing}} + \frac{1}{SL_{derm}}}$$

$$\text{Non-cancer } SL_{ing} = \frac{THQ * RfD}{Intake} \qquad \text{Cancer } SL_{ing} = \frac{TR}{Intake * CSF}$$

$$\text{Non-cancer } SL_{derm} = \frac{THQ * RfD}{Intake * ABS} \qquad \text{Cancer } SL_{derm} = \frac{TR}{Intake * ABS * CSF}$$

Where:

Target Risk (TR)	1E-05	
Target Hazard Quotient (THQ)	1	
Reference Dose (RfD)	Chemical-specific	mg/kg-day
Dermal Absorption Fraction (ABS)	Chemical-specific	
Cancer Slope Factor (CSF)	Chemical-specific	mg/kg
Incidental Ingestions Screening Level (SL_{ing})	Chemical-specific	mg/kg
Dermal Contact Screening Level (SL_{derm})	Chemical-specific	mg/kg

Sediment – Ingestion (Chemical)

$$\text{Intake Factor (IF)} = \frac{IR \times EF \times ED \times CF}{BW \times AT}$$

		Non-Cancer: Child	Non-Cancer: Adult	Cancer: Child	Cancer: Adult	Basis
Intake Factor (IF) =		7.3E-07	6.8E-08	6.3E-08	2.0E-08	
IR	Ingestion Rate (mg/day)	67	33	67	33	One-third of US EPA residential soil ingestion rate (Professional Judgment)
EF	Sediment Exposure Frequency (days/year)	60	60	60	60	2 days/week between April and October when air temperature > 70°F (Professional Judgment)
ED	Exposure Duration (years)	6	20	6	20	Default value for Resident (US EPA, 2021b)
CF	Conversion Factor (kg/mg)	0.000001	0.000001	0.000001	0.000001	
BW	Body Weight (kg)	15	80	15	80	Default value for Resident (US EPA, 2021b)
AT	Averaging Time (days)	2,190	7,300	25,550	25,550	Default value for Resident (US EPA, 2021b)

Sediment – Dermal Contact (Chemical)

$$\text{Intake Factor (IF)} = \frac{SA \times AF \times EF \times ED \times CF}{BW \times AT}$$

		Non-Cancer: Child	Non-Cancer: Adult	Cancer: Child	Cancer: Adult	Basis
Intake Factor (IF) =		2.2E-06	1.2E-06	1.9E-07	3.6E-07	
SA	Surface Area Exposed to Sediment (cm^2/day)	1,026	3,026	1,026	3,026	Age weighted SA for lower legs and feet (US EPA, 2011b)
AF	Sediment Skin Adherence Factor (mg/cm^2)	0.2	0.2	0.2	0.2	Age weighted AF for children exposed to sediment (US EPA, 2011b)
EF	Sediment Exposure Frequency (days/year)	60	60	60	60	2 days/week between April and October when air temperature > 70°F (Professional Judgment)
ED	Exposure Duration (years)	6	20	6	20	Default value for Resident (US EPA, 2021b)
CF	Conversion Factor (kg/mg)	0.000001	0.000001	0.000001	0.000001	
BW	Body Weight (kg)	15	80	15	80	Default value for Resident (US EPA, 2021b)
AT	Averaging Time (days)	2,190	7,300	25,550	25,550	Default value for Resident (US EPA, 2021b)

Table B.3.1 Recreator PRGs for Soil, input values

Variable	Recreator Soil Default Value	Form-input Value
A (PEF Dispersion Constant)	16.2302	16.8653
B (PEF Dispersion Constant)	18.7762	18.7848
City (Climate Zone)	Default	Chicago, IL (7)
C (PEF Dispersion Constant)	216.108	215.0624
Cover layer thickness for GSF (gamma shielding factor) cm	0 cm	0 cm
$CF_{rec\text{-}fowl}$ (fowl contaminated fraction) unitless	1	1
$CF_{rec\text{-}game}$ (game contaminated fraction) unitless	1	1
ED_{rec} (exposure duration - recreator) yr		26
EF_{rec} (exposure frequency - recreator) day/yr		60
$f_{p\text{-}fowl}$ (fowl on-site fraction) unitless	1	1
$f_{p\text{-}game}$ (land game on-site fraction) unitless	1	1
$f_{s\text{-}fowl}$ (fraction of year fowl is on site) unitless	1	1
$f_{s\text{-}game}$ (fraction of year land game is on site) unitless	1	1
$MLF_{pasture}$ (pasture plant mass loading factor) unitless	0.25	0.25
t_{rec} (time - recreator) yr		26
TR (target risk) unitless	0.000001	0.000001
F(x) (function dependent on U_m/U_t) unitless	0.194	0.182
PEF (particulate emission factor) m^3/kg	1,359,344,438	1,560,521,177
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	98.431
A_s (acres)	0.5	0.5
Site area for ACF (area correction factor) m^2	1,000,000 m^2	1,000 m^2
ED_{rec} (exposure duration - recreator) yr		26
$ED_{rec\text{-}a}$ (exposure duration - recreator adult) yr		20
$ED_{resc\text{-}c}$ (exposure duration - recreator child) yr		6
EF_{rec} (exposure frequency - recreator) day/yr		60
$EF_{rec\text{-}a}$ (exposure frequency - recreator adult) day/yr		60
$EF_{rec\text{-}c}$ (exposure frequency - recreator child) day/yr		60
ET_{rec} (exposure time - recreator) hr/day		8
$ET_{rec\text{-}a}$ (exposure time - recreator) hr/day		8
$ET_{rec\text{-}c}$ (exposure time - recreator) hr/day		8
$IFA_{rec\text{-}adj}$ (age-adjusted inhalation rate - recreator) m^3		9,200
$IFS_{rec\text{-}adj}$ (age-adjusted soil intake rate - recreator) mg		63,720
$IRA_{rec\text{-}a}$ (inhalation rate - recreator adult) m^3/day	20	20
$IRA_{rec\text{-}c}$ (inhalation rate - recreator child) m^3/day	10	10
$IRS_{rec\text{-}a}$ (soil intake rate - recreator adult) mg/day	100	33
$IRS_{rec\text{-}c}$ (soil intake rate - recreator child) mg/day	200	67
t_{rec} (time - recreator) yr		26
TR (target risk) unitless	0.000001	0.000001
U_m (mean annual wind speed) m/s	4.69	4.65
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Notes:

IL = Illinois; PRG = Preliminary Remediation Goal; yr = year.

Table B.3.2 Recreator PRGs for Soil, Ra-226

Isotope	ICRP Lung Absorption Type	Soil Ingestion Slope Factor (risk/pCi)	Inhalation Slope Factor (risk/pCi)	External Exposure Slope Factor (risk/yr per pCi/g)	Food Ingestion Slope Factor (risk/pCi)	Lambda (1/yr)	Half-life (yr)	1,000 m^2 Soil Volume Area Correction Factor	0 cm Soil Volume Gamma Shielding Factor	Particulate Emission Factor (m^3/kg)	Dry Soil-to-plant transfer factor (pCi/g-fresh plant per pCi/g-dry soil)	Beef Transfer Factor (pCi/kg per pCi/d)	Poultry Transfer Factor (pCi/kg per pCi/d)	Ingestion PRG TR=1.0E-06 (pCi/g)	Inhalation PRG TR=1.0E-06 (pCi/g)	External Exposure PRG TR=1.0E-06 (pCi/g)	Total PRG TR=1.0E-06 (pCi/g)	Total PRG TR=1.0E-06 (mg/kg)	Total PRG TR=1.0E-06 (pCi/kg)
Ra-226	S	6.77E-10	2.82E-08	2.50E-08	5.14E-10	4.33E-04	1.60E+03	6.85E-01	1.00E+00	1.56E+09	1.95E-02	1.70E-03	-	2.32E+01	6.02E+03	4.10E+01	1.48E+01	1.50E-05	1.48E+04

Notes:
d = Day; ICRP = International Commission on Radiological Protection; Ra = Radium; S = Slow; pCi = Picocurie; PRG = Preliminary Remediation Goal; TR = Target Risk; yr = Year.

Table B.3.3 Recreator PRGs for Soil, Ra-228

Isotope	ICRP Lung Absorption Type	Soil Ingestion Slope Factor (risk/pCi)	Inhalation Slope Factor (risk/pCi)	External Exposure Slope Factor (risk/yr per pCi/g)	Food Ingestion Slope Factor (risk/pCi)	Lambda (1/yr)	Half-life (yr)	1,000 m^2 Soil Volume Area Correction Factor	0 cm Soil Volume Gamma Shielding Factor	Particulate Emission Factor (m^3/kg)	Dry Soil-to-plant transfer factor (pCi/g-fresh plant per pCi/g-dry soil)	Beef Transfer Factor (pCi/kg per pCi/d)	Poultry Transfer Factor (pCi/kg per pCi/d)	Ingestion PRG TR=1.0E-06 (pCi/g)	Inhalation PRG TR=1.0E-06 (pCi/g)	External Exposure PRG TR=1.0E-06 (pCi/g)	Total PRG TR=1.0E-06 (pCi/g)	Total PRG TR=1.0E-06 (mg/kg)	Total PRG TR=1.0E-06 (pCi/kg)
Ra-228	S	1.98E-09	4.37E-08	3.43E-11	1.42E-09	1.21E-01	5.75E+00	1.00E+00	1.00E+00	1.56E+09	1.95E-02	1.70E-03	-	7.93E+00	3.89E+03	2.04E+04	7.91E+00	2.90E-08	7.91E+03

Notes:

d = Day; ICRP = International Commission on Radiological Protection; Ra= Radium; S = Slow; pCi = Picocurie; PRG = Preliminary Remediation Goal; TR = Target Risk; yr = Year.

Attachment B

Supporting Information for the Closure Alternatives Analysis – Primary Ash Pond at the Newton Power Plant

Illinois Power Generating Company
CLOSURE ALTERNATIVES ANALYSIS SUPPORTING INFORMATION REPORT

Newton Power Plant
Primary Ash Pond

July 2022

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FIGURES

TABLES

1. INTRODUCTION AND BACKGROUND

Illinois Power Generating Company (IPGC) is the owner of the coal-fired Newton Power Plant (NPP), located in Jasper County, Illinois. Newton is an active power plant and will remain active until 2027, at which time electricity production will cease and it will become inactive. This power plant has a surface impoundment called the Primary Ash Pond. Closure of the Primary Ash Pond (PAP) will take place in phases and upon shut down of the power plant in 2027, with final closure complete in fall of 2028.

This supplemental information was developed for the closure alternatives analysis as required in accordance with 35 Illinois Administrative Code (IAC) 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845). Closure of the PAP 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 845.710, to support the Closure Plan prepared pursuant to Section 845.720. The CAA for the Newton PAP will be performed by Gradient Corporation (Gradient). HDR 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 barging.
- **Section 3** includes an overview of the planned construction for closure-in-place (CIP), CBR-Onsite, and CBR-Offsite;
- **Section 4** includes a project schedule for CIP, CBR-Onsite and CBR-Offsite; and
- **Section 5** includes estimates for construction material quantities, cost, labor, vehicle miles, and equipment miles, for CIP, CBR-Onsite, and CBR-Offsite.
- **Section 6** includes references for information used in this report.

2. CLOSURE-BY-REMOVAL INFORMATION

Section 845.710(c)(1) of the IAC 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 an existing onsite landfill that can accept the CCR, or if constructing a new onsite landfill 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. Potential CBR - Onsite Landfill Options

2.1.1. Existing Newton CCR Landfill

An existing CCR landfill, the Newton CCR Landfill Phase II, is currently open at the site, but is not actively used to store CCR. The current landfill cell (Area 3) is approximately 7.2-acres in size, however, this cell would require reconstruction prior to use.

Cell Area 1 is 7.2-acres
+ Cell Area 2 is 4.5-acres
+ Cell Area 3 is 7.2-acres (unused, assumed rebuild required)
18.9-acres constructed in total

There are about 34 permitted landfill acres remaining to construct (including a rebuild of Area 3), resulting in about 3.2-million cubic yards of permitted capacity remaining. The current landfill is adjacent to a historic closed landfill to the north that does not have additional permitted capacity.

The PAP contains approximately 5.7-million cubic yards of CCR. Therefore, disposal of the CCR in an onsite landfill would require a permitted landfill expansion or permitted new landfill on-site.

2.1.2. Feasibility of New Onsite Landfill Construction

The NPP site boundary was evaluated for suitable areas for the construction of an onsite landfill. Three primary options were identified, as shown in **Figure 1**. The feasibility of constructing a new landfill or landfill expansion in each area is described below:

- The Option 1 area is approximately 28-acres in size and is located immediately north of the existing landfill. This expansion would require removal of a portion of the final cover system on the historic landfill to the north, and installation of an overliner system over the historic landfill.
    - The leachate drainage system of the current landfill would require re-evaluation and reconstruction to facilitate an expansion to the north. Existing site infrastructure would require re-routing.

- The national wetlands inventory mapper indicates possible presence of wetlands in the area and to the south. This represents a potential impact to a protected area.
- This area is not in the 100-year floodplain, per the Jasper County FIRM, panel number 170990-0125-B.
- Therefore, constructing a landfill within the Option 1 area is considered less preferred, due to impacts to the existing site infrastructure and potential impacts to adjacent protected areas.

- The Option 2 area is approximately 25-acres in size and is located east of the existing landfill.
  - Option 2 overlaps with the existing PAP. This area would require phased closure of the pond where waste was first moved from the pond and into the existing permitted landfill, and then the landfill would be expanded into the clean closed footprint to hold the remaining waste.
  - This area would require relocation of the site access road and possible relocation of a monitoring well.
  - This area is not in the 100-year floodplain, per the Jasper County FIRM, panel number 170990-0125-B. However, it would require rerouting a major site drainageway.
  - Based on a review of the national wetlands inventory mapper and current site conditions, this area is not anticipated to impact potential wetlands.
  - Therefore, with phasing considerations taken into account, the Option 2 Area represents potentially the most practical option for onsite landfilling, because it expands an existing landfill, thus requiring less acreage for volume required, and is not anticipated to be in a protected area or buffer zone.
- The Option 3 area is approximately 33-acres in size and is located to the north of the existing closed landfill.
  - Option 3 represents the option of a new onsite landfill, rather than expanding the existing landfill. With this option, a greater area is needed and requires use of an area currently used for farming. An estimated 33-acres, with 4:1 sideslopes and 50-ft in height would be required.
  - This area represents an increased haul distance from the current PAP, adding time to the total project.
  - This area is not in the 100-year floodplain, per the Jasper County FIRM, panel number 170990-0125-B.
  - Based on a review of the national wetlands inventory mapper and current site conditions,

this area is not anticipated to impact potential wetlands.

- Therefore, constructing a landfill in the Option 3 area is not preferred, due to use of land that has agricultural value, increased haul distance, and increased landfill footprint.

In summary, the areas available for potentially constructing a landfill within the site boundary each have challenges and potential limitations. The option considered potentially feasible above is the Option 2 Area – which is evaluated further on the attached tables.

2.2. Potential CBR-Offsite Receiving Landfills

Potential offsite landfills suitable for disposing of the approximately 5.7-million cubic yards of CCR within the PAP were evaluated using IEPA's online Illinois Disposal Capacity Report [3], and Indiana's Solid Waste Reporting website [4]. The closest landfills to the site, by road miles, were determined to be:

- Sanitation Service's Landfill 33, Ltd., located in Effingham, IL, (21-miles);
- Republic Services Sumner Landfill, located in Sumner, IL, (46-miles);
- Republic Services Sycamore Ridge Landfill, located in Pimento, Indiana, (75-miles).

Sycamore Ridge Landfill is the landfill evaluated in the supporting information tables due to its estimated potential to have sufficient capacity for the volume of CCR to be removed. This landfill is the furthest distance of the identified sites at about 75-miles. No landfills have not yet been contacted, as of the date of this report, to confirm that they would be willing and able to accept the CCR. Information on the landfills is provided in **Table 1** and the location of each landfill relative to the site is provided in **Figure 2**.

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 power plant does currently have an established rail terminal, although modifications would be required in order for it to be used to load and transport CCR material. Modifications would increase the project schedule due to the need to coordinate with the railroad, complete design and permitting, and construct the loading area. CCR would still need to be hauled by truck to the loading area and loaded into rail cars, resulting in additional CCR handling and potential exposure to the surrounding environment.

A direct rail route to Sumner Landfill does not exist. A direct route to Landfill 33 does exist, however, an existing terminal suitable for unloading CCR is not present at the landfill. The amount of permitted airspace remaining at both of the Illinois landfills is not sufficient for the total volume of waste from the PAP, and therefore not practical for development of rail lines or terminals.

Sycamore Ridge Landfill is located adjacent to an existing rail line, however, an existing terminal suitable for unloading CCR is not present at the landfill. A rail unloading terminal would need to be constructed which would increase the project schedule due to the need to coordinate with the railroad, complete design and permitting, and construct the terminal. CCR would still need to be hauled from the rail terminal to the active area of the landfill, resulting in additional CCR handling and potential exposure to the surrounding environment.

Hauling CCR to Sycamore Ridge Landfill in Indiana would require approximately 75-miles (one-way) of hauling by rail on tracks owned by three separate rail lines (CSX, Indiana Rail Road Company, and PVTX), as shown on **Figure 2**. 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 PAP CBR, 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 over which the CCR would need to be transported.

2.3.2. Transportation by Barge

The Newton Power Plant is not near rivers that accommodate barge traffic. It is estimated the nearest terminal for barge traffic is in St. Louis, approximately 125-miles away. This requires more trucking than the option to haul directly to a landfill, as well as installation of unloading infrastructure and additional hauling after the barge. Therefore, this option is not considered feasible.

2.3.3. Transportation by Truck

The PAP is located approximately eight miles from IL-33, which is suitable for receiving on-road truck hauling traffic. North 500th Street routinely receives truck traffic associated with the power plant. Potential travel routes between the PAP and landfills are shown on **Figure 2**, although actual travel routes may vary.

Transporting CCR by truck will not require the construction of additional loading or unloading infrastructure at either the receiving landfills or PAP. CCR would be loaded into trucks using heavy equipment at the PAP. CCR will then be unloaded at the receiving landfill by the truck directly. Since no construction is required, project delays related to coordination with other entities, design, and permitting are unlikely to occur. Therefore, transporting CCR by truck is a viable option for the PAP.

3. CLOSURE DESCRIPTION NARRATIVES

Section 845.720(a)(1)(A) requires a narrative description of CCR impoundment closures to be prepared. Narrative descriptions have been prepared for CIP, CBR-Onsite, and CBR-Offsite and are included within this section.

3.1. Closure in Place

A narrative description of how the PAP will be closed in place is provided in Section 2.1 of the PAP Closure Plan.

3.2. CBR-Onsite

A narrative description of CBR-Onsite of the PAP is as follows:

- The PAP will be unwatered by pumping free surface water to the adjacent Settling Pond for ultimate discharge at NPDES Outfall 001.

- A temporary water management system will be constructed within the PAP, including ditches and sumps. The system will maintain the PAP in an unwatered state by collecting contact stormwater during closure construction. Unwatering flows will be pumped to the Settling Pond for ultimate discharge at NDPES Outfall 001.

- CCR will be removed from the PAP using mass mechanical excavation techniques. Much of the CCR will be saturated or nearly saturated, so mass excavation will include the use of dewatering seepage trenches or other forms of passive dewatering (i.e., rim ditching or windrowing) to moisture-condition the CCR prior to handling. Dewatering flows will be pumped to the Settling Pond for ultimate discharge at NPDES Outfall 001.

- CCR will be loaded into dump trucks and hauled to the existing landfill, which will be expanded as the project progresses.

- The PAP outlet structure will be removed and disposed of at the offsite receiving landfill. Soil backfill will be placed at the previous outlet structure location.

- The PAP bottom and side- slopes will be decontaminated by removing approximately one foot of soil beneath the side-slope and bottom grades. The soils will be disposed of in the offsite receiving landfill.

- Once CBR is complete, the former PAP will be backfilled as needed to drain towards the south, in order to allow stormwater to gravity flow and preclude the impoundment of water. Backfill materials would include clean soil material excavated from the soil perimeter berm.

- The PAP will be restored by placing six inches of topsoil on the bottom and side slopes of the PAP and establishing vegetation. Stormwater best management practices (BMPs) such as erosion control blankets and straw wattles 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.

3.3. CBR-Offsite

A narrative description of CBR-Offsite of the PAP is as follows:

- The PAP will be unwatered by pumping free surface water to the adjacent Settling Pond for ultimate discharge at NPDES Outfall 001.
- A temporary water management system will be constructed within the PAP, including ditches and sumps. The system will maintain the PAP in an unwatered state by collecting contact stormwater during closure construction. Unwatering flows will be pumped to the Settling Pond for ultimate discharge at NDPES Outfall 001.
- CCR will be removed from the PAP using mass mechanical excavation techniques. Much of the CCR will be saturated or nearly saturated, so mass excavation will include the use of dewatering seepage trenches or other forms of passive dewatering (i.e., rim ditching or windrowing) to moisture-condition the CCR prior to handling. Dewatering flows will be pumped to the Settling Pond for ultimate discharge at NPDES Outfall 001.
- CCR will be loaded into on-road dump trucks and hauled to the offsite receiving landfill.
- The PAP outlet structure will be removed and disposed of at the offsite receiving landfill. Soil backfill will be placed at the previous outlet structure location.
- The PAP bottom and side- slopes will be decontaminated by removing approximately one foot of soil beneath the side-slope and bottom grades. The soils will be disposed of in the offsite receiving landfill.
- Once CBR is complete, the former PAP will be backfilled as needed to drain towards the south, in order to allow stormwater to gravity flow and preclude the impoundment of water. Backfill materials would include clean soil material excavated from the soil perimeter berm.
- The PAP will be restored by placing six inches of topsoil on the bottom and side slopes of the PAP and establishing vegetation. Stormwater best management practices (BMPs) such as erosion control blankets and straw wattles 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 CIP, CBR-Onsite, and CBR-Offsite and are included within this section. Schedules were prepared using estimates of task durations based on HDR's experience, typical weather conditions at the site, 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 PAP Closure Plan.

4.2. CBR-Onsite

The proposed closure construction schedule for CBR-Onsite is provided in **Table 2**.

4.3. CBR-Offsite

The proposed closure construction schedule for CBR-Offsite is provided in **Table 2**.

5. MATERIAL, QUANTITY, LABOR, AND MILEAGE ESTIMATES

5.1. Quantity and Cost Estimates

Section 845.710(d)(1) requires a cost estimate to be prepared in accordance with the Class 4 standards of the Association for the Advancement of Cost Engineering (AACE) [5]. Cost estimates for CIP, CBR-Onsite, and CBR-Offsite were prepared in accordance with the AACE Class 4 standards, 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**).
- Unit costs were estimated for each construction line-item utilizing RSMeans Heavy Construction Cost Data [6] (RS Means). For line-items where RSMeans data was not available, unit costs were estimated based on recent industry pricing observed by HDR on projects of similar size, scope, and complexity.
    - RSMeans unit costs were developed assuming Union labor for Effingham, Illinois (located approximately 23 miles from the PAP), for 2022.
- Soil fill was assumed to come from onsite borrow sources located within 4,000-ft of the construction on average. Soil borrow is currently planned to be obtained from within the pond area, existing berms, and if needed, elsewhere on site.
- A contingency of 30% was applied for the construction cost estimate total, based on the level of design and quantity estimate prepared as part of this Report.

5.2. Labor and Mileage Estimates

In addition to construction cost and quantity estimates, Gradient also utilized HDR's estimates of construction labor hours, equipment usage, haul truck mileage, daily labor mobilization vehicle mileage, material delivery mileage, and onsite vehicle mobilization mileage. These estimates were prepared using the following approach:

- For line items where RSMeans [6] was utilized to develop the costs, the corresponding RSMeans crew size, equipment description, and daily output were utilized to estimate the total number of man-hours and equipment hours.
- For line items where RSMeans data was unavailable, the crew size, equipment description, and daily output were estimated based on recent industry pricing observed by HDR on projects of similar size, scope, and complexity.

- 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 HDR's experience.

5.3. Results

The detailed labor and mileage estimates are provided in **Tables 3a** and **3b**, respectively for CIP.

The detailed labor and mileage estimates are provided in **Tables 4a** and **4b**, respectively for CBR-onsite.

The detailed labor and mileage estimates are provided in **Tables 5a** and **5b**, respectively for CBR-offsite.

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," August 2021.

[4] Indiana Department of Environmental Management, “Solid Waste Reporting - 2020,” accessed March 10, 2022.

[5] AACE International, "Recommended Practice 18R-97: Cost Estimate Classification System - As Applied in Engineering, Procurement, and Construction for the Process Industries," 2020.

[6] RSMeans, "Heavy Construction Costs with RSMeans Data," Gordian, 2022.

Figures

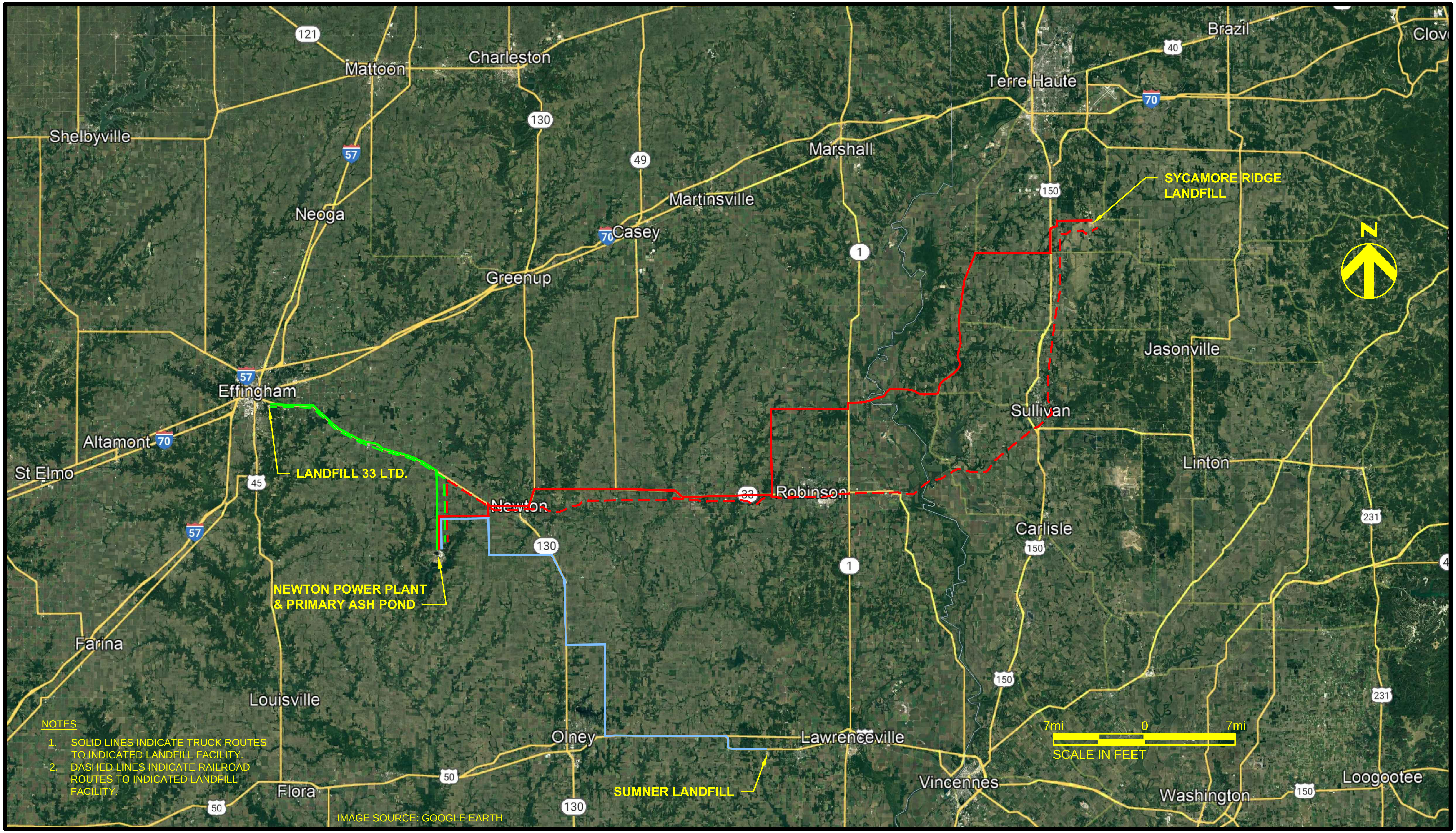
Source: Google Earth Imagery, 2022.
Note: Areas and boundaries are approximate/conceptual, for estimating purposes only.

IPGC NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE
NEWTON, ILLINOIS

ONSITE LANDFILL -POTENTIAL AREA OPTIONS

DATE
7.28.2022

FIGURE
1



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FDR

IPGC NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE
NEWTON, ILLINOIS

ALTERNATIVE LANDFILL PROXIMITY MAP

DATE 7.28.2022

FIGURE 1

Tables

Table 1: Offsite Landfill Information

Landfill Name:	Owner:	Location:	One-way Distance From Site:	5-yr Average Disposal Volume (CY):	Remaining Site Capacity (CY)
Sycamore Ridge Landfill	Republic Services, Inc.	Pimento, IN	75 miles	524,173 (tons)(2)	10,000,000 (1)
Landfill 33 Ltd. (3)	Sanitation Service, Inc.	Effingham, IL	21 miles	111,290	527,135
Sumner Landfill, Inc. (3)	Republic Services, Inc.	Sumner, IL	46 miles	93,890	2,807,604

1 Estimated - remaining permitted footprint
2 IDEM: Managing Waste: Solid Waste Reporting
3 Landfill Capacity Report - Landfill Capacity (illinois.gov)

Table 2: Closure Schedule

Milestone	Timeframe		
	Closure in Place	**Closure by Removal - On-site**	**Closure by Removal Off-Site**
Agency Coordination, Approvals, Permitting Obtain state permits, as needed, for dewatering/unwatering, water discharge, land disturbance, and outlet modifications	16 to 24 months after final Closure Plan Approval	16 to 24 months after final Closure Plan Approval	12 to 18 months after final Closure Plan Approval
Final Design and Bid Process* Complete final design of the closure and select a construction contractor	6 to 12 months during Agency Coordination, Approvals, and Permitting	6 to 12 months during Agency Coordination, Approvals, and Permitting	6 to 12 months during Agency Coordination, Approvals, and Permitting
Close CCR Unit Complete Contractor mobilization, installation of stormwater control measures for construction Complete dewatering and unwatering Complete Mass Excavation of CCR and decontamination of Ash Pond Install final cover system (closure in place only) Winter weather delays are assumed between November and March of each construction year	36 to 48 months after necessary permits are issued	12 months for grading and ash removal for lined landfill 24 months for construction of lined area after necessary permits are issued 48 to 60 months for ash removal and closure	252 months after necessary permits are issued
Slope to drain -backfill soil to maintain positive drainage	Concurrent with above item	6 to 8 months after final plant shutdown	6 to 8 months after final plant shutdown
Site Restoration Seed and stabilize the Ash Pond Complete Contractor demobilization	2-3 months after grading is complete	4 to 6 months after grading is complete	4 to 6 months after grading is complete
Timeframe to Complete Closure	**54 to 75 months**	**110 to 134 months**	**274 to 284 months**

*Assume final design and bidding is concurrent with final approvals and permitting

Table 3a: Quantity Estimate - Closure in Place

Item No.	Item	Crew	Worker Type	Workers (#)	Equipment Type	Equipment (#)	Daily Output	Labor Hours	Equipment Hours	Units	Quantity	Notes
1	**Pre-Construction**											
	Mobilization and Demobilization									LS	1	5% of project, based on experience, project size.
2	**Site Preparation**											
	Site Preparation: Clearing and Grubbing	B7	Operator x 1 Laborer x 5	6	Brush Chipper x 1 Crawler Loader x 1 Chainsaws x 2	4	1	3,000	2,000	AC	50	311110100020, Clearing and grubbing, cut and chip light trees
	Construction Soil Erosion and Sediment Controls	B62	Operator x 1 Laborer x 2	3	Skid Steer x 1	1	650	2,308	769	LF	50,000	312514161000, Silt fence, install and remove
	Construction Facilities - Office Trailer	-	-	-	-	-	-	-	-	LS	1	015213200400, Office Trailer, buy, 50'x10'
	Construction Facilities - Storage Trailers (2)	-	-	-	-	-	-	-	-	LS	2	0152132000200, Office trailer, buy, 20'x8'
	Construction Facilities - Portable Toilets (4)	-	-	-	-	-	-	-	-	MO	36	015433406410, Rent toilet portable chemical
	Dust Control	B59	Truck Driver x 1	1	Water Truck x 1	1	1	4,800	4,800	DAY	480	312323202510, Hauling, heavy, dust control
	Haul Road Maintenance	B86A	Operator x 1	1	Grader x 1	1	1	1,440	1,440	DAY	144	312323202600, Hauling, haul road maintenance
3	**Dewatering, Unwatering, and Stormwater Management**											
	Unwatering, Dewatering, and Stormwater Management for the Primary Ash Pond	B10K	Operator x 1 Laborer x 0.5	1.5	Pump x 1	1	1	21,900	14,600	DAY	1460	312309201100, Dewatering, pumping 8 hrs, times 3 for continuous
	Water Management (additives, sampling)	-	-	-	-	-	-	-	-	DAY	1460	Based on experience, project size.
	Unwatering, Dewatering, and Stormwater Management for Lake Jake and Settling Pond	B10K	Operator x 1 Laborer x 0.5	1.5	Pump x 1	1	1	2,700	1,800	DAY	180	312309201100, Dewatering, pumping 8 hrs, times 3 for continuous
	Outlet structure modification and temporary drainage features	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	0.05	300	200	LS	1	Based on experience, modification of existing infrastructure to re-route. Additional cost for piping
	Dewatering Sumps Installation	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	1	6,000	4,000	EA	400	Based on experience, project size.
4	**Closure**											
	Excavation of Ash Material											
	Excavation of ash material	B14J	Operator x 1 Laborer x 0.5	1.5	Front End Loader x 1	1	3,800.00	7,570	5,047	CY	1,917,700	312316432500, Excavating, large volume projects, restricted loading - doubled based on project experience
	Hauling material to northern portion of site	B34F	Truck Driver x 1	1	Dump Truck x 1	1	528.00	36,320	36,320	CY	1,917,700	Based on experience, project size.
	Spreading of Material	B10B	Operator x 1 Laborer x 0.5	1.5	Dozer x 1	1	1,000.00	28,766	19,177	CY	1,917,700	312323170020, spread dumped material, by dozer
	Compaction of Material	B10Y	Operator x 1 Laborer x 0.5	1.5	Vibratory Roller x 1	1	2,300.00	12,507	8,338	CY	1,917,700	312323235020, compaction, riding, vibrating roller, 3 passes, 6" lifts
	Fine grading of ash surface OR clean closed area	B11L	Operator x 1 Laborer x 1	2	Grader x 1	1	1.84	4,394	2,197	AC	404	312216103300, fine grading, slopes, gentle, finish grading
	Piezometer and Monitoring Well Extensions	C18	Laborer x 1.125	1.125	Concrete Cart x 1	1	1.00	45	40	EA	4	Based on experience.
	Material Conditioning (drying, stabilizing)	-	-	-	-	-	-	-	-	CY	958,850	Based on experience. Approx. half of consolidated material.
	Offsite Disposal Fee	-	-	-	-	-	-	-	-	CY	0	Based on experience.
5	**Onsite Landfill and Pond Capping**											
	Clay layer, 1.5-ft (onsite landfill closure)											
	Excavation and Loading of Material	B14J	Operator x 1 Laborer x 0.5	1.5	Front End Loader x 1	1	3,800	186	124	CY	47,110	312316432500, Excavating, large volume projects, restricted loading
	Hauling Material	B34F	Truck Driver x 1	1	Dump Truck x 1	1	528	892	892	CY	47,110	312323206470, Cycle hauling, 34-cy, 1-mile
	Spreading of Material	B10B	Operator x 1 Laborer x 0.5	1.5	Dozer x 1	1	1,000	707	471	CY	47,110	312323170020, spread dumped material, by dozer
	Compacting Material	B10D	Operator x 1 Laborer x 0.5	1.5	Dozer x 1 Compactor x 1	1	2,000	353	236	CY	47,110	312323235620, Compaction, 3 passes, 6" lifts, sheepsfoot
	Finish grading material	B11L	Operator x 1 Laborer x 1	2	Grader x 1	1	1.84	3,040	1,520	AC	280	312216103300, fine grading, slopes, gentle, finish grading
	Geomembrane, 40-mil LLDPE	HDR1	Operator x 2 Laborer x 10	12	Skid Steer x 1 Forklift x 1	5	2	16,770	6,988	AC	280	Based on experience.
	Geotextile, 8-oz.	HDR1	Operator x 2 Laborer x 10	12	Skid Steer x 1 Forklift x 1	5	2	16,770	6,988	AC	280	Based on experience, est. $0.50/SF
	Anchor Trench	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	250	810	540	LF	13,500	
	Temporary Anchor Trench	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	250	379	253	LF	6,320	
	Drainage Pipes on Geomembrane	HDR1	Operator x 2 Laborer x 10	12	Skid Steer x 1 Forklift x 1	5	7,500	590	246	LF	36,893	Based on experience.
	Placement of Protective Cover Soil (onsite source)											
	Excavation and Loading of Material	B14J	Operator x 1 Laborer x 0.5	1.5	Front End Loader x 1	1	3,800.00	2,750	1,833	CY	696,682	312316432500, Excavating, large volume projects, restricted loading
	Hauling Material	B34F	Truck Driver x 1	1	Dump Truck x 1	1	528.00	13,195	13,195	CY	696,682	312323206470, Cycle hauling, 34-cy, 1-mile
	Spreading of Material	B10B	Operator x 1 Laborer x 0.5	1.5	Dozer x 1	1	1,000.00	10,450	6,967	CY	696,682	312323170020, spread dumped material, by dozer
	Finish grading material	B11L	Operator x 1 Laborer x 1	2	Grader x 1	1	1.84	3,040	1,520	AC	280	312216103300, fine grading, slopes, gentle, finish grading
	Placement of Vegetative Soil (onsite source)											
	Excavation and Loading of Material	B14J	Operator x 1 Laborer x 0.5	1.5	Front End Loader x 1	1	3,800.00	917	611	CY	232,227	312316432500, Excavating, large volume projects, restricted loading
	Hauling Material	B34F	Truck Driver x 1	1	Dump Truck x 1	1	528.00	4,398	4,398	CY	232,227	312323206470, Cycle hauling, 34-cy, 1-mile
	Spreading of Material	B10B	Operator x 1 Laborer x 0.5	1.5	Dozer x 1	1	1,000.00	3,483	2,322	CY	232,227	312323170020, spread dumped material, by dozer
	Finish grading material	B11L	Operator x 1 Laborer x 1	2	Grader x 1	1	1.84	3,040	1,520	AC	280	312216103300, fine grading, slopes, gentle, finish grading
	Installation of drainage channels									*LF*	*15,884*	
	Erosion Control Blanket	2 Clab	Laborer x 2	2	-	0	1000	1,765	0	SY	88,244	312514160120, synthetic erosion control, revegetation mat, webbed
	Installation of drainage letdowns									*LF*	*5,028*	
	Riprap	B30	Operator x 1 Truck Driver x 2	3	Excavator x 1 Dump Trucks x 2	3	100	2,682	2,682	SY	8,939	313713100200, Riprap and rock lining, not grouted, crew and output adjusted for site.
	Geotextile, 10 oz.	B62	Operator x 1 Laborer x 2	3	Skid Steer x 1	1	2,500	107	36	SY	8,939	Based on experience, est. $0.60/SF
6	**Stormwater and Perimeter**											
	Removal of Outlet Structure	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	0.10	150	100	LS	1	Based on experience.
	Removal of Outlet Pipe	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	0.20	75	50	LS	1	Based on experience.
	Installation of permanent stormwater culverts, riprap aprons, ar	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	0.10	150	100	LS	1	Based on experience, includes final pond outlet.
	Establish Access Roads									*LF*	*13,500*	
	Gravel	B32	Operator x 3 Laborer x 1	4	Grader x 1 Roller x 1 Dozer x 1	3	5,000	360	270	SY	45,000	321123230370, base course, aggregate base course, 6"
	Geotextile, 10 oz.	B62	Operator x 1 Laborer x 2	3	Skid Steer x 1	1	2,500	540	180	SY	45,000	Based on experience, est. $0.60/SF
	Seed, fertilize, and maintain vegetated surfaces											
	Seeding	B66	Operator x 1	1	Loader-Backhoe x 1	1	1.5	**3,000**	3,000	AC	450	329219130020, mechanical seeding, 215 lb/ac
	Fertilizing	B66	Operator x 1	1	Loader-Backhoe x 1	1	3	1,500	1,500	AC	450	320190130110, fertilizing, dry granular, 4 lb/MSF, crew per project experience.
	Mulch (select areas/steep slopes)	B66	Operator x 1	1	Loader-Backhoe x 1	1	140,000	124	124	SF	1,742,400	329113160760, soil preparation, mulching
	Repair initial erosion	B66	Operator x 1	1	Loader-Backhoe x 1	1	1	400	400	AC	40	Based on experience, reseed 10% to establish vegetation
7	**Engineering and Construction Support**											
	Final Closure Design, Local Permitting Support, and Bid Support	HDR2	Engineering Staff x 4	4	-	0	0.01	4,000	0	LS	1	1% of total project, based on project scale.
	Engineering Support and CQA during Construction	HDR3	CQA Staff x 1 Engineering Staff x 1	2	Truck x 1	1	0.001	20,000	10,000	LS	1	5% of total project, based on duration of construction.
								Labor Hours: **248,673**	**Equipment Hours:** **169,793**			
							Contingency (30%)	**323,275**	**220,730**			

Notes:

1. RS Means used as reference - adjusted based on project size, location, type.
2. Grey crews were established based on HDR relevant project experience.

Table 3b: Labor, Equipment, and Mileage Estimate - Closure in Place - Totals

Item	Quantity	Assumptions
Labor Total Hours	323,275	10-hr days
Duration of Onsite Construction in Days	720	Working days, 9 months per year for 4 yrs, 20-working days per month average
Average Daily Crew Size	45	Crew Members
Daily Labor Mobilization Miles	2,262,925	Average of 70 miles round trip per day
Vehicles Miles Onsite	79,040	2 mile round trip from gate to parking 5 miles per day for CQA tech and Construction Supervisor 10% Contingency for site visitors (client and engineering support)
Equipment Mobilization Miles - Unloaded	33,110	Average of 300 miles one way for equipment hauling Average 1 load of equipment 2,000 Equipment working hours
Equipment Mobilization Miles - Loaded	33,110	Average of 300 miles one way for equipment hauling Average 1 load of equipment per working week
Daily Equipment Miles Onsite	720,000	Average of ~20 crew members running equipment Assume 50 miles per piece of equipment (average 5 mph, 10-hrs per day)
Onsite Haul Truck Miles - Unloaded	56,403	34 CY Haul Truck 1-mile route out
Onsite Haul Truck Miles - Loaded	56,403	34 CY Haul Truck 1-mile route back
Offsite Haul Truck Miles - Unloaded	0	16.5 CY Dump Truck 75 mile trip
Offsite Haul Truck Miles - Loaded	0	16.5 CY Dump Truck 75 mile trip
Material Delivery Miles - Unloaded	154,080	Assume geosynthetic source ~850-miles from site (possibly South Carolina) 60 extra trips for piping, seed, fertilizer, mulch, straw wattles, and concrete - source 1000 miles away average
Material Delivery Miles - Loaded	154,080	Assume geosynthetic source ~850-miles from site (possibly South Carolina) 60 extra trips for piping, seed, fertilizer, mulch, straw wattles, and concrete - source 1000 miles away average
Estimated Total	**3,549,150**	**miles**

Table 4a: Quantity Estimate - Onsite Landfill

Item No.	Item	Crew	Worker Type	Workers (#)	Equipment Type	Equipment (#)	Daily Output	Labor Hours	Equipment Hours	Units	Quantity	Notes
1	**Pre-Construction**											
	Mobilization and Demobilization									LS	1	5% of project, based on experience, project size.
2	**Site Preparation**											
	Site Preparation: Clearing and Grubbing	B7	Operator x 1 Laborer x 5	6	Brush Chipper x 1 Crawler Loader x 1 Chainsaws x 2	4	1	3,000	2,000	AC	50	311110100020, Clearing and grubbing, cut and chip light trees
	Construction Soil Erosion and Sediment Controls	B62	Operator x 1 Laborer x 2	3	Skid Steer x 1	1	650	2,308	769	LF	50,000	312514161000, Silt fence, install and remove
	Construction Facilities - Office Trailer	-	-	-	-	-	-	-	-	LS	1	015213200400, Office Trailer, buy, 50'x10'
	Construction Facilities - Storage Trailers (2)	-	-	-	-	-	-	-	-	LS	2	0152132000200, Office trailer, buy, 20'x8'
	Construction Facilities - Portable Toilets (4)	-	-	-	-	-	-	-	-	MO	36	015433406410, Rent toilet portable chemical
	Dust Control	B59	Truck Driver x 1	1	Water Truck x 1	1	1	4,800	4,800	DAY	480	312323202510, Hauling, heavy, dust control
	Haul Road Maintenance	B86A	Operator x 1	1	Grader x 1	1	1	1,440	1,440	DAY	144	312323202600, Hauling, haul road maintenance
3	**Dewatering, Unwatering, and Stormwater Management**											
	Unwatering, Dewatering, and Stormwater Management for the Primary Ash Pond	B10K	Operator x 1 Laborer x 0.5	1.5	Pump x 1	1	1	43,800	29,200	DAY	2920	312309201100, Dewatering, pumping 8 hrs, times 3 for continuous
	Water Management (additives, sampling)	-	-	-	-	-	-	-	-	DAY	2920	Based on experience, project size.
	Unwatering, Dewatering, and Stormwater Management for Lake Jake and Settling Pond	B10K	Operator x 1 Laborer x 0.5	1.5	Pump x 1	1	1	2,700	1,800	DAY	180	312309201100, Dewatering, pumping 8 hrs, times 3 for continuous
	Outlet structure modification and temporary drainage features	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	0.05	300	200	LS	1	Based on experience, modification of existing infrastructure to re-route. Additional cost for piping
	Dewatering Sumps Installation	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	1	6,000	4,000	EA	400	Based on experience, project size.
4	**Closure**											
	Excavation of Ash Material											
	Excavation of ash material	B14J	Operator x 1 Laborer x 0.5	1.5	Front End Loader x 1	1	3,800.00	22,500	15,000	CY	5,700,000	312316432500, Excavating, large volume projects, restricted loading - doubled based on project experience
	Hauling material to onsite landfill area	B34F	Truck Driver x 1	1	Dump Truck x 1	1	528.00	107,955	107,955	CY	5,700,000	312323206470, Cycle hauling, 34-cy, 1-mile
	Spreading of Material	B10B	Operator x 1 Laborer x 0.5	1.5	Dozer x 1	1	1,000.00	85,500	57,000	CY	5,700,000	312323170020, spread dumped material, by dozer
	Compaction of Material	B10Y	Operator x 1 Laborer x 0.5	1.5	Vibratory Roller x 1	1	2,300.00	37,174	24,783	CY	5,700,000	312323235020, compaction, riding, vibrating roller, 3 passes, 6" lifts
	Fine grading of ash surface OR clean closed area	B11L	Operator x 1 Laborer x 1	2	Grader x 1	1	1.84	4,394	2,197	AC	404	312216103300, fine grading, slopes, gentle, finish grading
	Piezometer and Monitoring Well Extensions	C18	Laborer x 1.125	1.125	Concrete Cart x 1	1	1.00	45	40	EA	4	Based on experience.
	Material Conditioning (drying, stabilizing)	-	-	-	-	-	-	-	-	CY	5,700,000	Based on experience.
	Offsite Disposal Fee	-	-	-	-	-	-	-	-	CY	0	Based on experience.
5	**Onsite Landfill Closure**											
	Landfill Bottom liner system (clay, 60-mil HDPE, drainage layer)											
	Mass Excavation	B14J	Operator x 1	1.5	Front End Loader x 1	1	3,800	3,947	2,632	CY	1,000,000	312316432500, Excavating, large volume projects, restricted loading
	Mas Excavation - Hauling	B34F	Truck Driver x 1	1	Dump Truck x 1	1	528	18,939	18,939	CY	1,000,000	Based on experience, project size.
	Clay layer, 2-ft (bottom liner - onsite landfill)											
	Excavation and Loading of Material	B14J	Operator x 1 Laborer x 0.5	1.5	Front End Loader x 1	1	3,800	708	472	CY	179,467	312316432500, Excavating, large volume projects, restricted loading
	Hauling Material	B34F	Truck Driver x 1	1	Dump Truck x 1	1	528	3,399	3,399	CY	179,467	Based on experience, project size.
	Spreading of Material	B10B	Operator x 1 Laborer x 0.5	1.5	Dozer x 1	1	1,000	2,692	1,795	CY	179,467	312323170020, spread dumped material, by dozer
	Compacting Material	B10D	Operator x 1 Laborer x 0.5	1.5	Dozer x 1 Compactor x 1	1	2,000	1,346	897	CY	179,467	312323235620, Compaction, 3 passes, 6" lifts, sheepsfoot
	Finish grading material	B11L	Operator x 1 Laborer x 1	2	Grader x 1	1	1.84	587	294	AC	54	312216103300, fine grading, slopes, gentle, finish grading
	Geomembrane, 60-mil HDPE	HDR2	Operator x 2 Laborer x 10	12	Skid Steer x 1 Forklift x 1	5	2	3,240	1,350	AC	54	Based on experience.
	Geotextile, 8-oz.	HDR2	Operator x 2 Laborer x 10	12	Skid Steer x 1 Forklift x 1	5	2	3,240	1,350	AC	54	Based on experience, est. $0.50/SF
	Anchor Trench (bottom liner)	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	250	180	120	LF	3,000	Based on experience.
	Drainage Layer (bottom liner)											
	Purchase Material	-	-	-	-	-	-	-	-	CY	89,734	Based on experience.
	Hauling Material	B34C	Truck Driver x 1	1	16.5-CY Truck x 1	1	99	9,064	9,064	CY	89,734	312323203314, 16.5-cy truck, 50 mph, 50-mile cycle
	Spreading of Material	B10B	Operator x 1 Laborer x 0.5	1.5	Dozer x 1	1	1,000	1,346	897	CY	89,734	312323170020, spread dumped material, by dozer
	Capping											
	Clay layer, 1.5-ft (onsite landfill closure)											
	Excavation and Loading of Material	B14J	Operator x 1 Laborer x 0.5	1.5	Front End Loader x 1	1	3,800	646	431	CY	163,764	312316432500, Excavating, large volume projects, restricted loading
	Hauling Material	B34F	Truck Driver x 1	1	Dump Truck x 1	1	528	3,102	3,102	CY	163,764	Based on experience, project size.
	Spreading of Material	B10B	Operator x 1 Laborer x 0.5	1.5	Dozer x 1	1	1,000	2,456	1,638	CY	163,764	312323170020, spread dumped material, by dozer
	Compacting Material	B10D	Operator x 1 Laborer x 0.5	1.5	Dozer x 1 Compactor x 1	1	2,000	1,228	819	CY	163,764	312323235620, Compaction, 3 passes, 6" lifts, sheepsfoot
	Finish grading material	B11L	Operator x 1 Laborer x 1	2	Grader x 1	1	1.84	715	357	AC	66	312216103300, fine grading, slopes, gentle, finish grading
	Geomembrane, 40-mil LLDPE	HDR1	Operator x 2 Laborer x 10	12	Skid Steer x 1 Forklift x 1	5	2	3,942	1,643	AC	66	Based on experience.
	Geotextile, 8-oz.	HDR1	Operator x 2 Laborer x 10	12	Skid Steer x 1 Forklift x 1	5	2	3,942	1,643	AC	66	Based on experience, est. $0.50/SF
	Anchor Trench	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	250	-	-	LF	-	
	Temporary Anchor Trench	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	250	-	-	LF	-	
	Drainage Pipes on Geomembrane	HDR1	Operator x 2 Laborer x 10	12	Skid Steer x 1 Forklift x 1	5	7,500	315	131	LF	19,710	Based on experience.
	Placement of Protective Cover Soil (onsite source)											
	Excavation and Loading of Material	B14J	Operator x 1 Laborer x 0.5	1.5	Front End Loader x 1	1	3,800.00	646	431	CY	163,764	312316432500, Excavating, large volume projects, restricted loading
	Hauling Material	B34F	Truck Driver x 1	1	Dump Truck x 1	1	528.00	3,102	3,102	CY	163,764	312323206470, Cycle hauling, 34-cy, 1-mile
	Spreading of Material	B10B	Operator x 1 Laborer x 0.5	1.5	Dozer x 1	1	1,000.00	2,456	1,638	CY	163,764	312323170020, spread dumped material, by dozer
	Finish grading material	B11L	Operator x 1 Laborer x 1	2	Grader x 1	1	1.84	715	357	AC	66	312216103300, fine grading, slopes, gentle, finish grading
	Placement of Vegetative Soil (onsite source)											
	Excavation and Loading of Material	B14J	Operator x 1 Laborer x 0.5	1.5	Front End Loader x 1	1	3,800.00	215	144	CY	54,588	312316432500, Excavating, large volume projects, restricted loading
	Hauling Material	B34F	Truck Driver x 1	1	Dump Truck x 1	1	528.00	1,034	1,034	CY	54,588	312323206470, Cycle hauling, 34-cy, 1-mile
	Spreading of Material	B10B	Operator x 1 Laborer x 0.5	1.5	Dozer x 1	1	1,000.00	819	546	CY	54,588	312323170020, spread dumped material, by dozer
	Finish grading material	B11L	Operator x 1 Laborer x 1	2	Grader x 1	1	1.84	715	357	AC	66	312216103300, fine grading, slopes, gentle, finish grading
	Installation of drainage channels									*LF*	*19,710*	
	Erosion Control Blanket	2 Clab	Laborer x 2	2	-	0	1000	2,190	0	SY	109,500	312514160120, synthetic erosion control, revegetation mat, webbed
	Installation of drainage letdowns									*LF*	*6,570*	
	Riprap	B30	Operator x 1 Truck Driver x 2	3	Excavator x 1 Dump Trucks x 2	3	100	3,504	3,504	SY	11,680	313713100200, Riprap and rock lining, not grouted, crew and output adjusted for site.
	Geotextile, 10 oz.	B62	Operator x 1 Laborer x 2	3	Skid Steer x 1	1	2,500	140	47	SY	11,680	Based on experience, est. $0.60/SF
6	**Stormwater and Perimeter**											
	Removal of Outlet Structure	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	0.10	150	100	LS	1	Based on experience.
	Removal of Outlet Pipe	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	0.20	75	50	LS	1	Based on experience.
	Installation of permanent stormwater culverts, riprap aprons, ar	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	0.10	150	100	LS	1	Based on experience, includes final pond outlet.
	Establish Access Roads									*LF*	*13,500*	
	Gravel	B32	Operator x 3 Laborer x 1	4	Grader x 1 Roller x 1 Dozer x 1	3	5,000	360	270	SY	45,000	321123230370, base course, aggregate base course, 6"
	Geotextile, 10 oz.	B62	Operator x 1 Laborer x 2	3	Skid Steer x 1	1	2,500	540	180	SY	45,000	Based on experience, est. $0.60/SF
	Seed, fertilize, and maintain vegetated surfaces											
	Seeding	B66	Operator x 1	1	Loader-Backhoe x 1	1	1.5	3,000	3,000	AC	450	329219130020, mechanical seeding, 215 lb/ac
	Fertilizing	B66	Operator x 1	1	Loader-Backhoe x 1	1	3	1,500	1,500	AC	450	320190130110, fertilizing, dry granular, 4 lb/MSF, crew per project experience.
	Mulch (select areas/steep slopes)	B66	Operator x 1	1	Loader-Backhoe x 1	1	140,000	124	124	SF	1,742,400	329113160760, soil preparation, mulching
	Repair initial erosion	B66	Operator x 1	1	Loader-Backhoe x 1	1	1	410	410	AC	41	Based on experience, reseed 10% to establish vegetation
7	**Engineering and Construction Support**											
	Final Closure Design, Local Permitting Support, and Bid Support	HDR2	Engineering Staff x 4	4	-	0	0.01	4,000	0	LS	1	1% of total project, based on project scale.
	Engineering Support and CQA during Construction	HDR3	CQA Staff x 1 Engineering Staff x 1	2	Truck x 1	1	0.001	20,000	10,000	LS	1	2% of total project, based on duration of construction.
								Labor Hours: **432,797**	**Equipment Hours:** **329,049**			
							Contingency (30%)	**562,636**	**427,763**			

Notes:

1. RS Means used as reference - adjusted based on project size, location, type.
2. Grey crews were established based on HDR relevant project experience.

Table 4b: Labor, Equipment, and Mileage Estimate - Closure by Removal -Onsite Landfill- Totals

Item	Quantity	Assumptions
Labor Total Hours	562,636	10-hr days
Duration of Onsite Construction in Days	1,440	Working days, 9 months per year for 8 yrs, 20-working days per month average
Average Daily Crew Size	39	Crew Members
Daily Labor Mobilization Miles	3,938,451	Average of 70 miles round trip per day
Vehicles Miles Onsite	139,620	2 mile round trip from gate to parking 5 miles per day for CQA tech and Construction Supervisor 10% Contingency for site visitors (client and engineering support)
Equipment Mobilization Miles - Unloaded	64,164	Average of 300 miles one way for equipment hauling Average 1 load of equipment 2,000 Equipment working hours
Equipment Mobilization Miles - Loaded	64,164	Average of 300 miles one way for equipment hauling Average 1 load of equipment per working week
Daily Equipment Miles Onsite	1,440,000	Average of ~20 crew members running equipment Assume 50 miles per piece of equipment (average 5 mph, 10-hrs per day)
Onsite Haul Truck Miles - Unloaded	167,647	34 CY Haul Truck 4000 ft cycle
Onsite Haul Truck Miles - Loaded	167,647	34 CY Haul Truck 4000 ft cycle
Offsite Haul Truck Miles - Unloaded	0	16.5 CY Dump Truck 75 mile trip
Offsite Haul Truck Miles - Loaded	0	16.5 CY Dump Truck 75 mile trip
Material Delivery Miles - Unloaded	82,115	Assume geosynthetic source ~850-miles from site (possibly South Carolina) 60 extra trips for piping, seed, fertilizer, mulch, straw wattles, and concrete - source 1000 miles away average
Material Delivery Miles - Loaded	82,115	Assume geosynthetic source ~850-miles from site (possibly South Carolina) 60 extra trips for piping, seed, fertilizer, mulch, straw wattles, and concrete - source 1000 miles away average
Estimated Total	**6,145,923**	**miles**

Table 5a: Quantity Estimate - Offsite Landfill

Item No.	Item	Crew	Worker Type	Workers (#)	Equipment Type	Equipment (#)	Daily Output	Labor Hours	Equipment Hours	Units	Quantity	Notes
1	**Pre-Construction**											
	Mobilization and Demobilization									LS	1	5% of project, based on experience, project size.
2	**Site Preparation**											
	Site Preparation: Clearing and Grubbing	B7	Operator x 1 Laborer x 5	6	Brush Chipper x 1 Crawler Loader x 1 Chainsaws x 2	4	1	3,000	2,000	AC	50	311110100020, Clearing and grubbing, cut and chip light trees
	Construction Soil Erosion and Sediment Controls	B62	Operator x 1 Laborer x 2	3	Skid Steer x 1	1	650	2,308	769	LF	50,000	312514161000, Silt fence, install and remove
	Construction Facilities - Office Trailer	-	-	-	-	-	-	-	-	LS	1	015213200400, Office Trailer, buy, 50'x10'
	Construction Facilities - Storage Trailers (2)	-	-	-	-	-	-	-	-	LS	2	0152132000200, Office trailer, buy, 20'x8'
	Construction Facilities - Portable Toilets (4)	-	-	-	-	-	-	-	-	MO	36	015433406410, Rent toilet portable chemical
	Dust Control	B59	Truck Driver x 1	1	Water Truck x 1	1	1	4,800	4,800	DAY	480	312323202510, Hauling, heavy, dust control
	Haul Road Maintenance	B86A	Operator x 1	1	Grader x 1	1	1	1,440	1,440	DAY	144	312323202600, Hauling, haul road maintenance
3	**Dewatering, Unwatering, and Stormwater Management**											
	Unwatering, Dewatering, and Stormwater Management for the Primary Ash Pond	B10K	Operator x 1 Laborer x 0.5	1.5	Pump x 1	1	1	49,275	32,850	DAY	3285	312309201100, Dewatering, pumping 8 hrs, times 3 for continuous
	Water Management (additives, sampling)	-	-	-	-	-	-	-	-	DAY	3285	Based on experience, project size.
	Unwatering, Dewatering, and Stormwater Management for Lake Jake and Settling Pond	B10K	Operator x 1 Laborer x 0.5	1.5	Pump x 1	1	1	2,700	1,800	DAY	180	312309201100, Dewatering, pumping 8 hrs, times 3 for continuous
	Outlet structure modification and temporary drainage features	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	0.05	300	200	LS	1	Based on experience, modification of existing infrastructure to re-route. Additional cost for piping
	Dewatering Sumps Installation	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	1	6,000	4,000	EA	400	Based on experience, project size.
4	**Closure**											
	Excavation of Ash Material											
	Excavation of ash material	B14J	Operator x 1 Laborer x 0.5	1.5	Front End Loader x 1	1	3,800.00	22,500	15,000	CY	5,700,000	312316432500, Excavating, large volume projects, restricted loading - doubled based on project experience
	Hauling material offsite	B34C	Truck Driver x 1	1	Haul Truck x 1	1	33	1,727,273	1,727,273	CY	5,700,000	312323203304, cycle hauling, adjusted for 150-mile cycle, Crew B34C -assume 2 cycles per day
	Spreading of Material	B10B	Operator x 1 Laborer x 0.5	1.5	Dozer x 1	1	1,000.00	85,500	57,000	CY	5,700,000	312323170020, spread dumped material, by dozer
	Compaction of Material	B10Y	Operator x 1 Laborer x 0.5	1.5	Vibratory Roller x 1	1	2,300.00	37,174	24,783	CY	5,700,000	312323235020, compaction, riding, vibrating roller, 3 passes, 6" lifts
	Fine grading of ash surface OR clean closed area	B11L	Operator x 1 Laborer x 1	2	Grader x 1	1	1.84	4,394	2,197	AC	404	312216103300, fine grading, slopes, gentle, finish grading
	Piezometer and Monitoring Well Extensions	C18	Laborer x 1.125	1.125	Concrete Cart x 1	1	1.00	0	0	EA	0	Based on experience.
	Material Conditioning (drying, stabilizing)	-	-	-	-	-	-	-	-	CY	5,700,000	Based on experience.
	Offsite Disposal Fee	-	-	-	-	-	-	-	-	CY	5,700,000	Based on experience.
5	**Onsite Landfill Closure**											
	Clay layer, 1.5-ft (onsite landfill closure)											
	Excavation and Loading of Material	B14J	Operator x 1 Laborer x 0.5	1.5	Front End Loader x 1	1	3,800	115	77	CY	29,163	312316432500, Excavating, large volume projects, restricted loading
	Hauling Material	B34F	Truck Driver x 1	1	Dump Truck x 1	1	528	552	552	CY	29,163	312323206470, Cycle hauling, 34-cy, 1-mile
	Spreading of Material	B10B	Operator x 1 Laborer x 0.5	1.5	Dozer x 1	1	1,000	437	292	CY	29,163	312323170020, spread dumped material, by dozer
	Compacting Material	B10D	Operator x 1 Laborer x 0.5	1.5	Dozer x 1 Compactor x 1	1	2,000	219	146	CY	29,163	312323235620, Compaction, 3 passes, 6" lifts, sheepsfoot
	Finish grading material	B11L	Operator x 1 Laborer x 1	2	Grader x 1	1	1.84	127	64	AC	12	312216103300, fine grading, slopes, gentle, finish grading
	Geomembrane, 40-mil LLDPE	HDR1	Operator x 2 Laborer x 10	12	Skid Steer x 1 Forklift x 1	5	2	702	293	AC	12	Based on experience.
	Geotextile, 8-oz.	HDR1	Operator x 2 Laborer x 10	12	Skid Steer x 1 Forklift x 1	5	2	702	293	AC	12	Based on experience, est. $0.50/SF
	Anchor Trench	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	250	0	0	LF		
	Temporary Anchor Trench	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	250	0	0	LF		
	Drainage Pipes on Geomembrane	HDR1	Operator x 2 Laborer x 10	12	Skid Steer x 1 Forklift x 1	5	7,500	56	23	LF	3,510	Based on experience.
	Placement of Protective Cover Soil (onsite source)											
	Excavation and Loading of Material	B14J	Operator x 1 Laborer x 0.5	1.5	Front End Loader x 1	1	3,800.00	115	77	CY	29,163	312316432500, Excavating, large volume projects, restricted loading
	Hauling Material	B34F	Truck Driver x 1	1	Dump Truck x 1	1	528.00	552	552	CY	29,163	312323206470, Cycle hauling, 34-cy, 1-mile
	Spreading of Material	B10B	Operator x 1 Laborer x 0.5	1.5	Dozer x 1	1	1,000.00	437	292	CY	29,163	312323170020, spread dumped material, by dozer
	Finish grading material	B11L	Operator x 1 Laborer x 1	2	Grader x 1	1	1.84	127	64	AC	12	312216103300, fine grading, slopes, gentle, finish grading
	Placement of Vegetative Soil (onsite source)											
	Excavation and Loading of Material	B14J	Operator x 1 Laborer x 0.5	1.5	Front End Loader x 1	1	3,800.00	38	26	CY	9,721	312316432500, Excavating, large volume projects, restricted loading
	Hauling Material	B34F	Truck Driver x 1	1	Dump Truck x 1	1	528.00	184	184	CY	9,721	312323206470, Cycle hauling, 34-cy, 1-mile
	Spreading of Material	B10B	Operator x 1 Laborer x 0.5	1.5	Dozer x 1	1	1,000.00	146	97	CY	9,721	312323170020, spread dumped material, by dozer
	Finish grading material	B11L	Operator x 1 Laborer x 1	2	Grader x 1	1	1.84	127	64	AC	12	312216103300, fine grading, slopes, gentle, finish grading
	Installation of drainage channels									*LF*	*3,510*	
	Erosion Control Blanket	2 Clab	Laborer x 2	2	-	0	1000	390	0	SY	19,500	312514160120, synthetic erosion control, revegetation mat, webbed
	Installation of drainage letdowns									*LF*	*1,170*	
	Riprap	B30	Operator x 1 Truck Driver x 2	3	Excavator x 1 Dump Trucks x 2	3	100	624	624	SY	2,080	313713100200, Riprap and rock lining, not grouted, crew and output adjusted for site.
	Geotextile, 10 oz.	B62	Operator x 1 Laborer x 2	3	Skid Steer x 1	1	2,500	25	8	SY	2,080	Based on experience, est. $0.60/SF
6	**Stormwater and Perimeter**											
	Removal of Outlet Structure	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	0.10	150	100	LS	1	Based on experience.
	Removal of Outlet Pipe	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	0.20	75	50	LS	1	Based on experience.
	Installation of permanent stormwater culverts, riprap aprons, ar	B14A	Operator x 1 Laborer x 0.5	1.5	Excavator x 1	1	0.10	150	100	LS	1	Based on experience, includes final pond outlet.
	Establish Access Roads									*LF*	*13,500*	
	Gravel	B32	Operator x 3 Laborer x 1	4	Grader x 1 Roller x 1 Dozer x 1	3	5,000	360	270	SY	45,000	321123230370, base course, aggregate base course, 6"
	Geotextile, 10 oz.	B62	Operator x 1 Laborer x 2	3	Skid Steer x 1	1	2,500	540	180	SY	45,000	Based on experience, est. $0.60/SF
	Seed, fertilize, and maintain vegetated surfaces											
	Seeding	B66	Operator x 1	1	Loader-Backhoe x 1	1	1.5	3,000	3,000	AC	450	329219130020, mechanical seeding, 215 lb/ac
	Fertilizing	B66	Operator x 1	1	Loader-Backhoe x 1	1	3	1,500	1,500	AC	450	320190130110, fertilizing, dry granular, 4 lb/MSF, crew per project experience.
	Mulch (select areas/steep slopes)	B66	Operator x 1	1	Loader-Backhoe x 1	1	140,000	124	124	SF	1,742,400	329113160760, soil preparation, mulching
	Repair initial erosion	B66	Operator x 1	1	Loader-Backhoe x 1	1	1	410	410	AC	41	Based on experience, reseed 10% to establish vegetation
7	**Engineering and Construction Support**											
	Final Closure Design, Local Permitting Support, and Bid Support	HDR2	Engineering Staff x 4	4	-	0	0.01	4,000	0	LS	1	1% of total project, based on project scale.
	Engineering Support and CQA during Construction	HDR3	CQA Staff x 1 Engineering Staff x 1	2	Truck x 1	1	0.001	20,000	10,000	LS	1	1% of total project, reduced with closure by removal scenario.
								Labor Hours: **1,982,651**	**Equipment Hours:** **1,893,572**			
							Contingency (30%)	**2,577,446**	**2,461,643**			

Notes:
1. RS Means used as reference - adjusted based on project size, location, type.
2. Grey crews were established based on HDR relevant project experience.

Table 5b: Labor, Equipment, and Mileage Estimate - Closure by Removal -Offsite Landfill- Totals

Item	Quantity	Assumptions
Labor Total Hours	2,577,446	10-hr days
Duration of Onsite Construction in Days	3,960	Working days, 9 months per year for 22 yrs, 20-working days per month average
Average Daily Crew Size	65	Crew Members
Daily Labor Mobilization Miles	18,042,120	Average of 70 miles round trip per day
Vehicles Miles Onsite	610,598	2 mile round trip from gate to parking 5 miles per day for CQA tech and Construction Supervisor 10% Contingency for site visitors (client and engineering support)
Equipment Mobilization Miles - Unloaded	369,247	Average of 300 miles one way for equipment hauling Average 1 load of equipment 2,000 Equipment working hours
Equipment Mobilization Miles - Loaded	369,247	Average of 300 miles one way for equipment hauling Average 1 load of equipment per working week
Daily Equipment Miles Onsite	3,960,000	Average of ~20 crew members running equipment Assume 50 miles per piece of equipment (average 5 mph, 10-hrs per day)
Onsite Haul Truck Miles - Unloaded	0	34 CY Haul Truck 4000 ft cycle
Onsite Haul Truck Miles - Loaded	0	34 CY Haul Truck 4000 ft cycle
Offsite Haul Truck Miles - Unloaded	25,909,091	16.5 CY Dump Truck 75 mile trip
Offsite Haul Truck Miles - Loaded	25,909,091	16.5 CY Dump Truck 75 mile trip
Material Delivery Miles - Unloaded	63,938	Assume geosynthetic source ~850-miles from site (possibly South Carolina) 60 extra trips for piping, seed, fertilizer, mulch, straw wattles, and concrete - source 1000 miles away average
Material Delivery Miles - Loaded	63,938	Assume geosynthetic source ~850-miles from site (possibly South Carolina) 60 extra trips for piping, seed, fertilizer, mulch, straw wattles, and concrete - source 1000 miles away average
Estimated Total	**75,297,270**	**miles**

Attachment B

Final Closure Plans and Material Specifications

Closure Drawings For

IPGC Newton Power Station

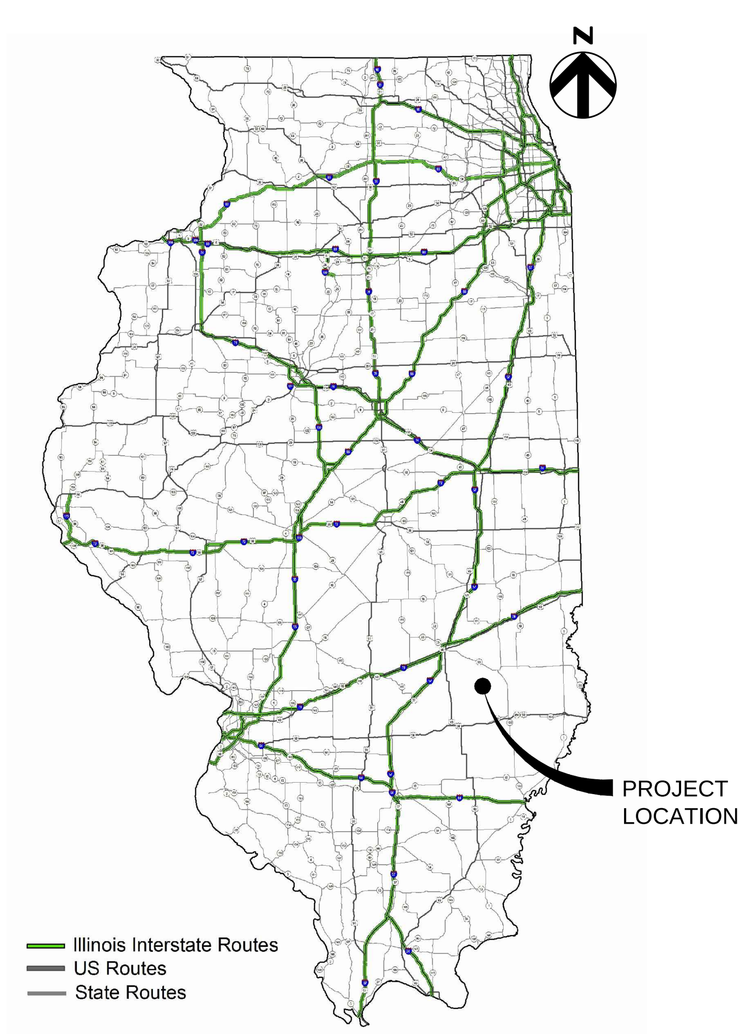
Primary Ash Pond Closure

Construction Permit Application

Project No.
10296144

Jasper County, IL
July 2022

INDEX OF DRAWINGS



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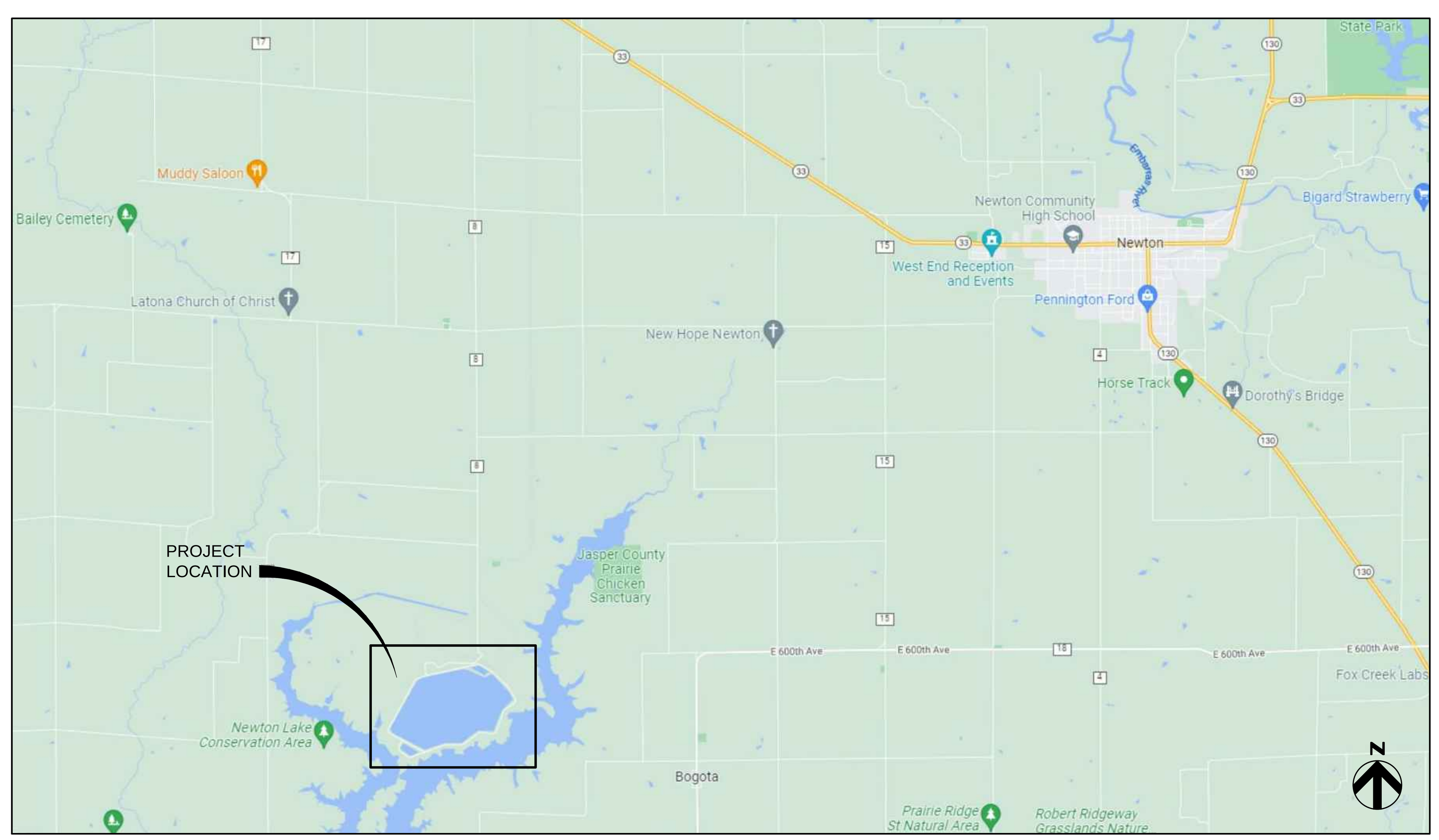
NOT TO SCALE



PROJECT LOCATION MAP
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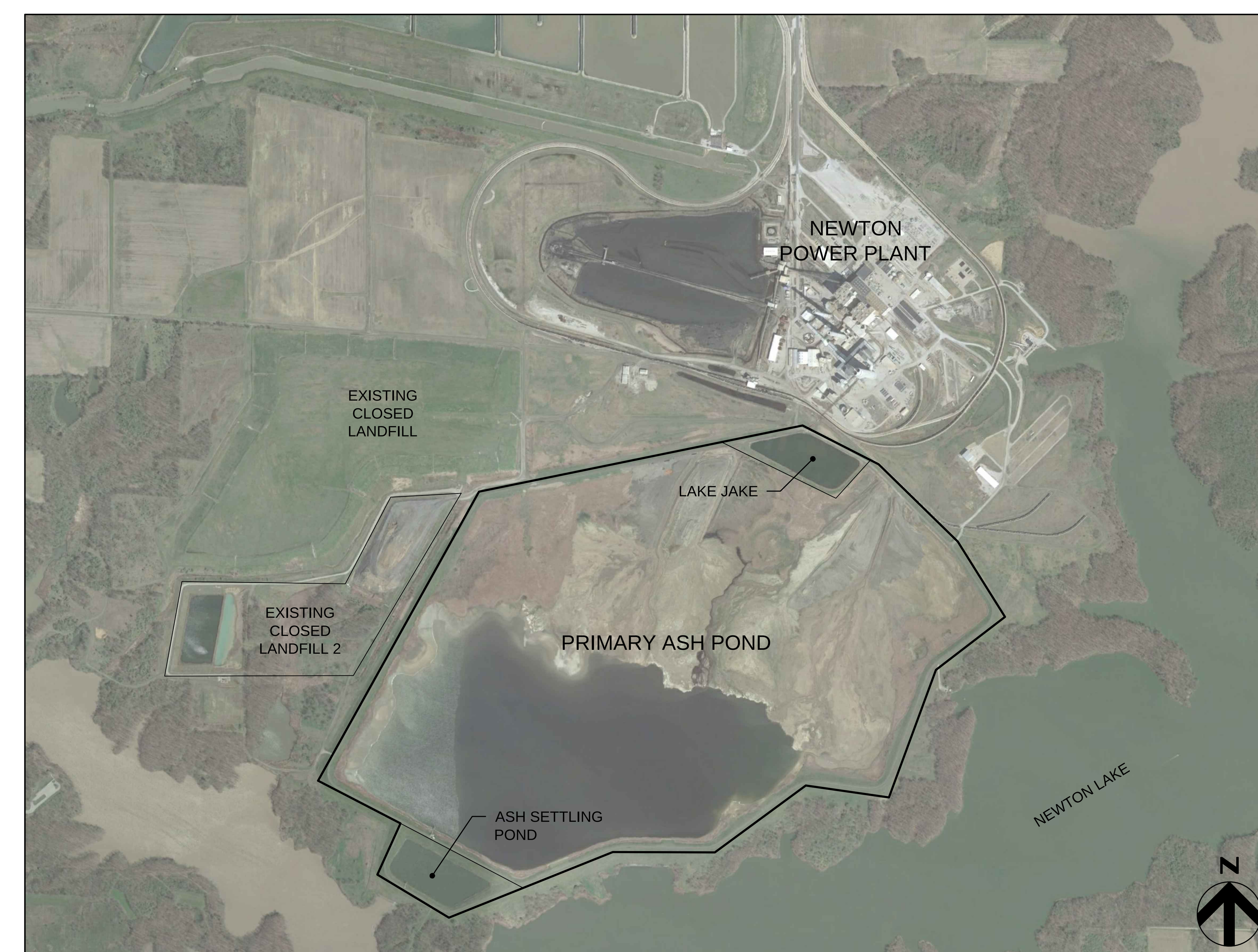

PROJECT SITE MAP
SCALE: 1" = 1000'

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LEGEND

— — WASTE — —	ESTIMATED ASH POND BOUNDARY
— — WASTE — —	EXISTING LANDFILL BOUNDARY
- - - - - - - -	LIMITS OF BATHYMETRIC SURVEY
—— 550 ——	EXISTING MAJOR CONTOUR
- - - - -	EXISTING MINOR CONTOUR
⊙	EXISTING GROUNDWATER WELL

NOTES

1. EXISTING GRADES REPRESENT EXISTING TOPOGRAPHIC AND BATHYMETRIC SURVEY PROVIDED BY INGENAE DATE DECEMBER 2, 2020 AND DECEMBER 14, 2020 RESPECTIVELY.
2. SOLID WASTE BOUNDARY ESTIMATED FROM INTERIOR EDGE OF CONTAINMENT BERM.

HDR

ISSUE	DATE	DESCRIPTION
0	07/28/2022	ISSUED TO IEPA

PROJECT MANAGER	M. ROBERTS
CIVIL	G. WILLIAMS
CIVIL	K. KINLEY
DRAWN BY	M. BICKFORD
PROJECT NUMBER	10296144

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

PHASE 1 - DEWATERING
EXISTING CONDITIONS PLAN

0 1" 2"

FILENAME 00C101.DWG
SCALE 1" = 300'

SHEET
00C101

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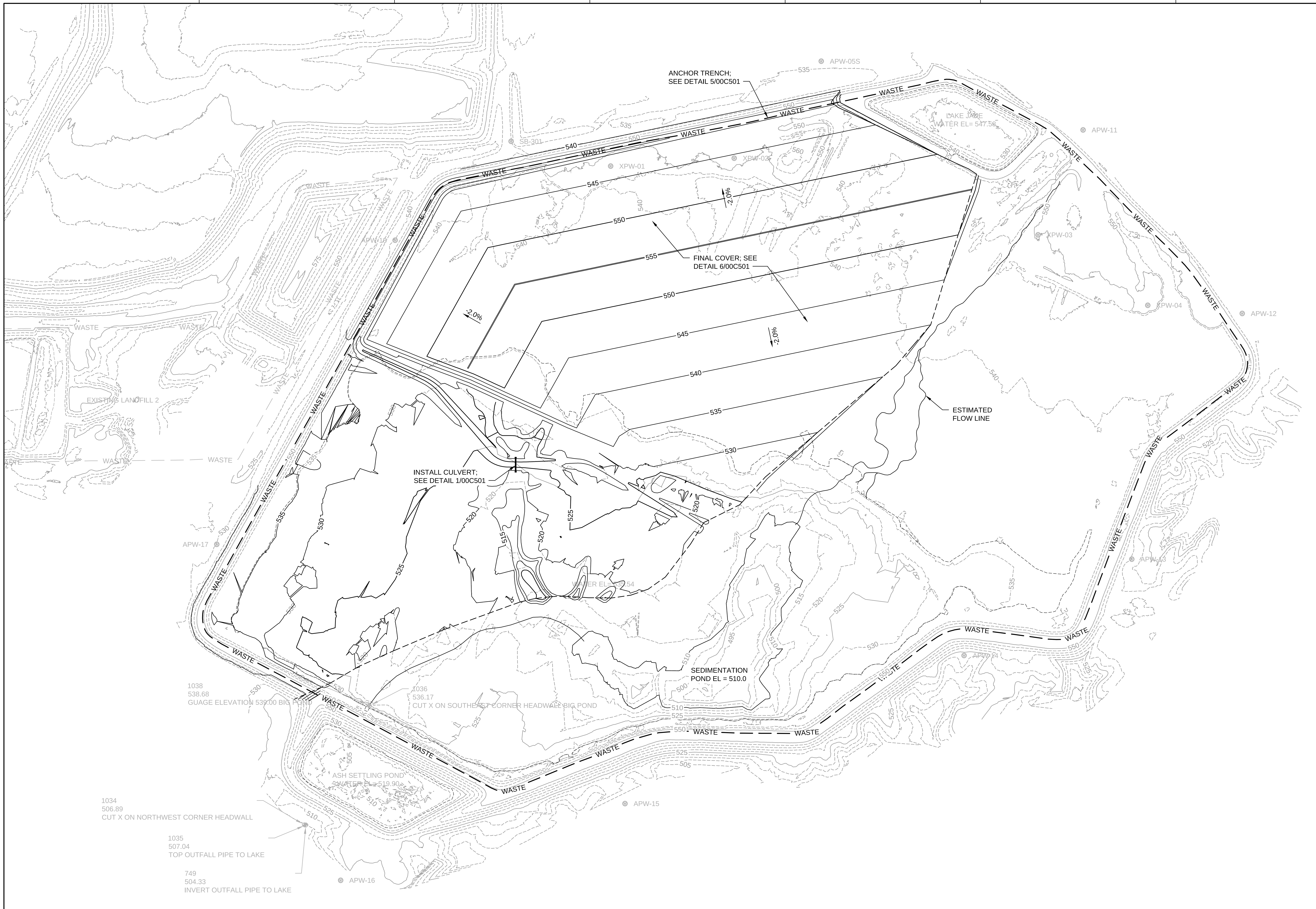
1 2 3 4 5 6 7 8



D C B A

LEGEND

— WASTE —	ESTIMATED ASH POND BOUNDARY
— WASTE —	EXISTING LANDFILL BOUNDARY
	LIMITS OF BATHYMETRIC SURVEY
— 550 —	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
— 550 —	PROPOSED MAJOR CONTOUR
	PROPOSED MINOR CONTOUR
	PHASE BOUNDARY
⊗	EXISTING GROUNDWATER WELL

NOTES

1. EXISTING GRADES REPRESENT EXISTING TOPOGRAPHIC AND BATHYMETRIC SURVEY PROVIDED BY INGENAE DATE DECEMBER 2, 2020 AND DECEMBER 14, 2020 RESPECTIVELY.
2. SOLID WASTE BOUNDARY ESTIMATED FROM INTERIOR EDGE OF CONTAINMENT BERM.
3. PROPOSED GRADES REPRESENT ANTICIPATED TOP OF FINAL POND CLOSURE ELEVATIONS.
4. CLOSURE BY REMOVAL GRADES ESTIMATED BASED ON HISTORIC TOPOGRAPHY AND MAY VARY BASED ON FIELD CONDITIONS.
5. PHASED CLOSURE TOTAL AREA MAY VARY BASED ON DEWATERING PROGRESS AND WASTE ENCOUNTERED.

HDR

ISSUE	DATE	DESCRIPTION
0	07/28/2022	ISSUED TO IEPA

PROJECT MANAGER	M. ROBERTS
CIVIL	G. WILLIAMS
CIVIL	K. KINLEY
DRAWN BY	M. BICKFORD
PROJECT NUMBER	10296144

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

PHASE 2 - CLOSURE
WEST ASH POND CLOSURE GRADING

0 1" 2"

FILENAME 00C102.DWG
SCALE 1" = 300'

SHEET **00C102**

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LEGEND

- WASTE — ESTIMATED ASH POND BOUNDARY
- WASTE — EXISTING LANDFILL BOUNDARY
- LIMITS OF BATHYMETRIC SURVEY
- 550 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- 550 — PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PHASE BOUNDARY
- EXISTING GROUNDWATER WELL
- FINAL COVER DRAIN PIPE
- DRAINAGE CHANNEL WITH DRAIN PIPE; SEE DETAIL 3/00C501
- LETDOWN STRUCTURE WITH DRAIN PIPE; SEE DETAIL 2/00C501
- ESTIMATED PHASE 3 CLOSURE-IN-PLACE (CIP); SEE DETAIL 6/00C501
- ESTIMATED PHASE 3 CLOSURE-BY-REMOVAL (CBR)

NOTES

1. EXISTING GRADES REPRESENT EXISTING TOPOGRAPHIC AND BATHYMETRIC SURVEY PROVIDED BY INGENAE DATE DECEMBER 2, 2020 AND DECEMBER 14, 2020 RESPECTIVELY.
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3. PROPOSED GRADES REPRESENT ANTICIPATED TOP OF FINAL POND CLOSURE ELEVATIONS.
4. CLOSURE BY REMOVAL GRADES ESTIMATED BASED ON HISTORIC TOPOGRAPHY AND MAY VARY BASED ON FIELD CONDITIONS.
5. PHASED CLOSURE TOTAL AREA MAY VARY BASED ON DEWATERING PROGRESS AND WASTE ENCOUNTERED.
6. POND GRADES MAY VARY IN ORDER TO FIND SUITABLE SOILS.

HDR

ISSUE	DATE	DESCRIPTION
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PROJECT MANAGER	M. ROBERTS
CIVIL	G. WILLIAMS
CIVIL	K. KINLEY
DRAWN BY	M. BICKFORD
PROJECT NUMBER	10296144

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

PHASE 3 - CLOSURE
EAST ASH POND CLOSURE GRADING

0 1" 2"

FILENAME 00C103.DWG
SCALE 1" = 300'

SHEET
00C103

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LEGEND

- ESTIMATED ASH POND BOUNDARY (— — WASTE — —)
- EXISTING LANDFILL BOUNDARY (— — WASTE — —)
- EXISTING MAJOR CONTOUR (550)
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR (550)
- PROPOSED MINOR CONTOUR
- PHASE BOUNDARY
- EXISTING GROUNDWATER WELL
- FINAL COVER DRAIN PIPE
- DRAINAGE CHANNEL WITH DRAIN PIPE; SEE DETAIL 3/00C501
- LETDOWN STRUCTURE WITH DRAIN PIPE; SEE DETAIL 2/00C501
- ESTIMATED PHASE 4 CLOSURE-IN-PLACE (CIP); SEE DETAIL 6/00C501
- ESTIMATED PHASE 4 CLOSURE-BY-REMOVAL (CBR)
- PREVIOUS CLOSURE AREA

NOTES

1. EXISTING GRADES REPRESENT EXISTING TOPOGRAPHIC AND BATHYMETRIC SURVEY PROVIDED BY INGENAE DATE DECEMBER 2, 2020 AND DECEMBER 14, 2020 RESPECTIVELY.
2. SOLID WASTE BOUNDARY ESTIMATED FROM INTERIOR EDGE OF CONTAINMENT BERM.
3. PROPOSED GRADES REPRESENT ANTICIPATED TOP OF FINAL POND CLOSURE ELEVATIONS.
4. CLOSURE BY REMOVAL GRADES ESTIMATED BASED ON HISTORIC TOPOGRAPHY AND MAY VARY BASED ON FIELD CONDITIONS.
5. PHASED CLOSURE TOTAL AREA MAY VARY BASED ON DEWATERING PROGRESS AND WASTE ENCOUNTERED.
6. POND GRADES MAY VARY IN ORDER TO FIND SUITABLE SOILS.

ISSUE	DATE	DESCRIPTION
0	07/28/2022	ISSUED TO IEPA

PROJECT MANAGER	M. ROBERTS
CIVIL	G. WILLIAMS
CIVIL	K. KINLEY
DRAWN BY	M. BICKFORD
PROJECT NUMBER	10296144

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

PHASE 4 - CLOSURE
REMAINING ASH POND CLOSURE GRADING

0 1" 2"

FILENAME 00C104.DWG
SCALE 1" = 300'

SHEET 00C104

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LEGEND

— — WASTE — —	ESTIMATED ASH POND BOUNDARY
– – WASTE – –	EXISTING LANDFILL BOUNDARY
—— 550 ——	EXISTING MAJOR CONTOUR
- - - -	EXISTING MINOR CONTOUR
—— 550 ——	PROPOSED MAJOR CONTOUR
———	PROPOSED MINOR CONTOUR
———	PHASE BOUNDARY
⊗	EXISTING GROUNDWATER WELL
—·—·—	FINAL COVER DRAIN PIPE
—>—>—	DRAINAGE CHANNEL WITH DRAIN PIPE; SEE DETAIL 3/00C501
—>>—>>—	LETDOWN STRUCTURE WITH DRAIN PIPE; SEE DETAIL 2/00C501
	ESTIMATED PHASE 5 CLOSURE-IN-PLACE (CIP); SEE DETAIL 6/00C501
	ESTIMATED PHASE 5 CLOSURE-BY-REMOVAL (CBR)
	PREVIOUS CLOSURE AREA

NOTES

1. EXISTING GRADES REPRESENT EXISTING TOPOGRAPHIC AND BATHYMETRIC SURVEY PROVIDED BY INGENAE DATE DECEMBER 2, 2020 AND DECEMBER 14, 2020 RESPECTIVELY.
2. SOLID WASTE BOUNDARY ESTIMATED FROM INTERIOR EDGE OF CONTAINMENT BERM.
3. PROPOSED GRADES REPRESENT ANTICIPATED TOP OF FINAL POND CLOSURE ELEVATIONS.
4. CLOSURE BY REMOVAL GRADES ESTIMATED BASED ON HISTORIC TOPOGRAPHY AND MAY VARY BASED ON FIELD CONDITIONS.
5. PHASED CLOSURE TOTAL AREA MAY VARY BASED ON DEWATERING PROGRESS AND WASTE ENCOUNTERED.
6. POND GRADES MAY VARY IN ORDER TO FIND SUITABLE SOILS.

HDR

ISSUE	DATE	DESCRIPTION
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PROJECT MANAGER	M. ROBERTS
CIVIL	G. WILLIAMS
CIVIL	K. KINLEY
DRAWN BY	M. BICKFORD
PROJECT NUMBER	10296144

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

PHASE 5 - CLOSURE
REMAINING ASH POND CLOSURE CAPPING

0 1" 2"

FILENAME 00C105.DWG
SCALE 1" = 300'

SHEET **00C105**

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PROJECT MANAGER	M. ROBERTS
CIVIL	G. WILLIAMS
CIVIL	K. KINLEY
DRAWN BY	M. BICKFORD
PROJECT NUMBER	10296144

ISSUE	DATE	DESCRIPTION
0	07/28/2022	ISSUED TO IEPA

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

FINAL CLOSURE CONDITIONS

0 1" 2"

FILENAME 00C106.DWG

SCALE 1" = 300'

SHEET **00C106**

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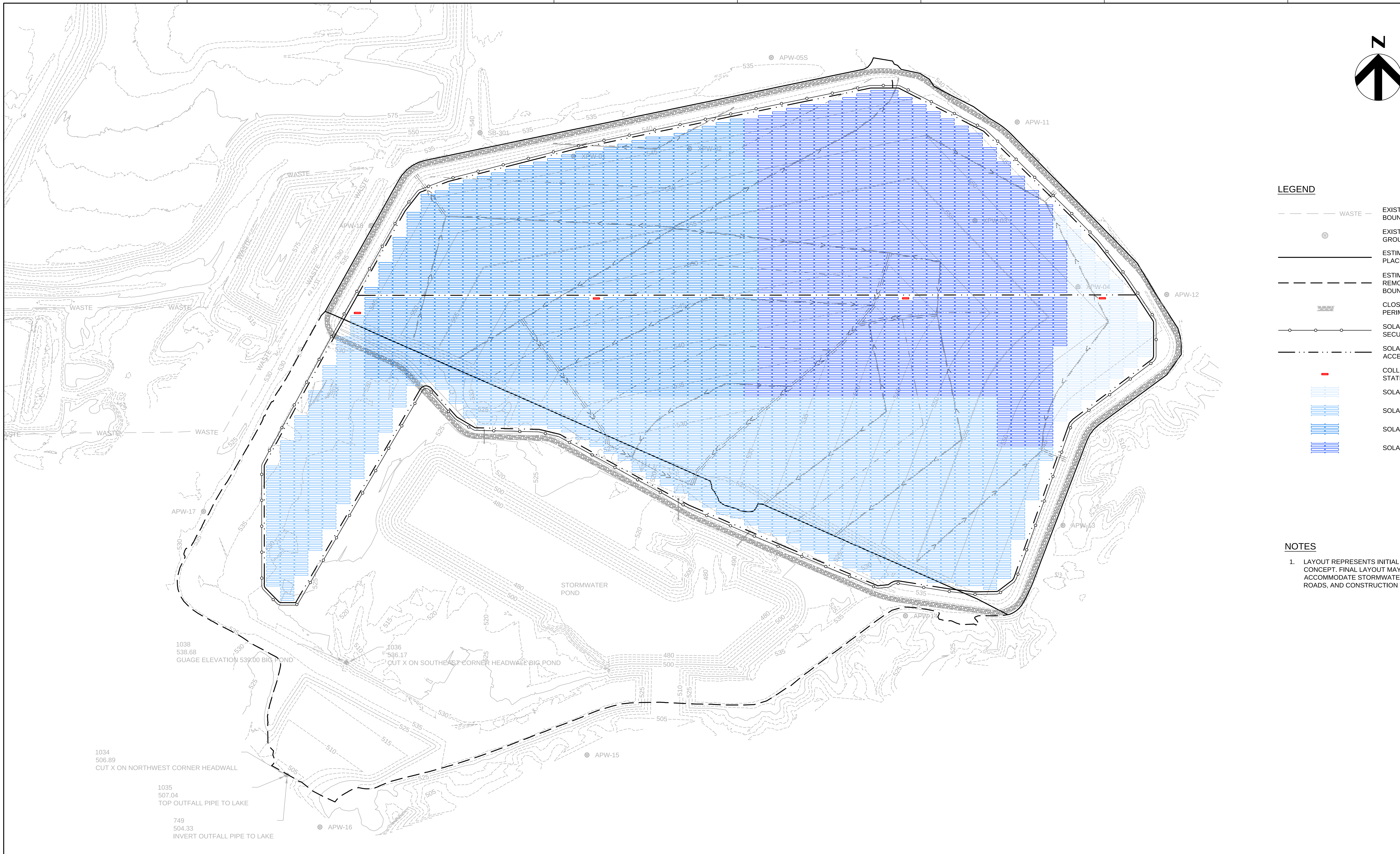

LEGEND

- EXISTING LANDFILL BOUNDARY
- EXISTING GROUNDWATER WELL
- ESTIMATED CLOSURE-IN-PLACE (CIP) BOUNDARY
- ESTIMATED CLOSURE-BY-REMOVAL (CBR) BOUNDARY
- CLOSED POND PERIMETER ROAD
- SOLAR FIELD SECURITY FENCE
- SOLAR FIELD ACCESS ROAD
- COLLECTION POWER STATION
- SOLAR ARRAY PHASE 1
- SOLAR ARRAY PHASE 2
- SOLAR ARRAY PHASE 3
- SOLAR ARRAY PHASE 4

NOTES

1. LAYOUT REPRESENTS INITIAL DESIGN CONCEPT. FINAL LAYOUT MAY VARY TO ACCOMMODATE STORMWATER FEATURES, ROADS, AND CONSTRUCTION TIMING.

HDR

ISSUE	DATE	DESCRIPTION
0	07/28/2022	ISSUED TO IEPA

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CIVIL	G. WILLIAMS
CIVIL	K. KINLEY
DRAWN BY	M. BICKFORD
PROJECT NUMBER	10296144

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

SOLAR LAYOUT PLAN

0 1" 2"

FILENAME 00C107.DWG
SCALE 1" = 300'

SHEET **00C107**

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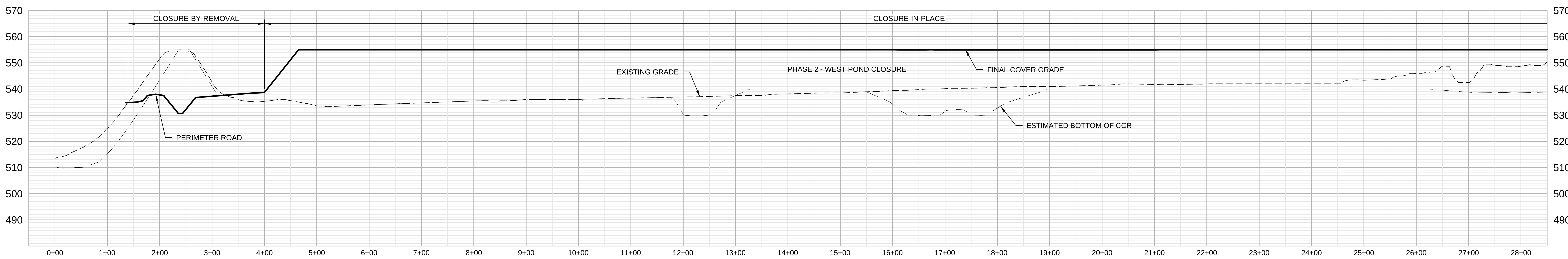
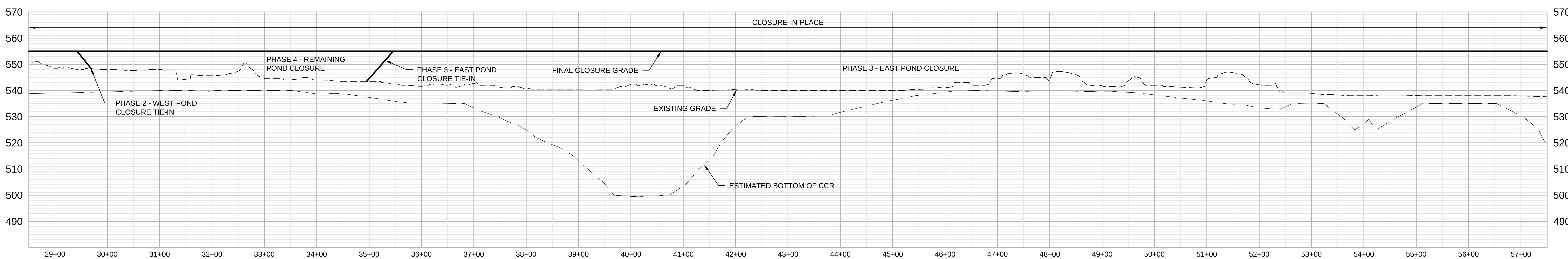


A-A
00C106
SECTION A-A
HORIZ: 1" = 100' | VERT: 1" = 20'



A-A
00C106
SECTION A-A (cont.)
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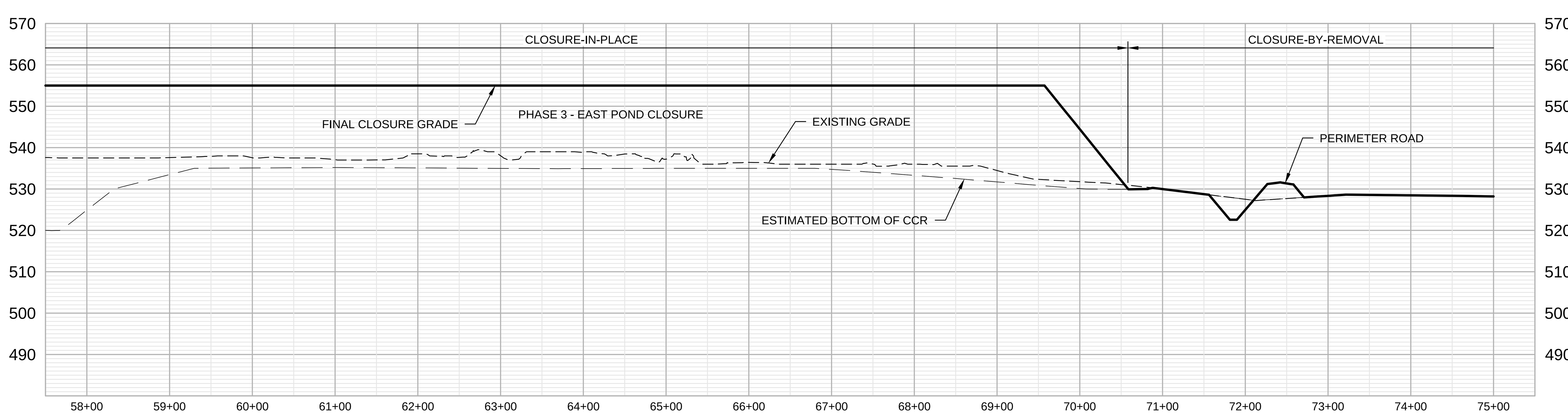

A-A
00C106
SECTION A-A (cont.)
HORIZ: 1" = 100' | VERT: 1" = 20'

HDR

ISSUE	DATE	DESCRIPTION
0	07/28/2022	ISSUED TO IEPA

PROJECT MANAGER	M. ROBERTS
CIVIL	G. WILLIAMS
CIVIL	K. KINLEY
DRAWN BY	M. BICKFORD
PROJECT NUMBER	10296144

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

CROSS SECTIONS

0 1" 2"

FILENAME 00C301.DWG
SCALE AS NOTED

SHEET
00C301

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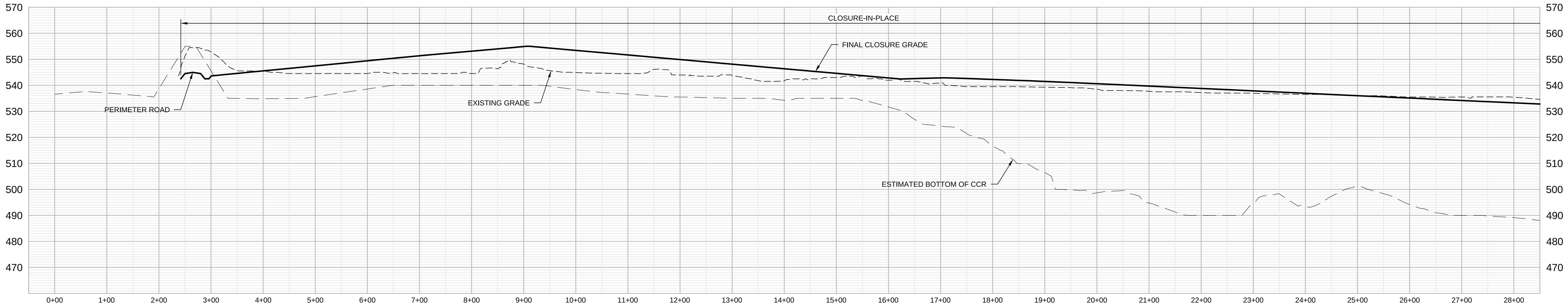

B-B
00C106
SECTION B-B
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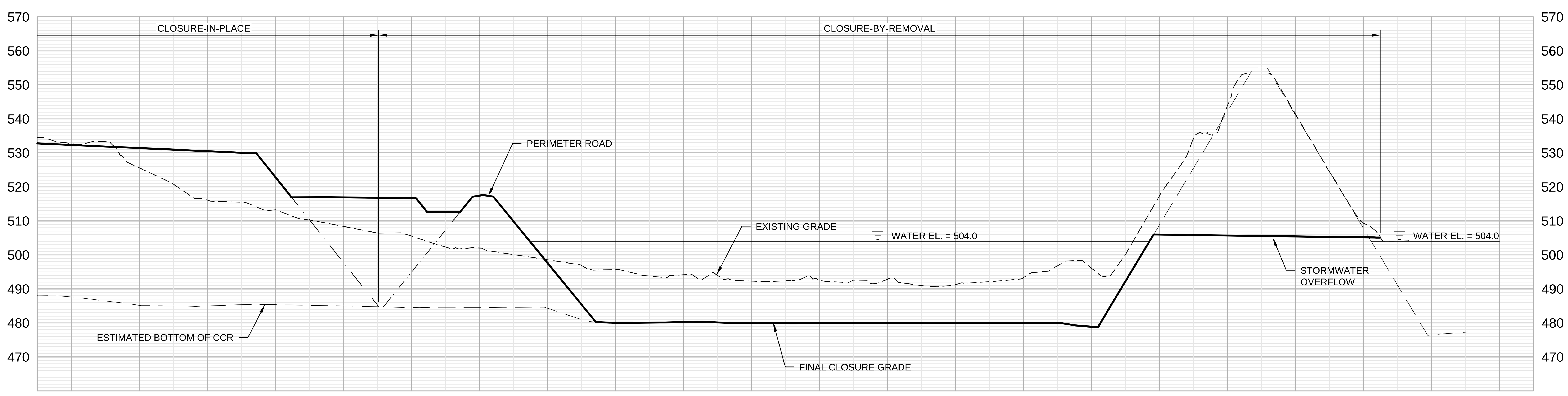

B-B
00C106
SECTION B-B (cont.)
HORIZ: 1" = 100' | VERT: 1" = 20'

ISSUE	DATE	DESCRIPTION
0	07/28/2022	ISSUED TO IEPA

PROJECT MANAGER	M. ROBERTS
CIVIL	G. WILLIAMS
CIVIL	K. KINLEY
DRAWN BY	M. BICKFORD
PROJECT NUMBER	10296144

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

CROSS SECTIONS

FILENAME 00C302.DWG
SCALE AS NOTED
SHEET 00C302

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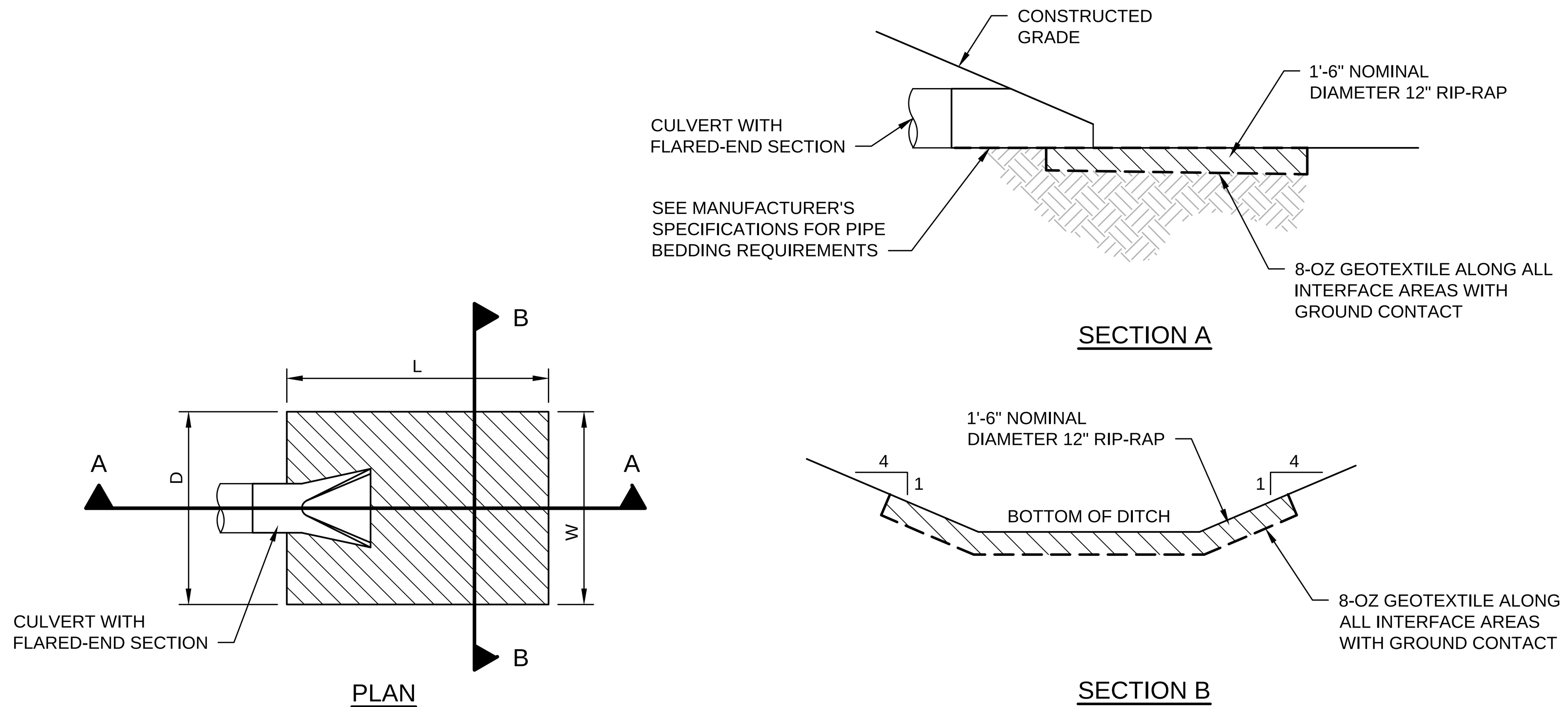
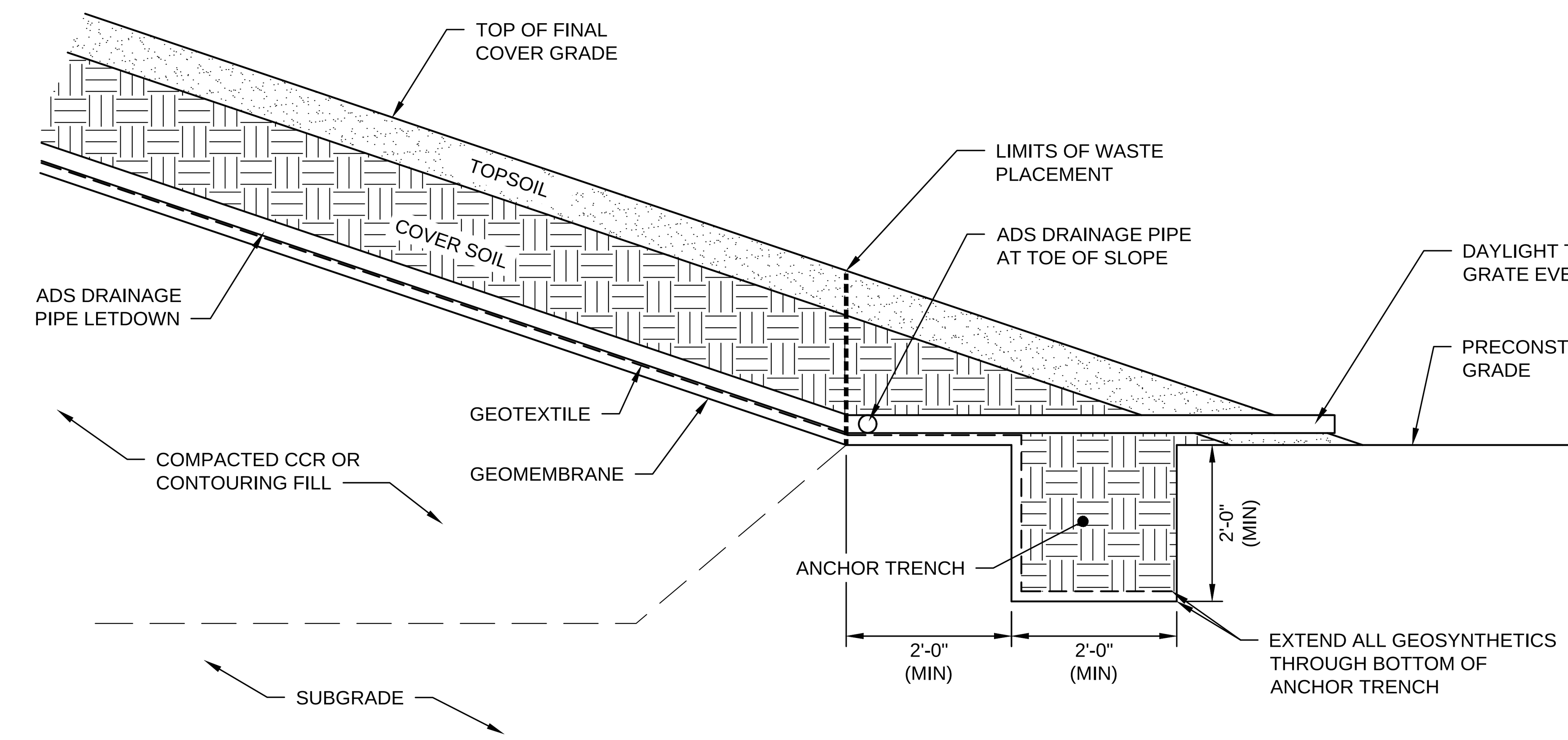
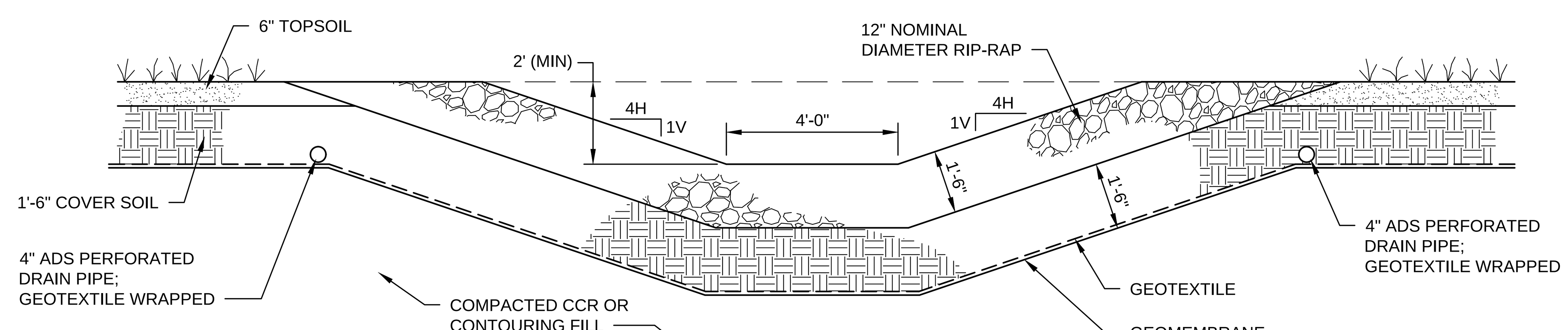


1 00C102 FLARED-END SECTION AND REVETMENT STONE APRON
NO SCALE



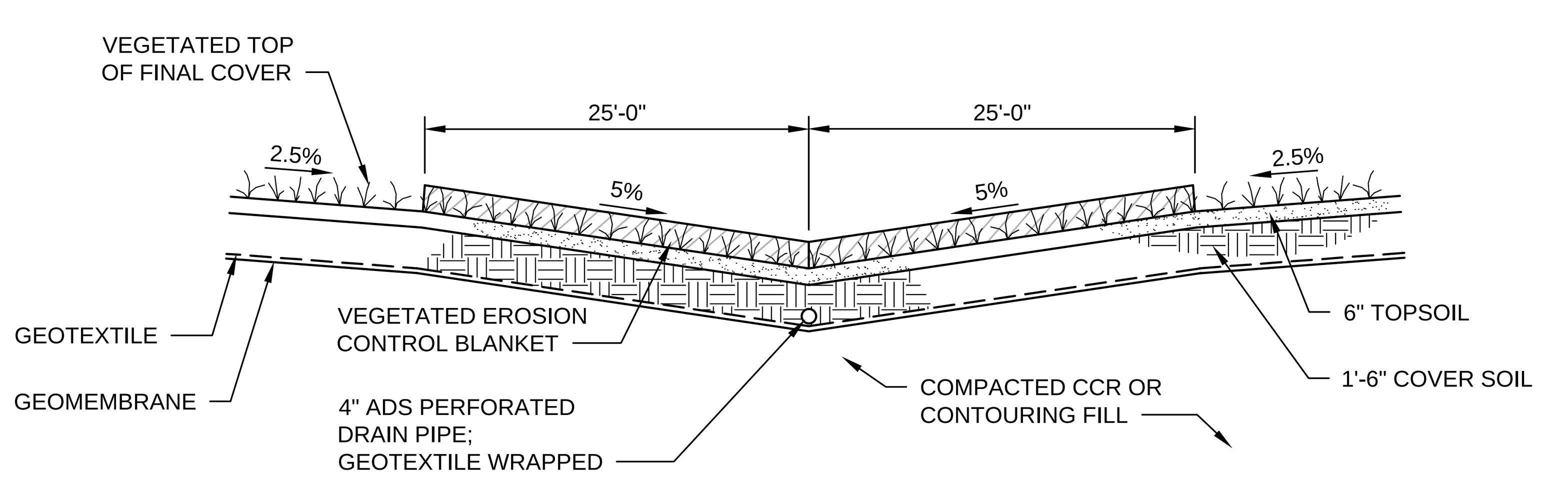
5 00C103 ANCHOR TRENCH
NO SCALE



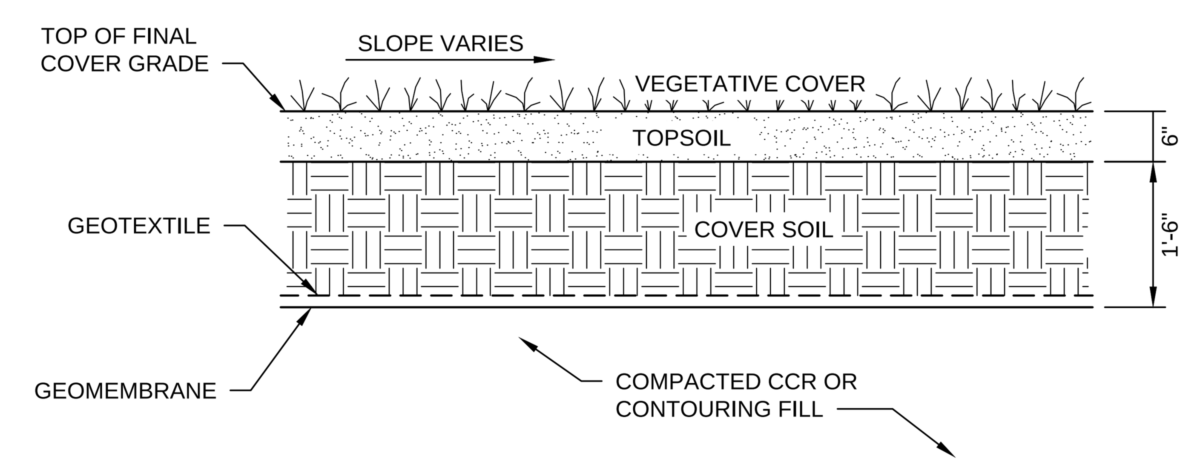
NOTES

1. CENTRAL LETDOWN STRUCTURE DRAINAGE CHANNEL TO BE INSTALLED WITH A 12-FOOT WIDE BOTTOM AND 3-FOOT DEPTH.

2 00C103 LETDOWN STRUCTURE
NO SCALE



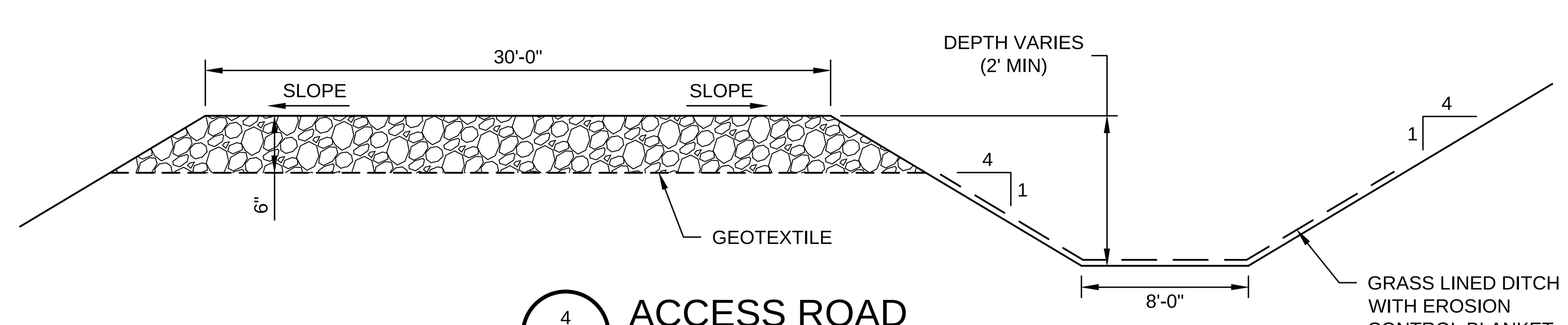
3 00C103 DRAINAGE CHANNEL
NO SCALE



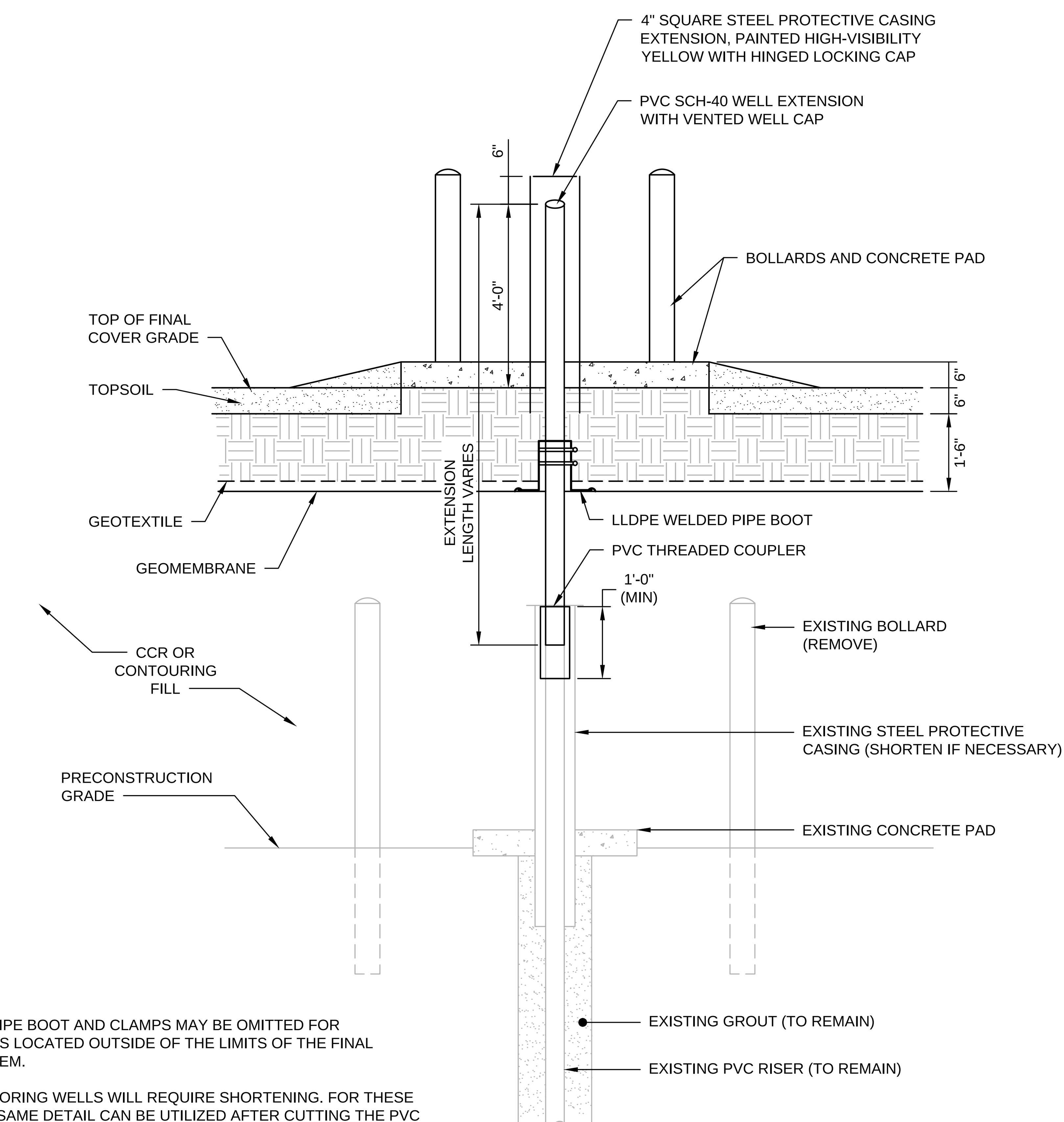
6 00C103 FINAL COVER
NO SCALE

NOTES

1. THE FINAL COVER IS DESIGNED WITH A 50-MIL LLDPE MICRODRAIN GEOMEMBRANE MATERIAL WITH DRAINAGE STUDS INSTALLED UPWARDS ND TEXTURED SIDE INSTALLED DOWNWARDS OVERLAIN WITH 8-OZ. GEOTEXTILE.
2. OPTIONALLY, THE MICRODRAIN GEOMEMBRANE AND GEOTEXTILE MAY BE REPLACED WITH A TEXTURED 40-MIL LLDPE GEOMEMBRANE OVERLAIN WITH A GEOCOMPOSITE DRAINAGE LAYER. ENGINEER TO VERIFY GEOCOMPOSITE MATERIAL MEETS DESIGN REQUIREMENTS FOR DRAINAGE.



4 00C103 ACCESS ROAD
NO SCALE



NOTES

1. THE LLDPE PIPE BOOT AND CLAMPS MAY BE OMITTED FOR PIEZOMETERS LOCATED OUTSIDE OF THE LIMITS OF THE FINAL COVER SYSTEM.
2. SOME MONITORING WELLS WILL REQUIRE SHORTENING. FOR THESE WELLS, THE SAME DETAIL CAN BE UTILIZED AFTER CUTTING THE PVC CASING TO THE FINAL TOP OF CASING ELEVATION (4-FT ABOVE THE FINAL COVER ELEVATION) AFTER THE GRADE AROUND THE WELL IS LOWERED.
3. FOR MONITORING WELLS 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 4-INCHES IN THICKNESS. ALL OTHER DETAILS ARE TO REMAIN THE SAME.

7 00C103 MONITORING WELL EXTENSION
NO SCALE

ISSUE	DATE	DESCRIPTION
0	07/28/2022	ISSUED TO IEPA

PROJECT MANAGER	M. ROBERTS
CIVIL	G. WILLIAMS
CIVIL	K. KINLEY
DRAWN BY	M. BICKFORD
PROJECT NUMBER	10296144

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

DETAILS

0 1" 2"

FILENAME 00C501.DWG
SCALE AS NOTED

SHEET 00C501

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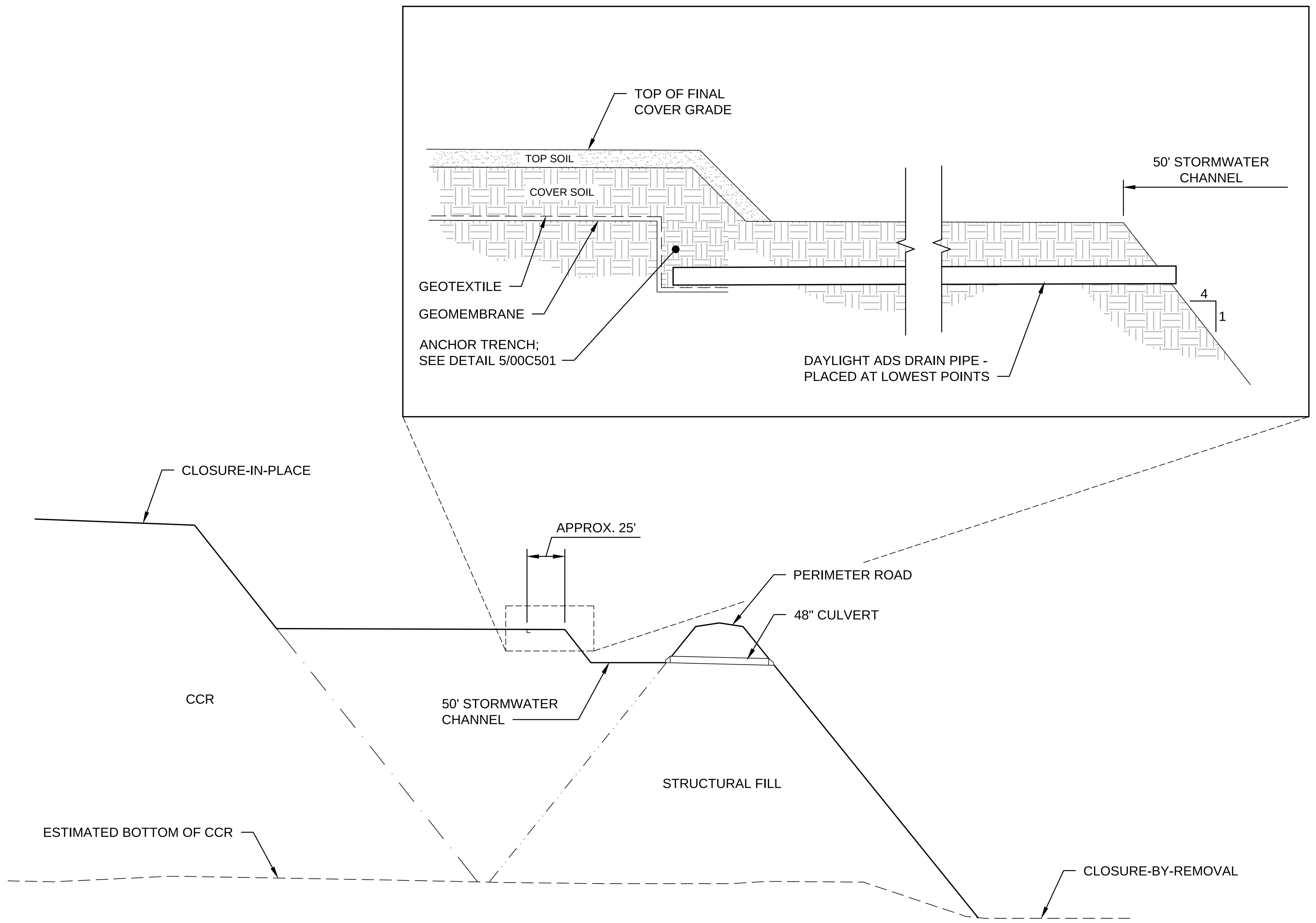

1 / 00C105

SOUTH PERIMETER ROAD STORMWATER CHANNEL ANCHOR TRENCH

NO SCALE

ISSUE	DATE	DESCRIPTION
0	07/28/2022	ISSUED TO IEPA

PROJECT MANAGER	M. ROBERTS
CIVIL	G. WILLIAMS
CIVIL	K. KINLEY
DRAWN BY	M. BICKFORD
PROJECT NUMBER	10296144

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

DETAILS

0 1" 2"

FILENAME 00C502.DWG
SCALE AS NOTED

SHEET **00C502**

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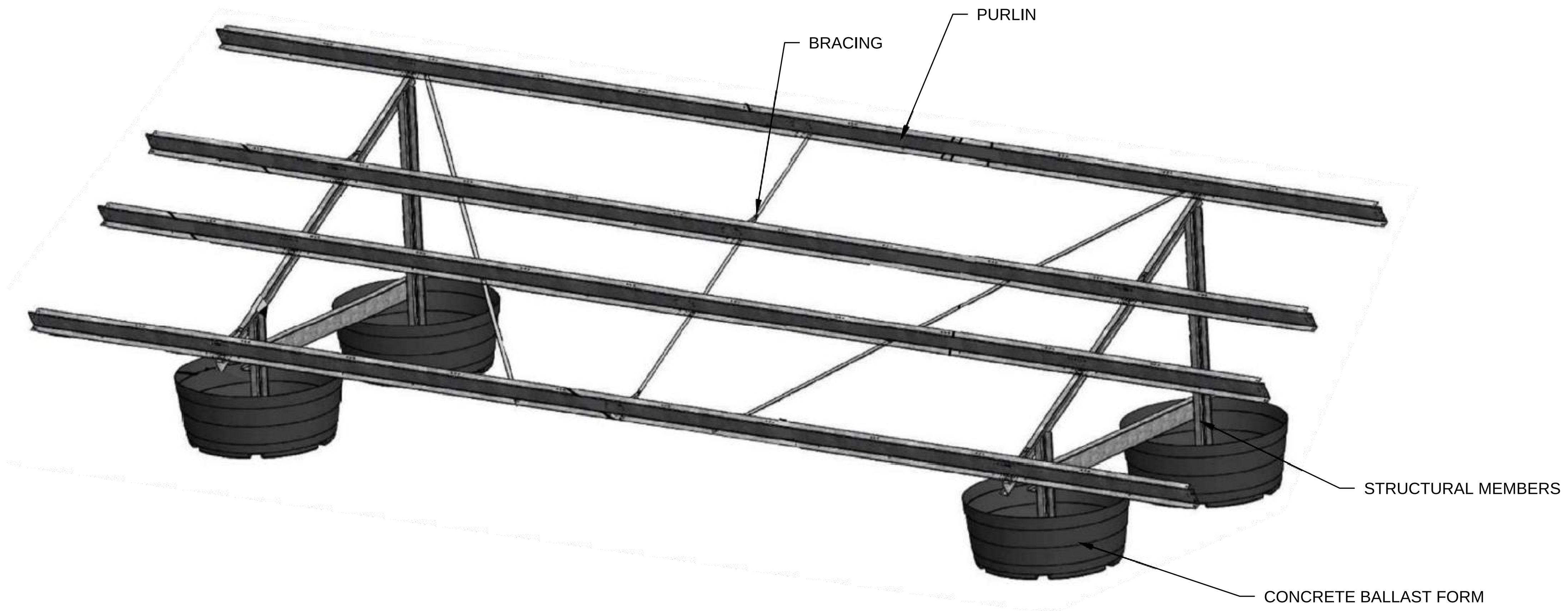
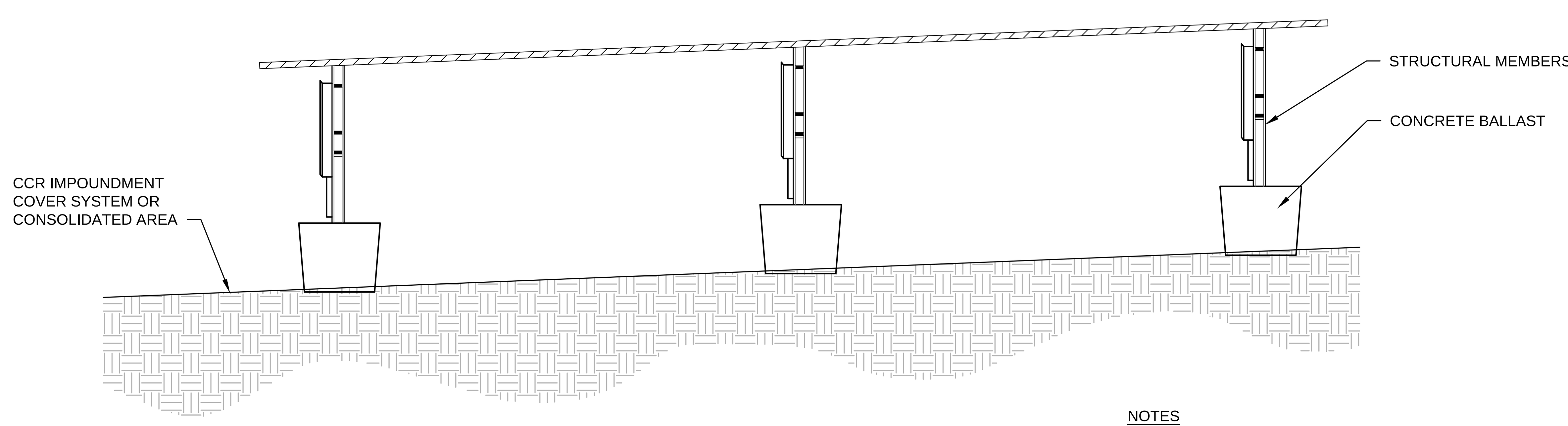


1 / 00C107 **TYP. FIXED TILT BALLAST RACKING**
NO SCALE

2 / 00C107 **TYP. SOLAR MODULE**
NO SCALE



NOTES

1. SOLAR ARRAY AND BALLAST SYSTEM SIT ON TOP OF FINAL COVER SYSTEM WITHOUT PENETRATING THE FINAL COVER. IN SOME LOCATIONS, ELECTRICAL LINES MAY BE BURIED IN THE TOP 24-INCHES OF THE CAP WITHOUT DISTURBING GEOSYNTHETICS IN ORDER TO MAINTAIN ACCESS ROUTES.

3 / 00C107 **PROFILE VIEW OF BALLAST ON CLOSED AREA**
NO SCALE

ISSUE	DATE	DESCRIPTION
0	07/28/2022	ISSUED TO IEPA

PROJECT MANAGER	M. ROBERTS
CIVIL	G. WILLIAMS
CIVIL	K. KINLEY
DRAWN BY	M. BICKFORD
PROJECT NUMBER	10296144

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

DETAILS

0 1" 2"

FILENAME 00C503.DWG
SCALE AS NOTED

SHEET **00C503**

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Attachment C

Hydrologic and Hydraulic Design of Stormwater Management System

Illinois Power Generating Company
HYDROLOGIC AND HYDRAULIC DESIGN OF STORMWATER MANAGEMENT SYSTEM

Newton Power Plant
Primary Ash Pond

April 2022

Table of Contents

1. PURPOSE

This calculation package provides documentation of the hydrologic and hydraulic calculations of the cover design for final closure of the approximately 400-acre Illinois Power Generating Company (IPGC) Newton Power Station Primary Ash Pond closure area. The analysis evaluates whether the proposed drainage features are adequate to manage 25-year and 100-year, 24-hour storm events. This analysis was completed to satisfy Illinois Administrative Code Part 845.510 and in support of the Closure Plan requirements detailed in IAC Section 845.750(a) to design a final cover with stormwater features promoting drainage away from the closure area and minimizing the need for future maintenance of the CCR surface impoundment.

2. ASSUMPTIONS AND DATA INPUT

The proposed drainage features were designed to convey both 25-year and 100-year, 24-hour storm events. AutoCAD Civil 3D Hydroflow Hydrographs Extension was used for the hydrologic analysis. The model estimated peak runoff rate for each subcatchment based on precipitation volumes derived from NOAA Atlas 14 data. AutoCAD Civil 3D Hydroflow Express Extension was used to confirm that proposed culverts would be sufficient to handle peak flows from 25-year and 100-year, 24-hour storm event. The following presents a summary of the assumptions and inputs used in the stormwater model.

2.1 Hydrology Inputs

Summary of Site Data
The existing surface grades for the Newton Ash Landfill are based on a topographic and bathymetric survey provided by IngenAE, LLC, dated December 2, 2020, and December 14, 2020. The proposed grades used for the hydrologic and hydraulic evaluation represent anticipated conditions and may be further modified during the design process, or due to field conditions at the time of construction.

Rainfall Depth and Distribution
Rainfall depths are based on the National Oceanic and Atmospheric Administration's (NOAA) Precipitation Frequency Data Server (PFDS). Precipitation estimates for the site location were input into the Hydrographs model for the 25-, and 100-year, 24-hour storm events. The NOAA PFDS outputs for the site location are included in **Appendix A**.

The Type II SCS storm distribution was used to evaluate the high rainfall intensity portion of the storm as a critical flood risk analysis. The SCS is considered a conservative model and is therefore considered adequate for design purposes. The following storm events were used to size the proposed stormwater features:

- Type II SCS 25-year, 24-hour event is 5.26 inches (Design)
- Type II SCS 100-year, 24-hour event is 6.58 inches (Convey Safely)

Curve Number (CN)
Curve numbers (CN) were estimated using Table 2-2 in the TR-55 manual embedded in the Hydrographs model. The curve numbers assumed soil conditions in the immediate vicinity of the landfill were generally type C, based on a review of the United States Department of Agriculture's (USDA) Web Soil Survey as

shown on the map print out in **Appendix A.** The final cover will include, from bottom to top, a geomembrane, geotextile, 1.5-ft of cover soil, 0.5-feet of topsoil, and established vegetation. The selected SCS curve number for the site was based on the following parameters:

- Open spaces, lawns, and parks
- Condition – Good
- Hydrologic Soil Group – C
- CN = 74

Subcatchments

The Newton basin design is comprised of seven (7) areas which stormwater drainage was analyzed. These approximate areas are indicated on Figure 1 and comprised as follows:

- Western Channel Area – 69-acres
- Eastern Channel Area – 61-acres
- Central Channel Area – 73-acres
- West Central Channel Area – 39-acres
- East Central Area – 14 Acres
- Inside Perimeter Road Area – 29-acres
- Storage and Outlet Area 144-acres of which 35-acresis wetted pond

The total approximate 400-acres is comprised of approximately 255-acres of cover, 144-acres of closure by removal, and 30-acres of ancillary areas. The areas were subdivided based on the grading plan and proposed drainage features, including drainage channels and letdowns to the perimeter ditch. Dividing the area into multiple subcatchments allows for a refined model that provides detailed information on stormwater flow over the site. The drainage map and associated subcatchment parameters are shown in **Figure 1**.

2.2 Hydraulic Inputs and Results

The following section summarizes the design assumptions and hydraulic parameters used to perform the hydraulic analysis.

Perimeter Ditches

The location and slope of the perimeter ditches were based on the permit application grading plans, approximated as 30% design. Perimeter drainage ditches were calculated as west and east channels and represent the interior ditch of the perimeter roadway. These perimeter drainage ditches originate at the north end of the construction and route stormwater toward the south. Initially the ditches are two (2) feet deep but increase depth as the flow continues south. Both ditches are minimally, 8-ft wide, 2-ft deep with 4:1 sideslopes. Channels were modeled at a minimum section of 2 ft of depth and a nominal 4-ft of depth and found to be sufficient to convey the 100-year, 24-hour storm event in both cases.

Drainage Channels

Areas of final cover have a 2% slope. The drainage terraces are designed as V-ditches with sideslopes of 5%, a longitudinal slope of about 0.5%, and a maximum flow depth of 1.25-ft. According to Manning's n for channels, a roughness coefficient of 0.022 was used for a clean, straight channel without rifts or deep pools.

Letdowns

The letdown structures were designed as trapezoidal structures with 1.5-feet of 12-inch diameter riprap. The riprap overlays a geomembrane, geotextile, and 1.5-feet of cover soil. The base of each letdown is 4-feet wide with 3:1 side slopes. The Manning's n used for the letdown structures was 0.026. The longitudinal slope of the letdowns varied based on location.

Central Drainageway
Much like the letdowns described above, the central drainage way consists of a trapezoidal channel with 1.5 feet of 12-inch diameter riprap. The central drainageway flows at 1% slopes, is 3 feet deep and 12 feet wide. This profile is similar to the letdowns across the side but increased in size to accommodate the larger drainage area and flow.

Culverts
Culverts for the work will be installed to route stormwater under the perimeter roadway and into the borrow area pond. The culverts will be category 2 or 3 reinforced concrete pipes with appropriate bedding, and inlet and outlet protections. It may be advantageous to install headwalls to manage the pipe inlets and outlets. Pipes will be 48" and laid at 2 percent slope.

Outlet Weir
The overall drainage path for the project culminates at an area of ponded water and outlet weir. The weir is designed to be 150 feet wide, with 4:1 sideslopes and approximately a 0.2% slope. The outlet weir is intended to convey stormwater originating from the development area out to the neighboring Lake Newton. The elevation of the outfall is such that no back flow from the Lake is expected into the project area.

3. CALCULATION OUTPUTS

This calculation package is intended to compute and model various stormwater features of the site as described in the previous section. This section indicates the anticipated flow and performance of the individual drainage features.

Perimeter Ditches
The West Drainage Channel consists of 68.65-acres where a calculated flow of 199.78-cfs is expected from the 100-year, 24-hour storm event. This results in approximately 2.6-feet of flow depth, at a velocity slightly above 4 feet per second. During establishment of vegetation, it would be advantageous to utilize an erosion control matting.

The East Drainage Channel consists of 61.34-acres where a calculated flow of 178.51-cfs is expected from the 100-year, 24-hour storm event. This results in approximately 2.64-feet of flow depth, at a velocity of 3.65 feet per second. During establishment of vegetation, it would be advantageous to utilize an erosion control matting.

Drainage Channels
The design drainage terrace was indicated by the largest drainage area flowing to a terrace. This area was measured at about 12-acres, resulting in approximately 35 cubic feet per second for a 100-year, 24-hour storm event. The drainage terrace can successfully manage this flow with over 5 inches of freeboard remaining at a velocity of 2.60 feet per second.

Letdowns
The letdown structures carry various flows around the project site with minimal flows being appropriately managed through short, robust riprap letdowns.

Central Drainageway
The central drainageway consists of 72.85-acres where a calculated flow of 211-cfs is expected from the 100-year, 24-hour storm event. This results in approximately 2.14 feet of flow depth, at a velocity of 4.8 feet per second.

Culverts
The culverts will convey approximately 285-acres of runoff resulting in 827-cfs from a 100-year, 24-hour storm event. Multiple culverts are to be installed to lessen the size of necessary culvert but also to provide redundancy to the system. The 48-inch RCP culvert flowing approximately full results is 217.5-cfs at the design slope and length. Installing four total pipes, two at each location as shown on the plans, will provide a free flow scenario to limit potential of holding water within the consolidation area. Flow out of each pipe will result in the potential for highly erosive velocities. Protections of the inlet and outlet areas should be further designed prior to construction.

Outlet Weir
The outlet weir provides conveyance for the entire project area. The weir will discharge all 428.5-acres of runoff. The runoff is calculated to be 1194-cfs from the 100-year, 24-hour storm event. The weir is 150-feet wide with a 0.2 percent slope. This equates to a flow depth of 1.78 feet at a velocity of 4.27 feet per second. The tailwater condition should be even or approximately even. Final design should confirm this condition.

Figures

Drainage Mapping

STORMWATER FIGURE 1

HDR

PROJECT MANAGER	M. ROBERTS
CIVIL	G. WILLIAMS
CIVIL	K. KINLEY
DRAWN BY	M. BICKFORD
PROJECT NUMBER	10296144

ISSUE DATE DESCRIPTION

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

FINAL CLOSURE CONDITIONS

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FILENAME 00C106.DWG
SCALE 1" = 300'

SHEET **00C106**

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PROJECT MANAGER	M. ROBERTS
CIVIL	G. WILLIAMS
CIVIL	K. KINLEY
DRAWN BY	M. BICKFORD
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ISSUE	DATE	DESCRIPTION

HDR

ILLINOIS POWER GENERATING COMPANY
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SHEET **00C106**

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Appendix A

NOAA Rainfall and WebSoil Survey Reports

NOAA Atlas 14, Volume 2, Version 3
Location name: Newton, Illinois, USA*
Latitude: 38.9287°, Longitude: -88.2879°
Elevation: 533.87 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	0.402 (0.364-0.445)	0.477 (0.433-0.528)	0.563 (0.510-0.623)	0.632 (0.571-0.699)	0.719 (0.646-0.793)	0.787 (0.705-0.868)	0.853 (0.761-0.939)	0.920 (0.818-1.01)	1.01 (0.891-1.11)	1.08 (0.944-1.18)
10-min	0.625 (0.565-0.691)	0.745 (0.676-0.825)	0.875 (0.792-0.968)	0.976 (0.882-1.08)	1.10 (0.989-1.21)	1.19 (1.07-1.32)	1.28 (1.15-1.41)	1.37 (1.22-1.51)	1.49 (1.31-1.63)	1.57 (1.38-1.72)
15-min	0.766 (0.693-0.847)	0.910 (0.826-1.01)	1.07 (0.973-1.19)	1.20 (1.09-1.33)	1.36 (1.22-1.50)	1.48 (1.32-1.63)	1.59 (1.42-1.76)	1.71 (1.52-1.88)	1.85 (1.64-2.04)	1.96 (1.72-2.15)
30-min	1.01 (0.916-1.12)	1.22 (1.11-1.35)	1.47 (1.33-1.63)	1.67 (1.51-1.84)	1.92 (1.73-2.12)	2.11 (1.89-2.33)	2.30 (2.05-2.54)	2.49 (2.22-2.74)	2.75 (2.42-3.02)	2.94 (2.58-3.22)
60-min	1.24 (1.12-1.37)	1.50 (1.36-1.66)	1.85 (1.67-2.04)	2.12 (1.92-2.34)	2.49 (2.24-2.74)	2.78 (2.49-3.07)	3.08 (2.75-3.39)	3.38 (3.01-3.72)	3.80 (3.35-4.17)	4.12 (3.62-4.53)
2-hr	1.49 (1.35-1.66)	1.80 (1.63-2.00)	2.24 (2.02-2.48)	2.57 (2.32-2.85)	3.04 (2.73-3.35)	3.41 (3.05-3.76)	3.79 (3.38-4.17)	4.18 (3.72-4.60)	4.72 (4.16-5.18)	5.14 (4.52-5.65)
3-hr	1.58 (1.43-1.77)	1.91 (1.73-2.13)	2.37 (2.14-2.64)	2.74 (2.47-3.05)	3.25 (2.91-3.60)	3.66 (3.27-4.05)	4.09 (3.64-4.53)	4.55 (4.03-5.03)	5.18 (4.55-5.71)	5.68 (4.95-6.26)
6-hr	1.89 (1.70-2.11)	2.27 (2.05-2.54)	2.80 (2.53-3.13)	3.24 (2.91-3.61)	3.84 (3.43-4.27)	4.33 (3.86-4.81)	4.84 (4.29-5.37)	5.38 (4.74-5.96)	6.12 (5.36-6.78)	6.72 (5.83-7.45)
12-hr	2.22 (2.02-2.44)	2.67 (2.43-2.94)	3.28 (2.98-3.60)	3.77 (3.42-4.14)	4.44 (4.01-4.87)	4.98 (4.49-5.46)	5.55 (4.97-6.07)	6.14 (5.48-6.71)	6.95 (6.15-7.59)	7.59 (6.67-8.29)
24-hr	2.64 (2.47-2.84)	3.17 (2.96-3.41)	3.89 (3.63-4.18)	4.47 (4.16-4.80)	5.26 (4.88-5.65)	5.91 (5.45-6.34)	6.58 (6.04-7.06)	7.28 (6.63-7.81)	8.24 (7.44-8.88)	9.01 (8.06-9.72)
2-day	3.09 (2.89-3.33)	3.70 (3.46-3.99)	4.52 (4.22-4.87)	5.17 (4.81-5.57)	6.05 (5.61-6.51)	6.75 (6.23-7.26)	7.46 (6.85-8.04)	8.19 (7.48-8.84)	9.18 (8.32-9.94)	9.96 (8.96-10.8)
3-day	3.30 (3.10-3.53)	3.95 (3.71-4.22)	4.81 (4.52-5.15)	5.50 (5.15-5.87)	6.42 (5.99-6.86)	7.15 (6.65-7.65)	7.90 (7.30-8.46)	8.66 (7.96-9.30)	9.69 (8.83-10.4)	10.5 (9.49-11.4)
4-day	3.51 (3.31-3.73)	4.20 (3.96-4.46)	5.11 (4.82-5.42)	5.82 (5.48-6.18)	6.79 (6.37-7.21)	7.56 (7.06-8.04)	8.34 (7.75-8.88)	9.13 (8.43-9.75)	10.2 (9.34-11.0)	11.0 (10.0-11.9)
7-day	4.09 (3.87-4.34)	4.90 (4.63-5.20)	5.93 (5.60-6.29)	6.72 (6.33-7.12)	7.74 (7.28-8.21)	8.53 (8.00-9.06)	9.32 (8.70-9.91)	10.1 (9.38-10.8)	11.1 (10.3-11.9)	11.9 (10.9-12.8)
10-day	4.65 (4.39-4.94)	5.55 (5.25-5.89)	6.68 (6.30-7.09)	7.52 (7.09-7.99)	8.63 (8.11-9.15)	9.47 (8.87-10.1)	10.3 (9.61-10.9)	11.1 (10.3-11.8)	12.2 (11.2-13.0)	13.0 (11.9-13.9)
20-day	6.42 (6.08-6.78)	7.62 (7.22-8.06)	9.05 (8.57-9.58)	10.1 (9.57-10.7)	11.5 (10.9-12.2)	12.6 (11.8-13.3)	13.6 (12.7-14.4)	14.6 (13.6-15.5)	15.8 (14.7-16.9)	16.8 (15.5-17.9)
30-day	7.87 (7.49-8.28)	9.29 (8.85-9.78)	10.9 (10.3-11.4)	12.0 (11.4-12.7)	13.5 (12.8-14.2)	14.6 (13.9-15.4)	15.7 (14.8-16.6)	16.7 (15.7-17.7)	18.0 (16.8-19.1)	19.0 (17.6-20.2)
45-day	9.81 (9.35-10.3)	11.6 (11.0-12.1)	13.4 (12.8-14.1)	14.7 (14.0-15.5)	16.5 (15.6-17.3)	17.7 (16.8-18.6)	18.9 (17.9-19.9)	20.1 (18.9-21.2)	21.5 (20.2-22.7)	22.5 (21.0-23.9)
60-day	11.6 (11.1-12.2)	13.7 (13.0-14.3)	15.7 (15.0-16.5)	17.3 (16.4-18.0)	19.1 (18.2-20.0)	20.5 (19.5-21.5)	21.8 (20.7-22.9)	23.1 (21.8-24.2)	24.6 (23.1-25.9)	25.6 (24.0-27.1)

[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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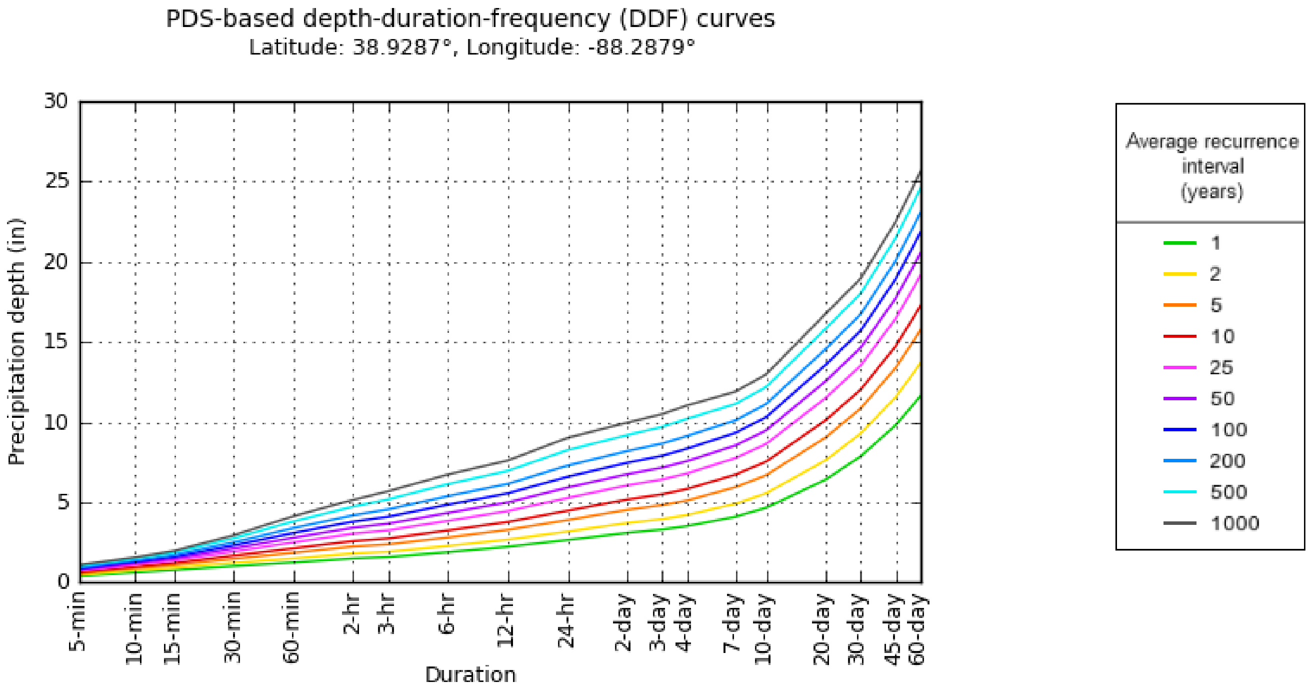
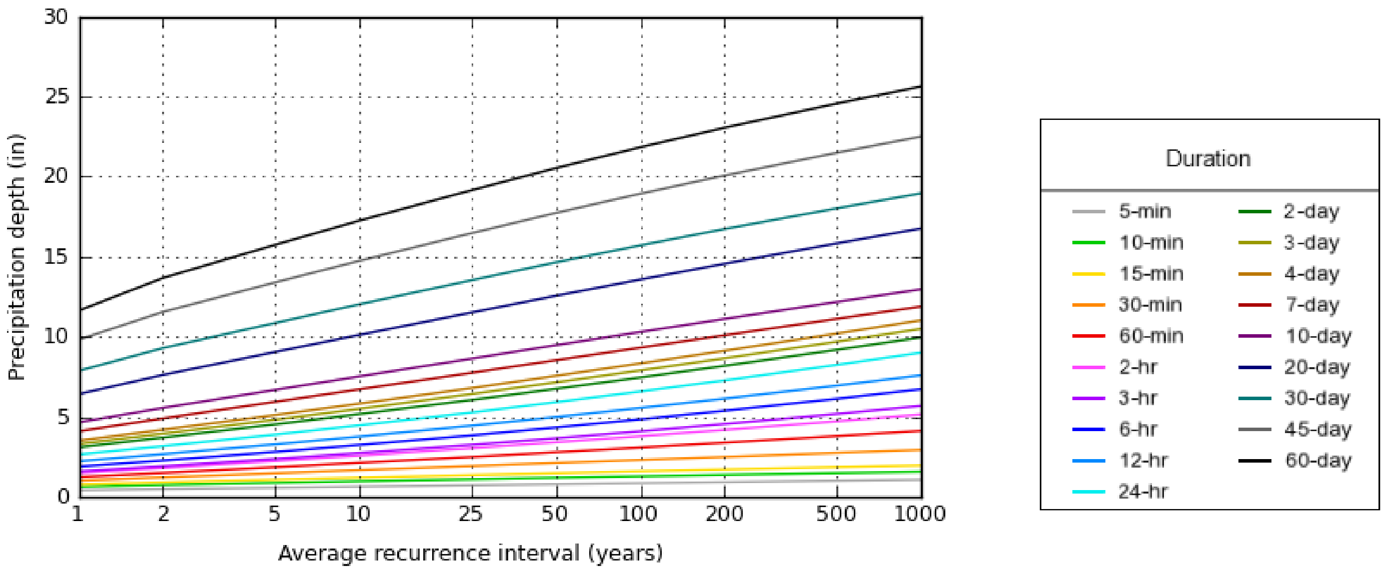
PF graphical





NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Wed Apr 6 19:02:32 2022

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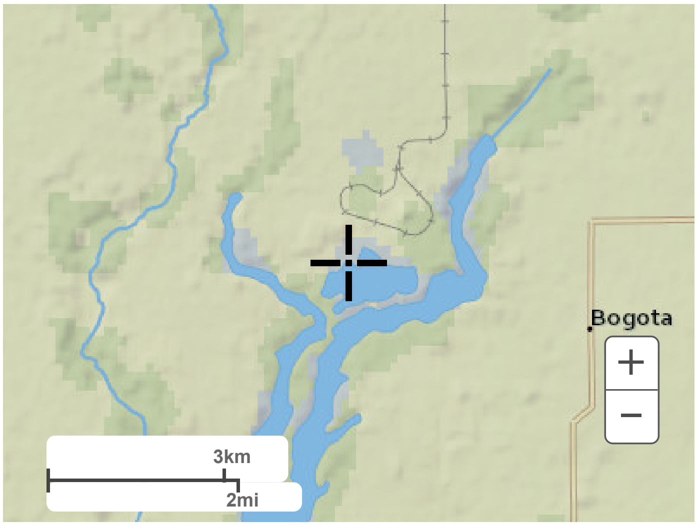
Maps & aerials

Small scale terrain



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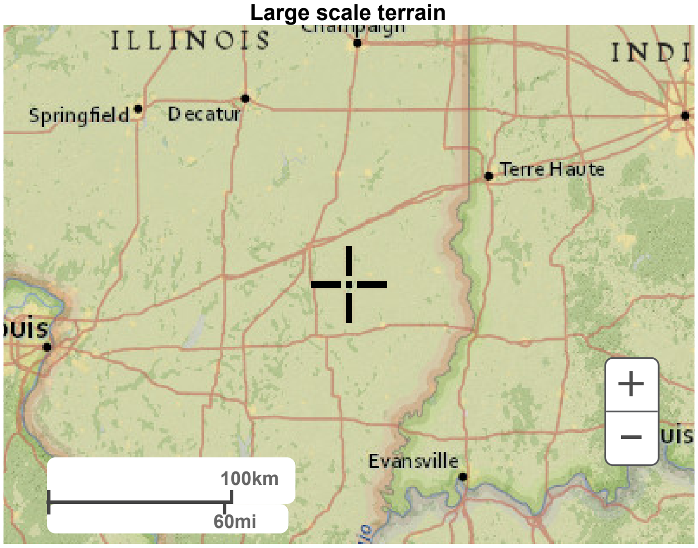

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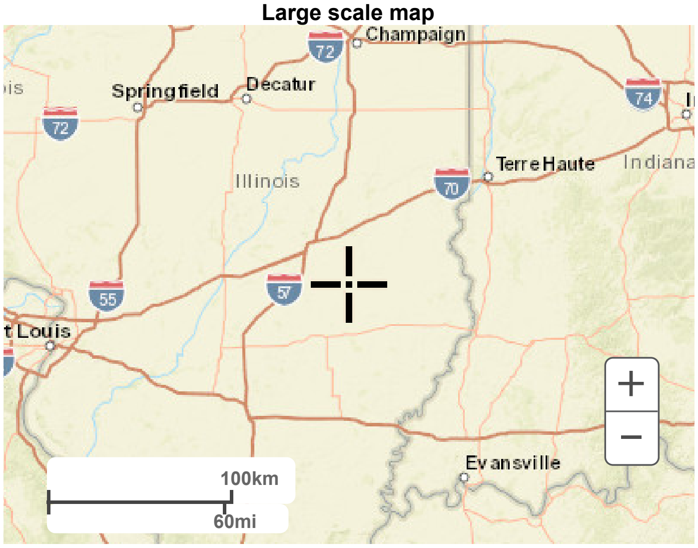
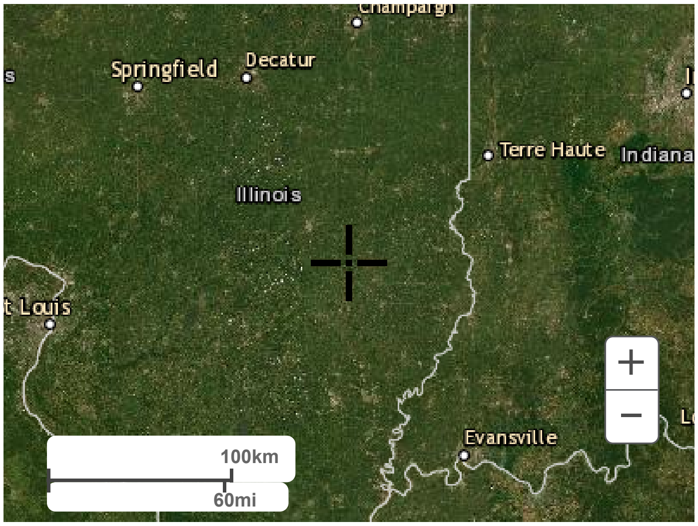


Large scale aerial



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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

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Jasper County, Illinois

April 19, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

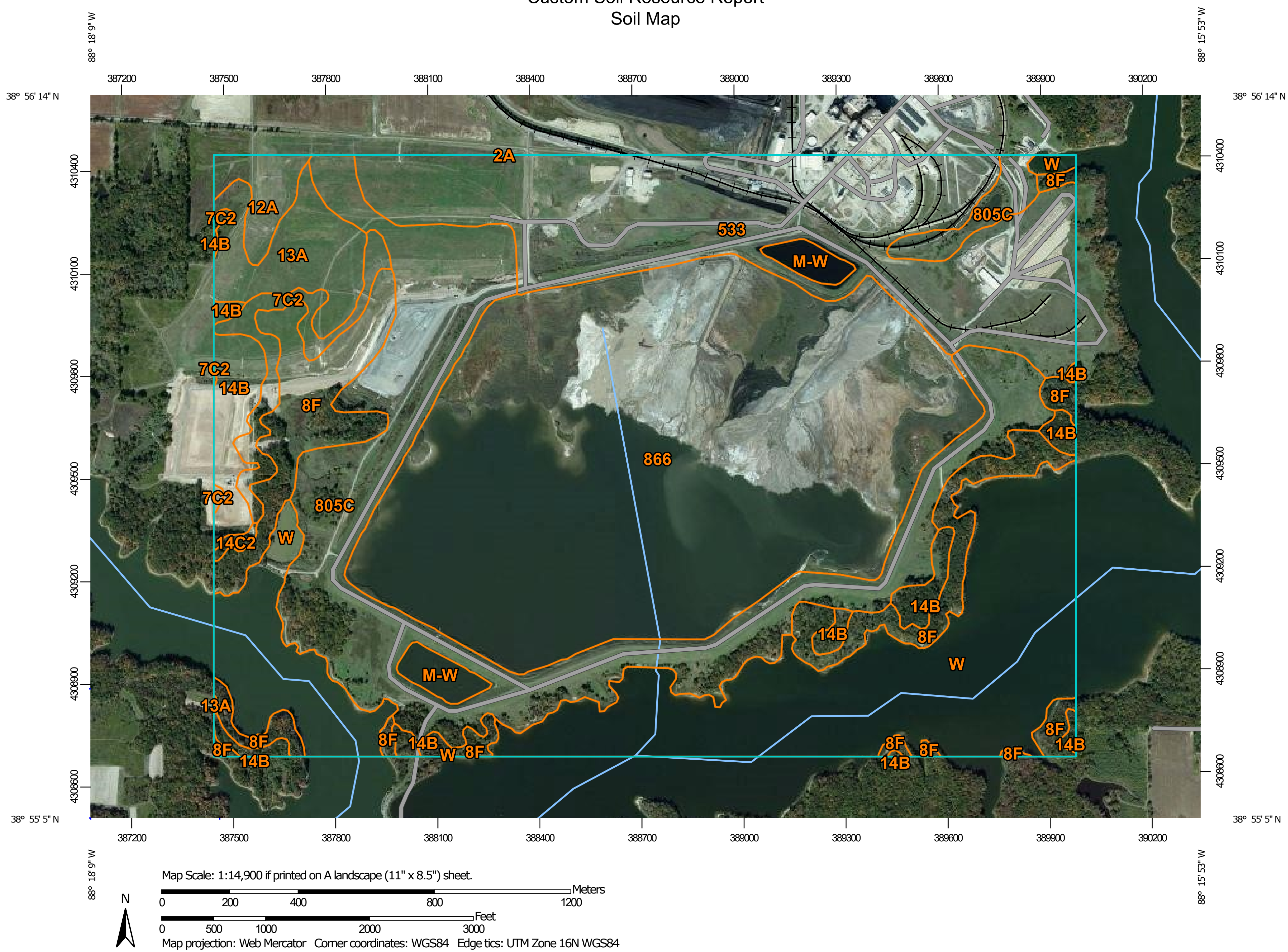
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map



Map Scale: 1:14,900 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jasper County, Illinois
Survey Area Data: Version 18, Aug 31, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 16, 2011—Oct 15, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2A	Cisne silt loam, 0 to 2 percent slopes	0.0	0.0%
7C2	Atlas silt loam, 5 to 10 percent slopes, eroded	17.6	1.6%
8F	Hickory silt loam, 18 to 35 percent slopes	76.7	6.9%
12A	Wynoose silt loam, 0 to 2 percent slopes	11.5	1.0%
13A	Bluford silt loam, 0 to 2 percent slopes	29.4	2.7%
14B	Ava silt loam, 2 to 5 percent slopes	31.9	2.9%
14C2	Ava silt loam, 5 to 10 percent slopes, eroded	1.3	0.1%
533	Urban land	178.2	16.1%
805C	Orthents, clayey, sloping	186.5	16.9%
866	Dumps, slurry	375.5	33.9%
M-W	Miscellaneous water	11.5	1.0%
W	Water	186.5	16.9%
Totals for Area of Interest		**1,106.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Jasper County, Illinois

2A—Cisne silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2rkjg
Elevation: 360 to 840 feet
Mean annual precipitation: 35 to 42 inches
Mean annual air temperature: 53 to 57 degrees F
Frost-free period: 175 to 195 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Cisne and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cisne

Setting

Landform: Ground moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty loess over silty drift

Typical profile

Ap - 0 to 8 inches: silt loam
E - 8 to 17 inches: silt loam
Bt1 - 17 to 37 inches: silty clay loam
2Bt2 - 37 to 60 inches: silty clay loam
2C - 60 to 77 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 12 to 19 inches to abrupt textural change
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.02 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 13.0
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: R113XY903IL - Wet Upland Prairie (silky dogwood/big bluestem - switchgrass) (Cornus obliqua/Andropogon gerardii - Panicum virgatum)
Hydric soil rating: Yes

Minor Components

Huey

Percent of map unit: 10 percent
Landform: Depressions
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F114BY502IN - Wet Till Upland Forest
Hydric soil rating: Yes

7C2—Atlas silt loam, 5 to 10 percent slopes, eroded

Map Unit Setting

National map unit symbol: 2tp1z
Elevation: 330 to 840 feet
Mean annual precipitation: 38 to 46 inches
Mean annual air temperature: 54 to 58 degrees F
Frost-free period: 180 to 195 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Atlas, eroded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Atlas, Eroded

Setting

Landform: Till plains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loess over paleosol formed in till

Typical profile

Ap - 0 to 7 inches: silt loam
2Btg1 - 7 to 29 inches: silty clay loam
2Btg2 - 29 to 79 inches: silty clay loam

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 6 to 18 inches

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Ecological site: F114BY502IN - Wet Till Upland Forest
Hydric soil rating: No

Minor Components

Ava, eroded

Percent of map unit: 10 percent
Landform: Hillslopes, ridges
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Convex
Across-slope shape: Linear, convex
Ecological site: F113XY910IL - Fragic Backslope Woodland (post oak - black oak/aromatic sumac/little bluestem - tick trefoil) (Quercus stellata - Quercus velutina/Rhus aromatica/Schizachyrium scoparium - Desmodium spp.)
Hydric soil rating: No

8F—Hickory silt loam, 18 to 35 percent slopes

Map Unit Setting

National map unit symbol: 2yb19
Elevation: 370 to 680 feet
Mean annual precipitation: 39 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 185 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Hickory and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hickory

Setting

Landform: Ground moraines
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear

Across-slope shape: Linear
Parent material: Loamy till

Typical profile

A - 0 to 4 inches: silt loam
E - 4 to 12 inches: loam
Bt1 - 12 to 26 inches: clay loam
Bt2 - 26 to 46 inches: clay loam
Bt3 - 46 to 60 inches: clay loam

Properties and qualities

Slope: 18 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: F113XY911IL - Loamy Till Backslope Forest (white oak - hickory/flowering dogwood/common blue wood aster) (Quercus alba - Carya spp./Cornus florida/Symphyotrichum cordifolium)
Hydric soil rating: No

Minor Components

Ava

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F113XY910IL - Fragic Backslope Woodland (post oak - black oak/aromatic sumac/little bluestem - tick trefoil) (Quercus stellata - Quercus velutina/Rhus aromatica/Schizachyrium scoparium - Desmodium spp.)
Hydric soil rating: No

Atlas, eroded

Percent of map unit: 3 percent
Landform: Ground moraines
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F114BY502IN - Wet Till Upland Forest
Hydric soil rating: No

Belknap, frequently flooded

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F113XY919IL - Wet Silty Floodplain Forest (common hackberry - green ash/roughleaf dogwood/Canadian woodnettle) (Celtis occidentalis - Fraxinus pennsylvanica /Cornus drummondii /Laportea canadensis)
Hydric soil rating: No

12A—Wynoose silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2t959
Elevation: 360 to 840 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 53 to 58 degrees F
Frost-free period: 175 to 195 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Wynoose and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wynoose

Setting

Landform: Ground moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over mixed loess and drift over sangamon age paleosol till

Typical profile

Ap - 0 to 7 inches: silt loam
Eg - 7 to 19 inches: silt loam
Btg - 19 to 36 inches: silty clay
2Btg - 36 to 66 inches: silty clay loam
3Btgb - 66 to 79 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 13 to 24 inches to abrupt textural change
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.02 to 0.20 in/hr)

Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 12.0
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: F113XY905IL - Wet Upland Woodland (pin oak - swamp white oak/green hawthorn /sweet woodreed) (Quercus palustris - Quercus bicolor/ Crataegus viridis /Cinna arundinacea)
Hydric soil rating: Yes

Minor Components

Bluford

Percent of map unit: 10 percent
Landform: Ground moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F113XY905IL - Wet Upland Woodland (pin oak - swamp white oak/ green hawthorn /sweet woodreed) (Quercus palustris - Quercus bicolor/ Crataegus viridis /Cinna arundinacea)
Hydric soil rating: No

13A—Bluford silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2t95c
Elevation: 360 to 840 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 53 to 58 degrees F
Frost-free period: 175 to 195 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Bluford and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bluford

Setting

Landform: Ground moraines
Landform position (two-dimensional): Summit

Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over mixed loess and drift

Typical profile

Ap - 0 to 7 inches: silt loam
E - 7 to 19 inches: silt loam
Btg - 19 to 35 inches: silty clay
2Btgx - 35 to 42 inches: silty clay loam
2Btg - 42 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 10 to 24 inches to abrupt textural change; 24 to 48 inches to fragipan
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 13.0
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F113XY905IL - Wet Upland Woodland (pin oak - swamp white oak/green hawthorn /sweet woodreed) (Quercus palustris - Quercus bicolor/ Crataegus viridis /Cinna arundinacea)
Hydric soil rating: No

Minor Components

Wynoose

Percent of map unit: 10 percent
Landform: Ground moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F113XY905IL - Wet Upland Woodland (pin oak - swamp white oak/ green hawthorn /sweet woodreed) (Quercus palustris - Quercus bicolor/ Crataegus viridis /Cinna arundinacea)
Hydric soil rating: Yes

14B—Ava silt loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2t95h
Elevation: 360 to 840 feet
Mean annual precipitation: 38 to 46 inches
Mean annual air temperature: 54 to 58 degrees F
Frost-free period: 180 to 195 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Ava and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ava

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess over mixed loess and drift over till

Typical profile

Ap - 0 to 6 inches: silt loam
E - 6 to 14 inches: silt loam
Bt - 14 to 34 inches: silty clay loam
2Btx - 34 to 50 inches: silty clay loam
3Btb - 50 to 79 inches: loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: 25 to 40 inches to fragipan
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.02 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Ecological site: F113XY910IL - Fragic Backslope Woodland (post oak - black oak/aromatic sumac/little bluestem - tick trefoil) (Quercus stellata - Quercus velutina/Rhus aromatica/Schizachyrium scoparium - Desmodium spp.)
Hydric soil rating: No

Minor Components

Bluford

Percent of map unit: 10 percent
Landform: Ground moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F113XY905IL - Wet Upland Woodland (pin oak - swamp white oak/green hawthorn /sweet woodreed) (Quercus palustris - Quercus bicolor/Crataegus viridis /Cinna arundinacea)
Hydric soil rating: No

14C2—Ava silt loam, 5 to 10 percent slopes, eroded

Map Unit Setting

National map unit symbol: 2t95l
Elevation: 360 to 840 feet
Mean annual precipitation: 38 to 46 inches
Mean annual air temperature: 54 to 58 degrees F
Frost-free period: 180 to 195 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ava, eroded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ava, Eroded

Setting

Landform: Hillslopes, ridges
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Loess over mixed loess and drift over till

Typical profile

Ap - 0 to 9 inches: silt loam
Bt and E - 9 to 28 inches: silty clay loam
Btx - 28 to 36 inches: silty clay loam
2Btx - 36 to 64 inches: silt loam
3Btb - 64 to 78 inches: silt loam

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: 25 to 40 inches to fragipan
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F113XY910IL - Fragic Backslope Woodland (post oak - black oak/aromatic sumac/little bluestem - tick trefoil) (Quercus stellata - Quercus velutina/Rhus aromatica/Schizachyrium scoparium - Desmodium spp.)
Hydric soil rating: No

Minor Components

Bluford, eroded

Percent of map unit: 10 percent
Landform: Ground moraines
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F113XY905IL - Wet Upland Woodland (pin oak - swamp white oak/green hawthorn /sweet woodreed) (Quercus palustris - Quercus bicolor/Crataegus viridis /Cinna arundinacea)
Hydric soil rating: No

533—Urban land

Map Unit Setting

National map unit symbol: 1q78h
Elevation: 510 to 980 feet
Mean annual precipitation: 28 to 40 inches
Mean annual air temperature: 45 to 54 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 90 percent

Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Down-slope shape: Linear
Across-slope shape: Linear

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Minor Components

Orthents, loamy, nearly level

Percent of map unit: 4 percent
Landform: Lake plains, ground moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Orthents, clayey, nearly level

Percent of map unit: 4 percent
Landform: Ground moraines, lake plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Orthents, loamy-skeletal, nearly level

Percent of map unit: 2 percent
Landform: Lake plains, ground moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

805C—Orthents, clayey, sloping

Map Unit Setting

National map unit symbol: y5ns
Elevation: 360 to 840 feet
Mean annual precipitation: 35 to 42 inches
Mean annual air temperature: 53 to 57 degrees F
Frost-free period: 175 to 195 days

Farmland classification: Not prime farmland

Map Unit Composition

Orthents, clayey, and similar soils: 90 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Orthents, Clayey

Setting

Parent material: Earthy cut and fill

Typical profile

H1 - 0 to 4 inches: silty clay loam
H2 - 4 to 60 inches: silty clay loam

Properties and qualities

Slope: 1 to 16 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.02 to 0.20 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Hydric soil rating: Unranked

Minor Components

Wynoose

Percent of map unit: 3 percent
Landform: Till plains
Ecological site: F113XY905IL - Wet Upland Woodland (pin oak - swamp white oak/ green hawthorn /sweet woodreed) (Quercus palustris - Quercus bicolor/ Crataegus viridis /Cinna arundinacea)
Hydric soil rating: Yes

866—Dumps, slurry

Map Unit Setting

National map unit symbol: y5nt
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Farmland classification: Not prime farmland

Map Unit Composition

Dumps, slurry: 90 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dumps, Slurry

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8

Hydric soil rating: No

M-W—Miscellaneous water

Map Unit Setting

National map unit symbol: 1qg37

Frost-free period: 175 to 195 days

Farmland classification: Not prime farmland

Map Unit Composition

Miscellaneous water: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Miscellaneous Water

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8w

Hydric soil rating: Unranked

W—Water

Map Unit Composition

Water: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Setting

Landform: Channels, perenial streams, drainageways, lakes, oxbows, rivers

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8w

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Appendix B

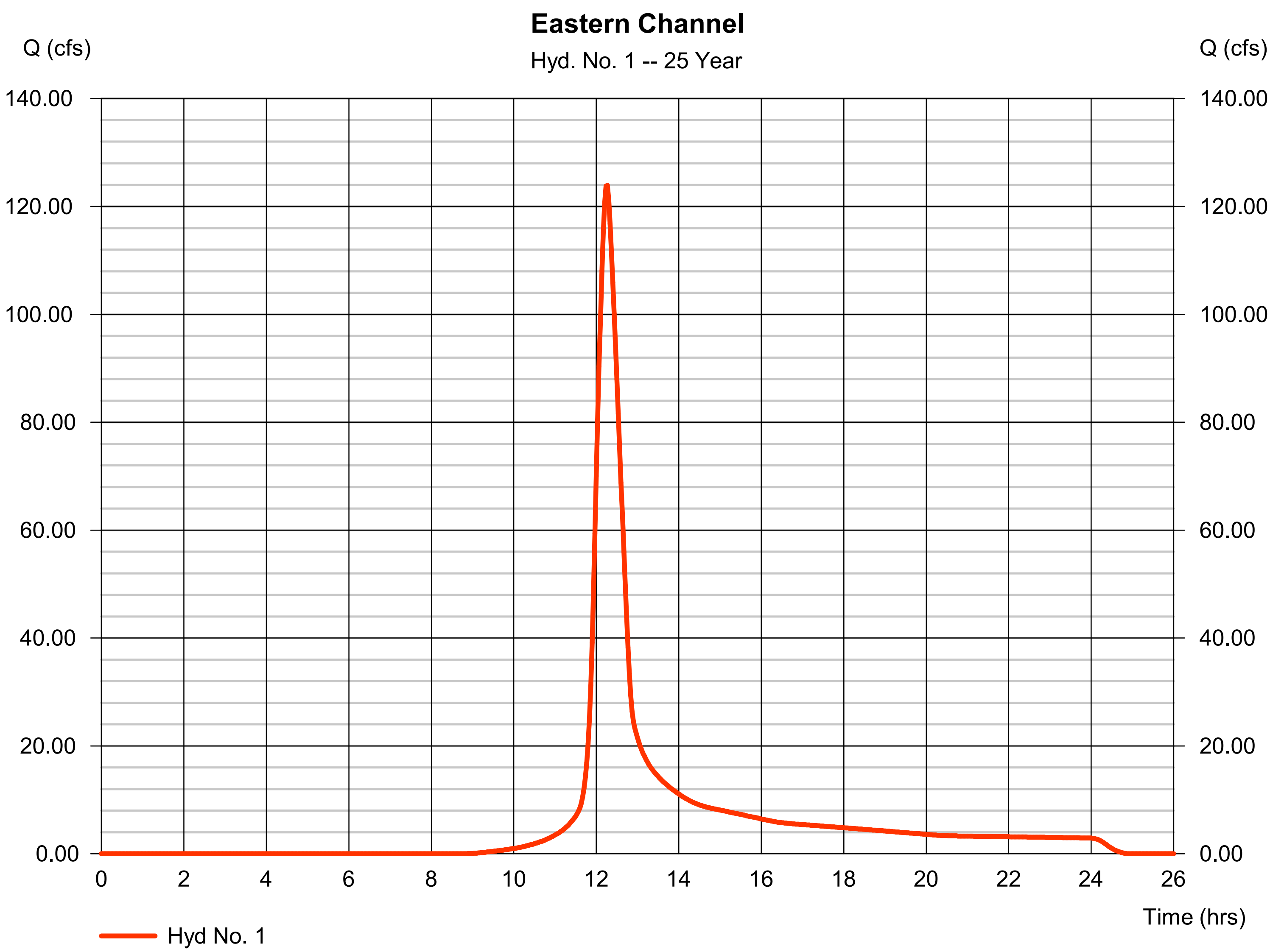
Hydroflow Hydrograph Output

Hydrograph Report

Hyd. No. 1

Eastern Channel

Hydrograph type	= SCS Runoff	Peak discharge	= 123.93 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 566,480 cuft
Drainage area	= 61.340 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.50 min
Total precip.	= 5.26 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

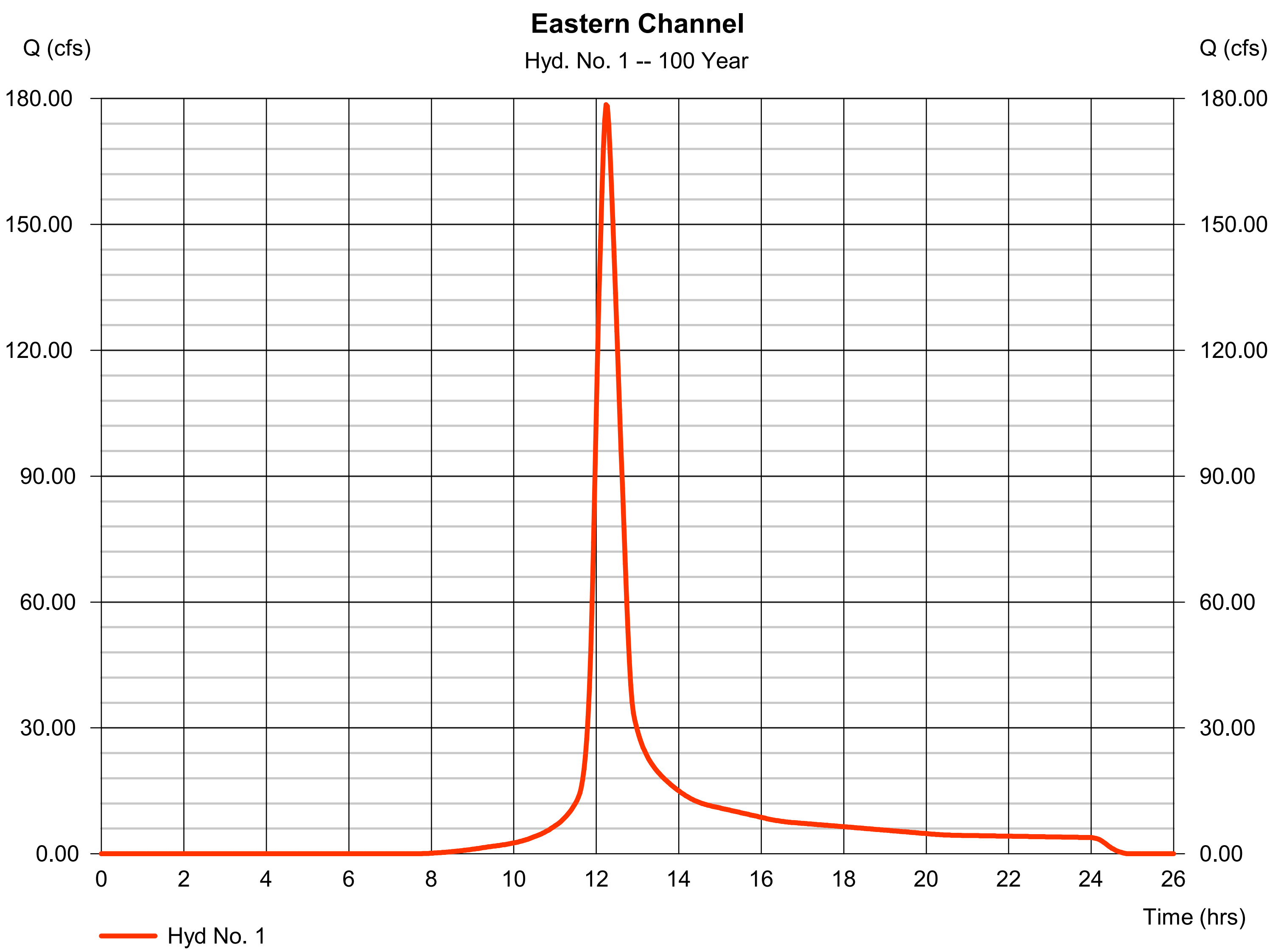


Hydrograph Report

Hyd. No. 1

Eastern Channel

Hydrograph type	= SCS Runoff	Peak discharge	= 178.51 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 809,728 cuft
Drainage area	= 61.340 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.50 min
Total precip.	= 6.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

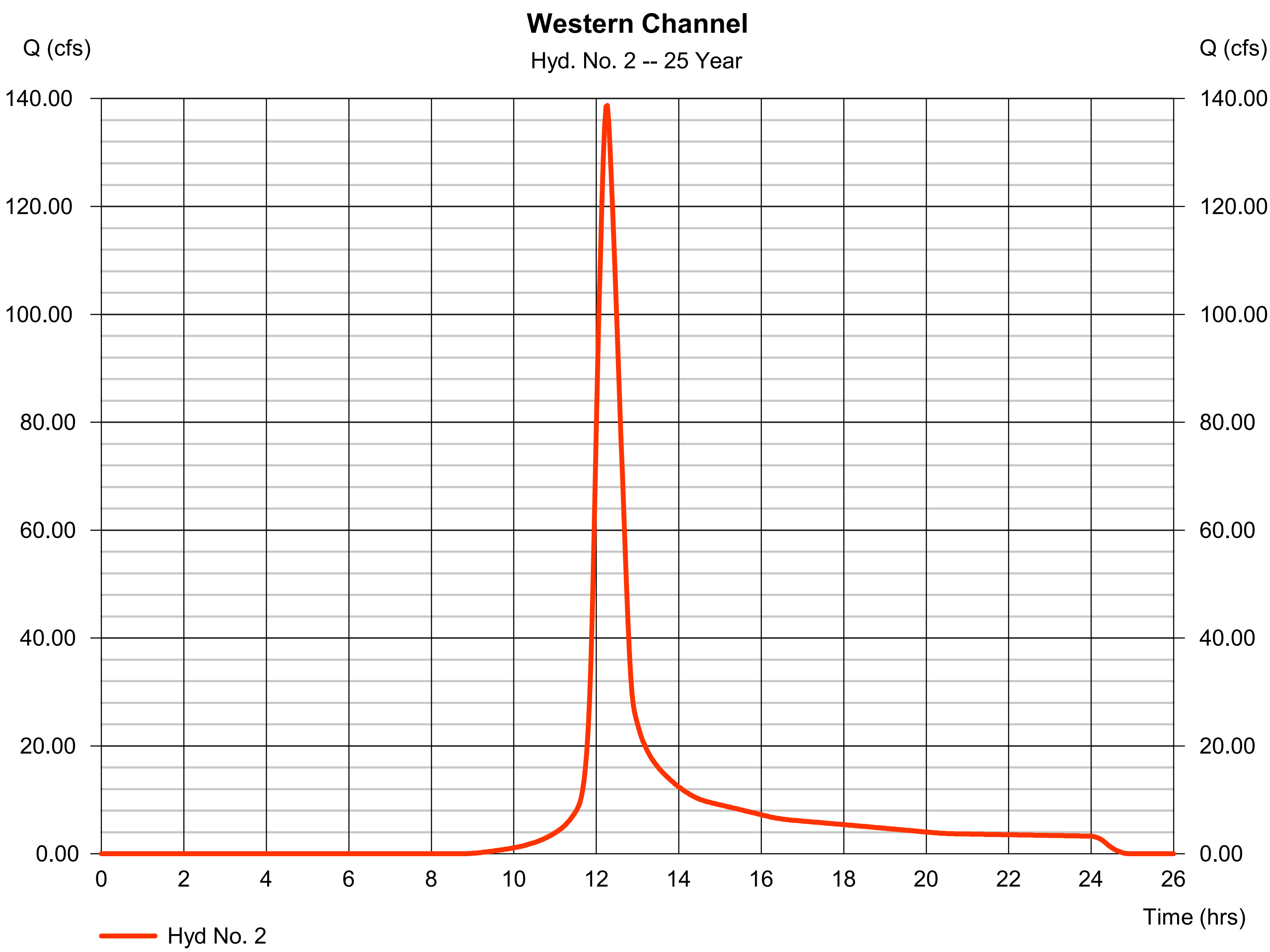


Hydrograph Report

Hyd. No. 2

Western Channel

Hydrograph type	= SCS Runoff	Peak discharge	= 138.69 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 633,988 cuft
Drainage area	= 68.650 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.50 min
Total precip.	= 5.26 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

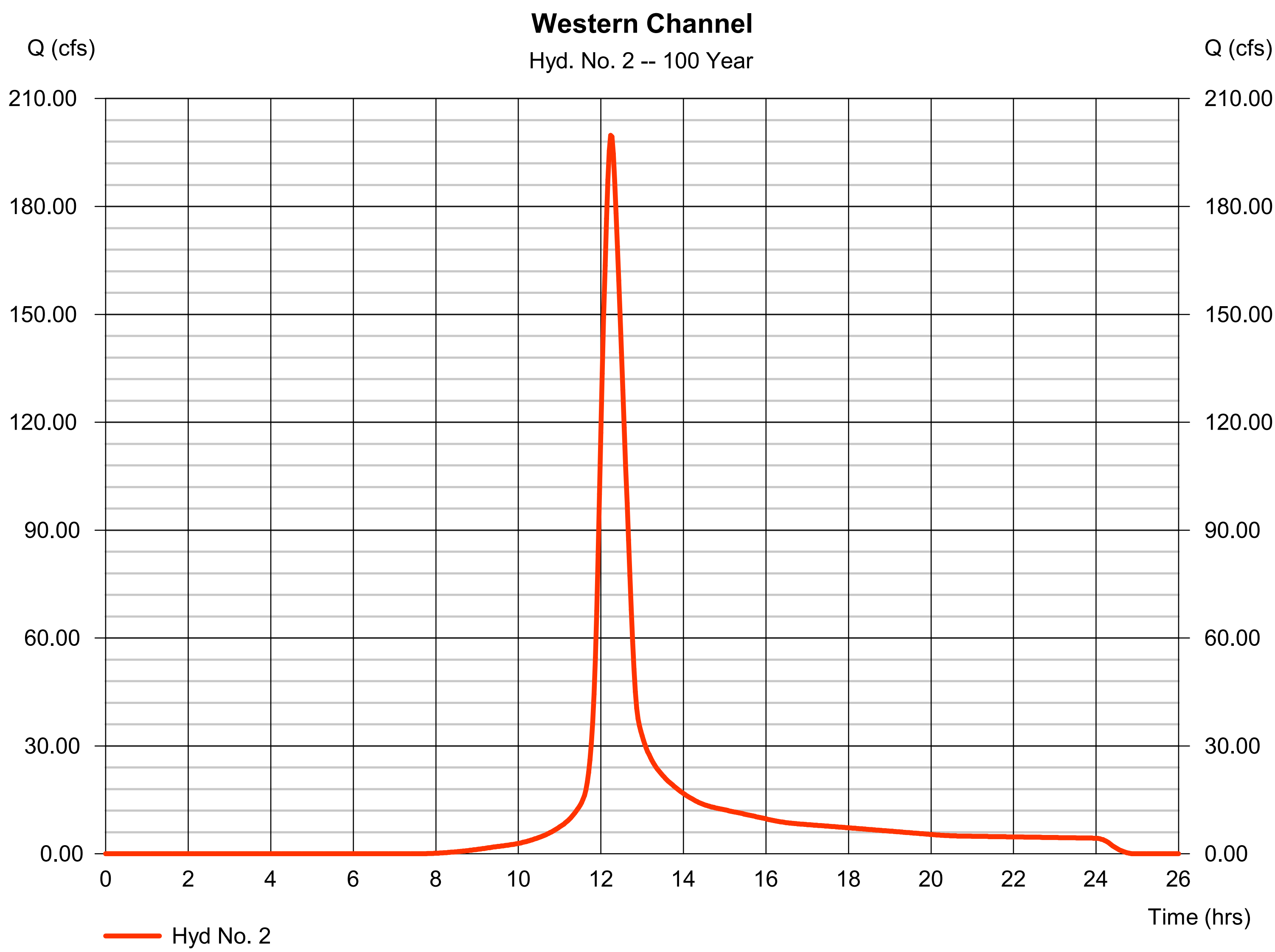


Hydrograph Report

Hyd. No. 2

Western Channel

Hydrograph type	= SCS Runoff	Peak discharge	= 199.78 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 906,225 cuft
Drainage area	= 68.650 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.50 min
Total precip.	= 6.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

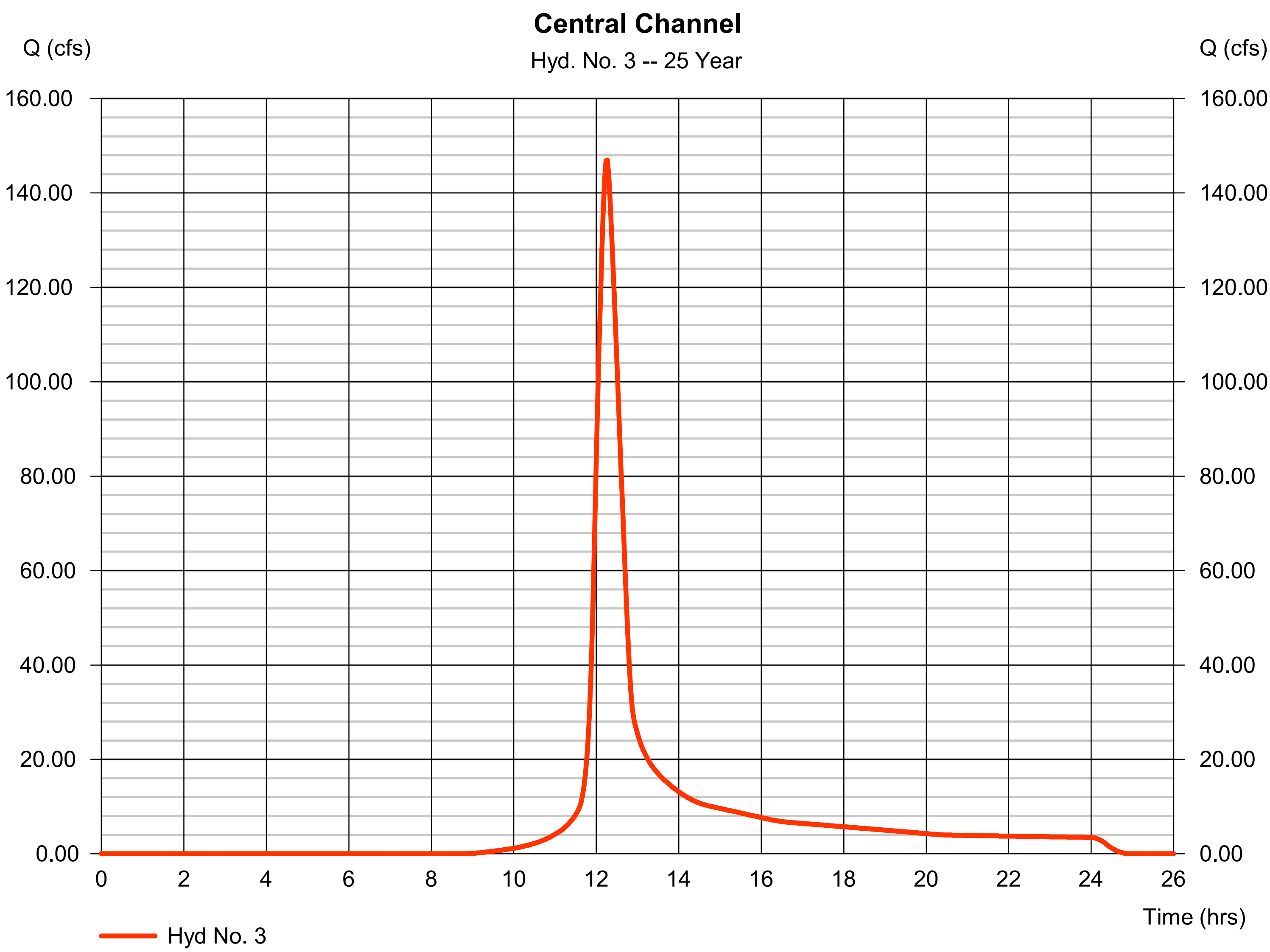


Hydrograph Report

Hyd. No. 3

Central Channel

Hydrograph type	= SCS Runoff	Peak discharge	= 146.98 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 671,851 cuft
Drainage area	= 72.750 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.50 min
Total precip.	= 5.26 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

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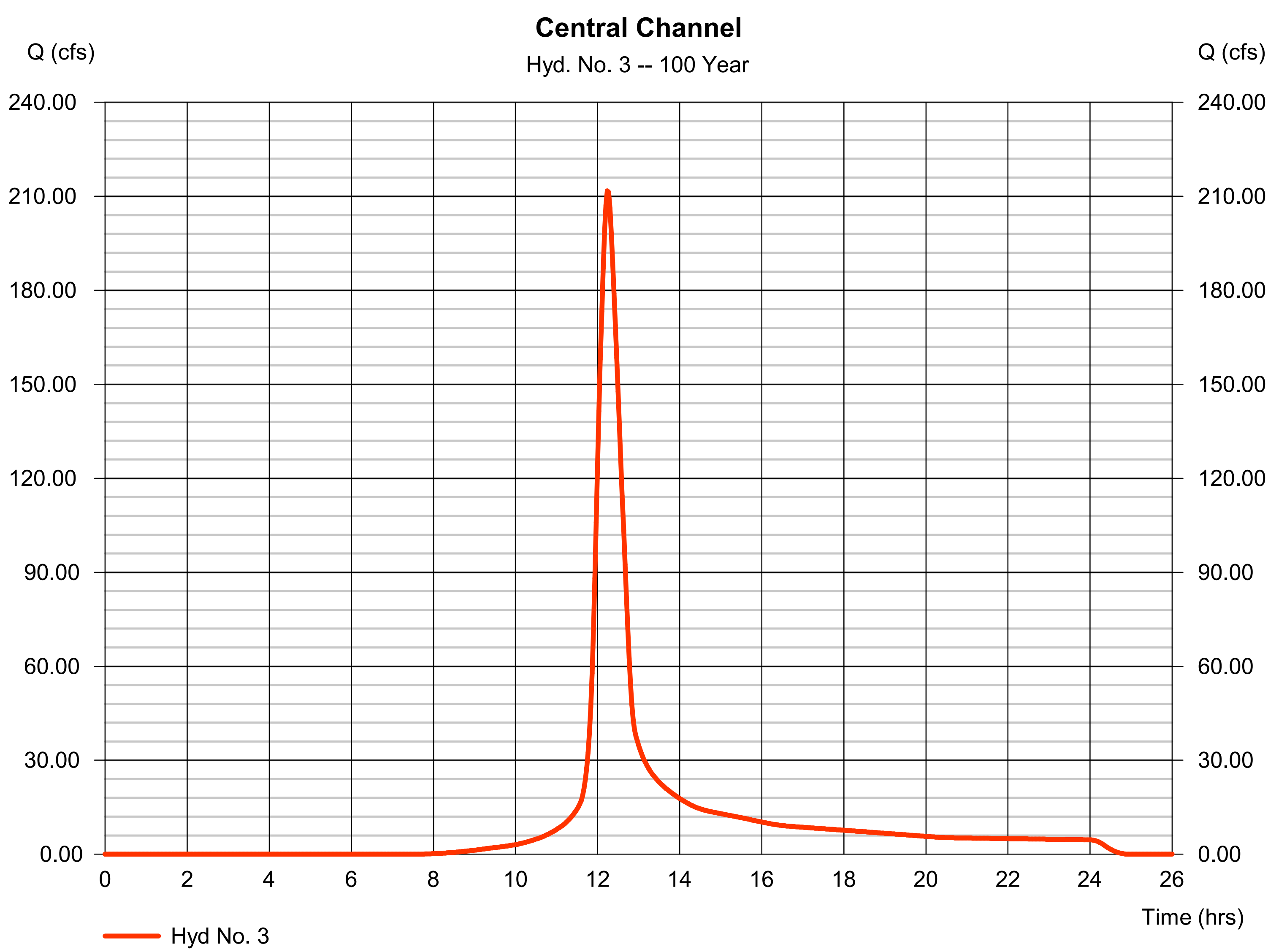
Hyd. No. 3

Central Channel

Hydrograph type	= SCS Runoff	Peak discharge	= 211.72 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 960,347 cuft
Drainage area	= 72.750 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.50 min
Total precip.	= 6.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

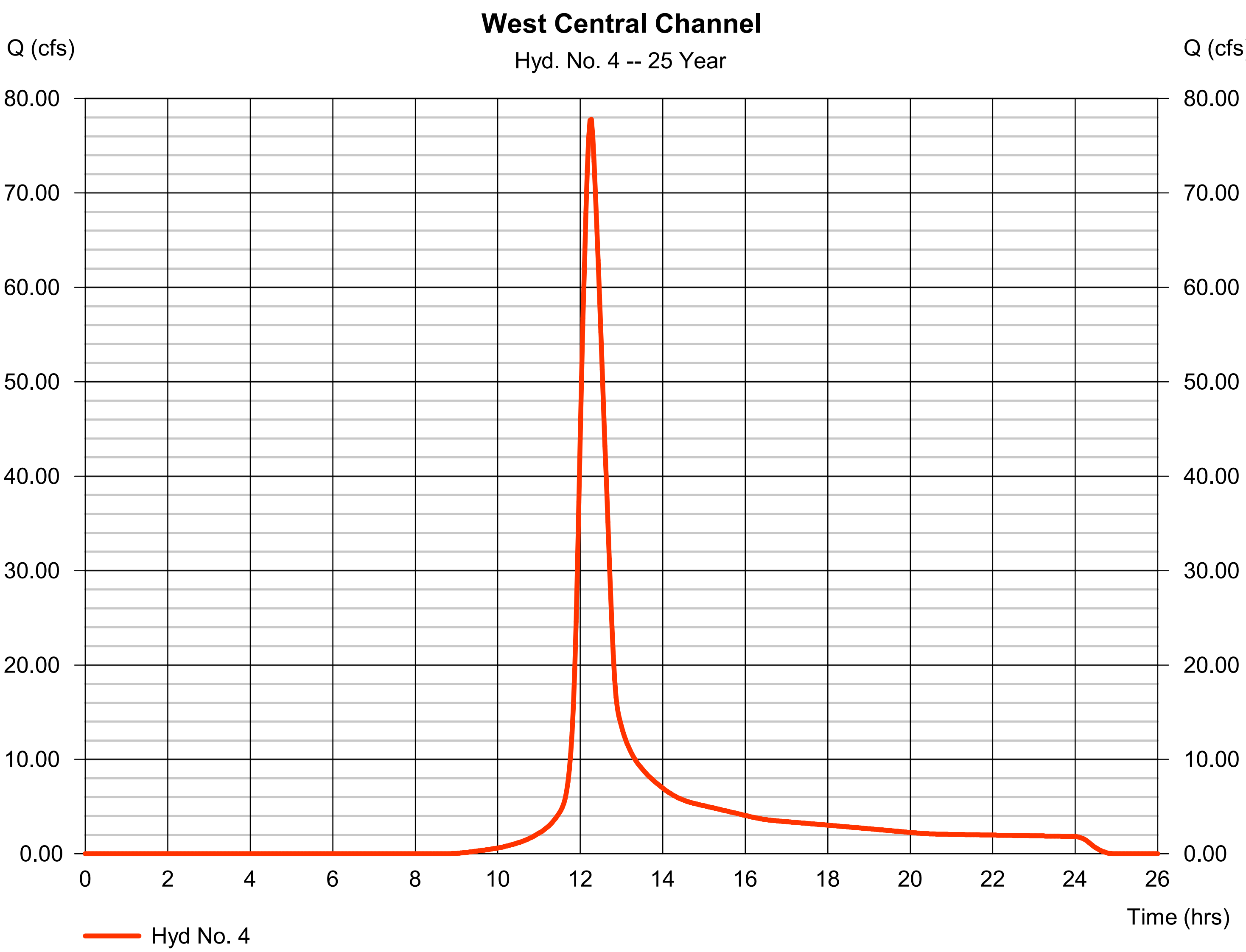


Hydrograph Report

Hyd. No. 4

West Central Channel

Hydrograph type	= SCS Runoff	Peak discharge	= 77.80 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 355,643 cuft
Drainage area	= 38.510 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.50 min
Total precip.	= 5.26 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

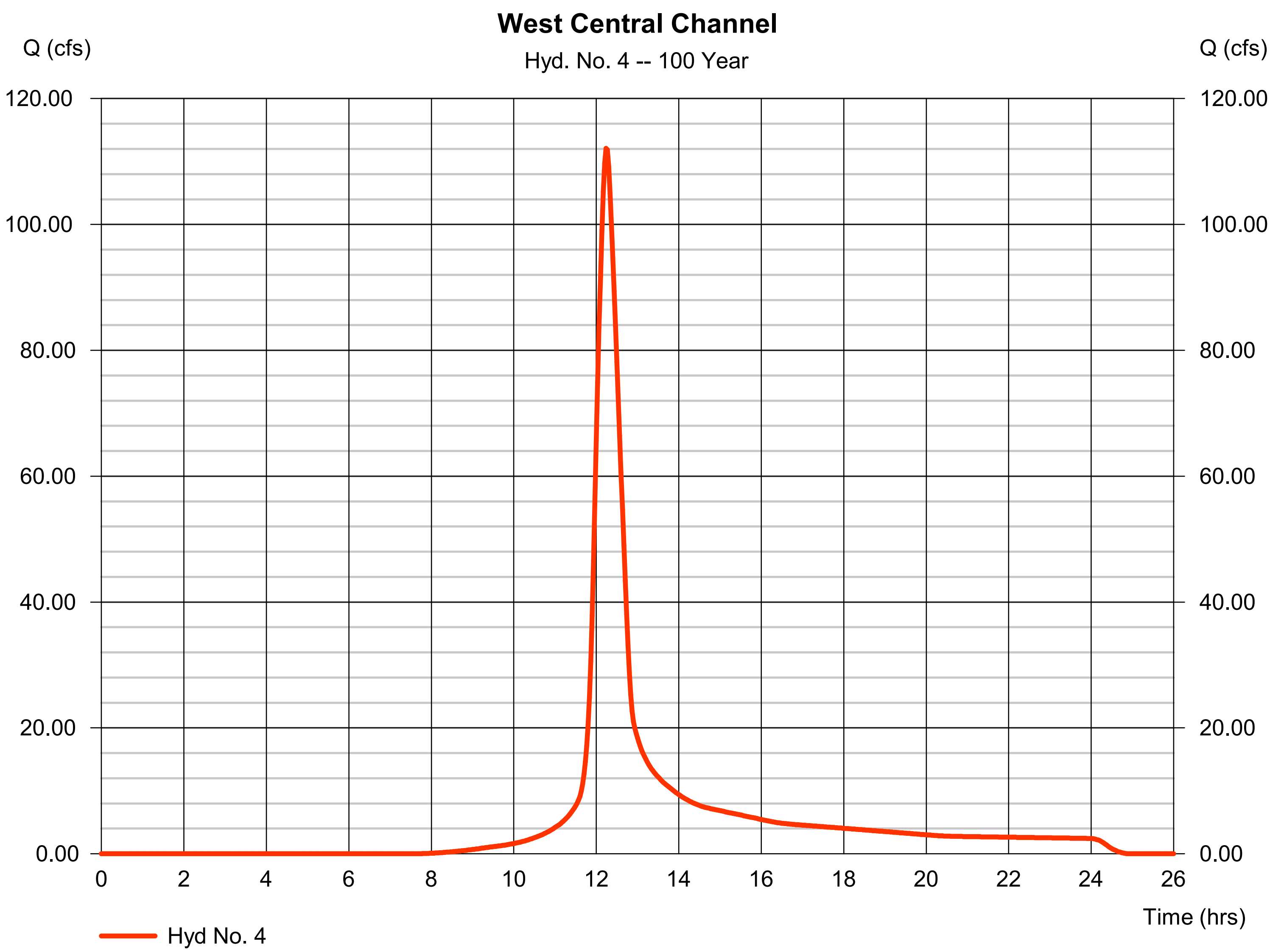


Hydrograph Report

Hyd. No. 4

West Central Channel

Hydrograph type	= SCS Runoff	Peak discharge	= 112.07 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 508,357 cuft
Drainage area	= 38.510 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.50 min
Total precip.	= 6.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

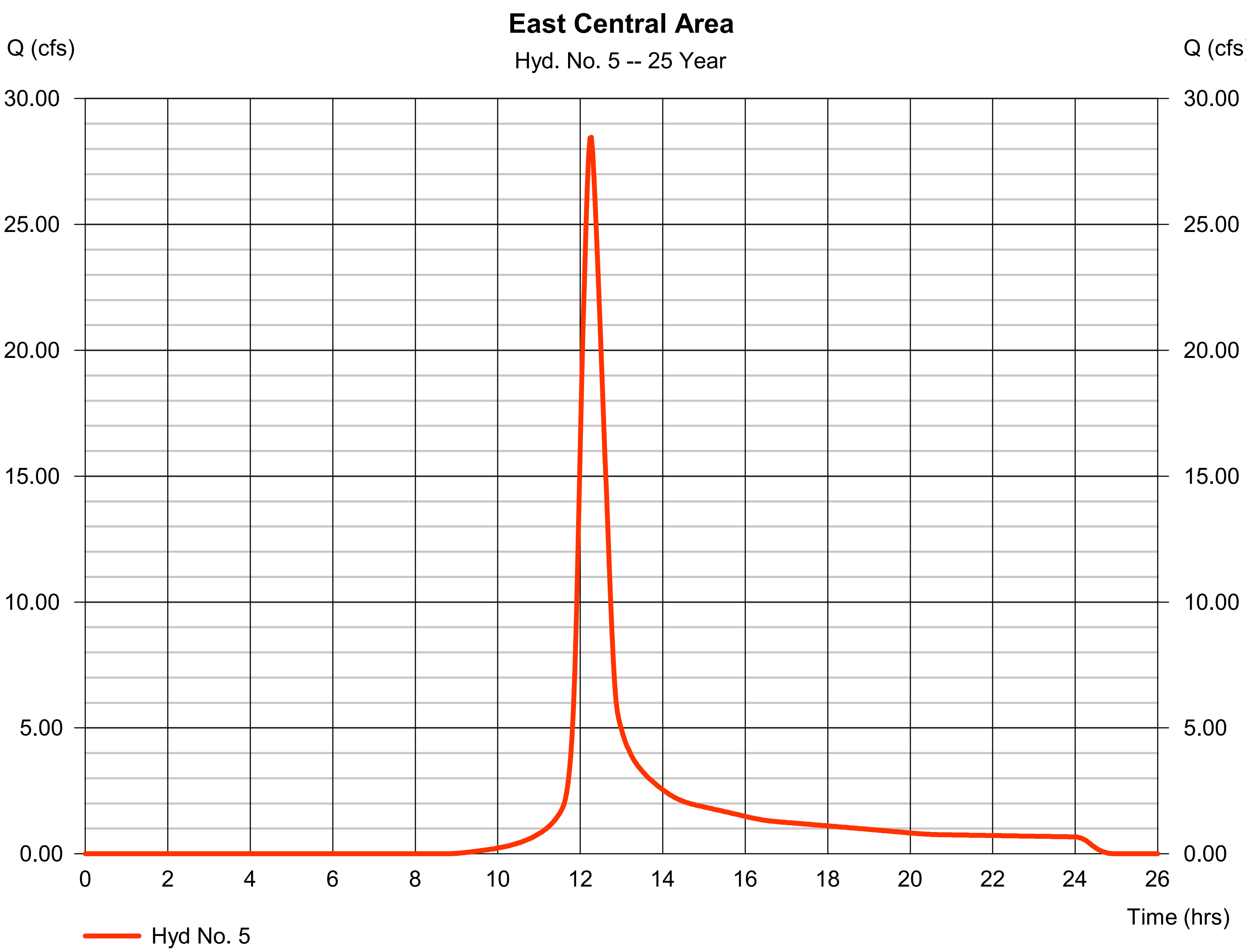


Hydrograph Report

Hyd. No. 5

East Central Area

Hydrograph type	= SCS Runoff	Peak discharge	= 28.47 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 130,122 cuft
Drainage area	= 14.090 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.50 min
Total precip.	= 5.26 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

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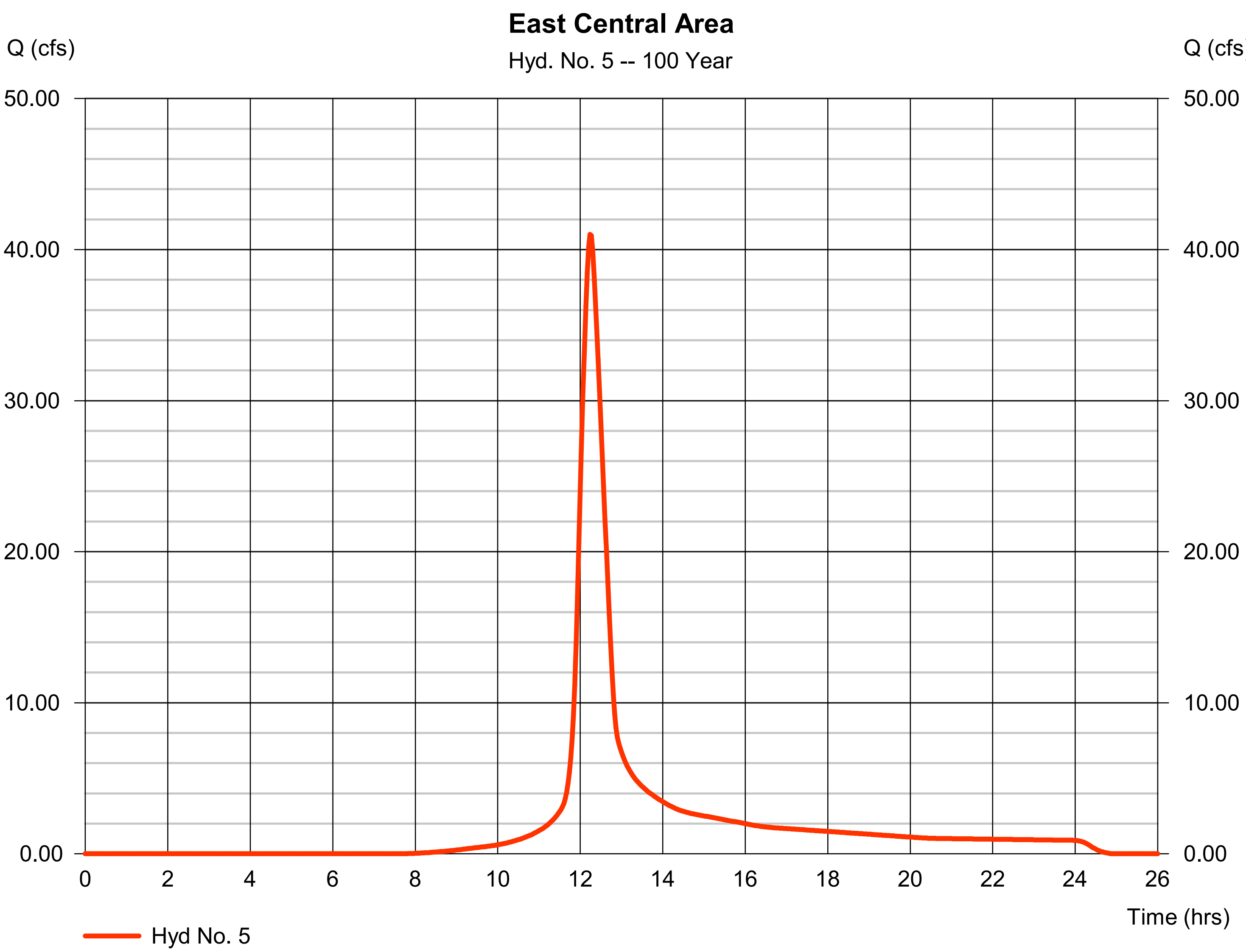
Hyd. No. 5

East Central Area

Hydrograph type	= SCS Runoff	Peak discharge	= 41.00 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 185,997 cuft
Drainage area	= 14.090 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.50 min
Total precip.	= 6.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

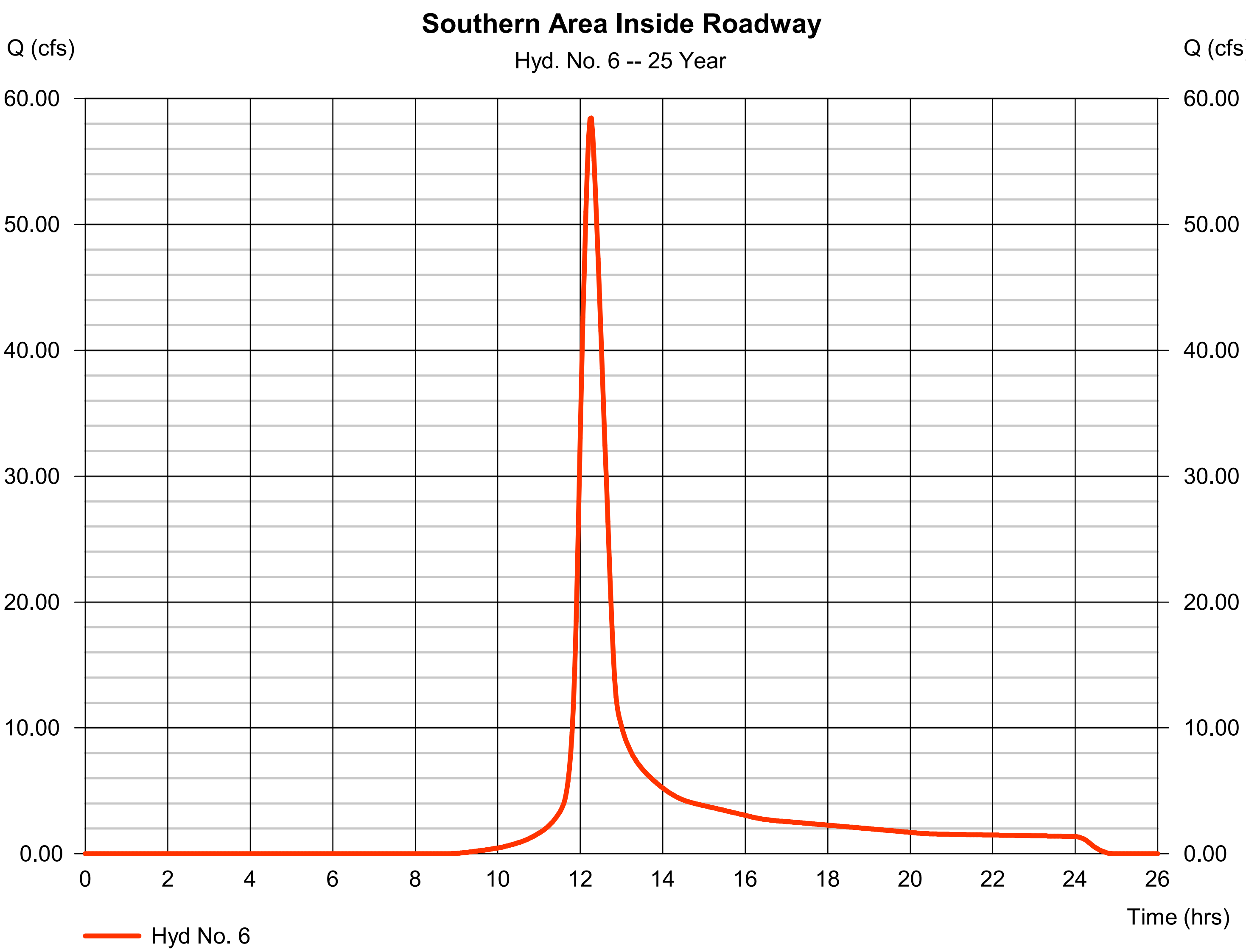


Hydrograph Report

Hyd. No. 6

Southern Area Inside Roadway

Hydrograph type	= SCS Runoff	Peak discharge	= 58.47 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 267,263 cuft
Drainage area	= 28.940 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.50 min
Total precip.	= 5.26 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

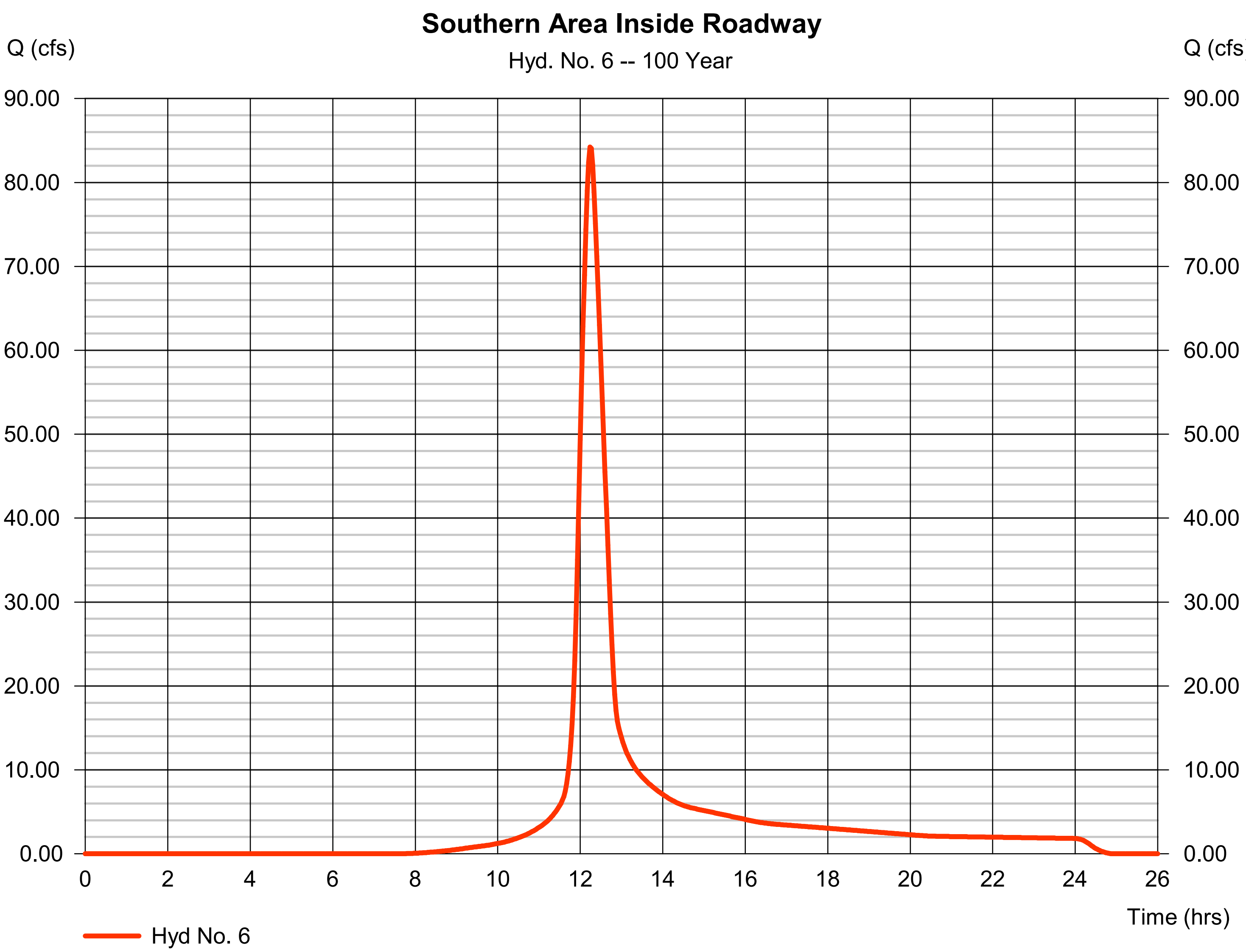


Hydrograph Report

Hyd. No. 6

Southern Area Inside Roadway

Hydrograph type	= SCS Runoff	Peak discharge	= 84.22 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 382,027 cuft
Drainage area	= 28.940 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.50 min
Total precip.	= 6.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

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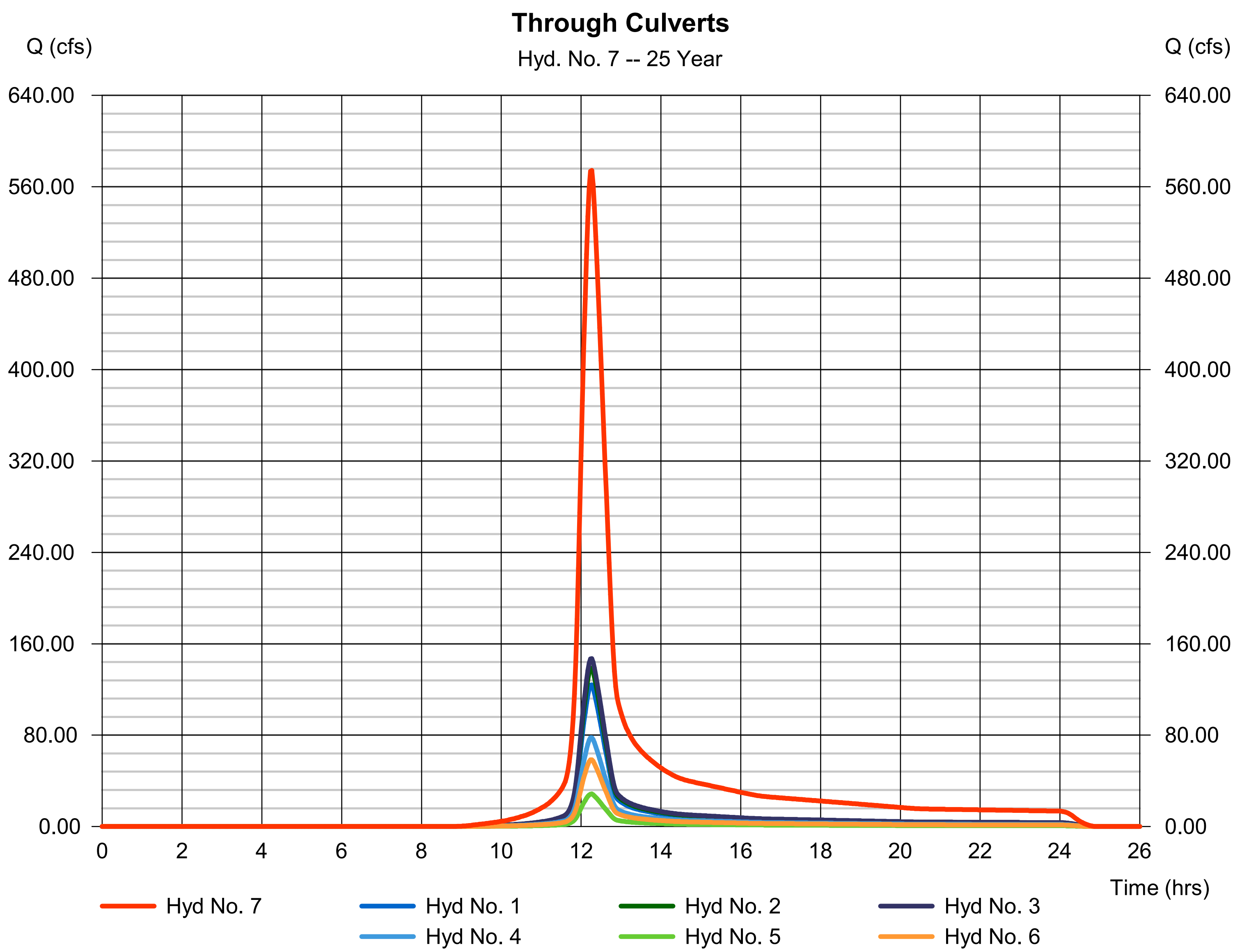
Hyd. No. 7

Through Culverts

Hydrograph type	= Combine	Peak discharge	= 574.33 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 2,625,349 cuft
Inflow hyds.	= 1, 2, 3, 4, 5, 6	Contrib. drain. area	= 284.280 ac



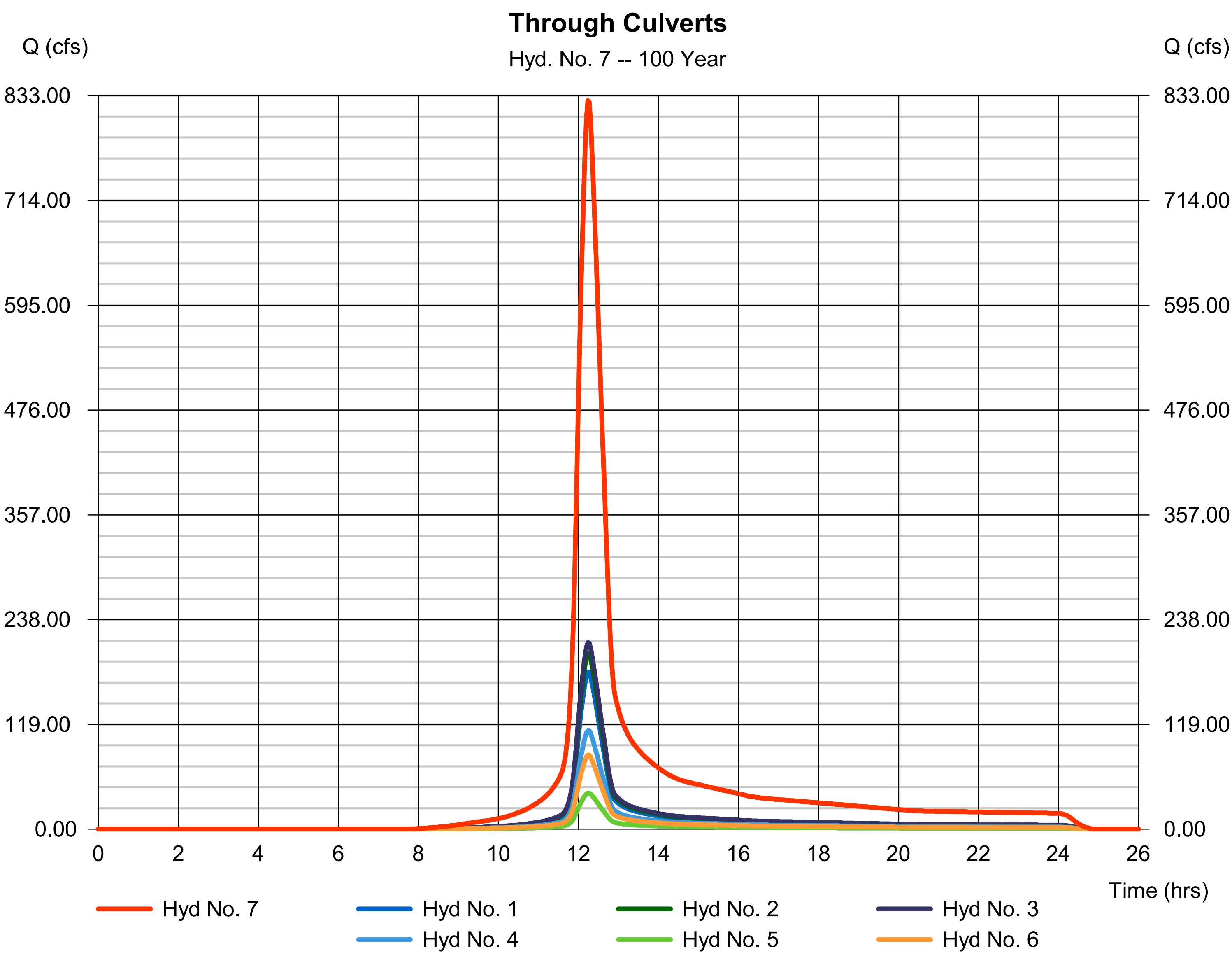
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3 — Tuesday, 04 / 19 / 2022

Hyd. No. 7

Through Culverts

Hydrograph type	= Combine	Peak discharge	= 827.31 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 3,752,680 cuft
Inflow hyds.	= 1, 2, 3, 4, 5, 6	Contrib. drain. area	= 284.280 ac



Hydrograph Report

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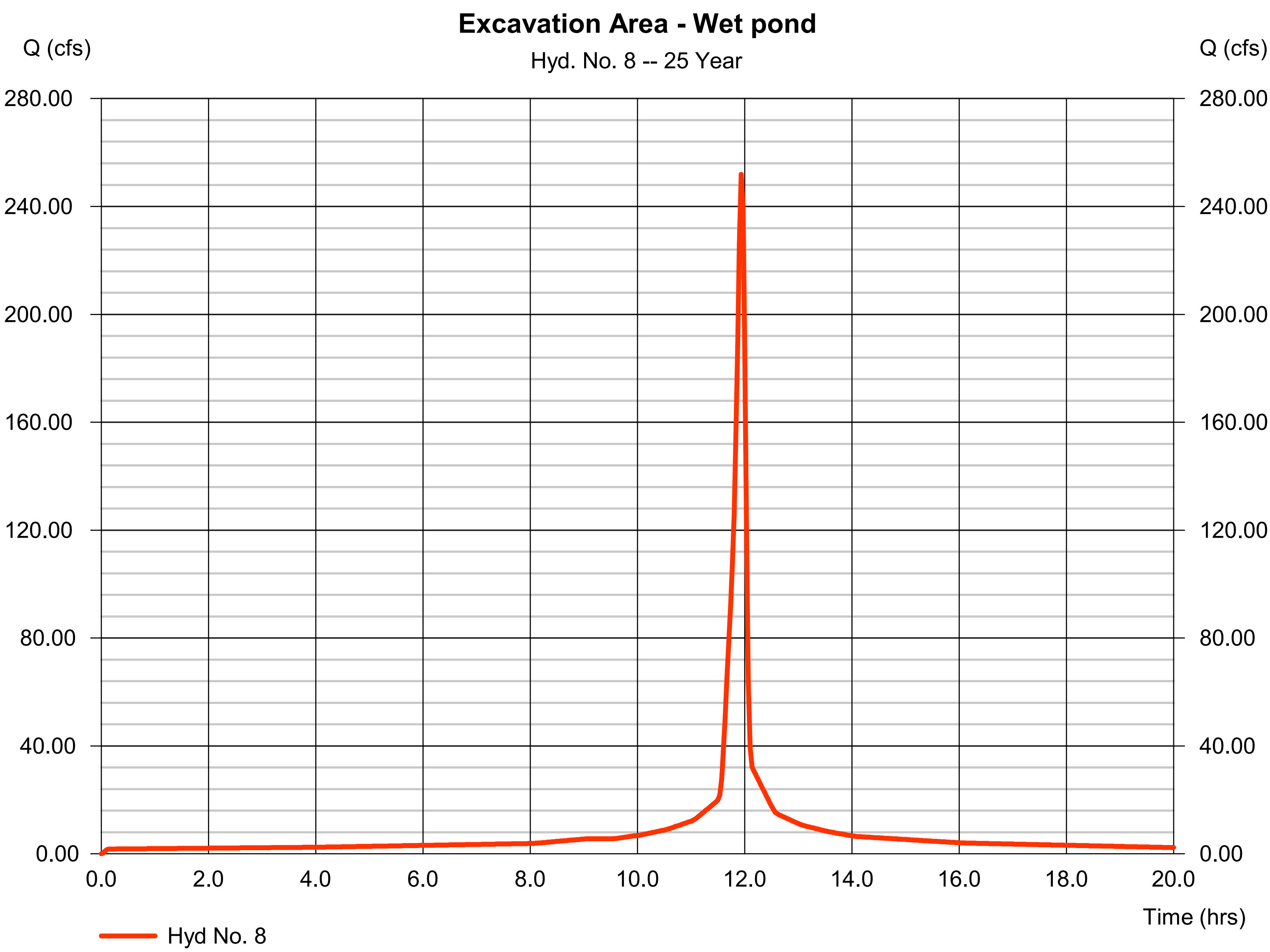
Hyd. No. 8

Excavation Area - Wet pond

Hydrograph type	= SCS Runoff	Peak discharge	= 251.91 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 627,410 cuft
Drainage area	= 35.050 ac	Curve number	= 100
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.26 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

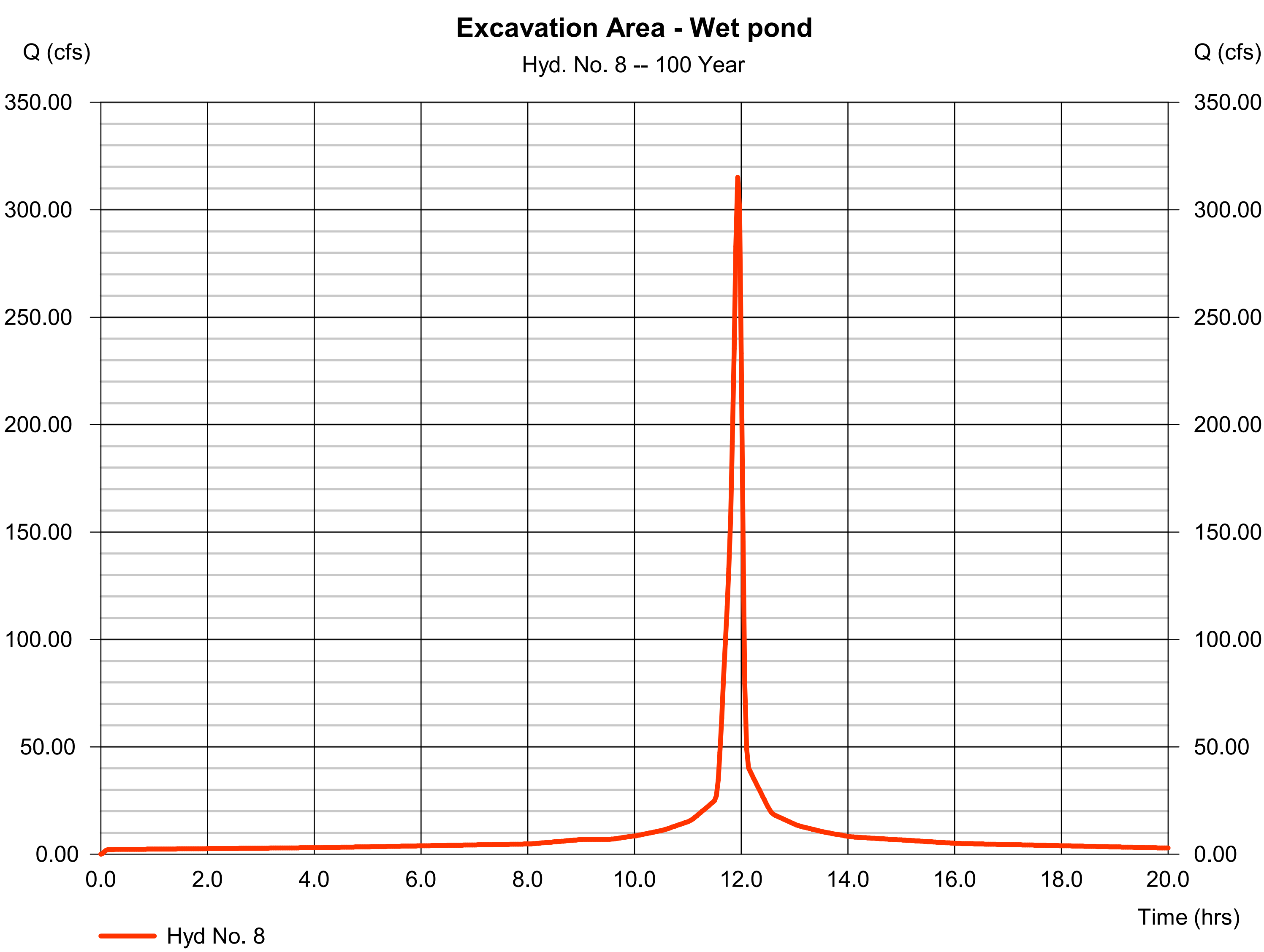


Hydrograph Report

Hyd. No. 8

Excavation Area - Wet pond

Hydrograph type	= SCS Runoff	Peak discharge	= 315.13 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 784,859 cuft
Drainage area	= 35.050 ac	Curve number	= 100
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

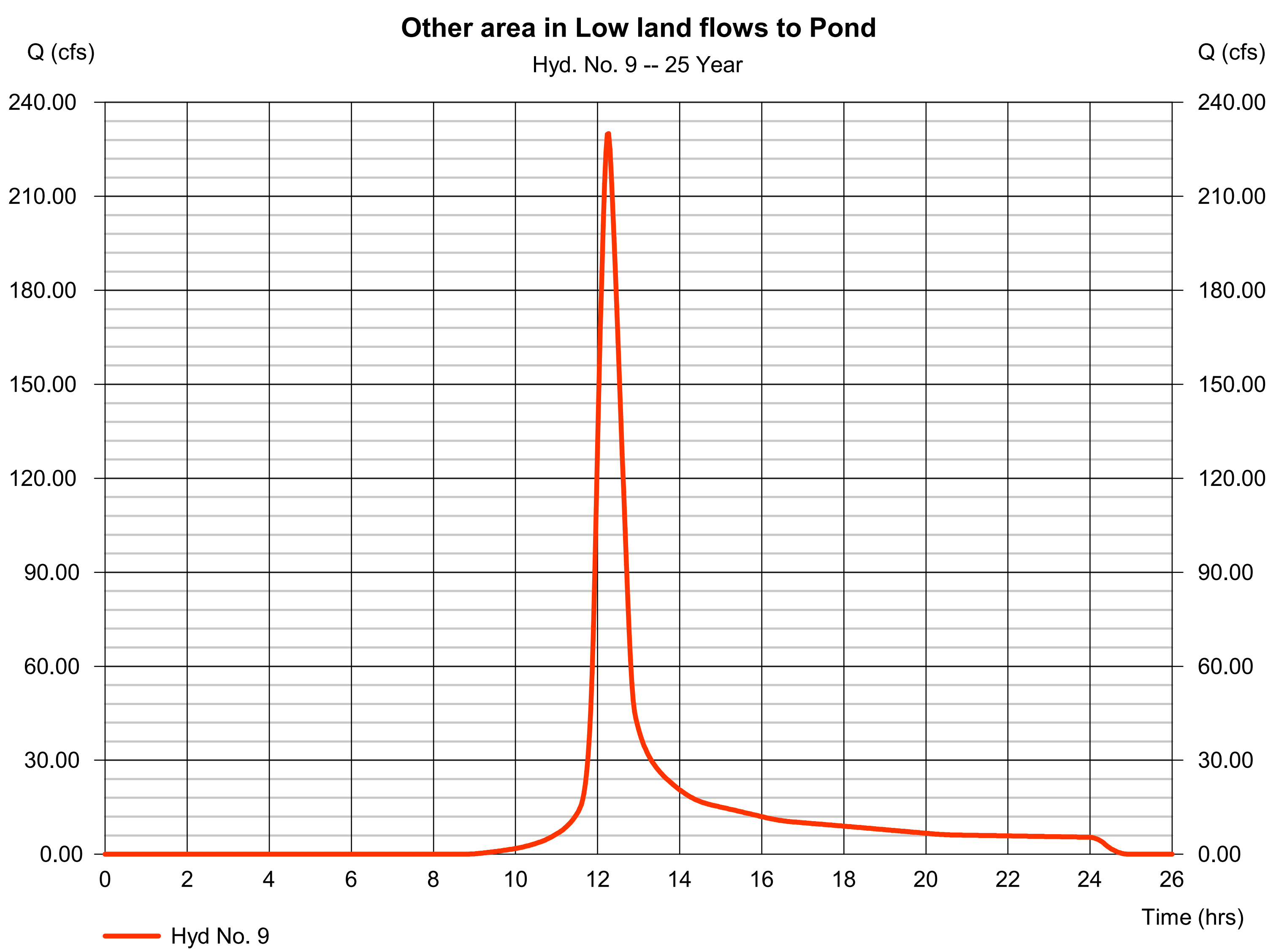


Hydrograph Report

Hyd. No. 9

Other area in Low land flows to Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 230.07 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 1,051,690 cuft
Drainage area	= 113.880 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.50 min
Total precip.	= 5.26 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

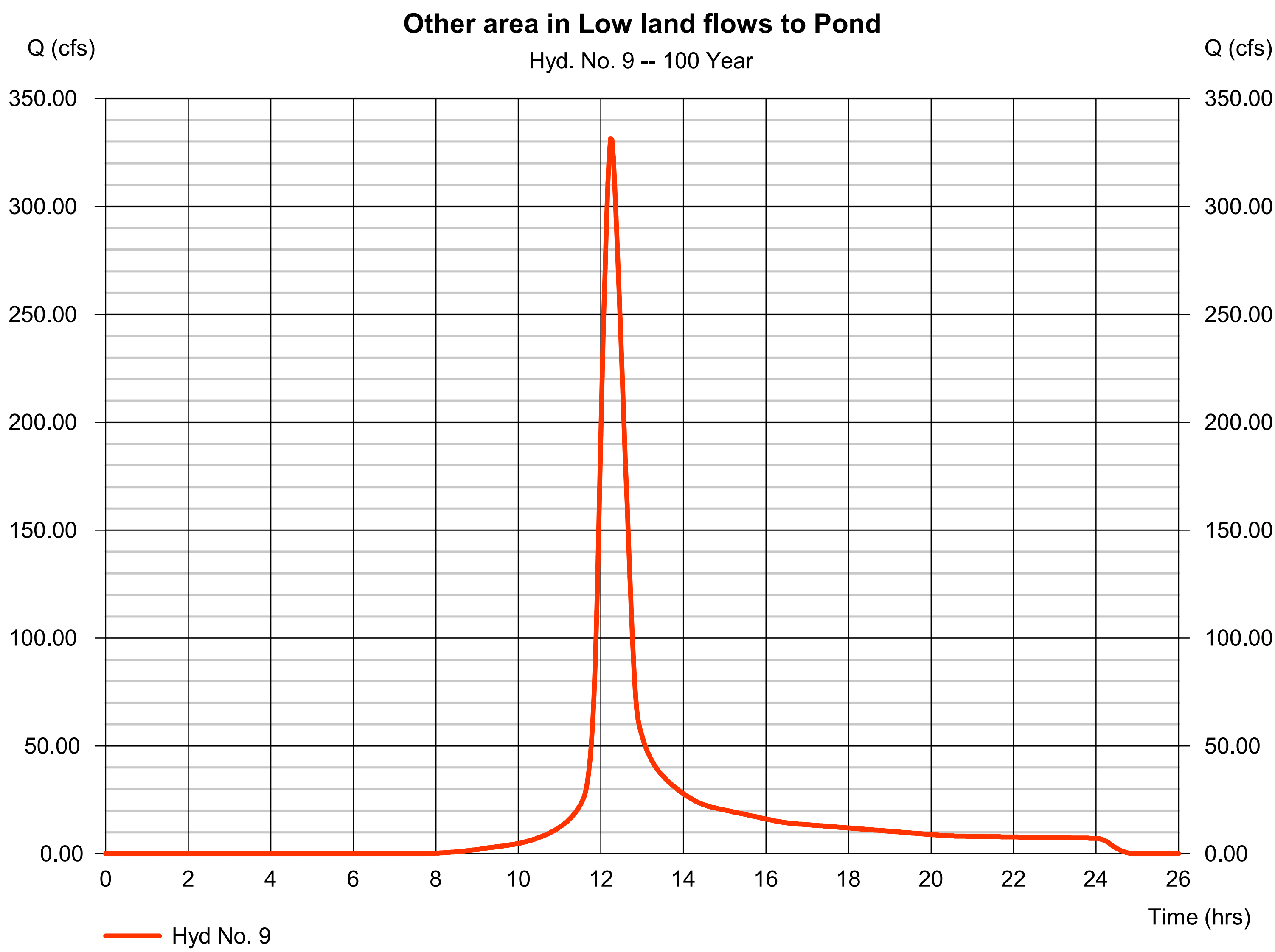


Hydrograph Report

Hyd. No. 9

Other area in Low land flows to Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 331.41 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 1,503,291 cuft
Drainage area	= 113.880 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.50 min
Total precip.	= 6.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

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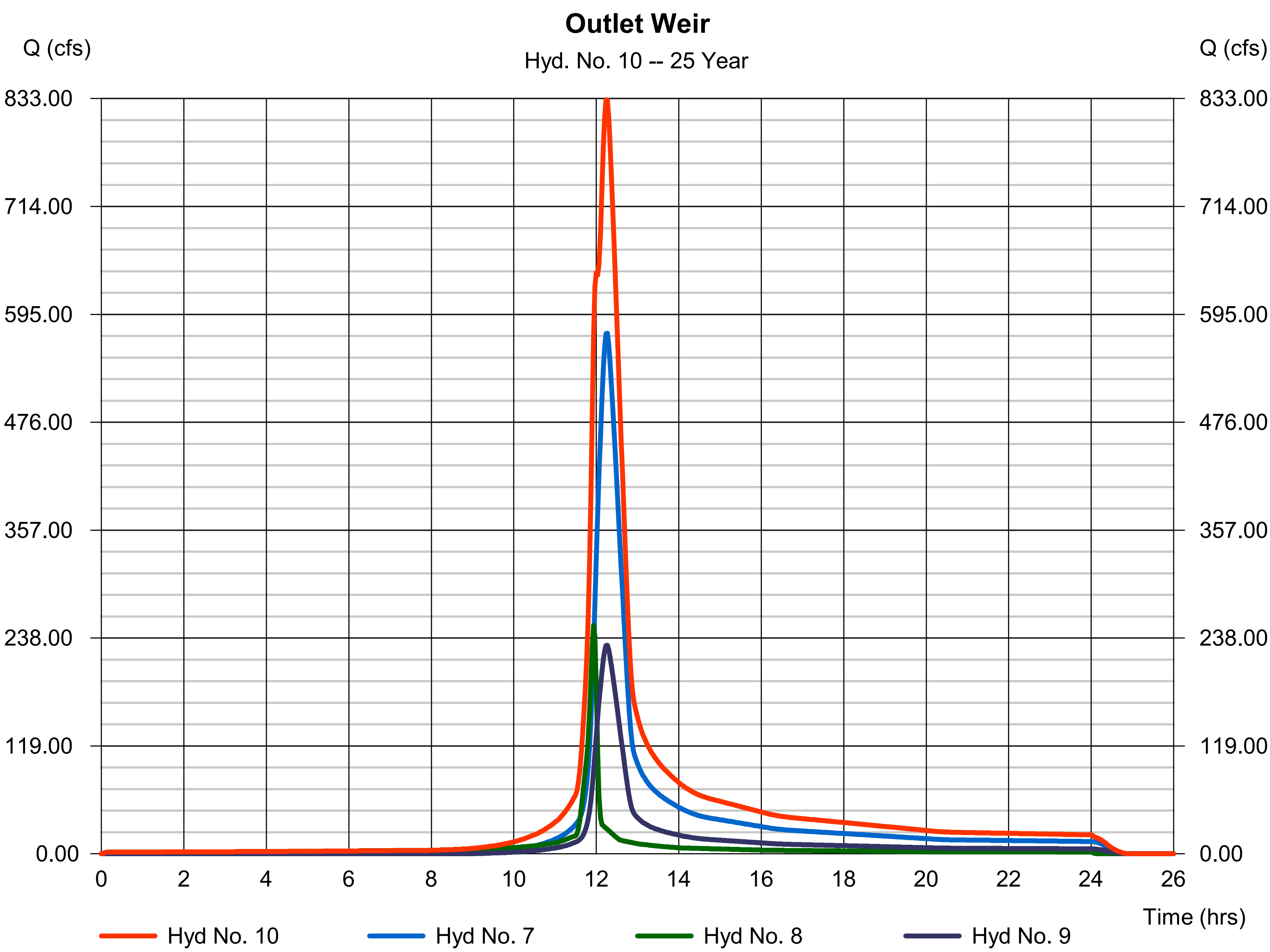
Hyd. No. 10

Outlet Weir

Hydrograph type	= Combine	Peak discharge	= 831.51 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 4,304,447 cuft
Inflow hyds.	= 7, 8, 9	Contrib. drain. area	= 148.930 ac



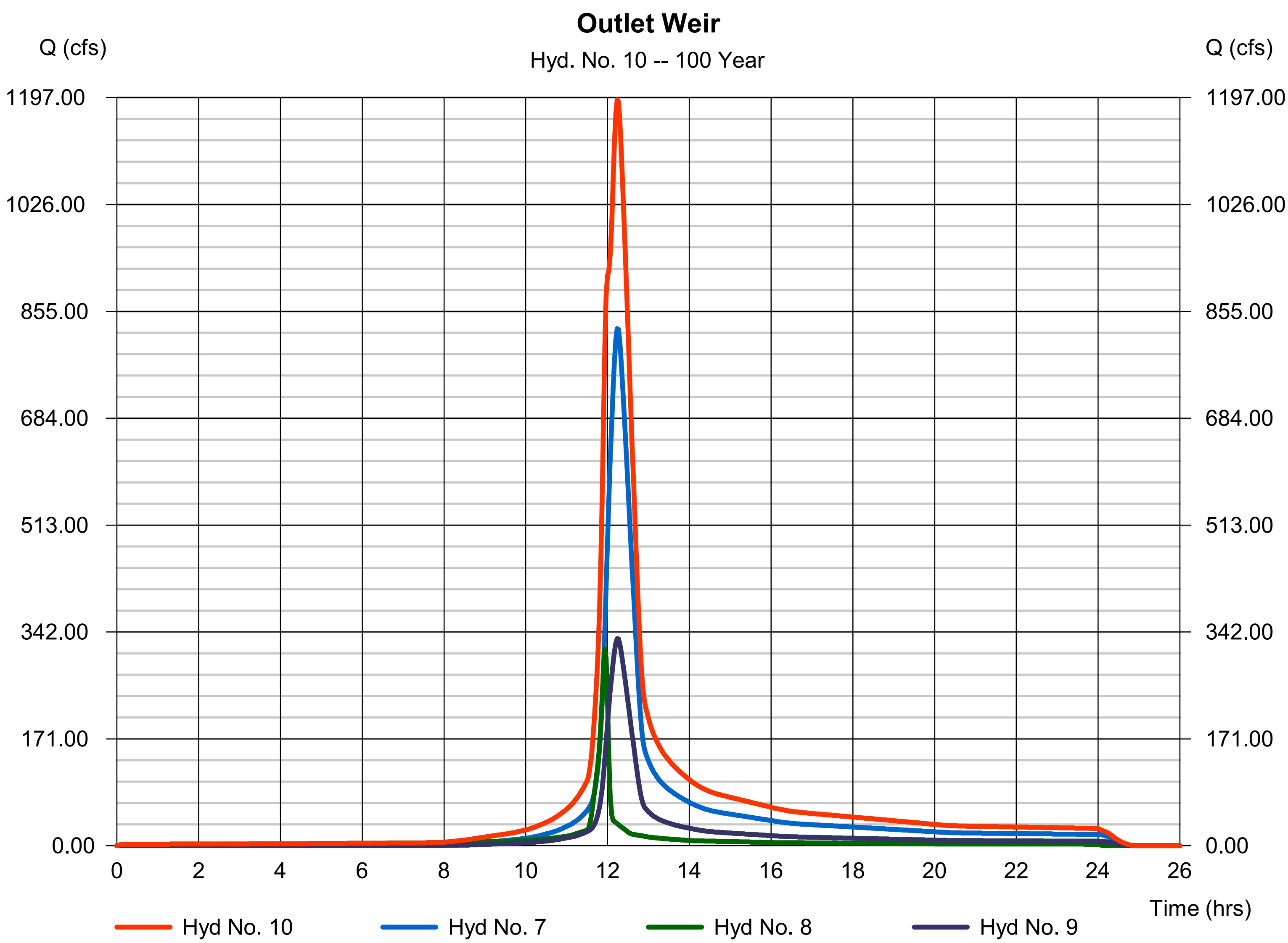
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3 Tuesday, 04 / 19 / 2022

Hyd. No. 10

Outlet Weir

Hydrograph type	= Combine	Peak discharge	= 1193.98 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 6,040,827 cuft
Inflow hyds.	= 7, 8, 9	Contrib. drain. area	= 148.930 ac

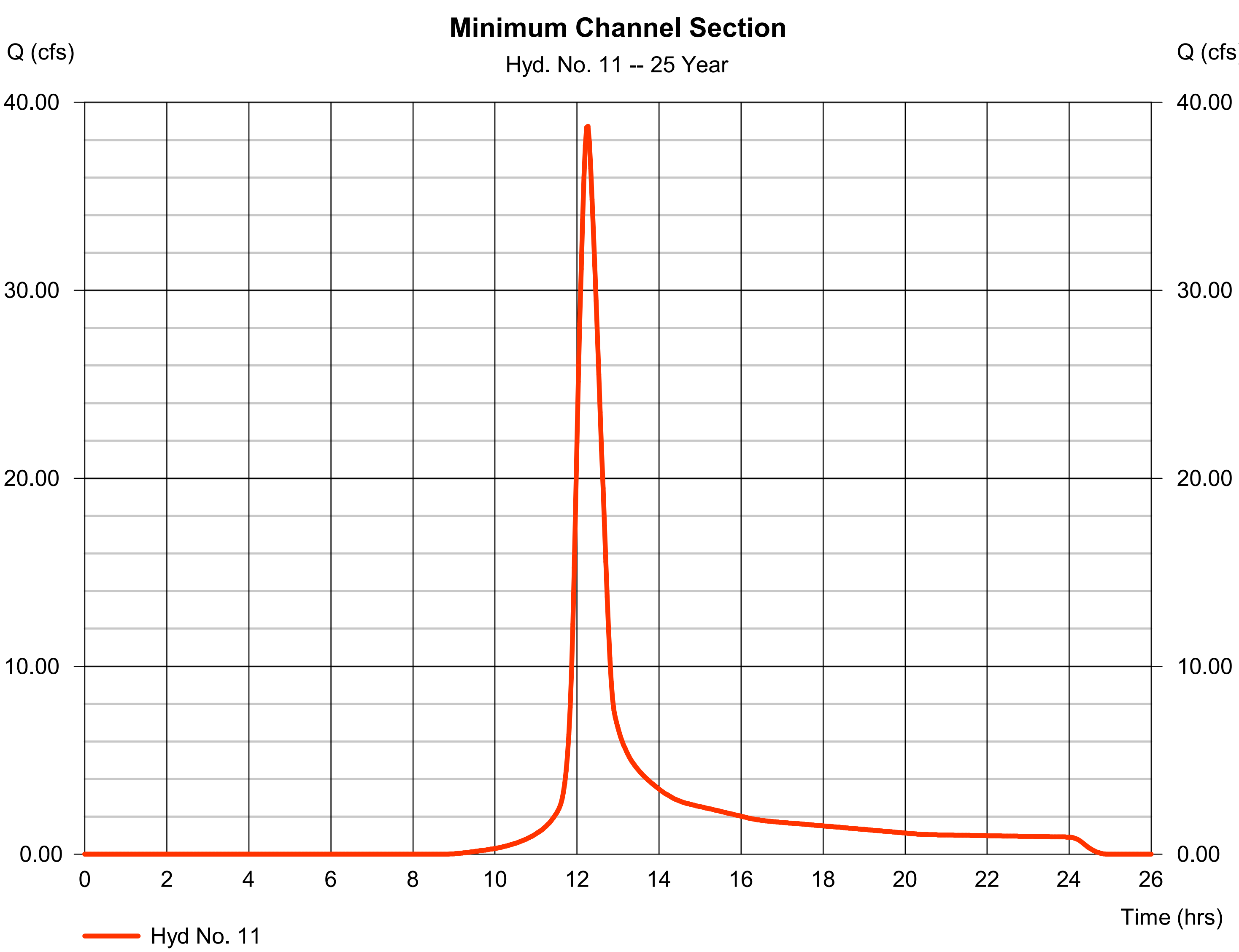


Hydrograph Report

Hyd. No. 11

Minimum Channel Section

Hydrograph type	= SCS Runoff	Peak discharge	= 38.73 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 177,036 cuft
Drainage area	= 19.170 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.50 min
Total precip.	= 5.26 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

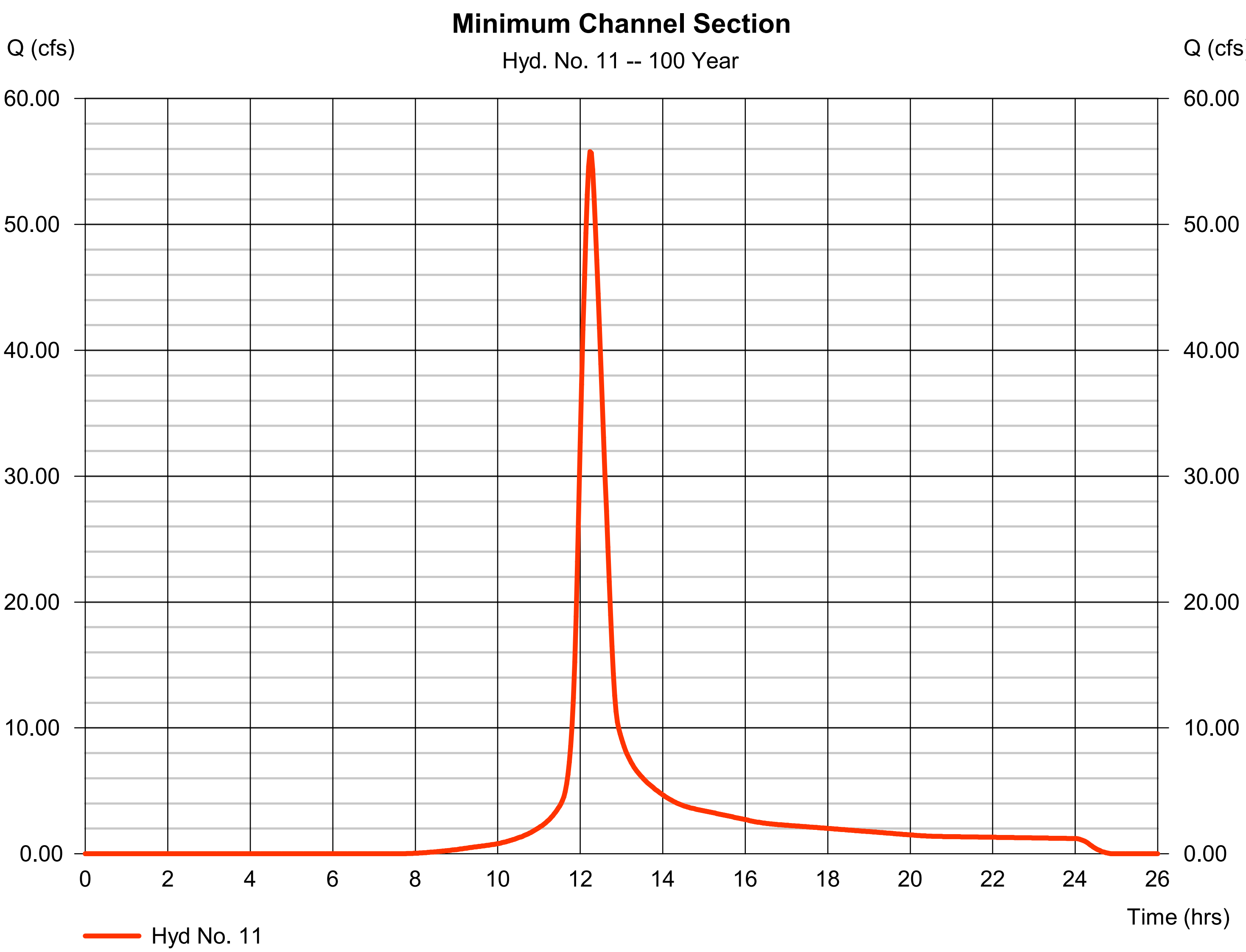


Hydrograph Report

Hyd. No. 11

Minimum Channel Section

Hydrograph type	= SCS Runoff	Peak discharge	= 55.79 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 253,056 cuft
Drainage area	= 19.170 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.50 min
Total precip.	= 6.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Appendix C

Hydroflow Express Output

Channel Report

East Channel Lower Reach

Trapezoidal

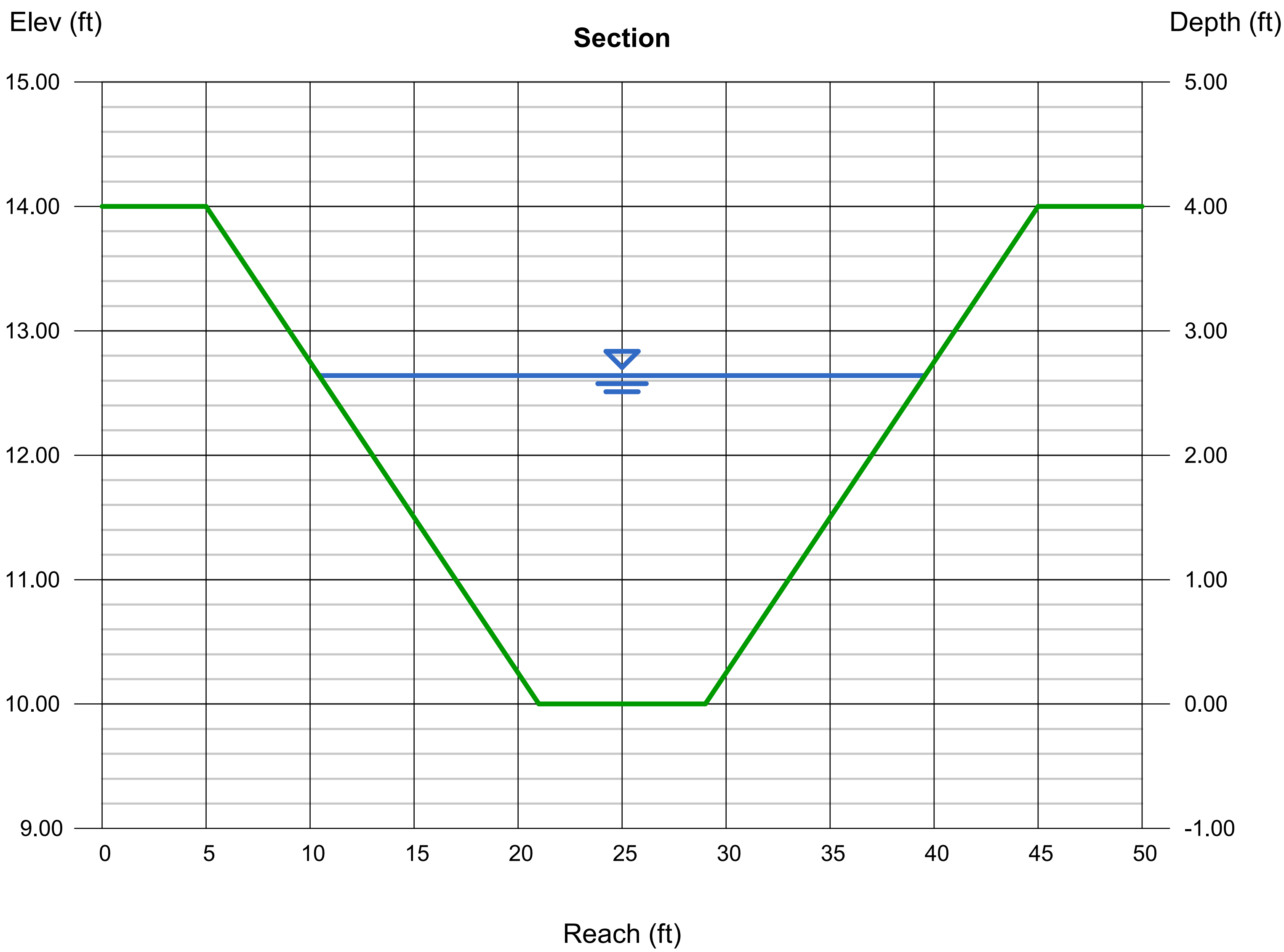
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 4.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.15
N-Value	= 0.022

Calculations

Compute by:	Known Q
Known Q (cfs)	= 178.63

Highlighted

Depth (ft)	= 2.64
Q (cfs)	= 178.63
Area (sqft)	= 49.00
Velocity (ft/s)	= 3.65
Wetted Perim (ft)	= 29.77
Crit Depth, Yc (ft)	= 1.84
Top Width (ft)	= 29.12
EGL (ft)	= 2.85



Channel Report

West Channel

Trapezoidal

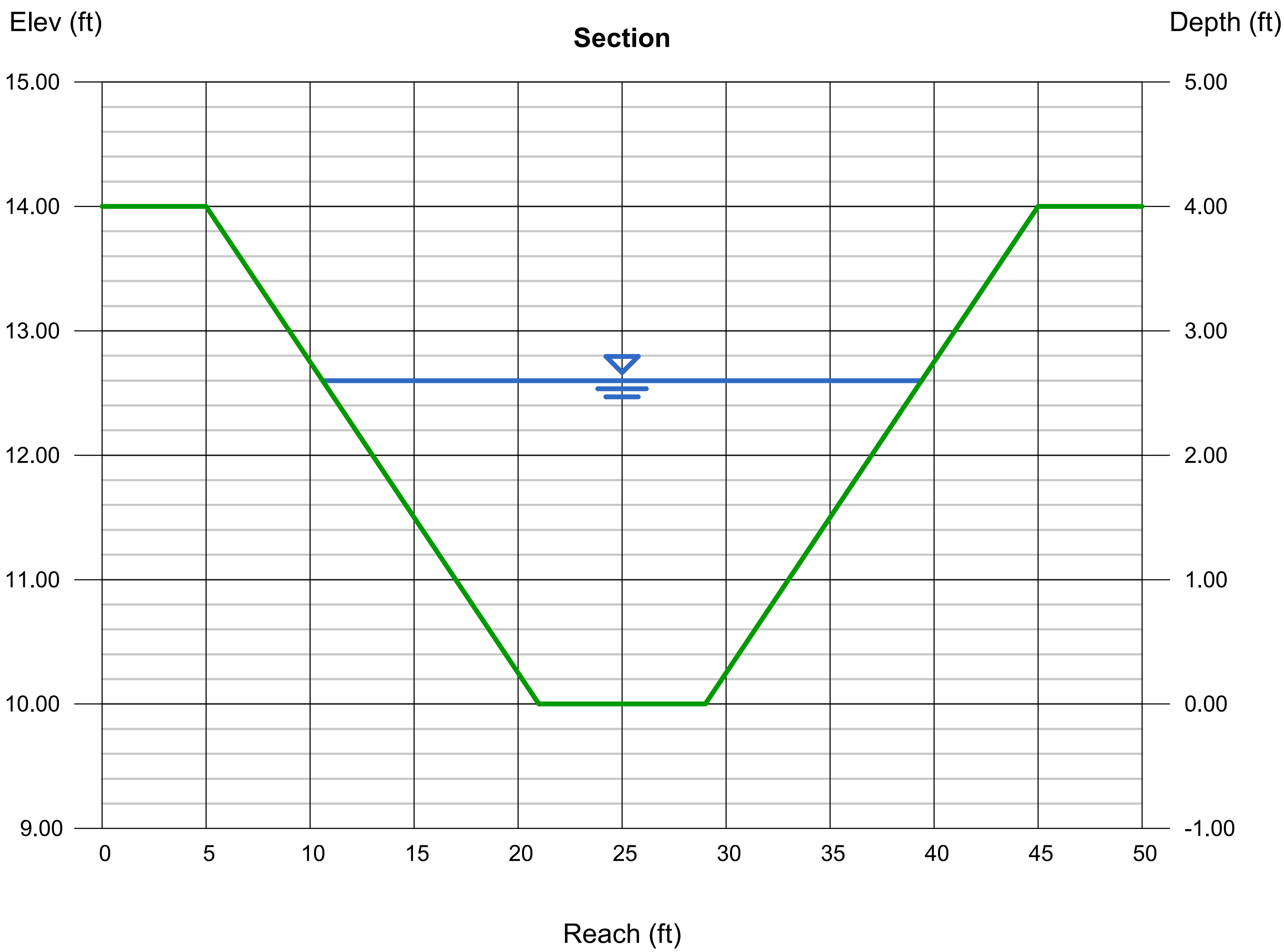
Bottom Width (ft)	=	8.00
Side Slopes (z:1)	=	4.00, 4.00
Total Depth (ft)	=	4.00
Invert Elev (ft)	=	10.00
Slope (%)	=	0.20
N-Value	=	0.022

Calculations

Compute by:		Known Q
Known Q (cfs)	=	199.60

Highlighted

Depth (ft)	=	2.60
Q (cfs)	=	199.60
Area (sqft)	=	47.84
Velocity (ft/s)	=	4.17
Wetted Perim (ft)	=	29.44
Crit Depth, Yc (ft)	=	1.95
Top Width (ft)	=	28.80
EGL (ft)	=	2.87



Channel Report

Central Drainageway

Trapezoidal

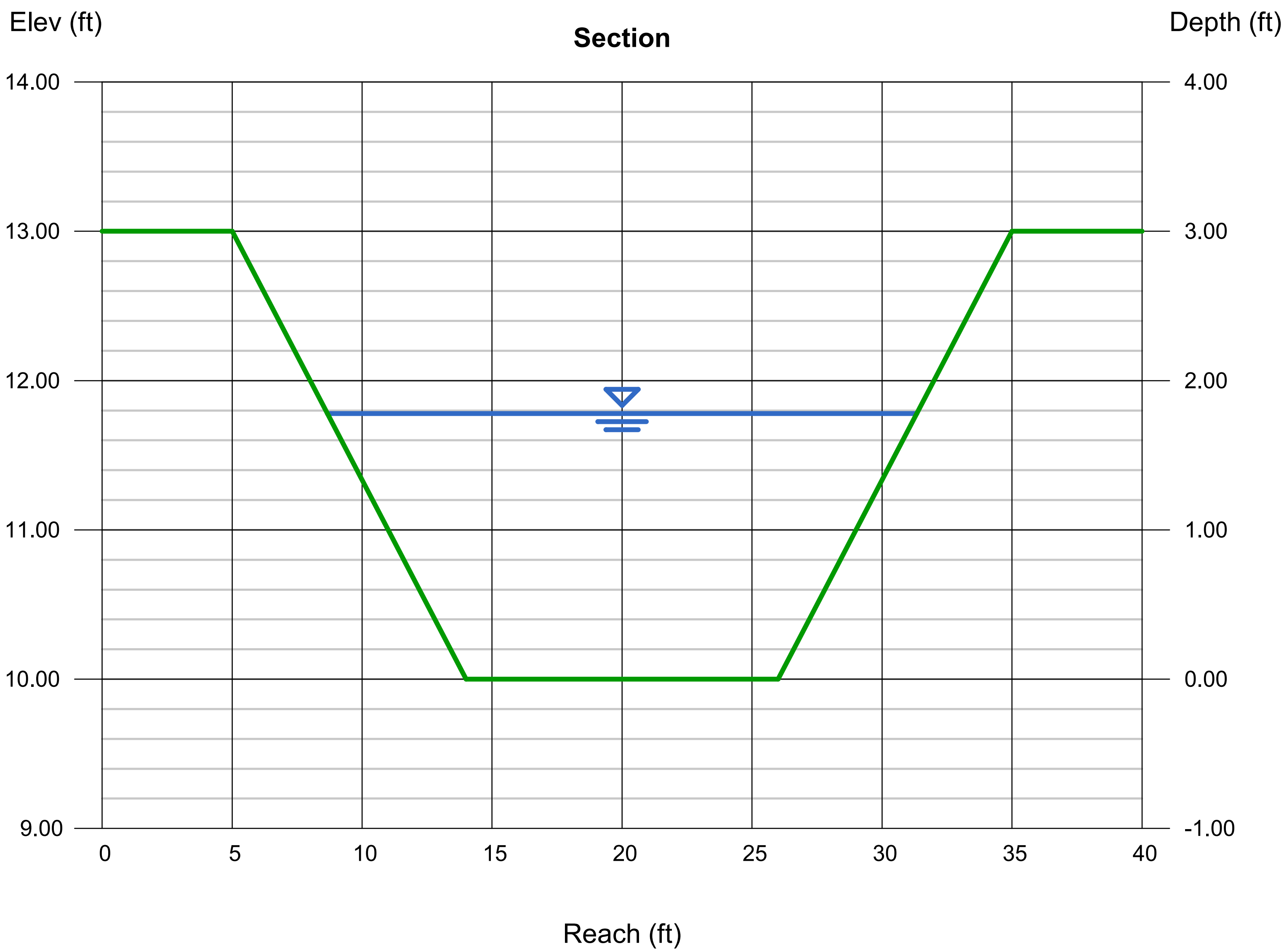
Bottom Width (ft)	=	12.00
Side Slopes (z:1)	=	3.00, 3.00
Total Depth (ft)	=	3.00
Invert Elev (ft)	=	10.00
Slope (%)	=	1.00
N-Value	=	0.026

Calculations

Compute by:		Known Q
Known Q (cfs)	=	212.00

Highlighted

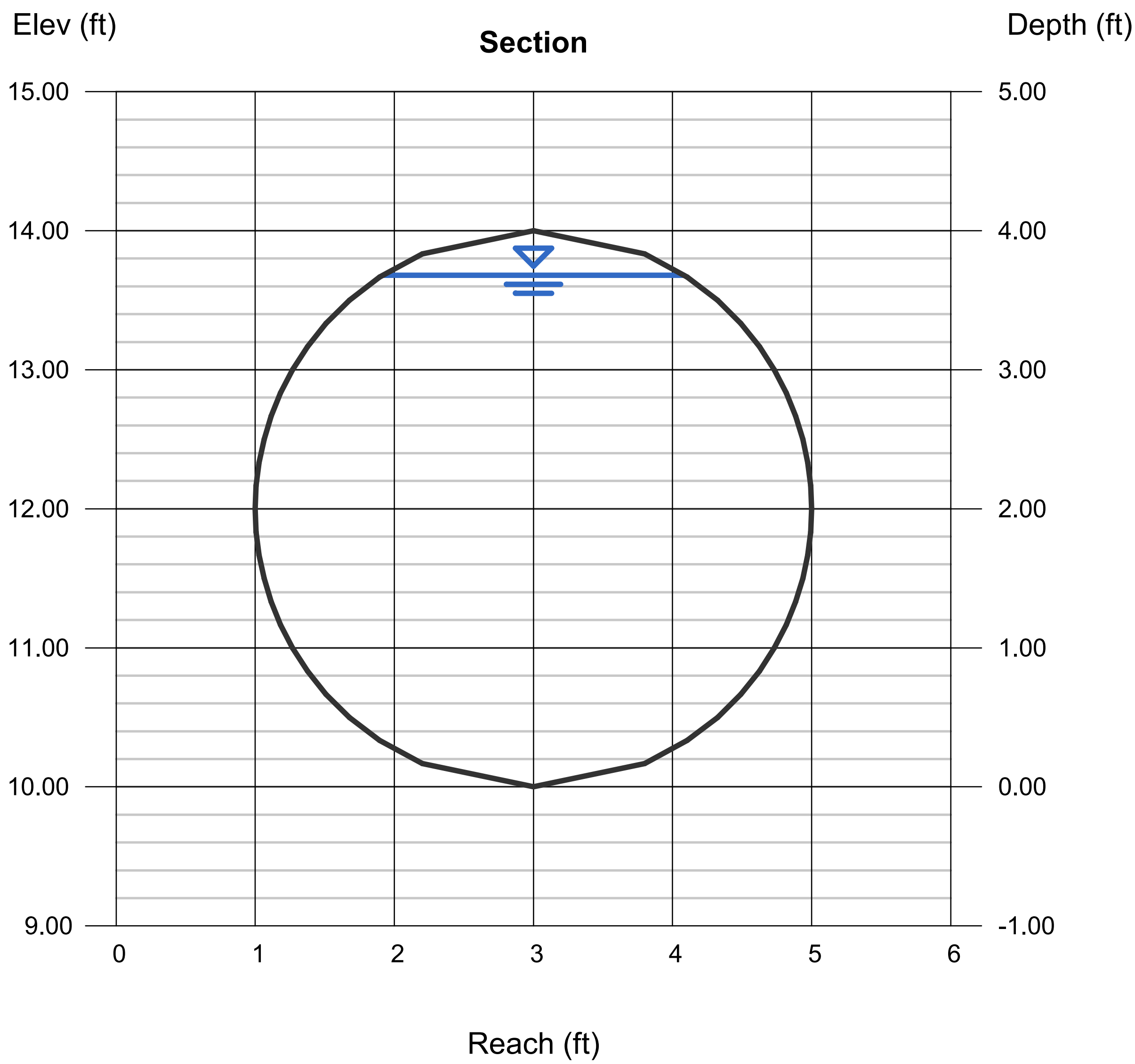
Depth (ft)	=	1.78
Q (cfs)	=	212.00
Area (sqft)	=	30.87
Velocity (ft/s)	=	6.87
Wetted Perim (ft)	=	23.26
Crit Depth, Yc (ft)	=	1.82
Top Width (ft)	=	22.68
EGL (ft)	=	2.51



Channel Report

Culvert Under Perimeter Road x4

Circular		**Highlighted**	
Diameter (ft)	= 4.00	Depth (ft)	= 3.68
		Q (cfs)	= 218.07
		Area (sqft)	= 12.10
Invert Elev (ft)	= 10.00	Velocity (ft/s)	= 18.02
Slope (%)	= 2.00	Wetted Perim (ft)	= 10.28
N-Value	= 0.013	Crit Depth, Yc (ft)	= 3.89
		Top Width (ft)	= 2.16
Calculations		EGL (ft)	= 8.73
Compute by:	Q vs Depth		
No. Increments	= 25		



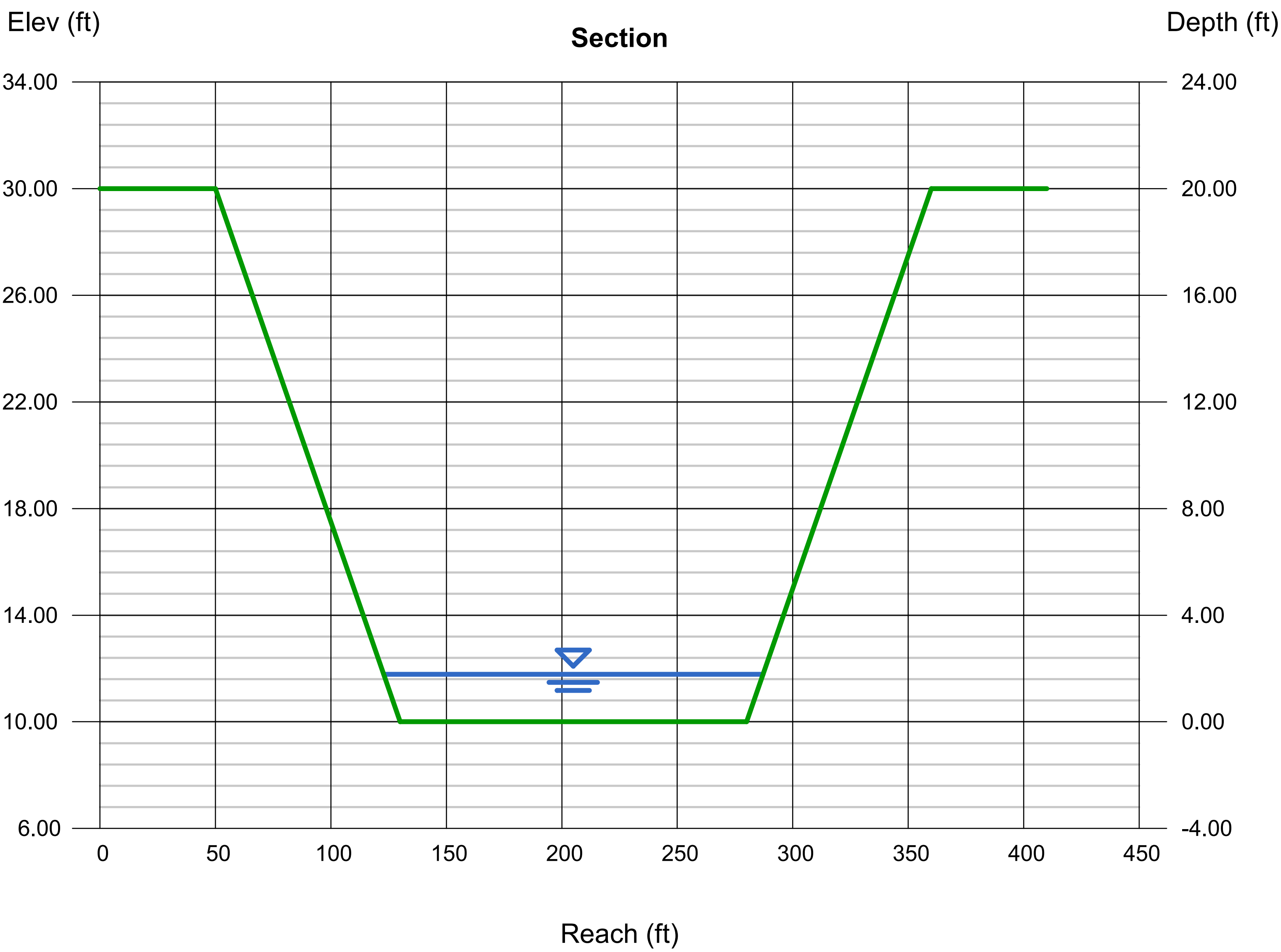
Channel Report

Outlet Weir

Trapezoidal	
Bottom Width (ft)	= 150.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 20.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.20
N-Value	= 0.022

Calculations	
Compute by:	Known Q
Known Q (cfs)	= 1194.00

Highlighted	
Depth (ft)	= 1.78
Q (cfs)	= 1,194
Area (sqft)	= 279.67
Velocity (ft/s)	= 4.27
Wetted Perim (ft)	= 164.68
Crit Depth, Yc (ft)	= 1.24
Top Width (ft)	= 164.24
EGL (ft)	= 2.06

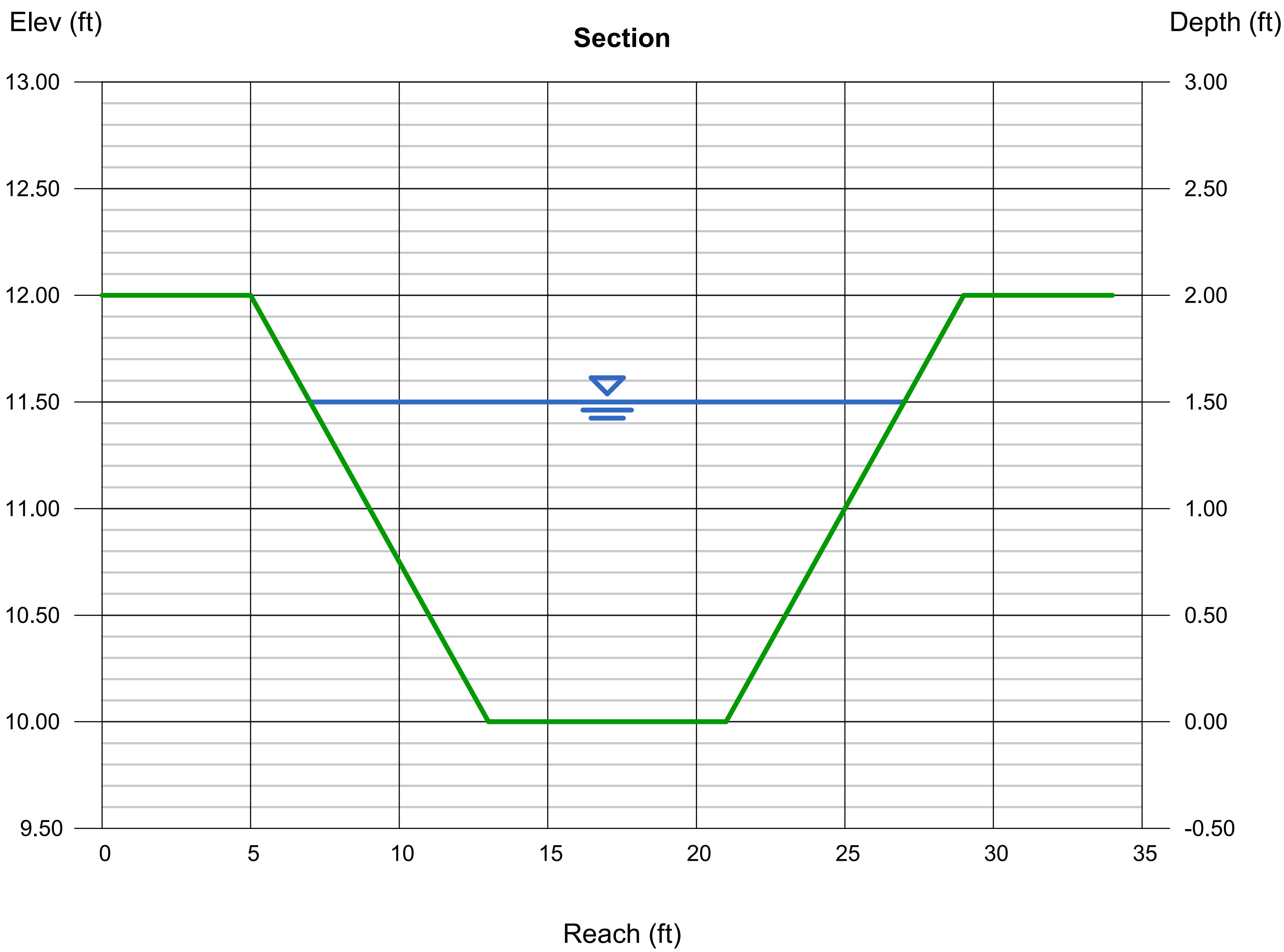


Channel Report

East Channel Minimum Section

Trapezoidal	
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.15
N-Value	= 0.022
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 56.00

Highlighted	
Depth (ft)	= 1.50
Q (cfs)	= 56.00
Area (sqft)	= 21.00
Velocity (ft/s)	= 2.67
Wetted Perim (ft)	= 20.37
Crit Depth, Yc (ft)	= 0.98
Top Width (ft)	= 20.00
EGL (ft)	= 1.61



Attachment D

Geotechnical Design of Slopes and Final Cover System

Slope Stability Report for IPGC Newton Primary Ash Pond Closure

Newton, Illinois

July 2022

Certification

LICENSED PROFESSIONAL ENGINEER MARK GLYN ROBERTS 062.062011 STATE OF ILLINOIS	I hereby certify that these engineering documents were prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Illinois. 7/28/2022 Mark Roberts, P.E. Date Illinois License No. 062062011 My license renewal date is November 30, 2023. Pages or sheets covered by this seal: All pages.

Table of Contents

Figures

Attachments

References

1. Slope/W Version v11.14.1.3, build 212549 x64_n6; GeoStudio 2019, Geo-Slope International, Ltd.
2. Global Stability Evaluation for Newton Power Station, Primary Ash Pond, Newton, Illinois, January 4, 2011.
3. Slope Stability Calculations, AECOM, 2016.
4. Geotechnical Engineering Properties of Fly Ash and Bottom Ash.
5. U.S. Geological Survey – Earthquake Hazards Program

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1 Purpose

The purpose of this report is to evaluate the global slope stability for the IPGC Newton Power Station Primary Ash Pond Closure slopes. These calculations focus on the stability of the existing base grades, placed ash, and final cover system, assuming typical material properties based on static and seismic conditions.

The global slope stability through the ash fill final closure slope for the following scenarios were evaluated:

- Run A – A northeast-southwest section through the south side slope in order to evaluate the slope stability of the ash fill on a 4H:1V slope. **Figure 2, Section A-A**.
- Run B – A northeast-southwest section through the south side slope in order to evaluate the slope stability of the ash fill on a 4H:1V slope and seismic impact. **Figure 3, Section A-A**.
- Run C – A northeast-southwest section through the south side slope in order to evaluate the sliding block slope stability of the ash fill on a 4H:1V slope. **Figure 4, Section A-A**.
- Run D – A northeast-southwest section through the south side slope in order to evaluate the sliding block slope stability of the ash fill on a 4H:1V slope and seismic impact. **Figure 5, Section A-A**.
- Run E – A northeast-southwest section through the south side slope in order to evaluate the slope stability of the ash fill on a 4H:1V slope. **Figure 6, Section B-B**.
- Run F – A northeast-southwest section through the south side slope in order to evaluate the slope stability of the ash fill on a 4H:1V slope and seismic impact. **Figure 7, Section B-B**.
- Run G – A northeast-southwest section through the south side slope in order to evaluate the sliding block slope stability of the ash fill on a 4H:1V slope. **Figure 8, Section B-B**.
- Run H – A northeast-southwest section through the south side slope in order to evaluate the sliding block slope stability of the ash fill on a 4H:1V slope and seismic impact. **Figure 9, Section B-B**.

2 Approach

Two-dimensional limit equilibrium methods were used to evaluate slope stability for the static condition. Per the historical permit documentation, the site was determined to be in a seismic impact zone.

Per the Illinois Department of Natural Resources, the seismic hazard analysis should use bedrock peak ground accelerations with a 2% probability of exceedance (PE) in 50 years (mean return time of 2,500 years). The National Seismic Hazards Mapping Project (NSHMP) interactive deaggregations model (2014 edition) was used to obtain the probabilistic bedrock accelerations at the site. The NSHMP model considers ground motion from many sources surrounding the site location with the assumption that the site condition is rock with an average shear wave velocity of 2,500 ft/s. Bedrock spectral response acceleration 0.2286 g were obtained from the NSHMP model (**Attachment B**). The seismic coefficient for the seismic slope stability runs was determined via the United States Army Corps of Engineers 'Rationalizing the Seismic Coefficient Method Report', published in July 1984, which states: "carry out a conventional pseudostatic stability analysis using a seismic coefficient equal to one-half the predicted peak bedrock acceleration". This method yields a seismic coefficient of 0.115 g based on a peak bedrock acceleration of 0.2286 g.

The base computer program Slope/W was used to run Morgenstern-Price analysis type circular arc surfaces and sliding block surfaces. Search techniques within Slope/W were used to find the critical slip surface producing the minimum factor of safety for each analysis. The location of the critical slip surface is a function of the site geometry (slope angle and height), material stratigraphy, physical properties of the soil and fly ash, external loads; weight of soil and/or waste above the slip surface and groundwater conditions.

3 Material Properties and Sections

3.1 Slope Stability

The materials were grouped into four (4) basic types similar to previous analyses (see references 2 and 3). Material properties were determined by review of site specific information and experience with similar materials. See Table 1 below. For this analysis, an internal angle of friction of 25-degrees for the fly ash was used based on typical results for dry fly ash. Each scenario is based on long-term properties, to be conservative.

In addition, final cover veneer slope stability analysis was conducted to evaluate the stability of the final cover soil over the final cover membrane system. Final cover veneer results are provided in **Attachment A.**

Table 1: Material Characteristics

Material/Description	Moist Unit Weight (PCF)	Cohesion (PSF)	Friction Angle (DEG)
Embankment Fill	125	50	25
Existing Silty-Clay/Clay	120	50	30
Fly Ash	112	0	25
Final Cover System	125	50	25

Notes (Basis):

1. Embankment Fill and Existing Silty-Clay/Clay characteristics are based on the Global Stability Evaluation Report.
2. Fly ash characteristics are based on industry standard values for dry fly ash.
3. Final cover system is based on average values.

4 Stability Analysis Results and Conclusions

4.1 Ash Fill Scenarios

The table below summarizes results from the stability analyses for the slopes:

Run	Case	Slope	Condition	Slip Surface	Factor of Safety
Final Cover Ash Fill Slope – Cross Section A-A					
A	Ash Fill Slope – Final Cover **(Figure 2)**	4H:1V	Long Term	Circular	1.971
B	Ash Fill Slope – Final Cover **(Figure 3)**	4H:1V	Long Term	Circular - Seismic	1.318
C	Ash Fill Slope – Final Cover **(Figure 4)**	4H:1V	Long Term	Sliding Block	1.893
D	Ash Fill Slope – Final Cover **(Figure 5)**	4H:1V	Long Term	Sliding Block - Seismic	1.272
Final Cover Ash Fill Slope – Cross Section B-B					
E	Ash Fill Slope – Final Cover **(Figure 6)**	4H:1V	Long Term	Circular	1.683
F	Ash Fill Slope – Final Cover **(Figure 7)**	4H:1V	Long Term	Circular - Seismic	1.596
G	Ash Fill Slope – Final Cover **(Figure 8)**	4H:1V	Long Term	Sliding Block	1.744
H	Ash Fill Slope – Final Cover **(Figure 9)**	4H:1V	Long Term	Sliding Block - Seismic	1.046
Final Cover Veneer Stability					
-	Final Cover Veneer – Static	4H:1V	Long Term	Veneer	2.11
-	Final Cover Veneer – Seismic	4H:1V	Long Term	Veneer	1.12

4.2 Conclusions

Illinois Department of Natural Resources recommends a minimum factor of safety of 1.5 for long-term stability. During an extreme event, such as an earthquake, a factor of safety of 1.0 or more is recommended. Based on the results of our analyses, the embankment slopes have satisfactory factors of safety for global stability and veneer stability.

This model was generated using typical material properties. Results are based on design assumptions as stated and HDR is not responsible for deviations from the operational/design assumptions.

The outputs from the computer results of stability analyses are attached to this report with the **Figures** section.

Figures

Plans, Cross Sections, and Slope Stability Output

PROJECT MANAGER	M. ROBERTS
CIVIL	G. WILLIAMS
CIVIL	K. KINLEY
DRAWN BY	M. BICKFORD
PROJECT NUMBER	10296144

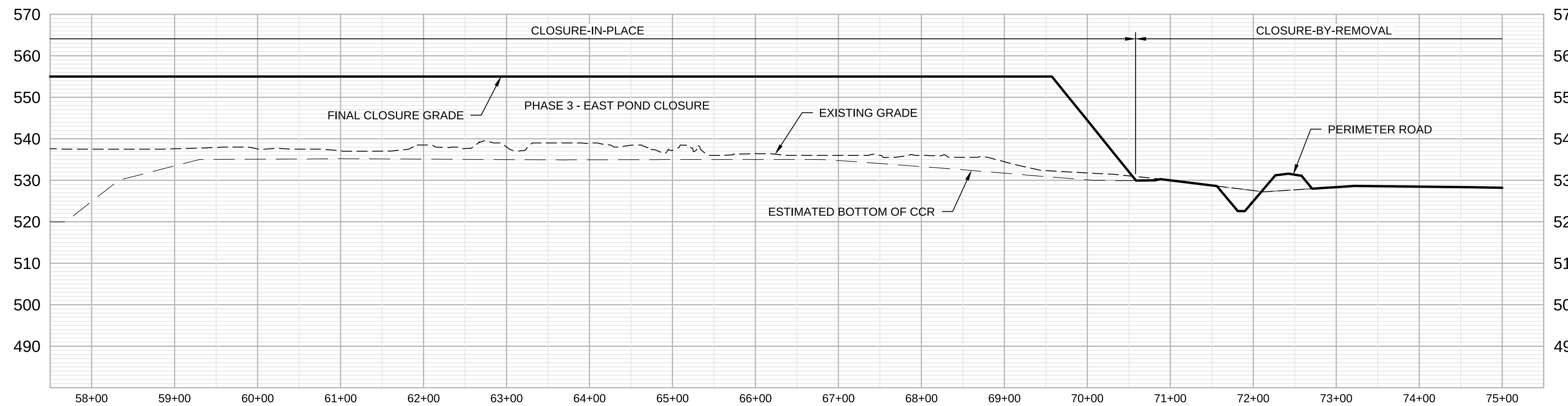
ISSUE	DATE	DESCRIPTION

ILLINOIS POWER GENERATING COMPANY
NEWTON POWER PLANT
PRIMARY ASH POND CLOSURE

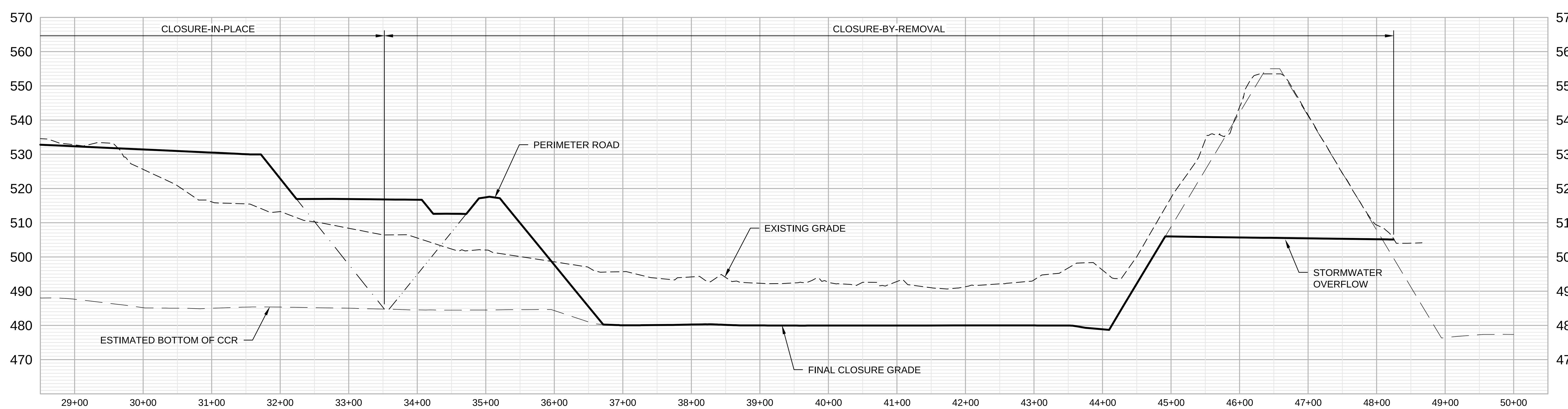
FINAL CLOSURE CONDITIONS

FILENAME 00C106.DWG
SCALE 1" = 300'
SHEET **00C106**

c:\pwworking\central01\d2372207\00C106.dwg, Layout1, 4/19/2022 4:30:55 PM, MBICKFORD



A-A
00C106
SECTION A-A (cont.)
HORIZ: 1" = 100' | VERT: 1" = 20'



B-B
00C106
SECTION B-B (cont.)
HORIZ: 1" = 100' | VERT: 1" = 20'

HDR

Figure 1
Closure Cross Sections

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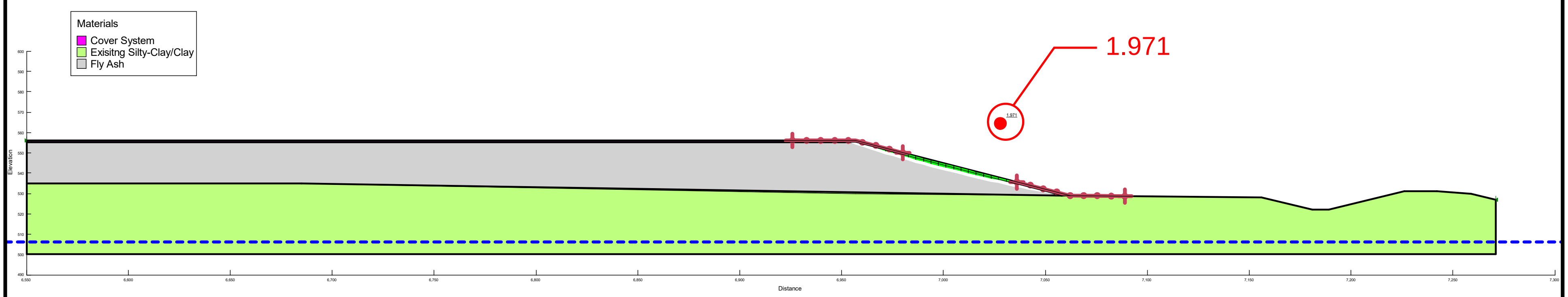

FIGURE 2

Note:
1. Water elevation estimated from Groundwater Modeling Report, Figure 2-2 Uppermost Aquifer Groundwater Elevation Contours, prepared by Ramboll, dated July 2022.

SLOPE/W Analysis	
AA Slope Circular.gsz	
07/20/2022	1:917

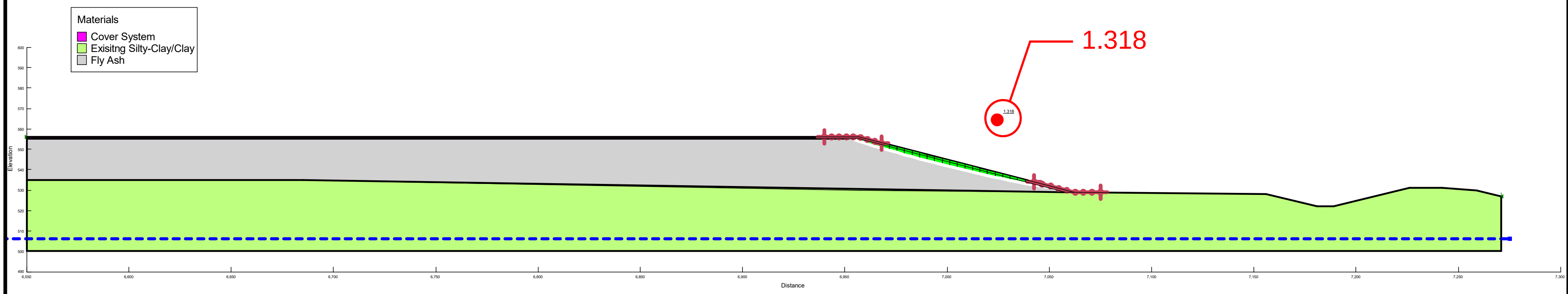

FIGURE 3

SLOPE/W Analysis	
AA Slope Circular - Seismic.gsz	
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Note:

1. Water elevation estimated from Groundwater Modeling Report, Figure 2-2 Uppermost Aquifer Groundwater Elevation Contours, prepared by Ramboll, dated July 2022.

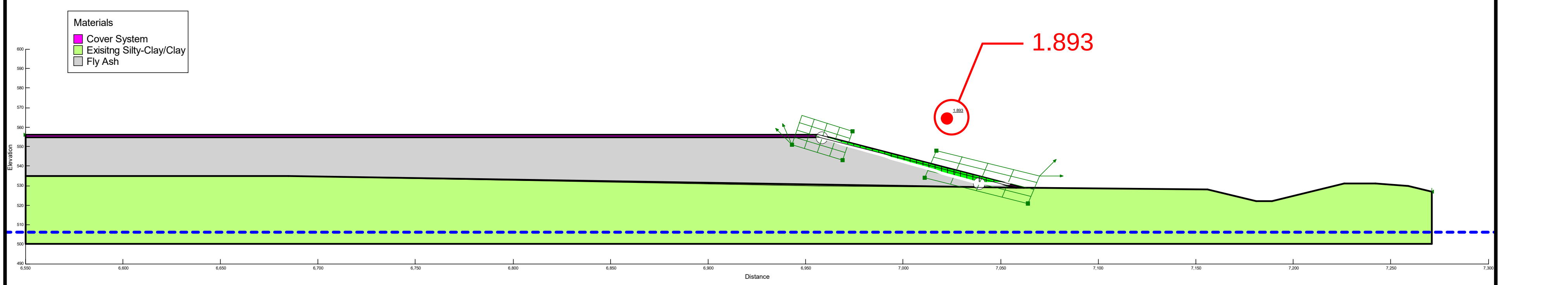

FIGURE 4

SLOPE/W Analysis	
AA Slope - Sliding Block.gsz	
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Note:

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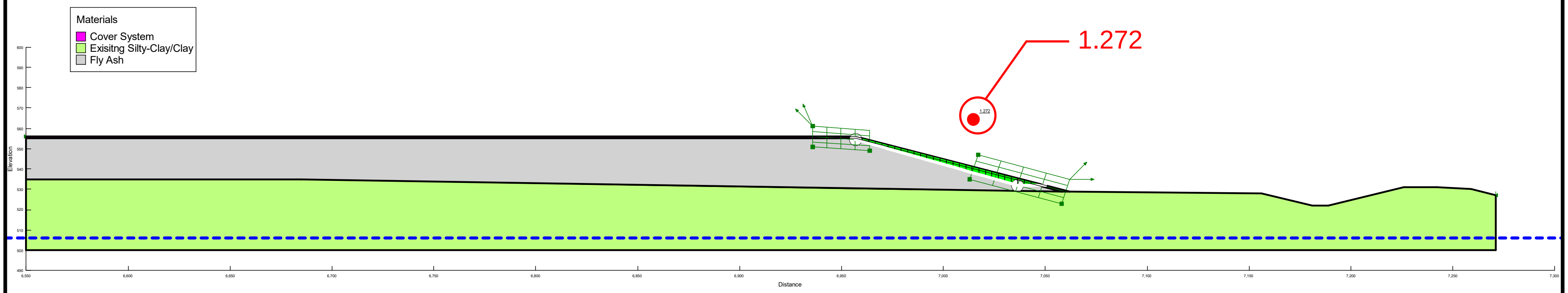

FIGURE 5

Note:
1. Water elevation estimated from Groundwater Modeling Report, Figure 2-2 Uppermost Aquifer Groundwater Elevation Contours, prepared by Ramboll, dated July 2022.

SLOPE/W Analysis	
AA Slope - Sliding Block - Seismic.gsz	
07/19/2022	1:917

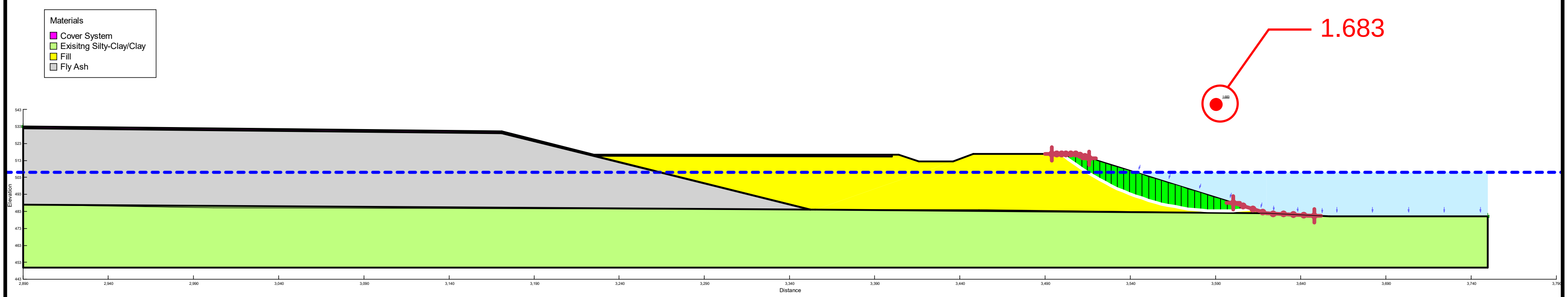

FIGURE 6

Note:
1. Water elevation estimated from Groundwater Modeling Report, Figure 2-2 Uppermost Aquifer Groundwater Elevation Contours, prepared by Ramboll, dated July 2022.

SLOPE/W Analysis	
BB Slope Circular.gsz	
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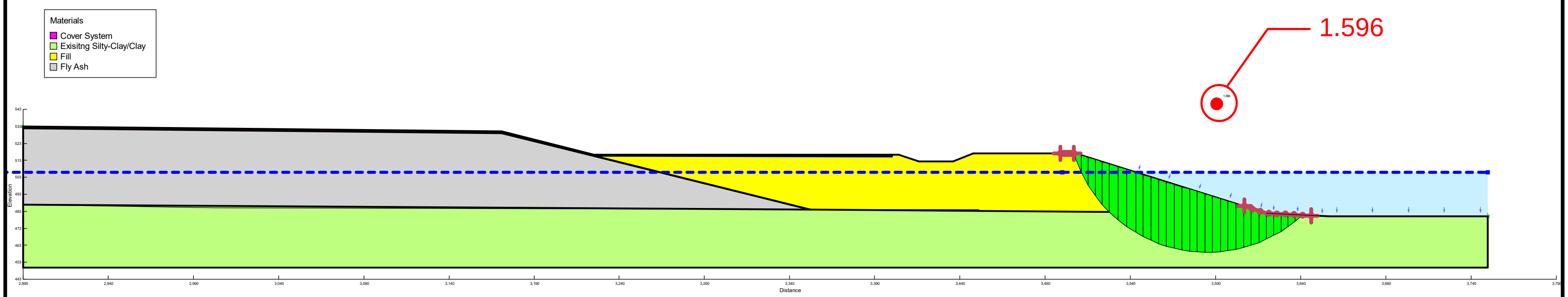

FIGURE 7

Note:
1. Water elevation estimated from Groundwater Modeling Report, Figure 2-2 Uppermost Aquifer Groundwater Elevation Contours, prepared by Ramboll, dated July 2022.

SLOPE/W Analysis	
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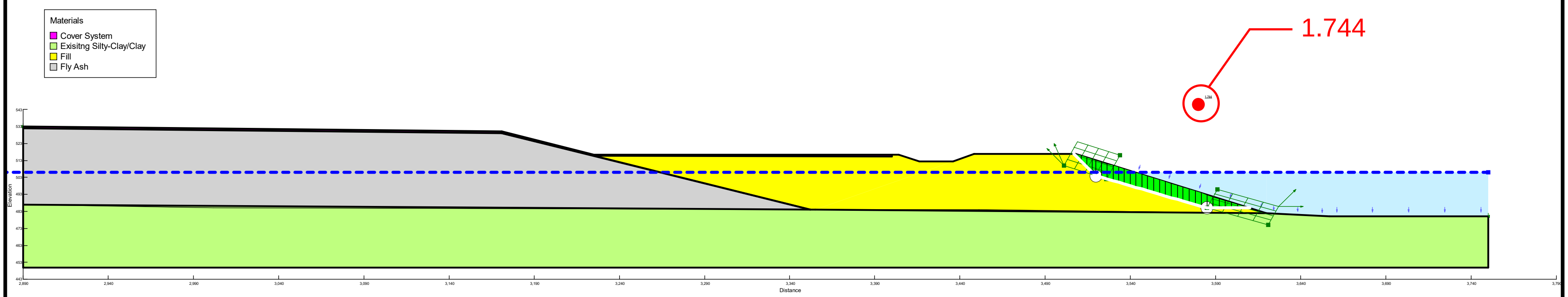

FIGURE 8

SLOPE/W Analysis	
BB Slope-Sliding Block.gsz	
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Note:

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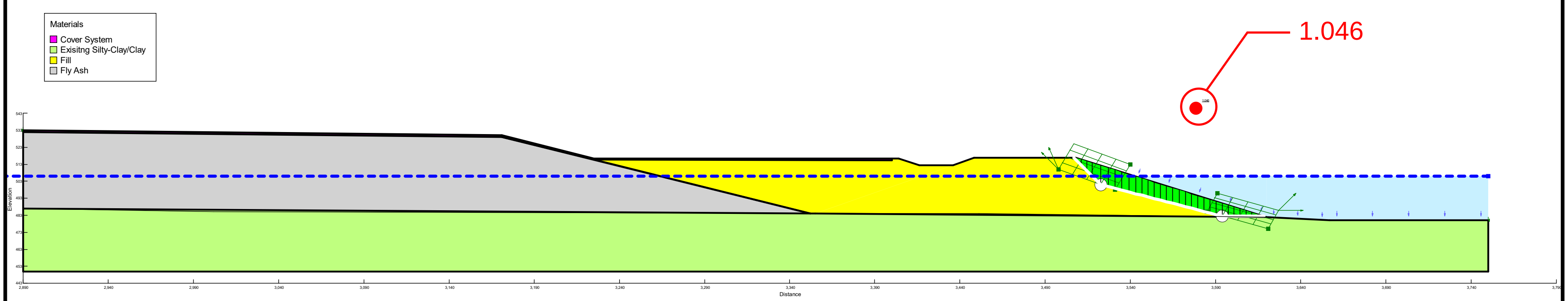


FIGURE 9

Note:
1. Water elevation estimated from Groundwater Modeling Report, Figure 2-2 Uppermost Aquifer Groundwater Elevation Contours, prepared by Ramboll, dated July 2022.

SLOPE/W Analysis	
BB Slope-Sliding Block - Seismic.gsz	
07/20/2022	1:1,097

Attachment A

Final Cover Veneer Stability

Project: IPGC Newton Power Station – Primary Ash Pond Closure
Project Number: 10296144
Date: April-22
Calculation: G. Shafer

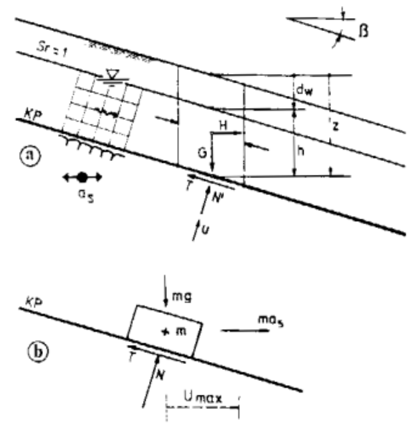
Objective: Evaluate the stability of the cover veneer against sliding

Reference: Matasovic, N. (1991), "Selection of Method for Seismic Slope Stability Analysis", Proc. 2nd International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamaics, St. Louis, Vol. 2, pp 1057-1062

Requirements: FSmin (Static) = 1.5; Fsmin (Dynamic) = 1.0 (If Applicable)

Analysis: Infinite Slope (Matasovic, 1991); See eqjua

0.115	**Ks**	Seismic coefficient - See next page 0.5*max horizontal accel
125	**gc**	Unit wight of protective cover materials (pcf)
62.4	**gw**	Unit weight of water (pcf)
	c	Cohesion/adhesion along assumed failure surface (psf)
	F	Interface friction angle along assumed failure surface (degrees)
2	**Zc**	Depth of protective cover (depth to failure surface) (ft)
1.95	**dw**	Depth to seepage surface (assumed parallel to slope (ft)
14	**b**	Slope angle of protective cover (degrees); 4H:1V



- Ground Water Level
- Seismic Exitation
- Steady Seepage
Umax - Permanent Displacement of sliding mass
KP - Sliding Surface

Fig. 2 Model of an infinite slope

Based on the above assumptions, the principles of limit equilibrium and the notation introduced in Figure 2, the following expression for the factor of safety, F_s, has been derived (Matasovic, 1989):

$$F_s = \frac{c/(\gamma z \cos^2\beta) + \tan\Phi[1 - \gamma_w(z-d_w)/(\gamma z)] - k_s \tan\beta \tan\Phi}{k_s + \tan\beta} \qquad (1)$$

where γ, γ_w, c and Φ are the unit weight of slope material, the unit weight of water, cohesion and the angle of internal friction respectively.

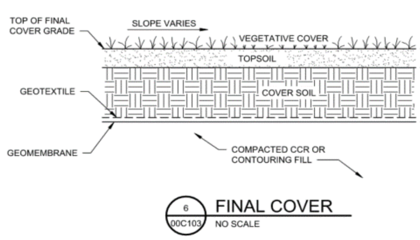
Calculate Static FS Against Sliding

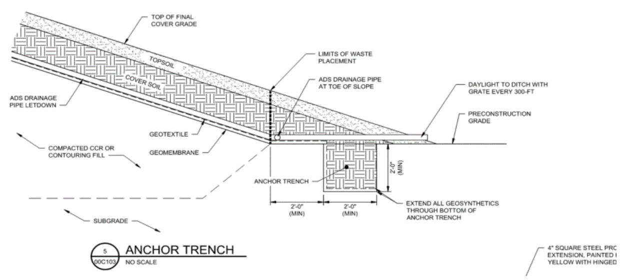
Soil Conditions at Interface	Interface Friction Angle (F)*	Cohesion/Adhesion (psf)	Resisting Force	Driving Force	F.S.	Normal Load	Interface Shear Strength
	28.0	0.0	0.408	0.364	1.12	125	66
			0.000	0.364	0.00	125	0
			0.000	0.364	0.00	125	0
			0.000	0.364	0.00	125	0
			0.000	0.364	0.00	125	0
			0.000	0.364	0.00	125	0
			0.000	0.364	0.00	125	0
			0.000	0.364	0.00	125	0
			0.000	0.364	0.00	125	0
			0.000	0.364	0.00	125	0

Iteration

	26.0	0.0	0.37	0.36	1.03	125	61
	27.0	0.0	0.39	0.36	1.07	125	64
	28.0	0.0	0.41	0.36	1.12	125	66
	29.0	0.0	0.43	0.36	1.17	125	69
	30.0	0.0	0.44	0.36	1.22	125	72

Sketches:
*Note: the geomembrane includes a microspike which acts as a drainage composite with the addition of the geotextile shown below.





***Conclusion:**
The proposed configuration is stable using 28 degrees as an assumed value for interface friction.
Prior to construction, the interface friction value should be confirmed with on-site site specific and geosynthetics.

Link: Unified Hazard Tool (usgs.gov)
Result: 0.2274 Use half for coefficient in analysis.

Ref: Rationalizing the Seismic Coefficient Method, Hynes-Griffin, Franklin USACE
Link: MP GL-84-13, Rationalizing the Seismic Coefficient Method (dren.mil)

U.S. Geological Survey - Earthquake Hazards Program

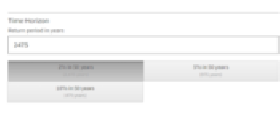
Unified Hazard Tool

Link: https://earthquake.usgs.gov/hazards/interactive/

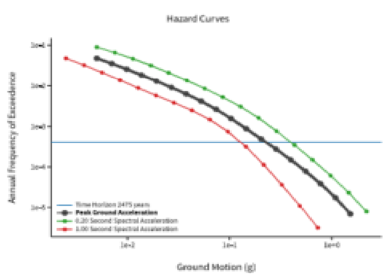
Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

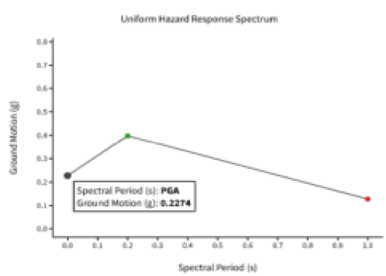
Input

Edition	Spectral Period
Conterminous U.S. 2014 (v4.0.x)	Peak Ground Acceleration
Latitude (Decimal degrees): 38.932	Time Horizon (Return period in years): 2475
Longitude (Decimal degrees, negative values for western longitudes): -88.296	
Site Class: 760 m/s (B/C boundary)	



Hazard Curve





View Raw Data

Project: IPGC Newton Power Station – Primary Ash Pond Closure
Project Number: 10296144
Date: April-22
Calculation: G. Shafer

	Objective:	Evaluate the stability of the cover veneer against sliding
	Reference:	Matasovic, N. (1991), "Selection of Method for Seismic Slope Stability Analysis", Proc. 2nd International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamaics, St. Louis, Vol. 2, pp 1057-1062
	Requirements:	FSmin (Static) = 1.5; Fsmin (Dynamic) = 1.0 (If Applicable)
	Analysis:	Infinite Slope (Matasovic, 1991); See eqjua
		Seismic coefficient (= peak horizontal acceleration) (= 0 for static stability)
0	**Ks**	Static
125	**gc**	Unit wight of protective cover materials (pcf)
62.4	**gw**	Unit weight of water (pcf)
	c	Cohesion/adhesion along assumed failure surface (psf)
	F	Interface friction angle along assumed failure surface (degrees)
2	**Zc**	Depth of protective cover (depth to failure surface) (ft)
1.95	**dw**	Depth to seepage surface (assumed parallel to slope (ft)
14	**b**	Slope angle of protective cover (degrees); 4H:1V

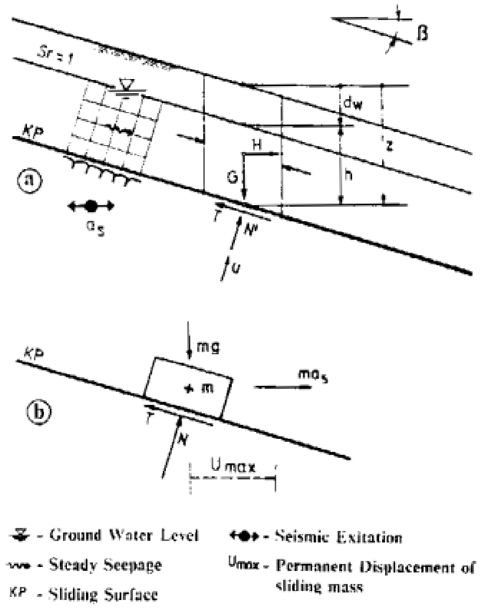


Fig. 2 Model of an infinite slope

Based on the above assumptions, the principles of limit equilibrium and the notation introduced in Figure 2, the following expression for the factor of safety, F_s, has been derived (Matasovic, 1989):

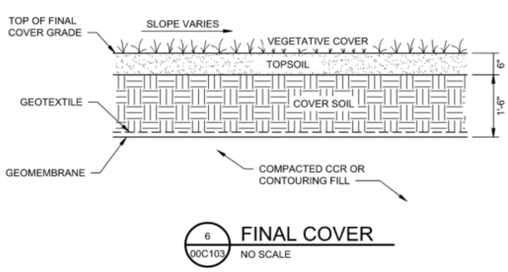
$$F_s = \frac{c/(\gamma\, z \cos^2 \beta) + \tan\Phi[1 - \gamma_w (z - d_w)/(\gamma\, z)] - k_s \tan\beta \tan\Phi}{k_s + \tan\beta} \qquad (1)$$

where γ, γ_w, c and Φ are the unit weight of slope material, the unit weight of water, cohesion and the angle of internal friction respectively.

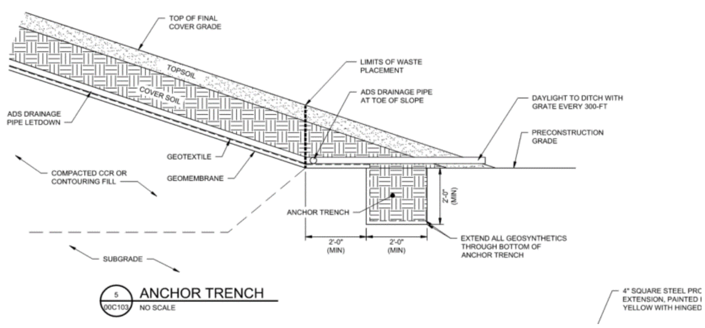
Calculate Static FS Against Sliding

Soil Conditions at Interface	Interface Friction Angle (F)*	Cohesion/Adhesion (psf)	Resisting Force	Driving Force	F.S.	Normal Load	Interface Shear Strength
	28.0	0.0	0.525	0.249	2.11	125	66
			0.000	0.249	0.00	125	0
			0.000	0.249	0.00	125	0
			0.000	0.249	0.00	125	0
			0.000	0.249	0.00	125	0
			0.000	0.249	0.00	125	0
			0.000	0.249	0.00	125	0
			0.000	0.249	0.00	125	0
			0.000	0.249	0.00	125	0
			0.000	0.249	0.00	125	0
Iteration							
	26.0	0.0	0.48	0.25	1.93	125	61
	27.0	0.0	0.50	0.25	2.02	125	64
	28.0	0.0	0.53	0.25	2.11	125	66
	29.0	0.0	0.55	0.25	2.20	125	69
	30.0	0.0	0.57	0.25	2.29	125	72
	31.0	0.0	0.59	0.25	2.38	125	75

Sketches:
*Note: the geomembrane includes a microspike which acts as a drainage composite with the addition of the geotextile shown below.



6 / 00C103 FINAL COVER
NO SCALE



5 / 00C103 ANCHOR TRENCH
NO SCALE

***Conclusion:**
The proposed configuration is stable using 28 degrees as an assumed value for interface friction.
Prior to construction, the interface friction value should be confirmed with on-site site specific
and geosynthetics.

Attachment B

Reference Information

-Soil Characteristics Data

-Seismic Support Data

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Conterminous U.S. 2014 (v4.0.x)

Latitude

Decimal degrees

38.933

Longitude

Decimal degrees, negative values for western longitudes

-88.279

Site Class

760 m/s (B/C boundary)

Spectral Period

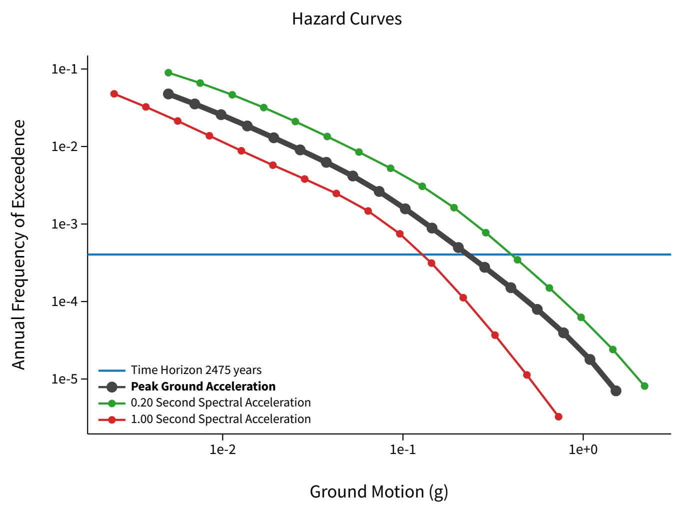
Peak Ground Acceleration

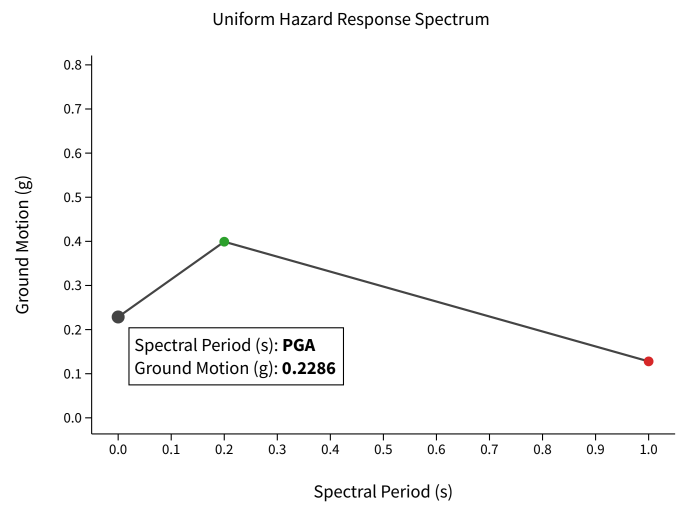
Time Horizon

Return period in years

2475

Hazard Curve





View Raw Data

GLOBAL STABILITY EVALUATION
NEWTON POWER STATION
PRIMARY ASH POND
NEWTON, ILLINOIS

Prepared for:

AMEREN ENERGY RESOURCES
St. Louis, Missouri

Prepared by:

GEOTECHNOLOGY, INC.
St. Louis, Missouri

Geotechnology Project No. J017150.01

January 4, 2011

GEOTECHNOLOGY INC
FROM THE GROUND UP

January 4, 2011 J017150.01

Mr. Gerald R. Ryckman, C.P.M.
Ameren Energy Resources
One Ameren Plaza
1901 Chouteau Avenue
St. Louis, Missouri 63166-6146

GLOBAL STABILITY EVALUATION
NEWTON POWER STATION
PRIMARY ASH POND
NEWTON, ILLINOIS

Dear Mr. Ryckman:

Presented in this report are the results of an embankment stability evaluation conducted for the referenced project. This exploration was conducted in general accordance with our May 21, 2010 revised proposal. This report includes our project understanding, observed site conditions, conclusions and/or recommendations, and support data as given in the Table of Contents.

It has been our pleasure to provide these services to you, and we would welcome the opportunity to provide other services during the course of the project. Please contact us if you need further information or clarification about this document.

Very truly yours,

GEOTECHNOLOGY, INC.

STATE OF ILLINOIS
SENTHIL B. KUMAR
062-054233
REGISTERED PROFESSIONAL ENGINEER

Senthil Kumar, P.E.
Senior Engineer
Geotechnical Group

Dale M. Smith, P.E.
Collinsville Branch Manager

Exp. 11/30/11

SK/DMS/JAB:sk/jsj

Copies submitted: (3) hard copies
(1) pdf format on CD

J017150.01

GLOBAL STABILITY EVALUATION
NEWTON POWER STATION
PRIMARY ASH POND
NEWTON, ILLINOIS

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ILLUSTRATIONS

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GLOBAL STABILITY EVALUATION
NEWTON POWER STATION
PRIMARY ASH POND
NEWTON, ILLINOIS

SECTION I - PROJECT DATA

AUTHORIZATION

The services documented in this report were provided in accordance with the terms, conditions and scope of services described in Geotechnology's May 21, 2010 revised proposal numbered P017237.01A. The project was authorized by issuance of Ameren Purchase Order No. 496284, dated June 14, 2010.

PURPOSE AND SCOPE OF SERVICES

The purpose of our services was to perform a stability analysis of the ash pond embankment. Briefly, services consisted of site reconnaissance, drilling five borings, installing two piezometers, laboratory testing, engineering analyses and preparation of this report. Important information prepared by The Association of Engineering Firms Practicing in the Geosciences (ASFE) for studies of the type is included in Appendix A for your review.

PROJECT AND SITE DESCRIPTION

We understand that the coal-ash waste materials from the power generating process at the Ameren Newton Power Plant are stored in the primary ash pond located south of the plant. The site location and general topography of the area as per U.S.G.S. map of the vicinity are shown on Plate 1. We understand that the ash pond was constructed circa 1974. Based on data provided by Ameren, the ash pond is contained by an approximately 17,000-foot long embankment. The ash pond is bordered to the south by Newton Lake. We understand that the normal pool level of Newton Lake is El 505[1]. At the time of our investigation, water was ponding along the inbound slope of the embankment at El 534. The slope of the embankment in the vicinity of our exploration was approximately 1V:3H (Vertical:Horizontal) and 40 feet wide at the top, which was at approximately El 555. The slope is generally covered with grass and weeds. An approximately 20-foot wide gravel access road is present on top of the embankment.

---

[1] All elevations herein refer to the mean sea level (msl) datum in feet.

SECTION II - FIELD EXPLORATION AND LABORATORY TESTING

FIELD EXPLORATION

The field exploration consisted of drilling five borings, designated as Borings B-1 through -5, at approximately the locations shown on Plate 2. The borings were located in the field by Geotechnology by measuring distances from existing site features at a representative section for height and steepness. Subsequently, the boring locations and the selected section of the embankment were surveyed by Milano & Grunloh Engineers LLC, and the location coordinates and elevations were provided to Geotechnology. Also, the surveyors obtained spot elevations along the crest of the embankment. These section details and spot elevations are included in Appendix E.

The borings were drilled to auger refusal or predetermined depths of 25 to 55 feet using a CME 750 rotary drill rig equipped with hollow stem augers. Standard Penetration Tests (SPT's) were performed using an automatic hammer. Split-spoon samples and relatively undisturbed Shelby tube samples were obtained at the depths indicated on the boring logs presented in Appendix B. An explanation of the terms and symbols used on the borings is provided in Appendix B.

At the completion of drilling, all borings except the borings where piezometers were installed were backfilled with a cement-bentonite grout or bentonite chips. Grout was pumped through a grout pipe inserted to the bottom of the boring, with grout backfilling bore holes from the bottom up. Grout was pumped until visible at the surface prior to withdrawing the grout pipe. A continuous positive head of grout was maintained during removal of the grout pipe.

A staff scientist from Geotechnology provided technical direction during field exploration, observed drilling and sampling, assisted in obtaining samples and prepared descriptive logs of the material encountered. The boring logs represent conditions observed at the time of exploration, and have been edited to incorporate results of the laboratory tests as appropriate.

Unless noted on the logs, the lines designating the changes between various strata represent approximate boundaries. The transition between materials may be gradual or may occur between recovered samples. The stratification given on the logs, or described herein, is for use by Geotechnology in its analyses and should not be used as the basis of design or construction cost estimates without realizing that there can be variation from that shown or described.

The logs and related information depict subsurface conditions only at the specific locations and times where sampling was conducted. The passage of time may result in changes in conditions, interpreted to exist, at or between the locations where sampling was conducted.

LABORATORY TESTING

Laboratory testing was performed to estimate pertinent engineering and index properties of the soil. Moisture contents were determined for cohesive soil samples, and Atterberg limits tests were accomplished on selected samples. Consolidated-undrained triaxial, unconfined compression and percent passing #200 sieve tests were performed on representative samples. Laboratory test results are presented in Appendices B and C.

SECTION III - SUBSURFACE CONDITIONS

STRATIGRAPHY

Fill is present in all borings drilled along the embankment (Borings B-1, -2 and -5). Fill consists of silty clay and clay with a trace of sand and gravel and extends to depths of 22 to 37 feet. Representative samples of the fill had unit dry densities in the range of 104 to 121 pounds per cubic foot (pcf). Moisture content percentages ranged from the mid teens to the lower twenties. SPT N-values in the embankment fill varied from 8 to 16 blows per foot (bpf).

Below the fill, and at the surface in Borings B- 3 and -4, an alluvial deposit of interbedded soft to very stiff, silty clay and clay is present. The thickness of the cohesive stratum varies between 8 and 25 feet. A representative sample had a unit dry density of 105 pcf. Moisture contents ranged from the upper single digits to upper teens. Below the silty clay/clay stratum hard, sandy clay, clay or silty clay is present. This stratum extends to the depths of exploration or auger refusal.

Auger refusal was encountered in Borings B-1 and -5 at depths of 57.5 and 47.5 feet, respectively. Auger refusal may represent either a hard soil layer or bedrock. Since rock coring was not performed, the character of these materials could not be determined.

GROUNDWATER

Groundwater was observed in the crest and toe borings while drilling at depths of 33 to 34, and 2 to 5 feet, respectively. Groundwater levels shown on the boring logs may not have stabilized before backfilling, which is typical in less permeable cohesive soil. Consequently, the indicated groundwater levels may not represent present or future levels.

Open-standpipe piezometers were installed in Borings B-2 and -3 to permit subsequent measurement of the groundwater levels. The piezometers consist of 2-inch diameter PVC pipe, with a 10-foot length of screen placed within the boring. The annular space within the screened interval was backfilled with sand, sealed above the screen with bentonite pellets, and the remainder backfilled with cement-bentonite grout or bentonite pellets. A protective steel well casing was placed over the riser pipe. Details of the piezometer installation at each of the borings are presented on the Piezometer construction diagrams in Appendix D. Groundwater was observed in Piezometers B-2 and -3 at depths of 26 feet and 1 foot, approximately 90 days after completion of drilling. Groundwater levels may vary significantly over time due to the effects of seasonal variation in precipitation, recharge, the level of Newton Lake or other factors not evident at the time of exploration.

SECTION IV –GLOBAL STABILITY EVALUATION

As part of the embankment evaluation, slope stability analyses were performed. A current topographic plan of the site was not available. However, the project surveyor provided the latitude, longitude and the surface elevation of the boring locations and points along the representative section. This information was used to develop the slope profile for the analyses. Results of the analyses are discussed in subsequent sections.

SLOPE STABILITY ANALYSIS

Slope stability analysis consists of comparing the driving forces within a cross-section of slope to the resisting forces and determining the factor of safety. Gravity forces tend to move the slope downwards (driving force), while resisting forces derived from the soil shear strength tend to keep the slope in place. When the driving force acting on the slope is greater than the resisting force, sliding can occur. The factor of safety of the slope is the ratio of the restraining force divided by the driving force. Generally, when the factor of safety is 1 or less, the slope is considered to be unstable. The accepted standard in local practice and consistent with Illinois Department of Natural Resources (IDNR) dam safety requirement is to have a factor of safety of 1.5 for long term static stability of a slope, and 1.0 for pseudo-static conditions (seismic loading).

Slope stability analyses were performed for a representative section of the embankment along the south perimeter of the primary ash pond. The location of the cross-section of the embankment analyzed is represented by Section A-A, and is shown on Plate 2. Soil properties used in the stability analysis were selected based on laboratory test results and Geotechnology's experience with similar materials. In our analyses the pond was assumed to be filled with fly ash. The soil properties used in the models are summarized in the following table:

SOIL PROPERTIES			
Soil Type	**Density (pcf)**	**Cohesion (psf)**	**Friction Angle (°)**
Embankment Fill	125	50	25
Silty Clay/Clay	120	50	30
Hard, Silty/Sandy Clay	120	50	30
Fly Ash	112	0	0

Geotechnology performed stability analysis for deep seated, global failure of the embankment. The cross-section of the embankment analyzed is shown on the attached Plate 3. Since the embankment has been in place for more than 35 years, long-term stability of the embankment was analyzed (i.e. effective stress conditions). Based on the piezometer data and the level of ponding groundwater to the north, a groundwater table for the analysis of the ash pond embankment was established as shown on Plate 3. A pseudo-static seismic analysis was performed on the selected embankment section using a horizontal acceleration of 0.18g, which corresponds to a seismic event with a mean return time of 2,500 years (Plate 4). Details of the methodology used in determining the horizontal acceleration is given in a subsequent section. The Morgenstern-Price procedure was used to compute factors of safety. The computer program SLOPE/W was used to perform the computations. The calculated factors of safety are given in the following table.

SLOPE STABILITY ANALYSIS RESULTS			
Analysis Condition	**Calculated Factor of Safety**	**Target Factor of Safety[a]**	**Reference Plate No.**
Existing Conditions, Steady State Seepage	1.8	1.5	3
Partially Saturated Slope, Steady State Seepage	1.5	1.5	4
Slope with Seismic Forces Mean Return Time 2,500 Years	1.1	1.0	5
Partially Saturated Slope Slope with Seismic Forces Mean Return Time 2,500 Years	0.9	1.0	6

[a] **"Procedural Guidelines for Preparation of Technical Data to be included in Application for Permits for Construction and Maintenance of Dams" issued by Illinois Department of Natural Resources.**

IDNR recommends a minimum factor of safety of 1.5 for long-term stability. During an extreme event, such as an earthquake, a factor of safety of 1.0 or more is recommended. Based on the results of our analyses, the embankment slopes have satisfactory factors of safety for global stability. Exception is the seismic event occurring when the slope is partially saturated (Plate 6).

SEISMICITY

The site is located in a region of the country that has a significant seismic risk due to the presence of the New Madrid Seismic Zone (NMSZ) in southeastern Missouri and the Wabash Valley Seismic Zone (WVSZ) in southeastern Illinois and southwestern Indiana. The NMSZ is the site of three of the largest magnitude earthquake events (estimated surface-wave magnitudes greater than or equal to 8.0) to strike North America in recorded history (December 1811 through February 1812). Researchers predict that the WVSZ is capable of producing large earthquakes similar in magnitude to the 1811-1812 NMSZ earthquakes.

Per the previously referenced Illinois Department of Natural Resources procedural guidelines for application of dam construction permit, the seismic hazard analysis should use bedrock peak ground accelerations with a 2% probability of exceedence (PE) in 50 years (mean return time of 2,500 years). The National Seismic Hazards Mapping Project (NSHMP) interactive deaggregations models (2002 edition) were used to obtain the probabilistic bedrock accelerations at the site. The NSHMP models consider ground motion from many sources surrounding the site location with the assumption that the site condition is rock with an average shear wave velocity of 2,500 ft/s. Bedrock spectral response acceleration at short periods (S_s), and at 1-second periods (S_1) of 0.58 g and 0.17 g, respectively, were obtained from the NSHMP models.

A detailed site-specific seismic hazard analysis was beyond our scope of services. The guidelines established by the International Building Code, 2006 edition (IBC 2006) were used to propagate the bedrock acceleration to the ground surface. Based on the boring data and Section 1613.5.6 of the IBC 2006, we calculated that the underlying soil profile within the upper 100 feet could be defined as Site Class C (Very Dense Soil and Soft Rock). Using Site Class C and guidelines in Section 1802 of IBC 2006, we were able to calculate an approximate surficial horizontal peak ground acceleration of 0.18g, which was used in the pseudo-static slope stability analysis.

SECTION V - LIMITATIONS OF REPORT

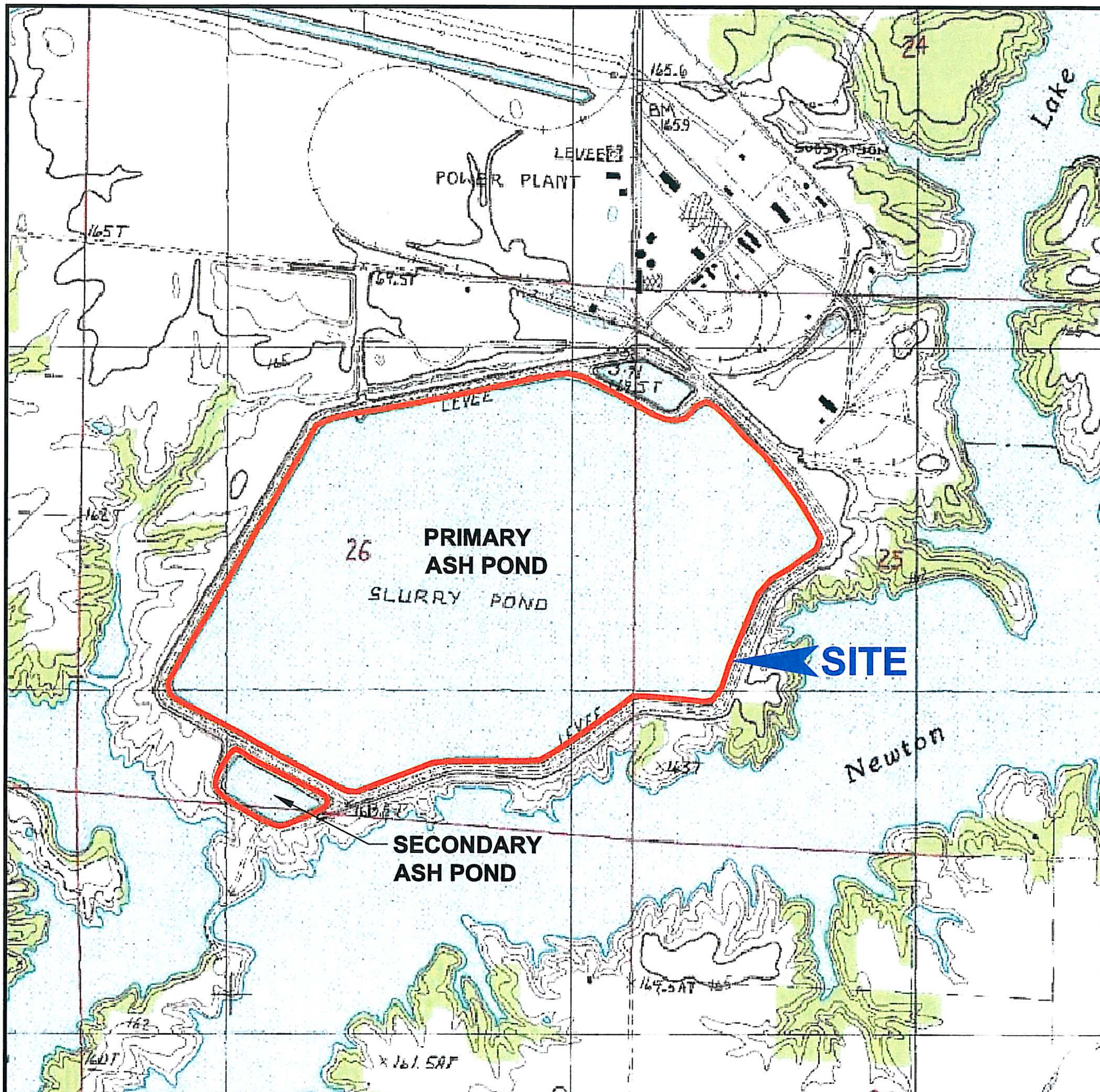
This report has been prepared on behalf of and for the exclusive use of the client for specific application to the named project as described herein. If this report is provided to prospective contractors, the client should make it clear that the information is provided for factual data only and not as a warranty of subsurface conditions included in this report. Unanticipated soil or rock conditions may require the expenditure of additional funds to attain a properly constructed project. Therefore, some contingency fund is recommended to accommodate such potential extra costs.

Geotechnology has attempted to conduct the services reported herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions. The recommendations and conclusions contained in this report are professional opinions. No other representation, expressed or implied, is included or intended.

Unless specifically stated in our proposal or this report, the scope of our services for this phase of the project did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic material in the soil, surface water, groundwater or air, on or below or around this site. Any statements in this report or on the boring logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of our client.

The analyses, conclusions, and recommendations contained in this report are based on the data obtained from the subsurface exploration. The field exploration methods used indicate subsurface conditions only at the specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Discrete sampling cannot be relied on to accurately reflect natural variations in stratigraphy that may exist between sample locations and/or intervals. Unless specifically noted, the scope of our services did not include an assessment of the effects of flooding and natural erosion of adjacent creeks or rivers on the project site.

The conclusions or recommendations presented in this report should not be used if the nature, design, or location of the facilities is changed or if there is a substantial lapse in time between the submittal of this report and the start of work at the site. If changes are contemplated, Geotechnology must review them to assess their impact on findings, conclusions, and/or design recommendations given in this report. Geotechnology will not be responsible for any claims, damages, or liability associated with any other party’s interpretations of the subsurface data or reuse of the subsurface data or engineering analyses in this report without our express written authorization.



NOTES

Plan adapted from a 7.5 minute U.S.G.S. map for Jasper County, Illinois Quadrangle, last revised in 1985.

0 2,000 4,000

SCALE IN FEET

LEGEND

Approximate Location of Ash Pond

N

Drawn By: SLC	Ck'd By:	App'vd By:
Date: 11-10-10	Date: 12/21/10	Date: 1/4/11

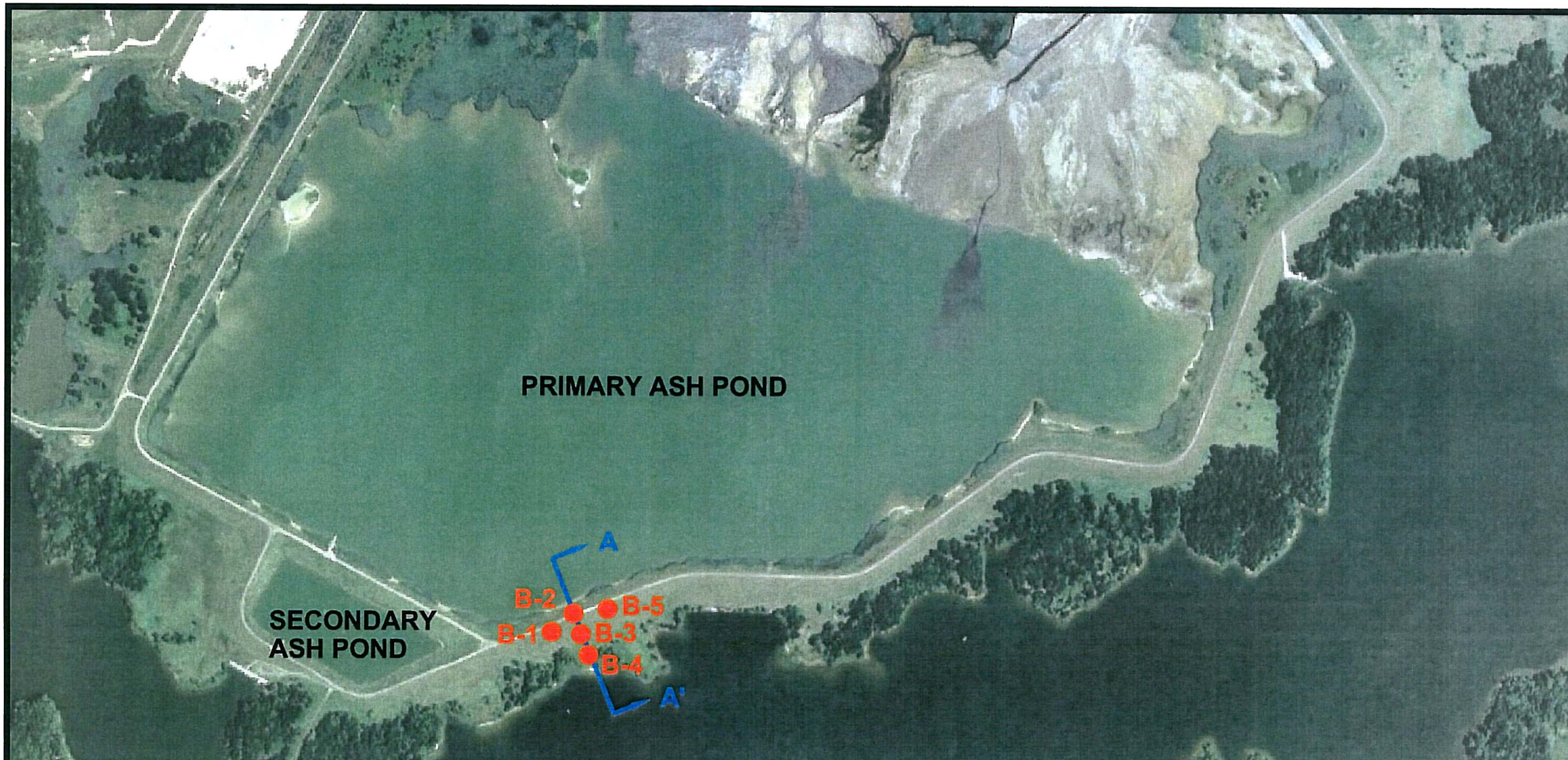
GEOTECHNOLOGY INC
FROM THE GROUND UP

Newton Power Station
Newton, Illinois

SITE LOCATION AND TOPOGRAPHY

Project Number J017150.01

PLATE 1



NOTES

1. Plan adapted from an aerial photograph courtesy of Google Earth.

LEGEND

● Boring Location

— Slope Stability Cross Section

0 400 800 1,600

SCALE IN FEET

N

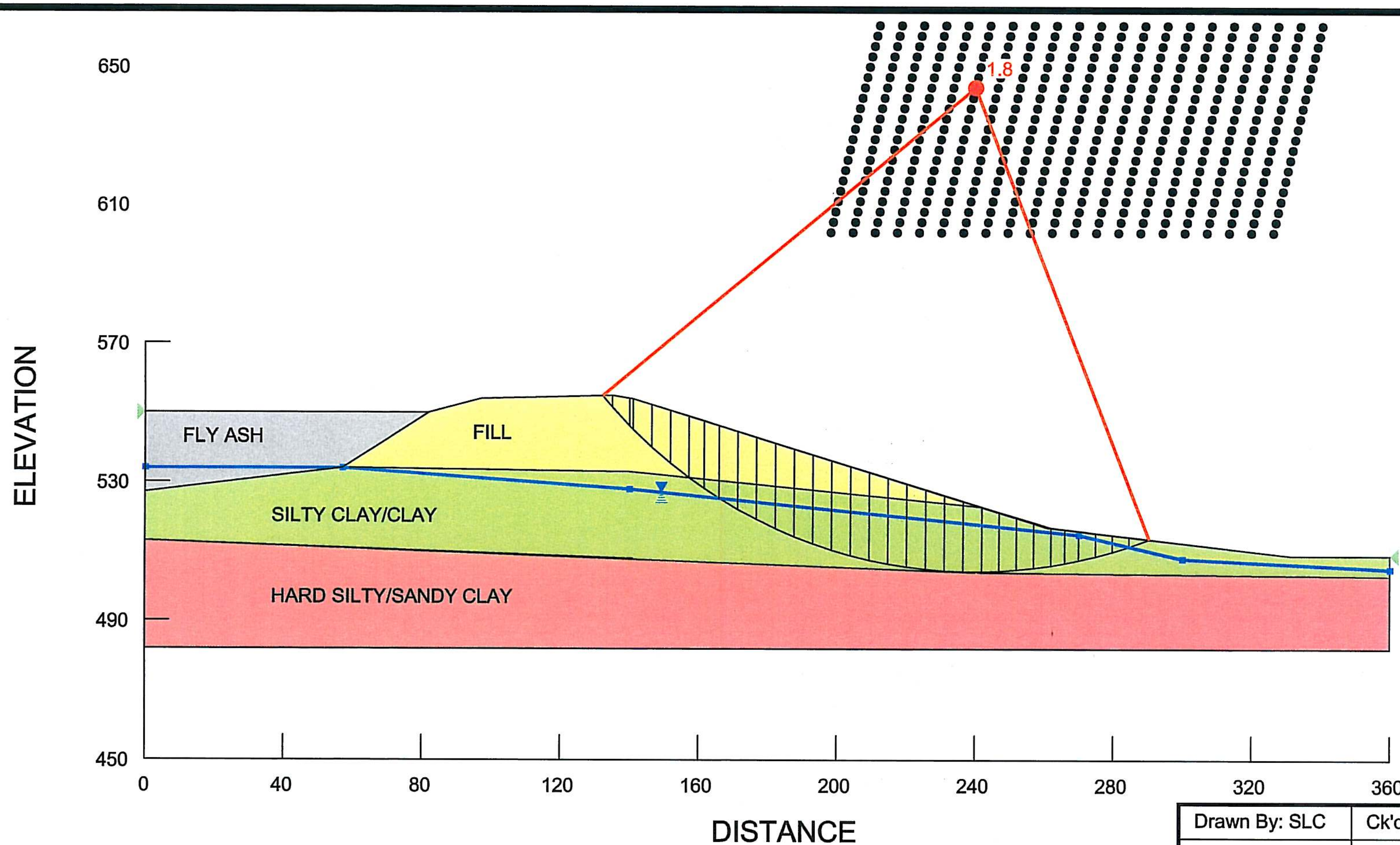
Drawn By: SLC	Ck'd By: SLC	App'vd By: SLC
Date: 11-10-10	Date: 11/12/10	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Newton Power Station
Newton, Illinois

AERIAL PHOTOGRAPH OF SITE AND BORING LOCATIONS

Project Number J017150.01	PLATE 2



NOTE
See plate 2 for location of cross section.

Material	Density (pcf)	Cohesion (psf)	Friction Angle (deg)
Fill	125	50	25
Silty Clay/Clay	120	50	30
Hard, Silty/Sandy Clay	120	50	30
Fly Ash	112	0	0

Drawn By: SLC	Ck'd By: SLC	App'vd By: DN
Date: 11-10-10	Date: 12/21/10	Date: 1/4/11

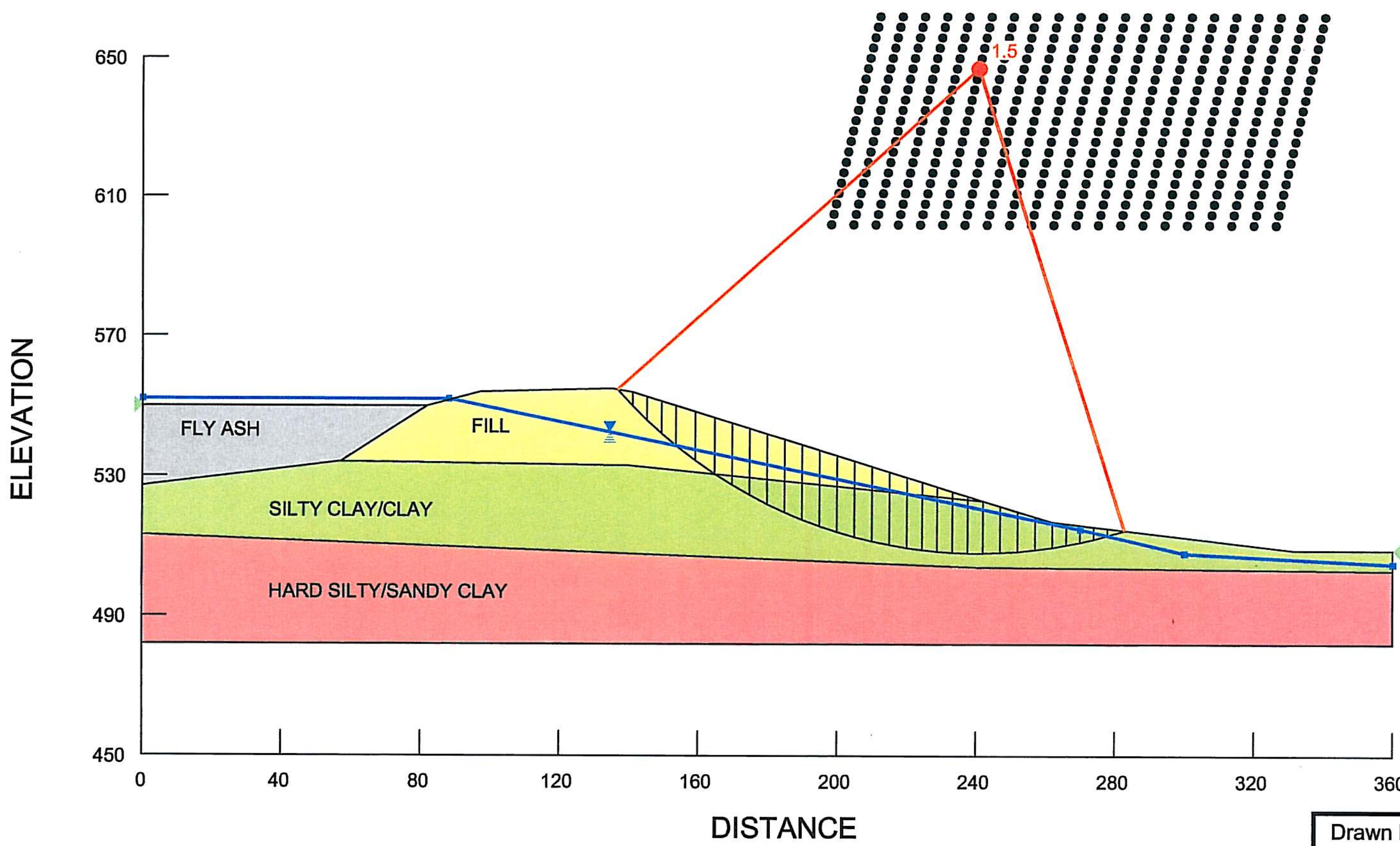
GEOTECHNOLOGY INC
FROM THE GROUND UP

Newton Power Station
Newton, Illinois

SLOPE STABILITY CROSS SECTION A-A'
STEADY STATE SEEPAGE

Project Number J017150.01

PLATE 3



NOTES

1. See plate 2 for location of cross section.

2. Analysis is a parametric study of piezometric surface for a corresponding FOS=1.5. The piezometric surface shown does not represent observed conditions but represents an upper limit below which the FOS is equal to or greater than the target FOS 1.5.

Material	Density (pcf)	Cohesion (psf)	Friction Angle (deg)
Fill	125	50	25
Silty Clay/Clay	120	50	30
Hard, Silty/Sandy Clay	120	50	30
Fly Ash	112	0	0

Drawn By: SLC	Ck'd By: SLC	App'vd By: DM
Date: 11-10-10	Date: 12/21/10	Date: 1/4/11

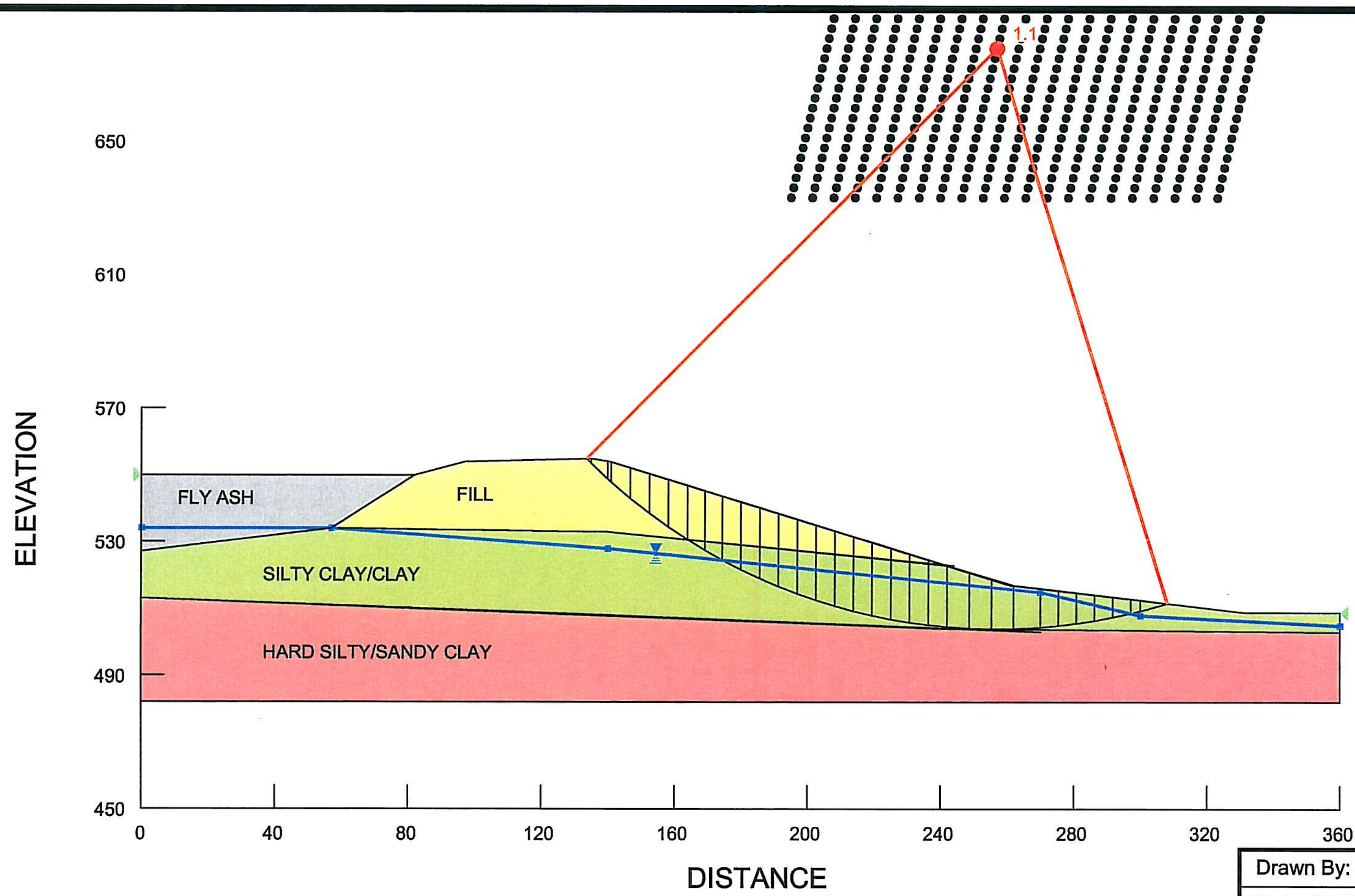
GEOTECHNOLOGY INC
FROM THE GROUND UP

Newton Power Station
Newton, Illinois

SLOPE STABILITY CROSS SECTION A-A'
STEADY STATE SEEPAGE
SATURATED SLOPE

Project Number J017150.01

PLATE 4



NOTE
See plate 2 for location of cross section.

Material	Density (pcf)	Cohesion (psf)	Friction Angle (deg)
Fill	125	50	25
Silty Clay/Clay	120	50	30
Hard, Silty/Sandy Clay	120	50	30
Fly Ash	112	0	0

Drawn By: SLC	Ck'd By: SLC	App'vd By: JAP
Date: 11-10-10	Date: 12/21/10	Date: 1/4/11

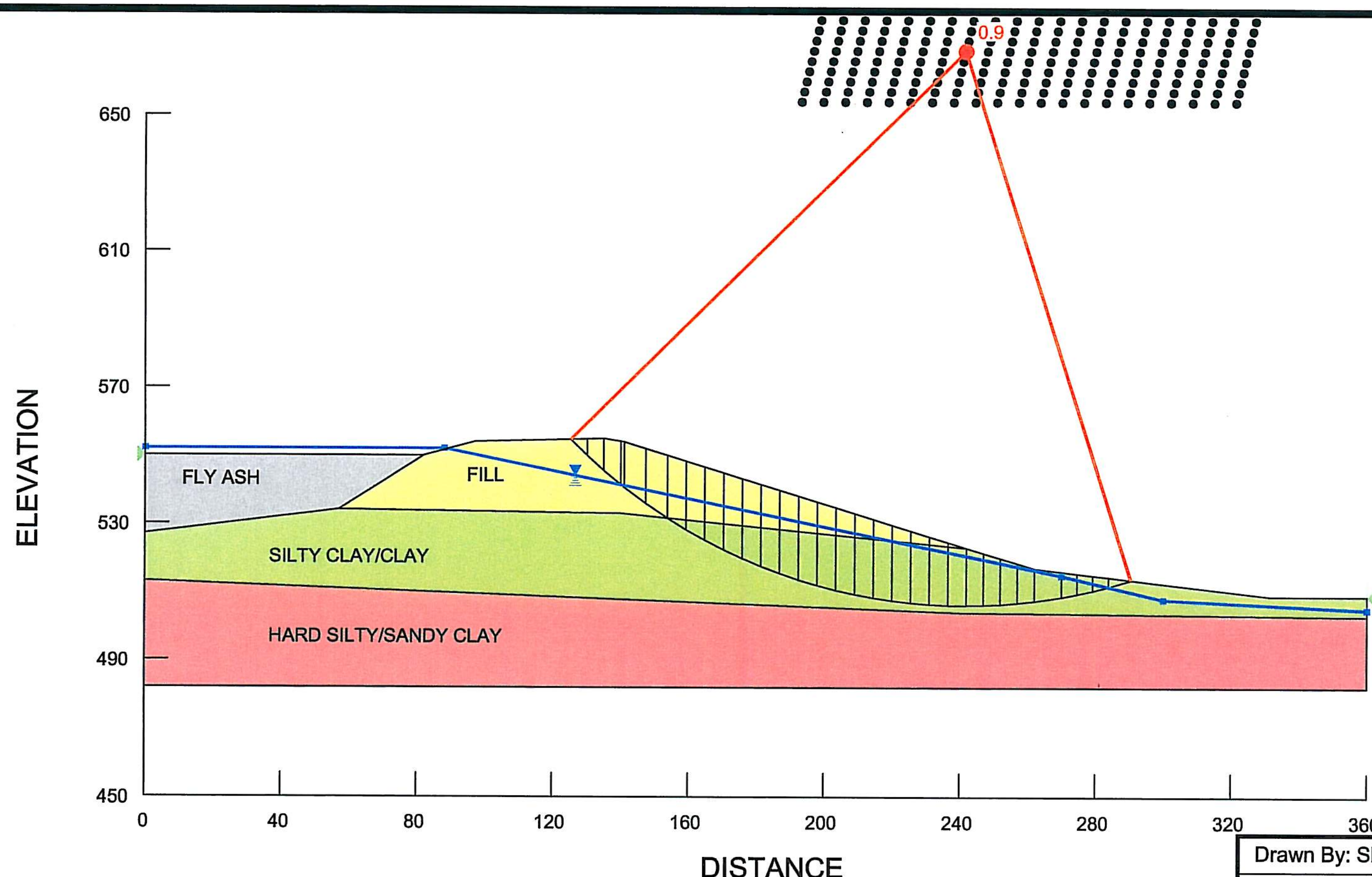
GEOTECHNOLOGY INC
FROM THE GROUND UP

Newton Power Station
Newton, Illinois

SLOPE STABILITY CROSS SECTION A-A'
SEISMIC ANALYSIS
(MEAN RETURN TIME 2,500 YEARS)

Project Number J017150.01

PLATE 5



NOTE

See plate 2 for location of cross section.

Material	Density (pcf)	Cohesion (psf)	Friction Angle (deg)
Fill	125	50	25
Silty Clay/Clay	120	50	30
Hard, Silty/Sandy Clay	120	50	30
Fly Ash	112	0	0

Drawn By: SLC	Ck'd By: SLC	App'vd By: DMV
Date: 11-10-10	Date: 12/21/10	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Newton Power Station
Newton, Illinois

SLOPE STABILITY CROSS SECTION A-A'
SEISMIC ANALYSIS
PARTIALLY SATURATED SLOPE
(MEAN RETURN TIME 2,500 YEARS)

Project Number J017150.01	PLATE 6

APPENDIX A

IMPORTANT INFORMATION ABOUT
YOUR GEOTECHNICAL ENGINEERING REPORT

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

APPENDIX B

DETAILED LOGS OF BORINGS
BORING LOG: TERMS AND SYMBOLS

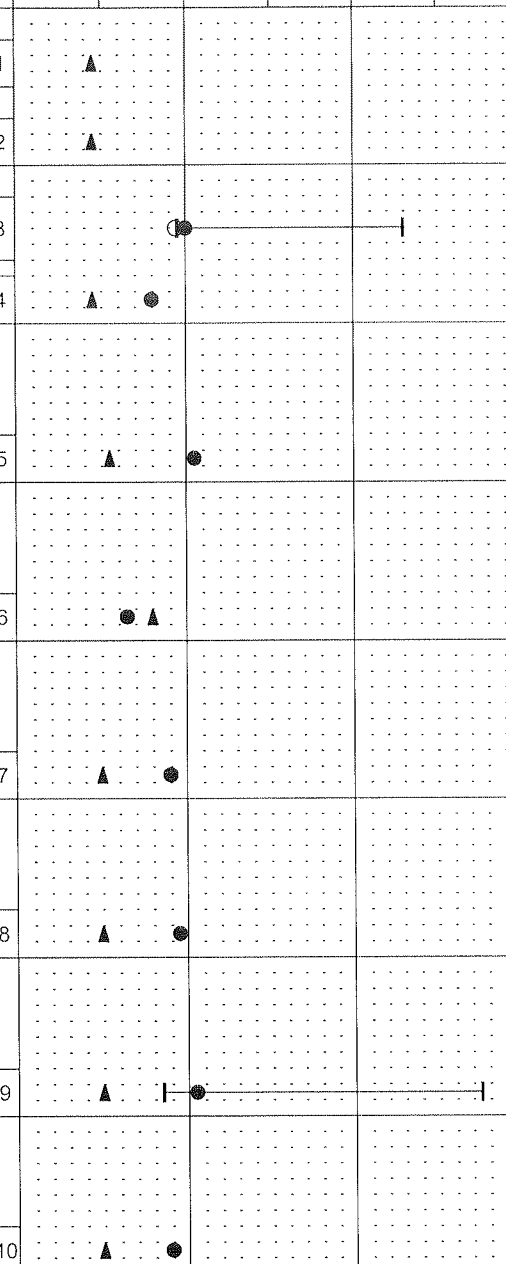
Surface Elevation: 554.1 | Completion Date: 6/15/10

Datum: msl

LOG OF BORING: B-1

DEPTH IN FEET	DESCRIPTION OF MATERIAL
0	FILL: brown, silty clay, trace sand and gravel
	FILL: brown clay
5	FILL: brown and gray, silty clay
	FILL: brown clay
	FILL: brown, silty clay, trace sand
	FILL: brown clay
	Stiff, brown and gray CLAY - (CH)
	trace gravel

DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD	SAMPLES
3-4-5	SS1
2-3-6	SS2
107	ST3
2-3-6	SS4
2-4-7	SS5
2-8-8	SS6
2-4-6	SS7
2-4-6	SS8
2-4-6	SS9
4-4-6	SS10



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

GROUNDWATER DATA

ENCOUNTERED AT 33 FEET ▽

DRILLING DATA

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM __ FEET

MVU DRILLER KCR LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, East Zone. N: 821256.011' E: 997512.963'

Drawn by: KA	Checked by: SM	App'vd. by: DN
Date: 6/23/10	Date: 1/3/11	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Newton Power Station
Newton, Illinois

LOG OF BORING: B-1

Project No. J017150.01

Surface Elevation: 554.1 | Completion Date: 6/15/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	N-VALUE (BLOWS PER FOOT)
	Stiff, brown and gray CLAY - (CH) *(continued)*				
	Very stiff, brown, silty CLAY, trace gravel - CL				
45			4-7-15	SS11	
	Hard, brown, sandy CLAY - CL				
	43.2 percent passing the No. 200 sieve.		26-48 -50/3"	SS12	98 / 9"
50					
55			27-45 -50/5"	SS13	95 / 11"
			13-24-37	SS14	61
	Auger refusal at 57.5 feet.				
60					
65					
70					
75					

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 ▯ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE (ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL ├──●──┤ LL

10 20 30 40 50

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

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

GROUNDWATER DATA

ENCOUNTERED AT 33 FEET ∇

DRILLING DATA

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM __ FEET

MVU DRILLER KCR LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, East Zone. N: 821256.011' E: 997512.963'

Drawn by: KA	Checked by: SU	App'vd. by: DMV
Date: 6/23/10	Date: 1/3/11	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Newton Power Station
Newton, Illinois

CONTINUATION OF
LOG OF BORING: B-1

Project No. J017150.01

Surface Elevation: 554.6

Datum msl

Completion Date: 6/16/10

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	FILL: brown, silty clay, interbedded with occasional clay			
			2-4-4	SS1
5			2-4-4	SS2
			117	ST3
10			117	ST4
15			2-4-5	SS5
			107	ST6
20			104	ST7
	Stiff, brown, silty CLAY - CL			
25			2-5-5	SS8
	Stiff, brown CLAY, trace gravel - CH			
30			2-5-6	SS9
	Medium stiff to hard, brown, silty CLAY, trace sand - CL	∇		
35	68.8 percent passing the No. 200 sieve.		1-3-4	SS10
			9-14-19	SS11

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

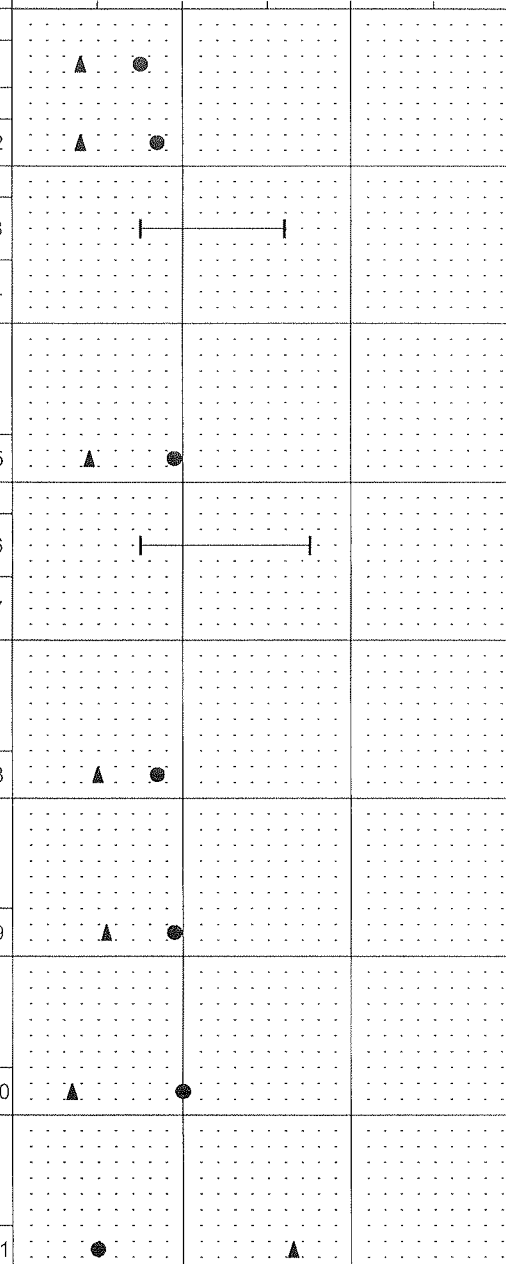
(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL ⊢—●—⊣ LL

10 20 30 40 50



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

GROUNDWATER DATA

ENCOUNTERED AT 33 FEET ∇

DRILLING DATA

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM __ FEET

MVU DRILLER KCR LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, East Zone. N: 821332.544' E: 997697.278'

Drawn by: KA	Checked by: SJE	App'vd. by: DAV
Date: 6/23/10	Date: 1/3/11	Date: 1/4/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Newton Power Station
Newton, Illinois

LOG OF BORING: B-2

Project No. J017150.01

Surface Elevation: 554.6 Completion Date: 6/16/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff to hard, brown, silty CLAY, trace sand - CL *(continued)*			
45			10-17-29	SS12
	Hard to very stiff, brown CLAY with sand and gravel - CH			
50			11-16-22	SS13
			8-13-16	SS14
55	Boring terminated at 55 feet.			
60				
65				
70				
75				

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 ▯ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE (ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL ⊢—●—⊣ LL

10 20 30 40 50

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

GROUNDWATER DATA

ENCOUNTERED AT 33 FEET ∇

DRILLING DATA

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM __ FEET

MVU DRILLER KCR LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, East Zone. N: 821332.544' E: 997697.278'

Drawn by: KA	Checked by: SL	App'vd. by: DM
Date: 6/23/10	Date: 1/3/11	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Newton Power Station
Newton, Illinois

CONTINUATION OF
LOG OF BORING: B-2

Project No. J017150.01

Surface Elevation: 515.0

Datum msl

Completion Date: 6/17/10

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Medium stiff to soft, brown, silty CLAY - CL			
			3-3-4	SS1
5	▽		1-1-2	SS2
			105	ST3
				ST4
10				
12	Hard, brown to gray silty CLAY - CL			
15			7-16-21	SS5
20			9-16-23	SS6
25			12-15-23	SS7
30			8-14-22	SS9
30	Boring terminated at 30 feet.			
35				

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 ▯ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL ⊢——●——⊣ LL

10 20 30 40 50

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

GROUNDWATER DATA

ENCOUNTERED AT 5 FEET ▽

DRILLING DATA

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM __ FEET

MVU DRILLER KCR LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, East Zone. N: 821206.705' E: 997735.386'

Drawn by: KA	Checked by: Sn	App'vd. by: DW
Date: 6/23/10	Date: 1/3/11	Date: 1/4/11

GEOTECHNOLOGY INC

FROM THE GROUND UP

Newton Power Station
Newton, Illinois

LOG OF BORING: B-3

Project No. J017150.01

Surface Elevation: 510.9 | Completion Date: 6/18/10

Datum: msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD	SAMPLES
0	Soft, brown, silty CLAY - (CL)			
2	▽		2-1-1	SS1
4			1-1-1	SS2
5.5	Stiff, brown and gray CLAY - CH		1-3-8	SS3
8	Hard, brown and gray, silty CLAY - CL		25-24-53	SS4
13.5			11-24-20	SS5
18.5			8-14-20	SS6
23.5			12-17-27	SS7
25	Boring terminated at 25 feet.			

SHEAR STRENGTH, tsf: Δ - UU/2 ○ - QU/2 ▯ - SV (0.5, 1.0, 1.5, 2.0, 2.5)

STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, % PL ⊢—●—⊣ LL (10, 20, 30, 40, 50)

SS4: 77

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

LOG OF BORING 2002 WL J017150.01 - AMEREN-NEWTON.GPJ GTINC 0638301.GPJ 12/3/10

GROUNDWATER DATA

ENCOUNTERED AT 2 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

MVU DRILLER KCR LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, East Zone. N: 821177.029' E: 997745.742'

Drawn by: KA	Checked by: Sx	App'vd. by: DW
Date: 6/23/10	Date: 1/3/11	Date: 1/4/11

GEOTECHNOLOGY INC — FROM THE GROUND UP

Newton Power Station
Newton, Illinois

LOG OF BORING: B-4

Project No. J017150.01

Surface Elevation: 554.0

Datum: msl

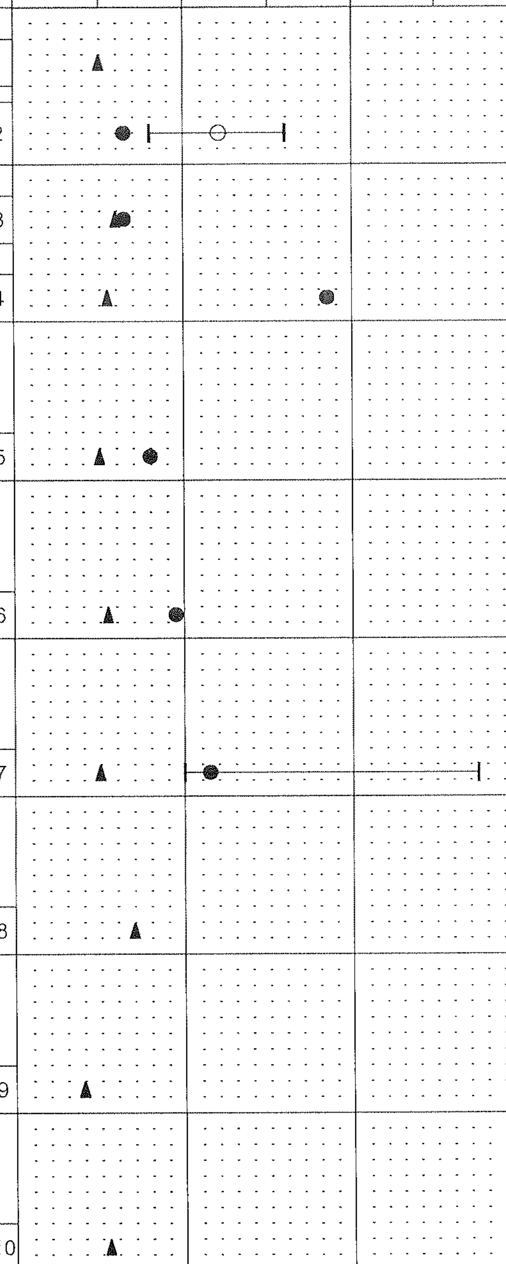
Completion Date: 6/17/10

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD	SAMPLES
0	FILL: brown, silty clay		
1.5–3		4-6-4	SS1
4		121	ST2
6	trace sand	3-5-7	SS3
8	FILL: brown and gray, clay		
9	trace gravel	3-5-6	SS4
14		2-4-6	SS5
19		2-4-7	SS6
24		2-4-6	SS7
28	trace sand and gravel		
29		4-7-7	SS8
32	FILL: brown, silty clay		
34		3-3-5	SS9
37	Stiff to hard, brown, silty CLAY - CL		
39		2-5-6	SS10

SHEAR STRENGTH, tsf: Δ - UU/2, O - QU/2, ▯ - SV (0.5, 1.0, 1.5, 2.0, 2.5)

STANDARD PENETRATION RESISTANCE (ASTM D 1586): ▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %: PL ├──●──┤ LL (10, 20, 30, 40, 50)



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

GROUNDWATER DATA

ENCOUNTERED AT 34 FEET ∇

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

MVU DRILLER KCR LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, East Zone. N: 821405.69' E: 997881.328'

Drawn by: KA Date: 6/23/10 | Checked by: SU Date: 1/3/11 | App'vd. by: DMS Date: 1/4/11

GEOTECHNOLOGY INC — FROM THE GROUND UP

Newton Power Station
Newton, Illinois

LOG OF BORING: B-5

Project No. J017150.01

Surface Elevation: 554.0 | Completion Date: 6/17/10
Datum msl

SHEAR STRENGTH, tsf — Δ - UU/2, O - QU/2, ▯ - SV (0.5, 1.0, 1.5, 2.0, 2.5)
STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT)
WATER CONTENT, % — PL ├ ● ┤ LL (10, 20, 30, 40, 50)

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Stiff to hard, brown, silty CLAY - CL *(continued)*			
45			7-14-24	SS11
	Hard, brown, sandy CLAY - CL		44-50/2"	SS12
	Sampler and auger refusal at 47.5 feet.			
50				
55				
60				
65				
70				
75				

2"

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

GROUNDWATER DATA

ENCOUNTERED AT 34 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM ___ FEET
MVU DRILLER KCR LOGGER
CME 750X DRILL RIG
HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, East Zone. N: 821405.69' E: 997881.328'

Drawn by: KA | Checked by: [signature] | App'vd. by: DW
Date: 6/23/10 | Date: 1/3/11 | Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Newton Power Station
Newton, Illinois

CONTINUATION OF LOG OF BORING: B-5

Project No. J017150.01

BORING LOG: TERMS AND SYMBOLS

GENERAL NOTES

1. *Information on each boring log is a compilation of subsurface conditions based on soil or rock classifications obtained from the field as well as from laboratory testing of samples. The strata lines on the logs may be approximate or the transition between the strata may be gradual rather than distinct. Water level measurements refer only to those ob - served at the times and places indicated, and may vary with time, geologic condition or construction activity.*
2. *Relative composition and Unified Soil Classification designations are based on visual estimates and are approximate only. If laboratory tests were performed to classify the soil, the unified designation is show in parenthesis.*
3. *Value given in Unit Dry Weight/SPT Column is either a unit dry weight in pounds per cubic foot, if adjacent to a ST sample designation, or blows per 6-inch increment if adjacent to a SS sample designation.*

ABBREVIATIONS

UU/2 *Shear Strength from Unconsolidated – Undrained Triaxial Test (ASTM D2850)*
QU/2 *Shear Strength from Unconfined Compression Test (ASTM D2166)*
SV *Shear Strength from Field Vane (ASTM D2573)*
PL *Plastic Limit (ASTM D4318)*
LL *Liquid Limit (ASTM D4318)*

LEGEND

CS	Continuous Sampler
GB	Grab Sample Taken From Auger Cuttings Or Wash Water Return
NX 100/42	NX Rock Core with Percent Recovery/R.Q.D. Given In Adjacent Column
PST	Three Inch Diameter Piston Tube Sample
SS	Split Spoon Sample (Standard Penetration Test)
ST	Three Inch Diameter Shelby Tube Sample
*	Sample Not Recovered
SV	Field Vane Test

SPLIT – BARREL SAMPLER DRIVING RECORD

Blow Per Foot (N-Value)	*Description*
25	*25 blows drove sampler 12 inches after initial 6 inches of seating.*
75/10"	*75 blows drove sampler 10 inches after initial 6 inches of seating.*
50/S3"	*50 blows drove sampler 3 inches during initial 6 inch seating interval.*

NOTES:
1. *To avoid damage to sampling tools, driving is limited to 50 blows during any six inch interval.*
2. *N-Value (Blow Count) is the standard penetration resistance based on the total number of blows, using a 140-lb hammer with 30-inch free fall, required to drive a split spoon the last two of three, 6-inch drive increments. (Example: 4/7/9, N = 7 + 9 = 16). Values are shown as a summation on grid plot and may be shown as 4/7/9 in Unit Dry Weight – SPT column.*

RELATIVE COMPOSITION

Trace……………………..0-10 %
With/Some…………...11-35 %
Soil modifier such……. > 35 %
As silty, clayey, sandy, etc.

DENSITY OF GRANULAR SOILS

Descriptive Term:	***N—Value***
Very Loose	*0 - 4*
Loose	*5 - 10*
Medium Dense	*11 - 30*
Dense	*31 - 50*
Very Dense	*> 50*

STRENGTH OF COHESIVE SOILS

Consistency	**Undrained Shear Strength Tons Per Sq. Ft.**	**Field Test**	**Approximate N-Value Range**
Very Soft	*less than 0.12*	*Thumb will penetrate soil more than 1"*	*0 - 1*
Soft	*13 to 0.25*	*Thumb will penetrate soil about 1"*	*2 - 4*
Medium Stiff	*0.26 to 0.50*	*Thumb will penetrate soil about ¼"*	*5 – 8*
Stiff	*0.51 to 1.00*	*Thumb hardly indents soil*	*9 – 15*
Very Stiff	*1.01 to 2.00*	*Thumb will not indent soil, but readily indented with thumbnail*	*16 – 30*
Hard	*greater than 2.00*	*Thumbnail will not indent soil*	*> 30*

SOIL GRAIN SIZE

U.S. STANDARD SIEVE

12" 3" ¾" 4 10 40 200

BOULDERS	COBBLES	GRAVEL		SAND			SILT	CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE		

300 76.2 19.1 4.76 2.00 0.42 0.074 0.002

SOIL GRAIN SIZE IN MILLIMETERS

SOIL STRUCTURE

Calcareous *– Having appreciable quantities of carbonate.*

Fissured *– Containing shrinkage or relief cracks, often filled with sand or silt; usually more or less vertical.*

Slickensided *– Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the ease of breaking along those planes.*

Layer *-- Inclusion greater than 3 inches thick.*

Seam *– Inclusion 1/8 inch to 3 inches thick extending through the sample*

Parting *– Inclusion less than 1/8 inch thick.*

Pocket *– Inclusion of material of different texture that is smaller than the diameter of the sample.*

Interlayered *– Soil samples composed of alternating layers of different soil types.*

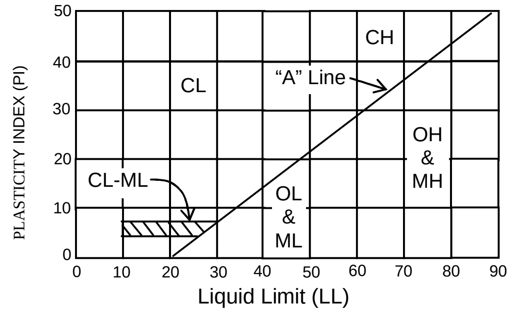
Intermixed *– Soil samples composed of pockets of different soil types and a layered or laminated structure is not evident.*

Laminated *– Soil sample composed of alternating partings or seams of different soil type.*

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			SYMBOL	DESCRIPTION
Coarse-Grained Soils (More than 50% Larger than No 200 Sieve Size)	Gravel and Gravelly Soils	Clean Gravels Little or no Fines	GW	Well-Graded Gravel, Gravel-Sand Mixture
			GP	Poorly –Graded Gravel, Gravel-Sand Mixture
		Gravels with Appreciable Fines	GM	Silty Gravel, Gravel-Sand-Silt Mixture
			GC	Clayey-Gravel, Gravel-Sand-Clay Mixture
	Sand and Sandy Soils	Clean Sands Little or no Fines	SW	Well-Graded Sand, Gravelly Sand
			SP	Poorly Graded Sand, Gravelly Sand
		Sands with Appreciable Fines	SM	Silty Sand, Sand-Silt Mixture
			SC	Clayey Sand, Sand-Clay Mixture
Fine-Grained Soils (More than 50% Smaller than No 200 Sieve Size)	Silts and Clays	Liquid Limit Less Than 50	ML	Silt, Clayey Silt, Silty or Clayey Very Fine Sand, Slight Plasticity
			CL	Clay, Sandy Clay, Silty Clay, Low to Medium Plasticity
			OL	Organic Silts, or Silty Clays of Low Plasticity
	Silts and Clays	Liquid Limit More Than 50	MH	Silt, Fine Sandy or Silt Soil with High Plasticity
			CH	Clay, High Plasticity
			OH	Organic Clay of Medium to High Plasticity
	Highly Organic Soils		PT	Peat, Humus, Swamp Soil

PLASTICITY CHART



RELATIVE PLASTICITY

Nonplastic	Cannot Roll Into Ball
Trace Plasticity	Barely Roll Into Ball
Medium Plastic	Can be Rolled Into Ball
Highly Plastic	No Rupture by Kneading

VISUAL DESCRIPTION CRITERIA*

TABLE 1: CRITERIA FOR DESCRIBING ANGULARITY OF COARSE-GRAINED PARTICLES

Description	***Criteria***
Angular	*Particles have sharp edges and relatively plane sides with unpolished surfaces*
Subangular	*Particles are similar to angular description but have rounded edges*
Subrounded	*Particles have nearly plane sides but have well-rounded corners and edges*
Rounded	*Particles have smoothly curved sides and no edges*

TABLE 2: CRITERIA FOR DESCRIBING PARTICLE SHAPE

Description	***Criteria***
Flat	*Particles with width/thickness X3*
Elongated	*Particles with length/width X3*
Flat and Elongated	*Particles meet criteria for both flat and elongated*

TABLE 3: CRITERIA FOR DESCRIBING MOISTURE CONDITION

Description	***Criteria***
Dry	*Absence of moisture, dusty, dry to the touch*
Moist	*Damp, but no visible water*
Wet	*Visible free water, usually soil is below the water table*

TABLE 4: CRITERIA FOR DESCRIBING REACTION WITH HCL

Description	***Criteria***
None	*No visible reaction*
Weak	*Some reaction, with bubbles forming slowly*
Strong	*Violent reaction, with bubbles forming rapidly*

TABLE 6: CRITERIA FOR DESCRIBING CEMENTATION

Description	***Criteria***
Weak	*Crumbles or breaks with handling or little finger pressure*
Moderate	*Crumbles or breaks with considerable finger pressure*
Strong	*Will not crumble or break with finger pressure*

**NOTES: 1. Tables adapted from ASTM D2488 "Description and identification of Soils" (Visual-Manual Procedure)*
2. Tables 5, 7 and 11 incorporated into other information on this plate.

TABLE 8: CRITERIA FOR DESCRIBING DRY STRENGTH

Description	***Criteria***
None	*The dry specimen crumbles into powder with mere pressure of handling*
Low	*The dry specimen crumbles into powder with some finger pressure*
Medium	*The dry specimen breaks into pieces or crumbles with considerable finger pressure*
High	*The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface.*
Very High	*The dry specimen cannot be broken between the thumb and a hard surface*

TABLE 9: CRITERIA FOR DESCRIBING DILATANCY

Description	***Criteria***
None	*No visible change in the specimen*
Slow	*Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing.*
Rapid	*Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing.*

TABLE 10: CRITERIA FOR DESCRIBING TOUGHNESS

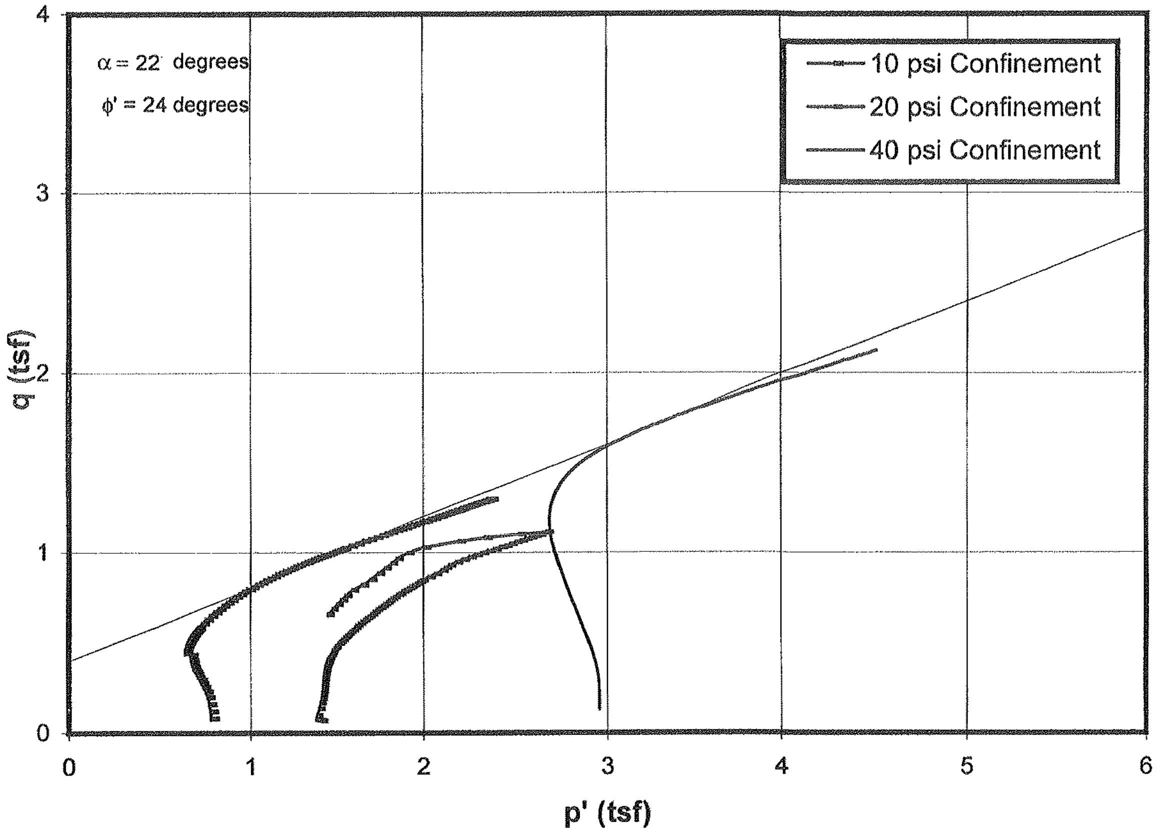
Description	***Criteria***
Low	*Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft.*
Medium	*Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness*
High	*Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness*

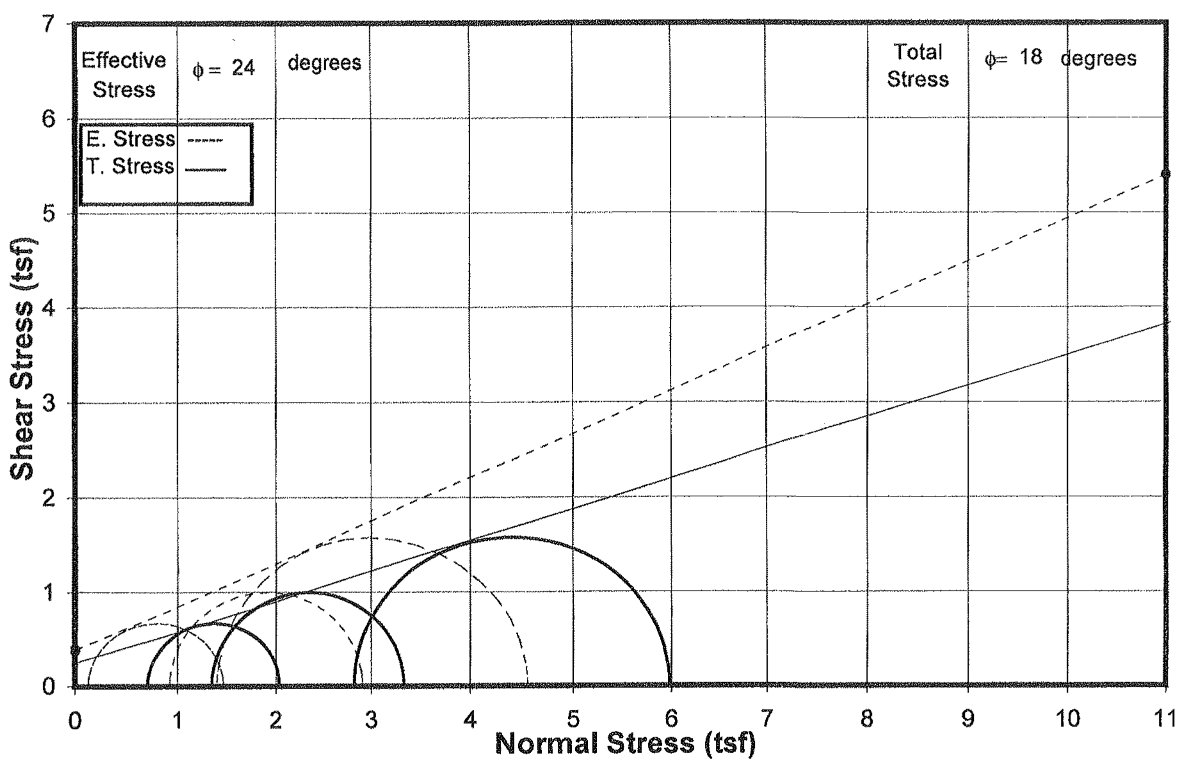
TABLE 12: IDENTIFICATION OF INORGANIC FINE-GRAINED SOILS FROM MANUAL TESTS

Soil Symbol	***Dry Strength***	***Dilatancy***	***Toughness***
ML	*None to low*	*Slow to rapid*	*Low or thread cannot be formed*
CL	*Medium to high*	*None to slow*	*Medium*
MH	*Low to medium*	*None to slow*	*Low to medium*
CH	*High to very high*	*none*	*High*

APPENDIX C

LABORATORY TEST DATA





CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

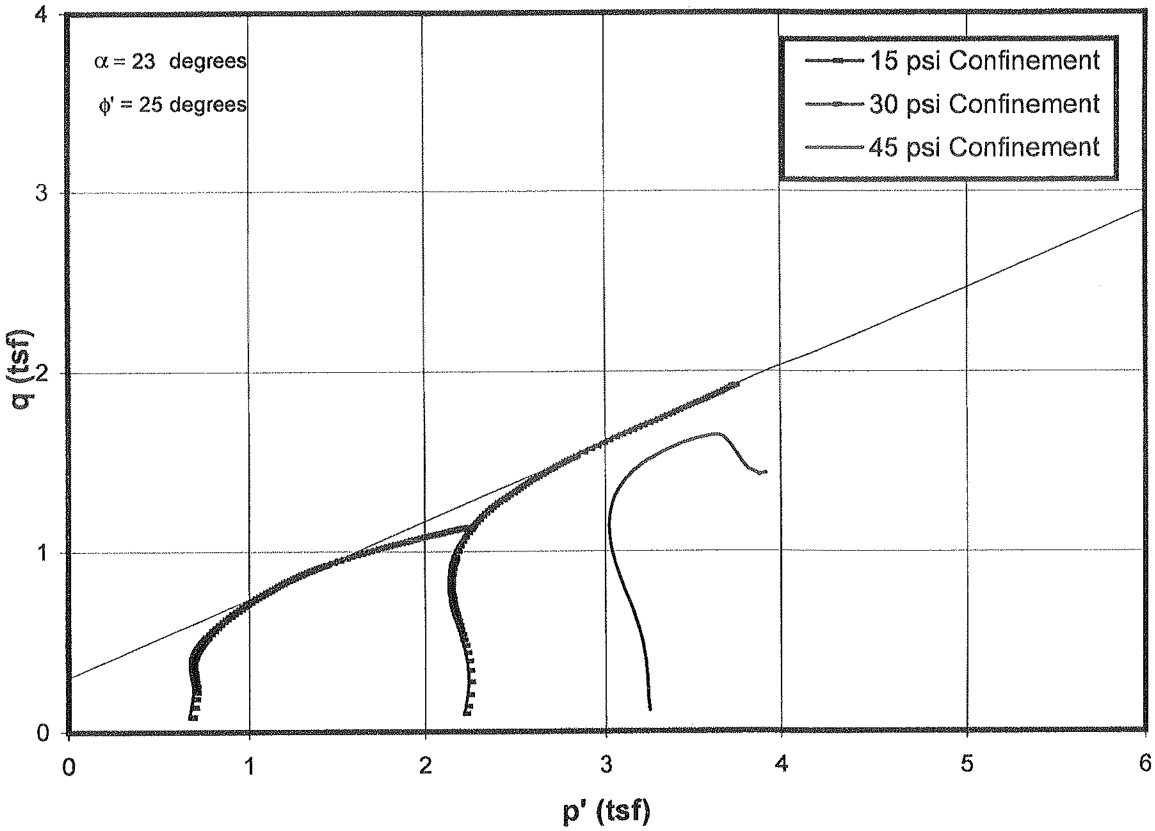
ASTM D 4767

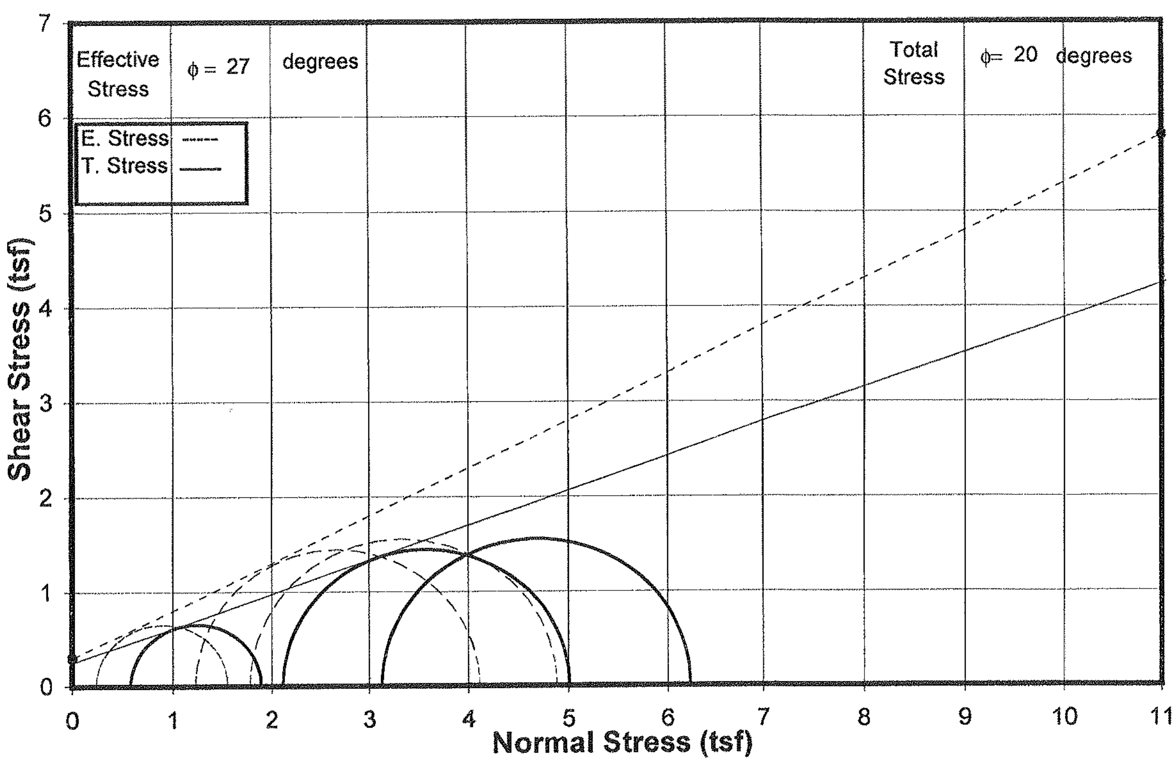
Project No.: J017150.01

Boring: B-2

Sample: ST-3, ST-4, ST-4 - Depth: 6, 8, 8

GEOTECHNOLOGY INC
FROM THE GROUND UP





CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 4767

Project No.: J017150.01

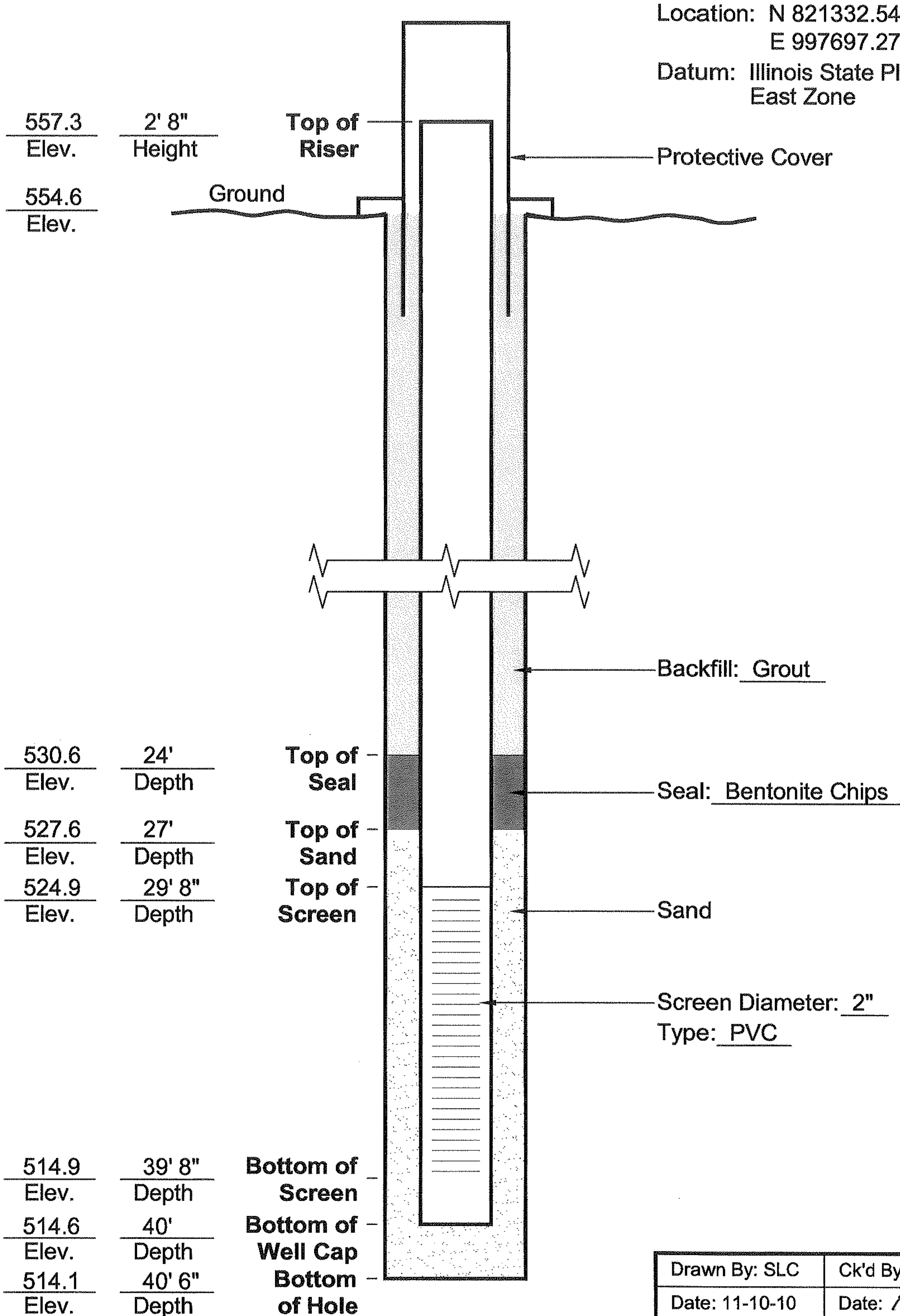
Boring: B-2

Sample: ST-6, ST-7, ST-7 - Depth: 16, 18, 18

APPENDIX D

PIEZOMETER INSTALLATION DETAILS

Date Installed: 06-16-10
Location: N 821332.544'
E 997697.278'
Datum: Illinois State Plane Coordinates, East Zone



Drawn By: SLC	Ck'd By: SM	App'vd By: DM
Date: 11-10-10	Date: 12/21/10	Date: 1/10/11

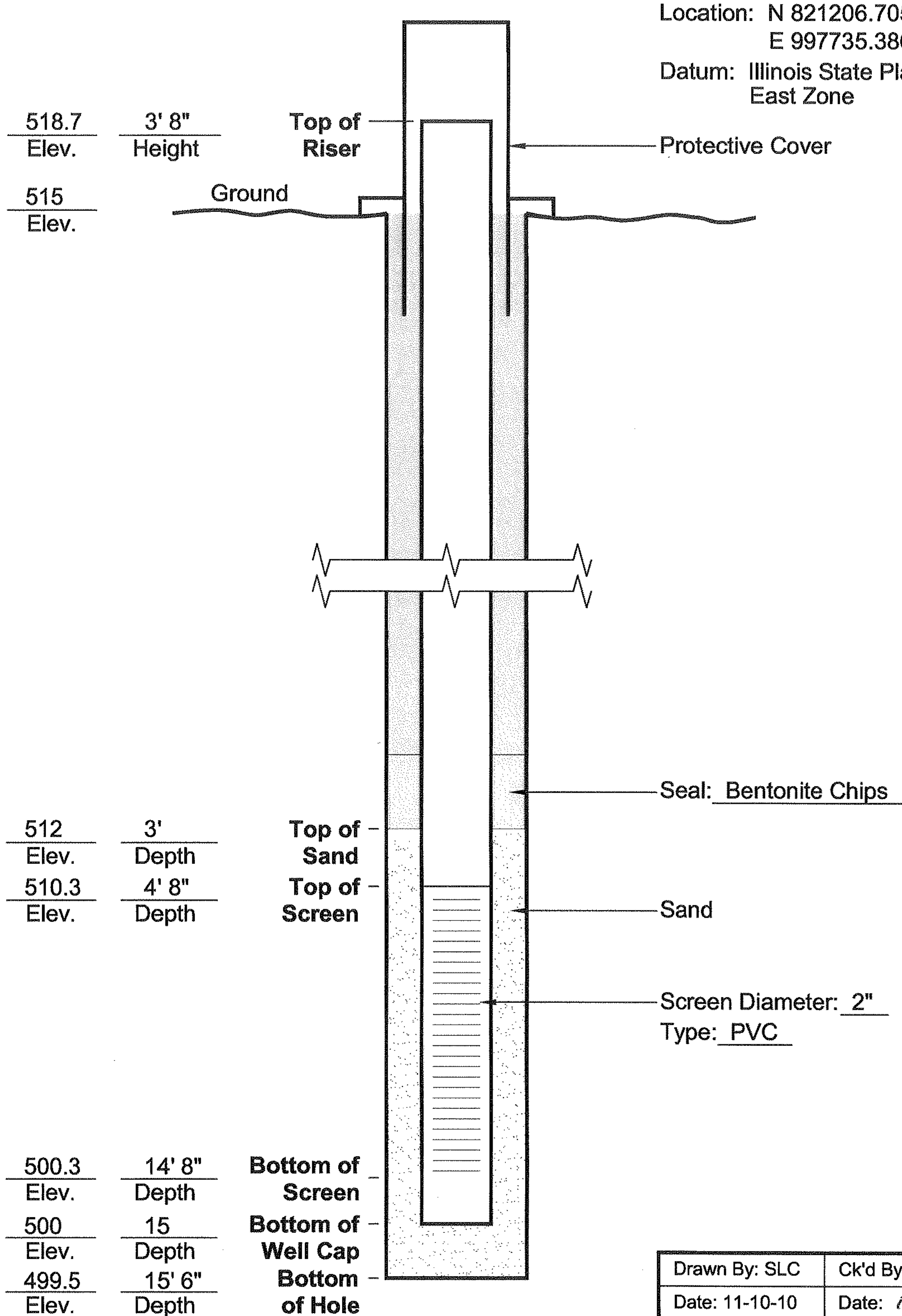
GEOTECHNOLOGY INC
FROM THE GROUND UP

Newton Power Station
Newton, Illinois

PIEZOMETER CONSTRUCTION DIAGRAM

Project Number J017150.01	B-2

Date Installed: 06-17-10
Location: N 821206.705'
E 997735.386'
Datum: Illinois State Plane Coordinates, East Zone



Drawn By: SLC	Ck'd By: SL	App'vd By: DW
Date: 11-10-10	Date: 12/21/10	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Newton Power Station
Newton, Illinois

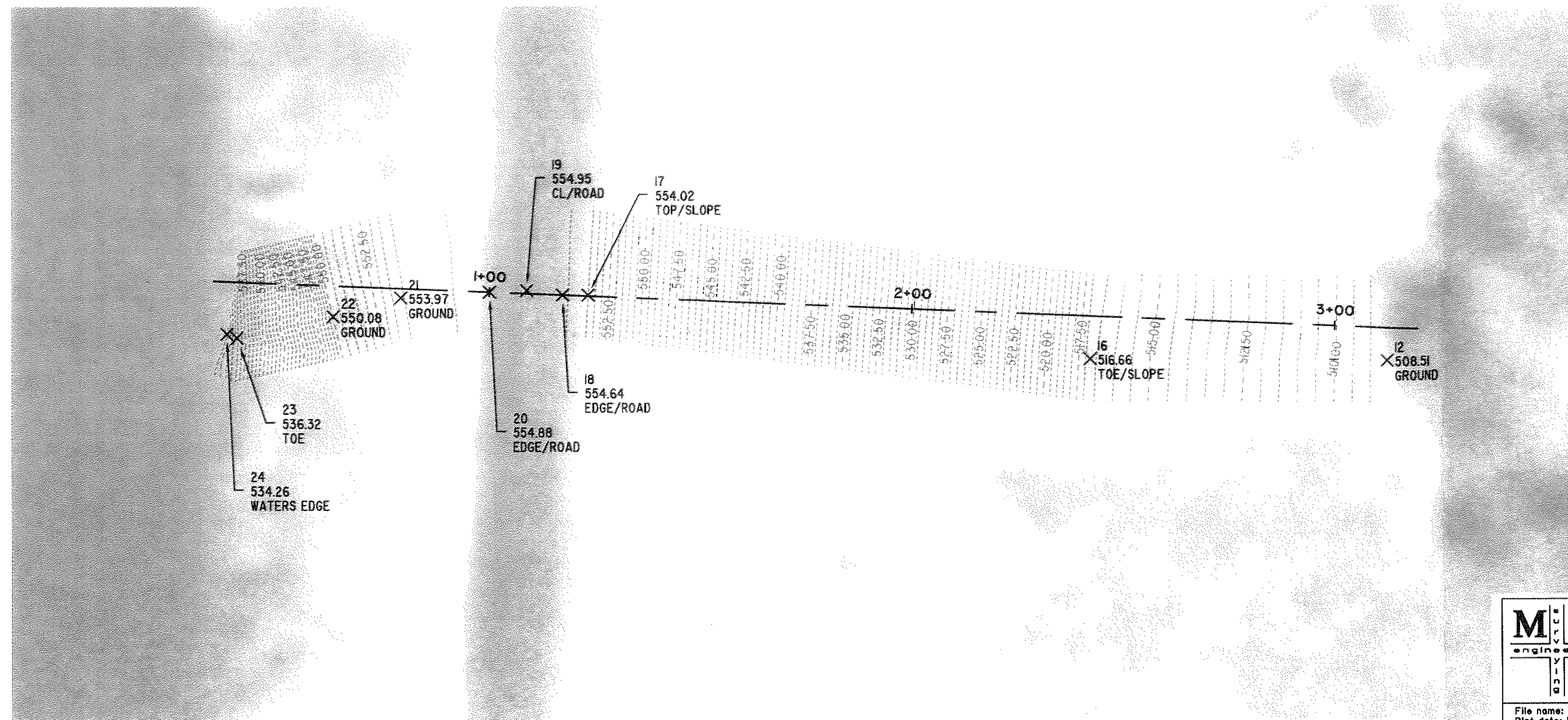
PEIZOMETER CONSTRUCTION DIAGRAM

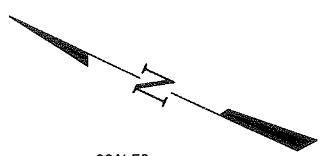
Project Number J017150.01	B-3

APPENDIX E

SURVEY DATA

Point	Station	Offset	Elevation	Description
12	3+12.97	7.724'	508.511'	GROUND
16	2+42.81	10.140'	516.664'	TOE/SLOPE
17	1+23.30	-0.246'	554.015'	TOP/SLOPE
18	1+17.28	0.000'	554.641'	EDGE/ROAD
19	1+08.75	-0.738'	554.950'	CL/ROAD
20	1+00.00	0.000'	554.879'	EDGE/ROAD
21	0+79.42	2.185'	553.969'	GROUND
22	0+63.83	7.278'	550.079'	GROUND
23	0+41.20	13.241'	536.323'	TOE
24	0+38.67	12.423'	534.256'	WATERS EDGE



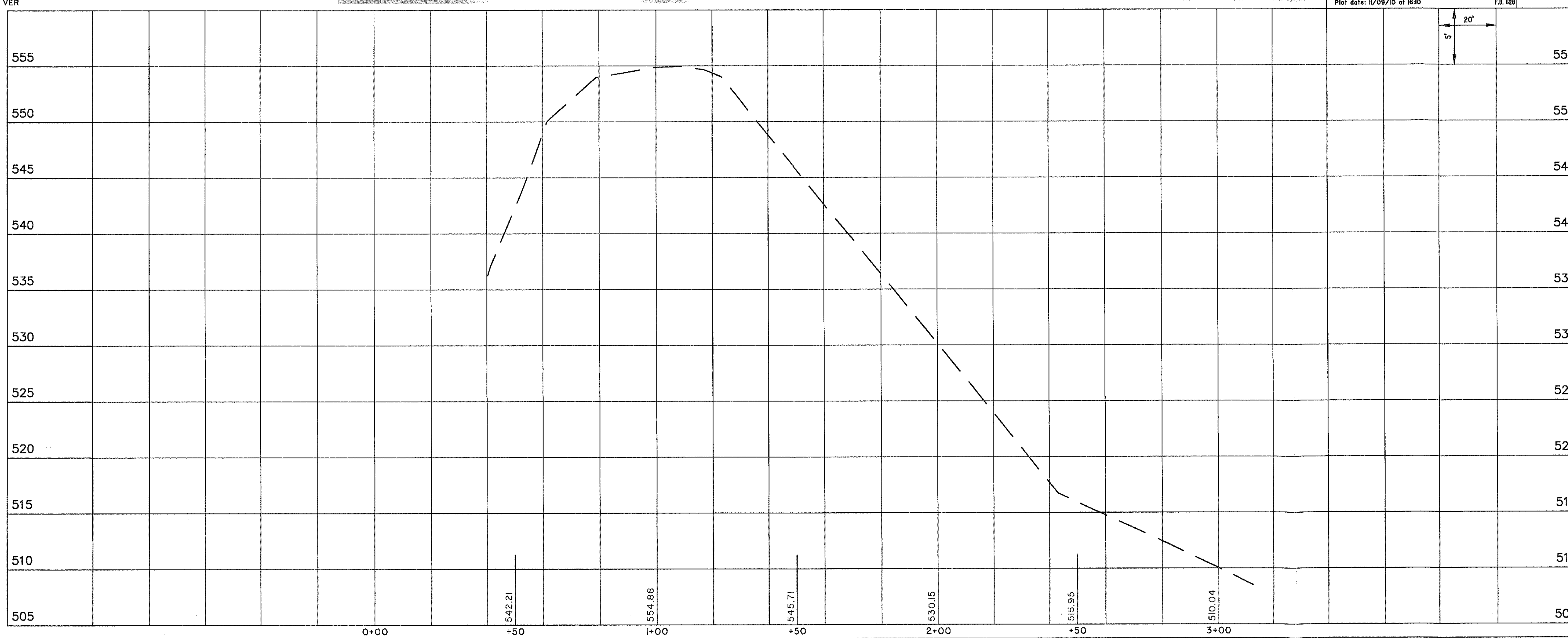


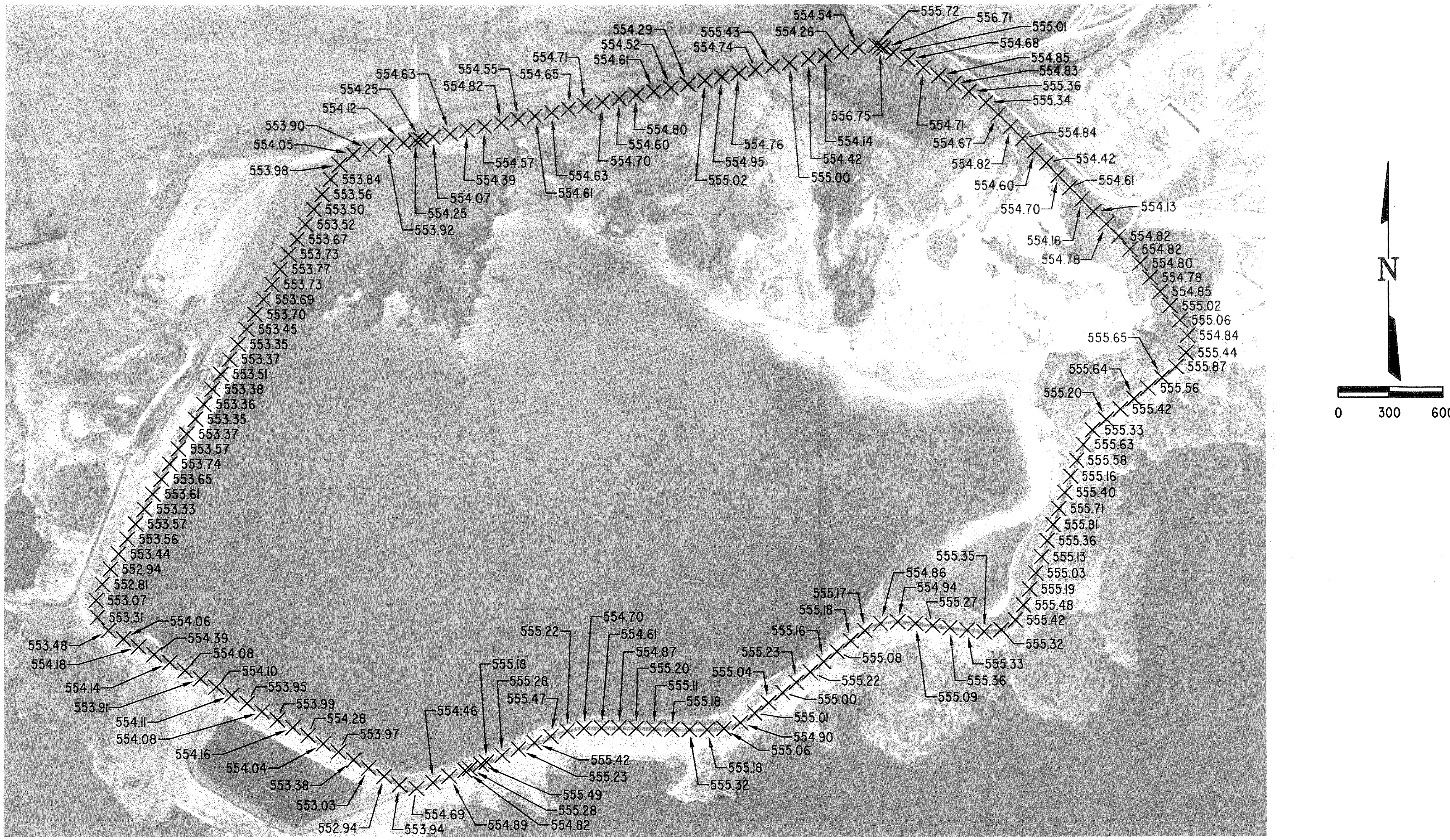
SCALES:
1" =20' HOR
1" =5' VER

MILANO & GRUNLOH ENGINEERS, LLC
114 WEST WASHINGTON
P.O. BOX 897
EFFINGHAM, ILLINOIS 62401
Phone: (217) 347-7262
(800) 677-2714
Fax #: (217) 342-3433
Web Address: www.mgengineers.com
Design Firm #: 184-003108

File name: S:\DWG\10\10165bg5\dwg\Section.dwg
Plot date: 11/09/10 at 16:10
F.B. 628

AMEREN-CIPS
NEWTON FACILITY
CROSS SECTION





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Web Address: www.mgengineers.com
Design Firm #: 184-003108

M surveying engineering G

File name: S:\DWG\10\10165bg5\dwg\Elevations.dwg
Plot date: 10/29/10 at 15:25 F.B. 628

AMEREN-CIPS
NEWTON FACILITY

S:\dwg\10\10165bg5\dwg\Elevations.dwg, 11x17, 10/29/2010 3:40:32 PM

Attachment E

Alternative Final Protective Layer Equivalency Demonstration

Geosyntec consultants

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Technical Memorandum

Date:	July 25, 2022
To:	Victor Modeer, P.E., DGE, Vistra on behalf of Illinois Power Generating Company
Copies to:	Phil Morris, Rhys Fuller, Vistra on behalf of Illinois Power Generating Company
From:	John Seymour, P.E., Geosyntec Consultants (Geosyntec) Lucas Carr, P.E., Geosyntec
Subject:	Proposed Alternative Final Protective Layer Equivalency Demonstration Primary Ash Pond, Newton Power Plant Jasper County, Illinois Geosyntec Project: GLP8025

PROPOSAL

An alternative final protective layer is proposed by Illinois Power Generating Company (IPGC) for the Primary Ash Pond (PAP) surface impoundment that will be closed-in-place at the Newton Power Plant (NPP). 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 geocomposite drainage layer consisting of geogrid web with geotextiles molded on top and bottom of the geogrid ("drainage layer") will be 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 drainage layer[1]; 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**.

[1] The drainage layer is not required by Section 845 but has been included to provide for additional reduction of water available for infiltration and for protection for the geomembrane.

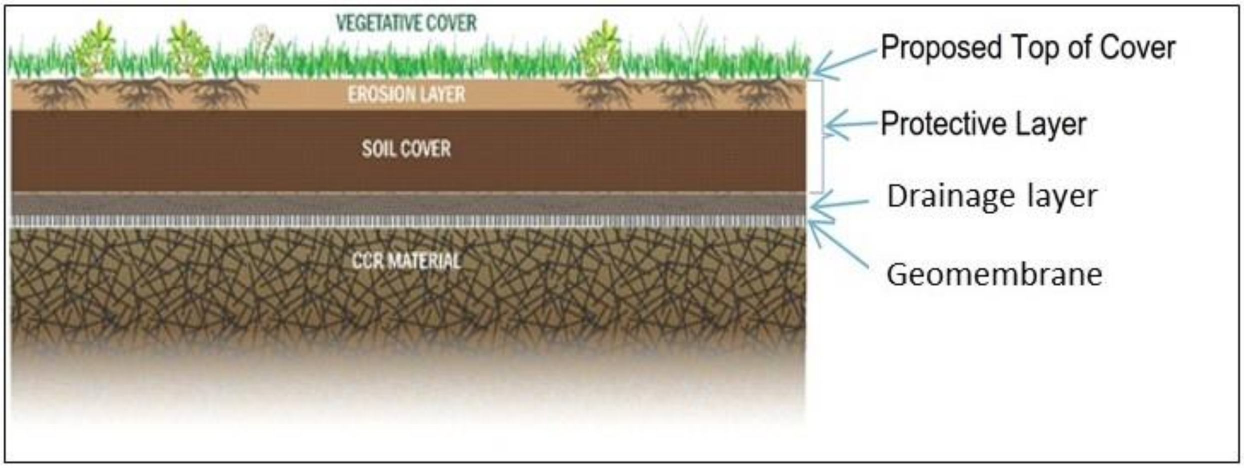


Figure 1: Proposed Alternative Final Cover System

The NPP Site is slated for re-development as a utility-scale solar facility if closure-in-place (CIP) is approved. A solar facility atop the cover system is currently being designed. Components of the vegetative cover may change as details of the solar facility are finalized. This will be discussed further under "Additional Considerations."

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 Appendix 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 NPP PAP. 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.
    - In fact, 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 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 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 geocomposite drainage layer covered by a geotextile filter, 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 NPP 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 NPP PAP 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 NPP PAP 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 2-ft-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 topsoil layer placed as part of the final protective layer will be fertilized and vegetated, 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
    - Final cover system slopes will be installed at relatively gentle grades (e.g., typically 2%). The use of gentle grades will reduce water runoff velocities and therefore reduce the potential for water erosion of the final cover soils.
    - The geocomposite drainage layer helps to facilitate lateral drainage of infiltration off the geomembrane, thereby reducing the amount of water available for infiltration through the geomembrane and provides cushioning over the geomembrane. This layer is not required by Section 845.750, but it enhances the final cover system performance.
    - A stormwater management system consisting of channels, pipes, and letdown structures is included in the drawings within the Closure Plan [2] and will be designed to collect stormwater in a controlled manner and route it off the final cover system which 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 relatively gentle at 2%; 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 analysis was performed to by Ramboll, within the NPP PAP Construction Permit Application [8], to estimate post-closure liquid infiltration rates through both the default and the proposed alternate final cover systems at the NPP PAP. 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 – NPP PAP Final Cover Systems for Infiltration Analysis

Description	Low Permeability Layer[2]	Final Protective Layer	Infiltration Rate[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 200-mil geosynthetic drainage net layer, 1.5 ft of sandy silty clay and 0.5 ft of sandy clay loam	0.042 in/yr
Default Cover with Geomembrane Barrier	40-mil LLDPE Geomembrane	3 ft of cover material, including, from bottom to top, a 200-mil geosynthetic drainage net layer, 2.5 ft of sandy silty clay and 0.5 ft of sandy clay loam	0.053 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 sandy silty clay and 0.5 ft of sandy clay loam	2.07 in/yr

The NPP PAP analysis indicated that the performance of the proposed alternative final cover system with a geomembrane and a two-foot-thick final protective cover exceeds the performance offered by the default final cover system utilizing a geomembrane with the default three-foot-thick protective layer and cushion layer, with the infiltration rate reduced by a factor of 1.3.

Furthermore, the proposed alternate final cover system performance excess 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) by reducing infiltration by a factor of 49.

Post-Closure Construction of Solar Panel Electrical Generating System

The NPP Site is slated for re-development as a utility-scale solar facility if closure-in-place (CIP) is approved. A solar facility atop the cover system is currently being designed. Components of the vegetative cover may change as details of the solar facility are finalized. The system will be designed, installed, and operated such that the closure performance standards will be maintained at an equivalent level as proposed in the NPP PAP Closure Plan [2].

For example, the panels are expected to be supported by concrete slab ballast foundations that will replace portions of the erosion (topsoil) layer and not cause excessive settlement of the cover and

[2] All HELP run versions used a pinhole density of 1 hole per acre, installation defects of 1 hole/acre, and construction quality as “good”.
[3] Infiltration is out the bottom of the low permeability layer.

will reduce the amount of infiltration. The ballast foundations will not penetrate the geomembrane low-permeability layer to reduce the potential for defects that could otherwise increase infiltration. The space around the panel foundations will be replaced with an alternative to shallow rooted vegetation and will include stormwater runoff and erosion materials that will meet the erosion control standards of Section 845.750 and may also include forbs (herbaceous flowering plants).

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:

- 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.
- The installation of a solar panel electrical generating system will provide green energy to the community and reduce the maintenance associated with the shallow rooted vegetation.

SUMMARY

The proposed alternate final protective layer will:

- Provide equivalent or superior performance to the requirements of Section 845.750 (c)(2).
- Have a drainage layer, which is not required by Section 845.750, over the geomembrane that adds both lateral drainage layer to reduce the amount of water available for infiltration through the geomembrane and physical protection for the geomembrane.
- Have a lower infiltration rate than the infiltration through the default soil final cover system.
- 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 NPP PAP.
- A solar panel electrical generating system will provide green energy to the community and reduce the maintenance of the cover.

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] HDR, "Primary Ash Pond Final Closure Plan," 2022.

[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] HDR, "Illinois Power Generating Company, Primary Ash Pond, Construction Permit Application," 2022.

[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: NPP PAP- 2-FT FINAL PROTECTIVE COVER SOIL

A-2: NPP PAP-3-FT FINAL PROTECTIVE COVER SOIL

A-3: NPP PAP-3-FT COMPACTED EARTH LAYER, 3-FT FINAL PROTECTIVE COVER SOIL

APPENDIX A-1

NPP PAP- 2-FT FINAL PROTECTIVE COVER SOIL

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: NEW AP CIP Cons **Simulated On:** 6/21/2022 10:43

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
SCL - Sandy Clay Loam
Material Texture Number 10

Thickness	=	6	inches
Porosity	=	0.398	vol/vol
Field Capacity	=	0.244	vol/vol
Wilting Point	=	0.136	vol/vol
Initial Soil Water Content	=	0.2475	vol/vol
Effective Sat. Hyd. Conductivity	=	1.20E-04	cm/sec

Layer 2

Type 1 - Vertical Percolation Layer
Sandy Silty Clay - PAP
Material Texture Number 43

Thickness	=	18	inches
Porosity	=	0.4	vol/vol
Field Capacity	=	0.35	vol/vol
Wilting Point	=	0.3	vol/vol
Initial Soil Water Content	=	0.3706	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-05	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	=	0.0581	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	2	%
Drainage Length	=	1500	ft

Layer 4

Type 4 - Flexible Membrane Liner
LDPE Membrane
Material Texture Number 36

Thickness	=	0.04	inches
Effective Sat. Hyd. Conductivity	=	4.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 5

Type 1 - Vertical Percolation Layer (Waste)
High-Density Electric Plant Coal Fly Ash
Material Texture Number 30

Thickness	=	156	inches
Porosity	=	0.541	vol/vol
Field Capacity	=	0.187	vol/vol
Wilting Point	=	0.047	vol/vol
Initial Soil Water Content	=	0.1871	vol/vol
Effective Sat. Hyd. Conductivity	=	5.00E-05	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	84.4	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	265	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	5.928	inches
Upper Limit of Evaporative Storage	=	7.188	inches
Lower Limit of Evaporative Storage	=	4.416	inches
Initial Snow Water	=	1.570044	inches
Initial Water in Layer Materials	=	37.354	inches
Total Initial Water	=	38.924	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.93	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	120	days

End of Growing Season (Julian Date)	=	300	days
Average Wind Speed	=	8	mph
Average 1st Quarter Relative Humidity	=	73	%
Average 2nd Quarter Relative Humidity	=	71	%
Average 3rd Quarter Relative Humidity	=	75	%
Average 4th Quarter Relative Humidity	=	75	%

Note: Evapotranspiration data was obtained for Newton, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
3.464157	2.363177	4.307613	4.875747	5.596821	4.968593
3.874885	3.10377	3.080127	3.602883	4.376843	2.870644

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
39	38.7	47.8	61.1	70.7	80.8
84.9	82.3	72.7	58.1	47.1	38.2

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28

Average Annual Totals Summary

Title: Newton Ash Pond
Simulated on: 6/21/2022 10:44

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	46.49	[5.78]	44,716,495.2	100.00
Runoff	5.561	[3.492]	5,349,478.7	11.96
Evapotranspiration	30.979	[2.74]	29,800,414.9	66.64
Subprofile1				
Lateral drainage collected from Layer 3	9.9514	[2.1689]	9,572,702.5	21.41
Percolation/leakage through Layer 4	0.041772	[0.018348]	40,183.0	0.09
Average Head on Top of Layer 4	1.4441	[0.6401]	---	---
Subprofile2				
Percolation/leakage through Layer 5	0.042250	[0.019041]	40,642.1	0.09
Water storage				
Change in water storage	-0.0486	[1.0288]	-46,743.0	-0.10

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

Peak Values Summary

Title: Newton Ash Pond
Simulated on: 6/21/2022 10:44

	Peak Values for Years 1 - 30*	
	(inches)	(cubic feet)
Precipitation	3.43	3,301,549.4
Runoff	3.048	2,931,612.5
Subprofile1		
Drainage collected from Layer 3	0.1514	145,634.4
Percolation/leakage through Layer 4	0.001891	1,818.8
Average head on Layer 4	24.0066	---
Maximum head on Layer 4	38.7320	---
Location of maximum head in Layer 3	289.48 (feet from drain)	
Subprofile2		
Percolation/leakage through Layer 5	0.001526	1,467.8
Other Parameters		
Snow water	3.0807	2,963,435.7
Maximum vegetation soil water	0.3993 (vol/vol)	
Minimum vegetation soil water	0.2453 (vol/vol)	

Final Water Storage in Landfill Profile at End of Simulation Period

Title: Newton Ash Pond
Simulated on: 6/21/2022 10:44
Simulation period: 30 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	1.6232	0.2705
2	6.6658	0.3703
3	0.0052	0.0262
4	0.0000	0.0000
5	29.1717	0.1870
Snow water	0.0000	---

APPENDIX A-2

NPP PAP- 3-FT FINAL PROTECTIVE COVER SOIL

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: NEW AP Default **Simulated On:** 6/21/2022 10:56

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
SCL - Sandy Clay Loam
Material Texture Number 10

Thickness	=	6	inches
Porosity	=	0.398	vol/vol
Field Capacity	=	0.244	vol/vol
Wilting Point	=	0.136	vol/vol
Initial Soil Water Content	=	0.2475	vol/vol
Effective Sat. Hyd. Conductivity	=	1.20E-04	cm/sec

Layer 2

Type 1 - Vertical Percolation Layer
Sandy Silty Clay - PAP
Material Texture Number 43

Thickness	=	30	inches
Porosity	=	0.4	vol/vol
Field Capacity	=	0.35	vol/vol
Wilting Point	=	0.3	vol/vol
Initial Soil Water Content	=	0.3718	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-05	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	=	0.092	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	2	%
Drainage Length	=	1500	ft

Layer 4

Type 4 - Flexible Membrane Liner
LDPE Membrane
Material Texture Number 36

Thickness	=	0.04	inches
Effective Sat. Hyd. Conductivity	=	4.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 5

Type 1 - Vertical Percolation Layer (Waste)
High-Density Electric Plant Coal Fly Ash
Material Texture Number 30

Thickness	=	156	inches
Porosity	=	0.541	vol/vol
Field Capacity	=	0.187	vol/vol
Wilting Point	=	0.047	vol/vol
Initial Soil Water Content	=	0.1872	vol/vol
Effective Sat. Hyd. Conductivity	=	5.00E-05	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	84.4	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	265	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	5.92	inches
Upper Limit of Evaporative Storage	=	7.188	inches
Lower Limit of Evaporative Storage	=	4.416	inches
Initial Snow Water	=	1.570044	inches
Initial Water in Layer Materials	=	41.857	inches
Total Initial Water	=	43.427	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.93	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	120	days

End of Growing Season (Julian Date)	=	300	days
Average Wind Speed	=	8	mph
Average 1st Quarter Relative Humidity	=	73	%
Average 2nd Quarter Relative Humidity	=	71	%
Average 3rd Quarter Relative Humidity	=	75	%
Average 4th Quarter Relative Humidity	=	75	%

Note: Evapotranspiration data was obtained for Newton, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
3.464157	2.363177	4.307613	4.875747	5.596821	4.968593
3.874885	3.10377	3.080127	3.602883	4.376843	2.870644

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
39	38.7	47.8	61.1	70.7	80.8
84.9	82.3	72.7	58.1	47.1	38.2

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28

Average Annual Totals Summary

Title: Newton Ash Pond
Simulated on: 6/21/2022 10:57

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	46.49	[5.78]	44,716,495.2	100.00
Runoff	5.416	[3.469]	5,210,333.7	11.65
Evapotranspiration	30.948	[2.734]	29,770,001.9	66.57
Subprofile1				
Lateral drainage collected from Layer 3	10.1178	[2.2092]	9,732,826.8	21.77
Percolation/leakage through Layer 4	0.053103	[0.027784]	51,082.0	0.11
Average Head on Top of Layer 4	1.8201	[0.9543]	---	---
Subprofile2				
Percolation/leakage through Layer 5	0.054052	[0.028093]	51,994.9	0.12
Water storage				
Change in water storage	-0.0506	[1.0901]	-48,662.0	-0.11

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

Peak Values Summary

Title: Newton Ash Pond
Simulated on: 6/21/2022 10:57

	Peak Values for Years 1 - 30*	
	(inches)	(cubic feet)
Precipitation	3.43	3,301,549.4
Runoff	3.048	2,931,607.7
Subprofile1		
Drainage collected from Layer 3	0.1514	145,640.0
Percolation/leakage through Layer 4	0.002901	2,790.3
Average head on Layer 4	35.9348	---
Maximum head on Layer 4	54.8096	---
Location of maximum head in Layer 3	355.60 (feet from drain)	
Subprofile2		
Percolation/leakage through Layer 5	0.001630	1,567.7
Other Parameters		
Snow water	3.0807	2,963,435.7
Maximum vegetation soil water	0.3993 (vol/vol)	
Minimum vegetation soil water	0.2453 (vol/vol)	

Final Water Storage in Landfill Profile at End of Simulation Period

Title: Newton Ash Pond
Simulated on: 6/21/2022 10:57
Simulation period: 30 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	1.6232	0.2705
2	11.1032	0.3701
3	0.0112	0.0560
4	0.0000	0.0000
5	29.1720	0.1870
Snow water	0.0000	---

APPENDIX A-3

NPP PAP-3-FT COMPACTED EARTH LAYER, 3-FT FINAL PROTECTIVE COVER SOIL

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title:	NEW AP Default Earth	**Simulated On:**	6/21/2022 11:11

Layer 1
Type 1 - Vertical Percolation Layer (Cover Soil)
SCL - Sandy Clay Loam
Material Texture Number 10

Thickness	=	6	inches
Porosity	=	0.398	vol/vol
Field Capacity	=	0.244	vol/vol
Wilting Point	=	0.136	vol/vol
Initial Soil Water Content	=	0.3858	vol/vol
Effective Sat. Hyd. Conductivity	=	1.20E-04	cm/sec

Layer 2
Type 1 - Vertical Percolation Layer
Sandy Silty Clay - PAP
Material Texture Number 43

Thickness	=	30	inches
Porosity	=	0.4	vol/vol
Field Capacity	=	0.35	vol/vol
Wilting Point	=	0.3	vol/vol
Initial Soil Water Content	=	0.4	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-05	cm/sec

Layer 3
Type 3 - Barrier Soil Liner
Liner Soil (High)
Material Texture Number 16

Thickness	=	36	inches
Porosity	=	0.427	vol/vol
Field Capacity	=	0.418	vol/vol
Wilting Point	=	0.367	vol/vol
Initial Soil Water Content	=	0.427	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-07	cm/sec

Layer 4
Type 1 - Vertical Percolation Layer (Waste)
High-Density Electric Plant Coal Fly Ash

Material Texture Number 30

Thickness	=	156	inches
Porosity	=	0.541	vol/vol
Field Capacity	=	0.187	vol/vol
Wilting Point	=	0.047	vol/vol
Initial Soil Water Content	=	0.1996	vol/vol
Effective Sat. Hyd. Conductivity	=	5.00E-05	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	84.4	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	265	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	7.115	inches
Upper Limit of Evaporative Storage	=	7.188	inches
Lower Limit of Evaporative Storage	=	4.416	inches
Initial Snow Water	=	1.570044	inches
Initial Water in Layer Materials	=	60.819	inches
Total Initial Water	=	62.389	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.93	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	120	days
End of Growing Season (Julian Date)	=	300	days
Average Wind Speed	=	8	mph
Average 1st Quarter Relative Humidity	=	73	%
Average 2nd Quarter Relative Humidity	=	71	%
Average 3rd Quarter Relative Humidity	=	75	%
Average 4th Quarter Relative Humidity	=	75	%

Note: Evapotranspiration data was obtained for Newton, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec

3.464157	2.363177	4.307613	4.875747	5.596821	4.968593
3.874885	3.10377	3.080127	3.602883	4.376843	2.870644

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
39	38.7	47.8	61.1	70.7	80.8
84.9	82.3	72.7	58.1	47.1	38.2

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.93/-88.28

Average Annual Totals Summary

Title: Newton Ash Pond
Simulated on: 6/21/2022 11:12

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	46.49	[5.78]	44,716,495.2	100.00
Runoff	12.238	[4.888]	11,772,719.1	26.33
Evapotranspiration	32.236	[2.871]	31,009,280.2	69.35
Subprofile1				
Percolation/leakage through Layer 3	2.070136	[0.059537]	1,991,367.4	4.45
Average Head on Top of Layer 3	23.9878	[1.7467]	---	---
Subprofile2				
Percolation/leakage through Layer 4	1.821708	[0.604523]	1,752,392.2	3.92
Water storage				
Change in water storage	0.1893	[1.099]	182,103.7	0.41

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

Peak Values Summary

Title: Newton Ash Pond
Simulated on: 6/21/2022 11:12

	Peak Values for Years 1 - 30*	
	(inches)	(cubic feet)
Precipitation	3.43	3,301,549.4
Runoff	3.183	3,062,071.3
Subprofile1		
Percolation/leakage through Layer 3	0.006803	6,544.2
Average head on Layer 3	35.9998	
Subprofile2		
Percolation/leakage through Layer 4	0.009219	8,868.7
Other Parameters		
Snow water	3.0807	2,963,435.7
Maximum vegetation soil water	0.3993 (vol/vol)	
Minimum vegetation soil water	0.2453 (vol/vol)	

Final Water Storage in Landfill Profile at End of Simulation Period

Title: Newton Ash Pond
Simulated on: 6/21/2022 11:12
Simulation period: 30 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	2.1868	0.3645
2	11.9241	0.3975
3	15.3720	0.4270
4	38.5853	0.2473
Snow water	0.0000	---

Attachment H

Public Notification and Public Meeting Certification

Luminant

James Marshall
Illinois Power Generating Company
1500 Eastport Plaza Drive
Collinsville, IL 62234

July 28, 2022

Illinois Environmental Protection Agency
DWPC – Permits MC # 15
ATTN: Part 845 Coal Combustion Residual Rule Submittal
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Re: 35 IAC 845.220(a)(9) Certification Statement
Newton Power Plant Primary Ash Pond (IEPA ID # W0798070001-01)

Dear Mr. Darin LeCrone:

For the above-refenced CCR surface impoundment and in accordance with 35 IAC 845.220(a)(9), Illinois Power Generating Company 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,
Illinois Power Generating Company

James R Marshall

James Marshall
Plant Manager

Newton Public Meeting Summary, May 24, 2022

On April 24, 2022, Illinois Power Generating Company (IPGC) made available to the public its plans to close the Primary Ash Pond (PAP) located at the Newton Power Plant. On Tuesday, May 24, 2022, Illinois Power Generating Company held in-person public meetings at West End Reception and Events, in Newton, Illinois at 3:00 pm and 5:30 pm to present its decision-making process. A comparison of projected groundwater impacts for the alternatives presented, and an objective comparison of the pros and cons of each alternative were presented at these meetings. During the question-and-answer portion of the meeting, the public asked questions relating to the proposed closure and the company provided answers. 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, and a summary of the company's responses to those issues or comments. All questions asked during the meeting were addressed.

Issue/Topic		**Summary of Response Provided at Meeting**	**Additional Written Response**
1.	On-Site Landfill	There is an existing landfill located on the Newton Power Plant Property. The landfill is located west of the PAP. The use of this existing landfill for disposal of ash in the PAP was evaluated in the Closure Alternatives Analysis (CAA); the evaluation concluded that the landfill would need to be reconstructed and expanded prior to receiving ash from the PAP. The use of the on-site landfill for disposal of ash in the PAP was not the selected closure alternative in the CAA.	The existing composite lined landfill onsite has approximately 11.7-acres constructed and been closed/capped. There is an area of about 7.2-acres that was constructed and not used. This area would require re-construction prior to use. There are about 33.96-acres remaining to construct in the permitted landfill footprint (including the area requiring reconstruction). Even with the remaining area to construct, the permitted landfill area is not adequate to hold the volume of waste that is held in the PAP. Expansion of the onsite landfill would require additional infrastructure to be installed, time for permitting efforts, and the closure itself would take significantly longer to complete. Additionally, landfill height would have to be increased and potentially more visible to surrounding areas.
2.	Ash Pond Closure	Closure of an ash pond means that that ash within the pond is either capped in place or excavated and disposed in an alternative landfill. In Part 845, IEPA allows different closure approaches to be evaluated and sets criteria that must be evaluated for each	The Closure Alternatives Analysis (CAA) provides a detailed evaluation of the different factors that were evaluated for the closure alternatives that were considered for the PAP at the Newton Power Plant as required by Part 845. These factors include, but are not limited to, reduction of risks,

Issue/Topic		Summary of Response Provided at Meeting	Additional Written Response
		potential closure approach. The IEPA will review the site's closure and post closure plans prior to approval of a closure approach and may re-evaluate groundwater corrective action during post-closure based on closure conditions or monitoring results. The post closure care period is a minimum of 30 years.	likelihood of future releases, impacts to workers and the community, impacts to scenic, historic, and recreational areas, time until the GWPSs are achieved, and reliability and implementability of the closure approach.
3.	Groundwater/ Groundwater Protection Standards (GWPS)s	Under the Illinois Part 845 regulations, the groundwater monitoring has demonstrated that there currently are "potential" exceedances of the GWPSs. These exceedances are still considered "potential" because IEPA has not yet approved the statistical approach used to evaluate the groundwater data. If these "potential" GWPS exceedances are confirmed, corrective measures will be evaluated as required by Part 845. Groundwater monitoring is on-going at the site. While there are some monitoring wells that have existed at the property for many years, additional monitoring wells were installed as a result of the Federal CCR rule in 2015. Moreover, monitoring wells were also installed more recently as a result of the Illinois Part 845 regulations. Groundwater at these monitoring wells is sampled and analyzed routinely to comply with both the Federal and State requirements.	

Issue/Topic		Summary of Response Provided at Meeting	Additional Written Response
4.	Closure-in Place/Ash Consolidation	Closure in place includes consolidating to the north, and placement of a geomembrane liner over the consolidated ash.	The composite cap components used for final cover include an LLDPE geomembrane liner, cover soil, vegetation, and stormwater control features. Consolidation to the north allows for a smaller closure footprint than the current PAP area and ash will remain above the upper most aquifer. Also, it provides for the establishment of slopes that direct stormwater away from the composite cap to the stormwater management system south of the closure area.
5.	Groundwater Monitoring	For the closure-in-place alternative, groundwater monitoring will continue on the property for at least 30 years. However, if GWPSs have not been achieved in that timeframe, groundwater monitoring will continue as required.	
6.	Post-Closure Conditions	The selected closure approach involves removing liquid waste from the ash, consolidating the ash within a smaller portion of the ash pond located above the uppermost aquifer, and covering the consolidated ash with a geomembrane. By removing liquid waste, consolidating the ash, and installing a geomembrane over the ash, infiltration into the ash and releases to groundwater will be minimized. Modeling has demonstrated that this closure process will result in groundwater concentrations achieving the groundwater protection standards at the same or similar rate as closure by removal. After closure is completed, slopes will be maintained, and the southern berm will be	

Issue/Topic		Summary of Response Provided at Meeting	Additional Written Response
		removed to ensure that water is not impounded on top of the consolidated and capped ash.	
7.	Public Meeting Announcements and Advertising	The advertising and announcements for this public meeting were conducted consistent with IEPA and Part 845 requirements. Specifically, 30 days prior to the meeting, notices were mailed to all residents that live within 1 mile of the Newton Power Plant. Moreover, notices were posted in public areas including local libraries and post offices within 10 miles of the Newton Power Plant. With the ongoing application process, the IEPA will circulate a public notice of its tentative decision following submittal of the application in August. This will be followed by a 45-day public comment period. If the IEPA determines there is significant public interest, a public hearing will be held.	

In accordance with 845.240(f)(4), a list of people who requested to be added to the IEPA Listserv for Newton is as follows:

Newton construction permit public meetings	
People requesting to be added to IEPA Listserv	
Name	Email address
Phil Rauch	philiprauch63@icloud.com
Paula Frohning	dprnf67@gmail.com
Rick Cochran	rpcochran73@gmail.com
Debby & Greg Fehn	debbyjfeh@yahoo.com

Attachment I

Closure Prioritization Category Letter

Phil Morris
Illinois Power Generating Company
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 Illinois Power Generating Company

Dear Mr. LeCrone:

Pursuant to 35 I.A.C. 845.700(c), Illinois Power Generating Company submits the information necessary to categorize the CCR surface impoundments located at the Newton Power Plant and the now retired Coffeen Power Plant. 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 Newton and Coffeen 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 2.

- 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)
Coffeen	Ash Pond 1	Inactive	No	No	No	Yes	5
	GMF Pond	Inactive	No	No	No	Yes	5
	GMF Recycle Pond	Inactive	No	No	No	Yes	5
Newton	Primary Ash Pond	Existing	No	No	No	Yes	5

[1] See Attachment 2 Environmental Justice Area Map

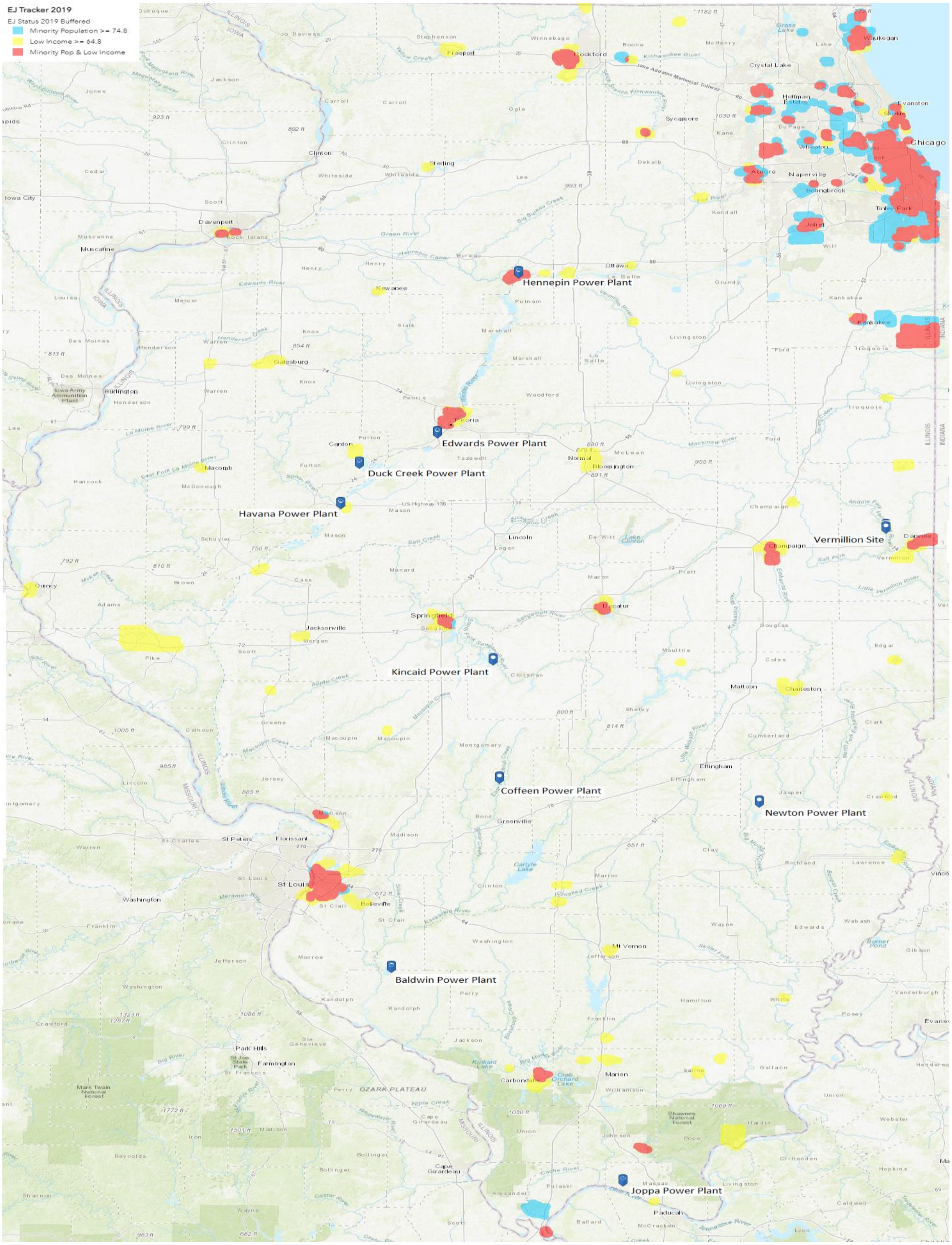
[2] Ground water analyses for purposes of categories 4-7, assumptions have been made based on current groundwater data. However, since sampling and analysis is ongoing and subject to IEPA review and approval, IPGC reserves the right to update its category designations for Categories 4-7.

Table 2: Impacts to Potable Water Supply[1]

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
Coffeen	**Present, but not at risk** Thirty-four (34) 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, or they do not appear to be used for potable purposes. None of the off-site wells are located in a downgradient direction.	**Present, but not at risk** Three (3) non-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.	Absent	Absent	Absent
Newton	**Present, but not at risk** Twenty-four (24) 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, and/or they are unlikely to be present based on the mapped location. None of the offsite wells are located in a downgradient direction.	Absent	Absent	Absent	Absent

[1] Ramboll, WELL/WATER SUPPLY SURVEY AND EVALUATION COAL-FIRED POWER PLANTS IN ILLINOIS (September 24, 2020), filed with the Illinois Pollution Control Board in R2020-019.

Attachment 2: EJ Mapping Denoting Facilities with Impoundments



Attachment J

Post-Closure Care Plan

POST-CLOSURE PLAN FOR EXISTING CCR SURFACE IMPOUNDMENT
40 C.F.R. § 257.104 rule and 35 I.A.C. 845.780
REV 0 – 10/30/2021

SITE INFORMATION

Site Name / Address	Newton Power Plant / 6725 North 500th Street, Newton, IL 62448		
Owner Name / Address	Illinois Power Generating Company / 6555 Sierra Drive Irving, Texas 75039		
CCR Unit	Primary 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) 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.	Illinois Power Generating Company 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 currentlyunknown, 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 Newton Primary Ash Pond 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; Newton Power Plant; Primary 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

10/18/2021

Date

JOHN ROBERT HESEMANN
062-058523
LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

John R. Hesemann
Exp.: 11/30/2021

Attachment K

Contractor Training Certification

Phil Morris
Illinois Power Generating Company
1500 Eastport Plaza Drive
Collinsville, IL 62234

July 28, 2022

Illinois Environmental Protection Agency
DWPC – Permits MC # 15
ATTN: Part 845 Coal Combustion Residual Rule Submittal
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Re: 415 ILCS 5/22.59(b)(4) Certification Statement
Newton Power Plant Primary Ash Pond (IEPA ID# W0798070001-01)

Dear Mr. Darin LeCrone:

For the above-referenced CCR surface impoundment and in accordance with 415 ILCS 5/22.59(b)(4), Illinois Power Generating Company certify that all contractors, subcontractors, and installers utilized to construct, install, modify, or close a CCR surface impoundment will be participants in a training program that is approved by and registered with the US Department of Labor's Employment and Training Administration and that includes instruction in the following: erosion control, environmental remediation, operation of heavy equipment and excavation.

Sincerely,
Illinois Power Generating Company

Phil Morris, P.E.
Senior Director, Environmental