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

October 25, 2021

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: Duck Creek Power Plant GMF Pond; IEPA ID # W0578010001-04

Dear Mr. LeCrone:

In accordance with 35 I.A.C. § 845.200, Illinois Power Resource Generating, LLC (IPRG) is submitting an operating permit application for the Duck Creek Power Plant GMF Pond (IEPA ID # W0578010001-04). One hardcopy and one digital copy are provided with this submittal.

The permit application was prepared in accordance with 35 I.A.C. § 845.230(d)(2) (Existing, Inactive and Inactive Closed CCR Surface Impoundment that have not completed an Agency approved closure before July 30, 2021). This submittal includes the completed permit forms as required by § 845.210.

Sincerely,

Cynthia Vodopivec
SVP-Environmental Health and Safety

Enclosures

Prepared for

Illinois Power Resources Generating, LLC
1500 Eastport Plaza Drive, Collinsville, Illinois 62234

INITIAL OPERATING PERMIT

DUCK CREEK GMF POND

Prepared by

425 South Woods Mill Road, Suite 300
St. Louis, MO 63017

October 25, 2021

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1. INTRODUCTION

Illinois Power Resources Generating, LLC (Dynegy) is operator of the coal-fired Duck Creek Power Plant (Plant) located near Canton, Illinois. The IEPA assigned identification numbers assigned to the Duck Creek GMF Pond is: W0578010001-04. The National Inventory of Dams (NID) number assigned for the Duck Creek GMF Pond is IL50573.

This initial operating 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).

This initial operating permit application is for the Duck Creek GMF Pond.

1.1. Facility Information

Section 845.210(b)(1): All permit applications must contain the name, address, email address and telephone number of the operator, or duly authorized agent, and the property owner to whom all inquiries and correspondence shall be addressed.

Facility:	Duck Creek GMF Pond Duck Creek Power Plant 17751 North Cilco Road Canton, IL 61520
Owner/Operator:	Illinois Power Resources Generating, LLC 1500 Eastport Plaza Drive Collinsville, Illinois 62234

1.2. Owner Signatures

Section 845.210(b)(2): All permit applications must be signed by the owner, operator or a duly authorized agent of the operator.

The owner of the Duck Creek Power Plant is a corporation.

Section 845.210(b)(3): An application submitted by a corporation must be signed by a principal executive officer of at least the level of vice president, or his or her duly authorized representative, if that representative is responsible for the overall operation of the facility described in the application form..

The signature of Cynthia Vodopivec on behalf of Illinois Power Resources Generating, LLC can be found in the cover letter as well as the permit applications located in Section 3.

1.3. Legal Description

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

A legal description has been developed in compliance with Section 845.210(c) and is included in Attachment A.

1.4. Previous Assessments

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

Previous assessments were performed in accordance with 40 CFR § 257 and are referenced within the permit application and included in the appropriate Attachments.

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.

A previous hydrogeologic site investigation or characterization, groundwater monitoring well or system, or groundwater monitoring plan have been completed with a seal from an Illinois Licensed Professional Geologist or Licensed Professional Engineer. However, field investigations have

been completed that supplement that work that will be utilized in the following sections of this report.

> *<u>Section 845.210(d)(2):</u> For existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and Section 845.340 (Unstable Areas) provided that the previously completed assessments meet the applicable requirements of those Sections.*

Previous assessments are provided for Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and Section 845.340 (Unstable Areas) in Attachment D.

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

Previous assessments are provided for Section 845.440 (Hazard Potential Classification Assessment), Section 845.450 (Structural Stability Assessment) and Section 845.460 (Safety Factor Assessment) in Attachments O, P, and Q respectively. The addendum and certification for the Hazard Potential Classification Assessment, Structural Stability Assessment and Safety Factor Assessment are located in Attachment U.

> *<u>Section 845.210(d)(4):</u> 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 was previously approved by the Agency.

2. OPERATING PERMIT

2.1. Initial Operating Permit

Section 845.230(d): Initial Operating Permit for Existing, Inactive and Inactive Closed CCR Surface Impoundments

The Duck Creek GMF Pond is defined by the IEPA as an existing CCR surface impoundment that has not completed post-closure care. Per Part 845, Illinois Power Resources Generating, LLC is submitting an initial operating permit application to IEPA by October 31, 2021. The permit applications (CCR-1 and CCR-2E) are provided in Section 3.

The following sections contain information or references to documents required for the Operating Permit application (Section 845.230).

2.2. History of Construction

Section 845.230(d)(2)(A): The history of construction specified in Section 845.220(a)(1);

The history of construction prepared in 2016 pursuant to 40 CFR § 257.73(c) is provided in Attachment B. An amendment to the history of construction has been prepared in compliance with Section 845.220(a)(1) and is provided in Attachment U.

2.3. Chemical Constituents

Section 845.230(d)(2)(B): An analysis of the chemical constituents found within the CCR to be placed in the CCR surface impoundment;

An analysis of the chemical constituents found within the CCR placed within the Duck Creek GMF Pond is provided in Attachment C.

Section 845.230(d)(2)(C): An analysis of the chemical constituents of all waste streams, chemical additives and sorbent materials entering or contained in the CCR surface impoundment;

An analysis of the chemical constituents of all waste streams, chemical additives and sorbent materials entering or contained within the Duck Creek GMF Pond is provided in Attachment C.

2.4. Location Standards Demonstration

<u>Section 845.230(d)(2)(D):</u> A demonstration that the CCR surface impoundment, as built, meets, or an explanation of how the CCR surface impoundments fails to meet, the location standards in the following Sections:

The Duck Creek GMF Pond location standards as specified in Section 845.230(d)(2)(D) are described in the following sections.

<u>Section 845.230(d)(2)(D)(i):</u> Placement Above the Uppermost Aquifer;

The previous upper aquifer demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.60. The requirements described in 40 C.F.R. § 257.60 are identical to the requirements contained in Section 845.300. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed upper aquifer demonstration is included in Attachment D.

<u>Section 845.230(d)(2)(D)(ii):</u> Wetlands;

The previous wetlands demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.61. The requirements described in 40 C.F.R. § 257.61 are identical to the requirements contained in Section 845.310. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed wetlands demonstration is included in Attachment D.

<u>Section 845.230(d)(2)(D)(iii):</u> Fault Areas;

The previous fault area demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.62. The requirements described in 40 C.F.R. § 257.62 are identical to the requirements contained in Section 845.320. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed fault area demonstration is included in Attachment D.

<u>Section 845.230(d)(2)(D)(iv):</u> Seismic Impact Zone; and

The previous seismic impact zone demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.63. The requirements described in 40 C.F.R. § 257.63 are identical to the requirements contained in Section 845.330. Pursuant to Section 845.210(d)(2), a certification is not required for this

demonstration. The previously completed seismic impact zone demonstration is included in Attachment D.

Section 845.230(d)(2)(D)(v): Unstable Areas and Floodplains;

The previous unstable area demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.64. The requirements described in 40 C.F.R. § 257.64 are identical to the requirements contained in Section 845.340. Pursuant to Section 845.210(d)(2), a certification is not required for the unstable area demonstration. The previously completed unstable area demonstration is included in Attachment D.

The boundaries of the impoundment were determined by a survey conducted by a professional surveyor licensed in the State of Illinois. The boundaries of the GMF Pond were compared to the existing FEMA floodplain map, and it was determined that the GMF Pond is not located within the floodplain. A certification attesting to this is provided in Attachment D.

2.5. Permanent Markers

Section 845.230(d)(2)(E): Evidence of permanent markers required by Section 845.130 have been installed;

Evidence of permanent markers at the Duck Creek GMF Pond as required by Section 845.130 is provided in Attachment E.

2.6. Slope Maintenance

Section 845.230(d)(2)(F): Documentation that the CCR surface impoundment, if not incised, will be operated and maintained with one of the forms of slope protection specified in Section 845.430;

The Duck Creek GMF Pond is not incised. Documentation of slope protection as required by Section 845.430 is provided in Attachment J.

2.7. Initial Emergency Action Plan

Section 845.230(d)(2)(G): Initial Emergency Action Plan and accompanying certification (see Section 845.520(e));

The initial emergency action plan and certification has been completed as specified by Section 845.520(e) and is provided in Attachment F.

2.8. Fugitive Dust Control Plan

Section 845.230(d)(2)(H): Fugitive dust control plan and accompanying certification (see Section 845.500(b)(7));

The fugitive dust control plan and certification has been completed as specified by Section 845.500(b)(7) and is provided in Attachment G.

2.9. Groundwater Monitoring

Section 845.230(d)(2)(I): Groundwater monitoring information:

The groundwater monitoring information for the Duck Creek GMF Pond are described in the following sections.

Section 845.230(d)(2)(I)(i): Hydrogeologic site characterization (see Section 845.620);

Hydrogeologic site characterization for the Duck Creek GMF Pond are provided in Attachment H.

Section 845.230(d)(2)(I)(ii): Design and construction plans of a groundwater monitoring system (see Section 845.630);

Design and construction plans of a groundwater monitoring system are provided in Attachment I.

Section 845.230(d)(2)(I)(iii): A groundwater sampling and analysis program that includes selection of the statistical procedures to be used for evaluating groundwater monitoring data (see Section 845.640); and

A groundwater sampling and analysis program that meets the requirements of Section 845.640 is provided in Attachment I.

Section 845.230(d)(2)(I)(iv): Proposed groundwater monitoring program that includes a minimum of eight independent samples for each background and downgradient well (see Section 845.650(b));

A proposed groundwater monitoring program that meets the requirements of Section 845.650(b) is provided in Attachment I.

2.10. Initial Post-Closure Care Plan

Section 845.230(d)(2)(K): Initial written post-closure care plan, if applicable (see Section 845.780(d));

The Duck Creek GMF Pond closure will be completed by capping the CCR in place. The initial post closure care plan was developed in accordance with Section 845.780 and is provided in Attachment K.

2.11. Liner Certification

Section 845.230(d)(2)(L): The certification required by Section 845.400(h), or a statement that the CCR surface impoundment does not have a liner that meets the requirements of Section 845.400(b) or (c);

The liner certification has been completed as specified by Section 845.400(h) that states the surface impoundment does have a liner that meets the requirements of Section 845.400(c). A liner evaluation was conducted for the Duck Creek Power Plant GMF Pond in 2016 to evaluate conformance with liner design criteria set forth in 40 C.F.R. § 257.71 and 257.70 (as referenced in 257.71). Because the liner design criteria set forth in Section 845.400 are nearly identical to those presented in 40 C.F.R. § 257.71 and 257.70, the previous liner evaluation report and associated certification demonstrate that the Duck Creek Power Plant GMF Pond meets the design criteria for an alternative composite liner set forth in Section 845.400(c). The previous liner evaluation report and associated certification are provided in Attachment L.

2.12. History of Groundwater Exceedances

Section 845.230(d)(2)(M): History of known exceedances of the groundwater protection standards in Section 845.600, and any corrective action taken to remediate the groundwater;

A history of known exceedances and any corrective action taken is provided in Attachment M.

2.13. Financial Assurance Requirements

Section 845.230(d)(2)(N): A certification that the owner or operator meets the financial assurance requirements of Subpart I;

A certification meeting the requirement of Section 845.230(d)(2)(N) stating that the Owner meets the financial assurance requirements of *Subpart I* is provided in Attachment N.

2.14. Hazard Potential Classification

Section 845.230(d)(2)(O): Hazard potential classification assessment and accompanying certification (see Section 845.440(a)(2));

The previous Hazard Potential Classification Assessment completed in compliance with 40 CFR §257.73(a) is provided in Attachment O. The addendum to the Hazard Potential Classification Assessment and certification as required by Section 845.440(a) is provided in Attachment U.

2.15. Structural Stability Assessment

Section 845.230(d)(2)(P): Structural stability assessment and accompanying certification (see Section 845.450(c));

The previous Structural Stability Assessment completed in compliance with 40 CFR §257.73(d) is provided in Attachment P. The addendum to the Structural Stability Assessment and certification as required by Section 845.450(c) is provided in Attachment U.

2.16. Safety Factor Assessment

Section 845.230(d)(2)(Q): Safety factor assessment and accompanying certification (see Section 845.460(b));

The previous Safety Factor Assessment completed in compliance with 40 CFR §257.73(e) is provided in Attachment Q. The addendum to the Safety Factor Assessment and certification as required by Section 845.460(b) is provided in Attachment U.

2.17. Inflow Design Flood Control System Plan

Section 845.230(d)(2)(R): Inflow design flood control system plan and accompanying certification (see Section 845.510(c)(3));

The previous Inflow Design Flood Control System Plan Assessment completed in compliance with 40 CFR §257.82 is provided in Attachment R. The addendum to the Inflow Design Flood Control Plan Assessmentas required by Section 845.510(c)(3) is provided in Attachment U.

2.18. Safety and Health Plan

Section 845.230(d)(2)(S): Safety and health plan (see Section 845.530); and

The safety and health plan in accordance with Section 845.530 is included in Attachment S.

2.19. Proposed Closure Priority Categorization

Section 845.230(d)(2)(T): For CCR surface impoundments required to close under 845.700, the proposed closure priority categorization required by Section 845.700(g).

A CCR Surface Impoundment Category Designation and Justification letter was submitted to IEPA on May 19, 2021. The Duck Creek GMF Pond was designated as Category 3 Inactive CCR surface impoundment in compliance with groundwater protection standards in Section 845.600. This letter is provided in Attachment T.

3. PERMIT APPLICATION

All permit applications must be made on the forms prescribed by the Agency and must be mailed or delivered to the address designated by the Agency on the forms. The permit applications (CCR-1 and CCR-2E) are provided below.

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

Bureau of Water ID Number:
W0578010001

CCR Permit Number:
Initial Permit

Facility Name:
Duck Creek Power Plant

For IEPA Use Only

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

Facility, Operator, and Owner Information

1.1	Facility Name		
	Illinois Power Resources Generating, LLC - Duck Creek 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 17751 North CILCO Road		
	County name Fulton	County code (if known)	
	City or town Canton	State IL	Zip Code 61520
1.6	Name of Owner/Operator		
	Illinois Power Resources Generating, LLC		

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

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

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

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

Internet Site				
3.1	Web Address(es) to publicly accessible internet site(s) (CCR website)			
	www.luminant.com/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.		
	W0578010001-04 (see Attachment A)	☑	Attached written description
		☐	Attached written description
		☐	Attached written description
		☐	Attached written description
		☐	Attached written description
		☐	Attached written description

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

SECTION 5: CHECKLIST AND CERTIFICATION STATEMENT

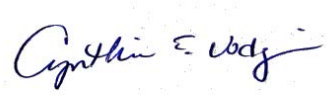
Checklist and Certification Statement

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

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

5.2 **Certification Statement**

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

Name (print or type first and last name) of Owner/Operator	Official Title
Cynthia Vodopivec	SVP - Environmental
Signature 	Date Signed 10/25/2021

Form CCR 2E	Illinois Environmental Protection Agency CCR Surface Impoundment Permit Application Form CCR 2E – Initial Operating Permit for Existing or Inactive CCR Surface Impoundments That Have Not Completed an Agency-approved Closure Before July 30, 2021

Bureau of Water ID Number: W0578010001 **CCR Permit Number:** Initial Permit **Facility Name:** Duck Creek Power Plant	For IEPA Use Only

SECTION 1: CONSTRUCTION HISTORY (35 Ill. Adm. Code 845.220 AND 35 Ill. Adm. Code 845.230)

Construction History	1.1	CCR surface impoundment name.
		GMF Pond
	1.2	Identification number of the CCR surface impoundment (if one has been assigned by the Agency).
		W0578010001-04
	1.3	Description of the boundaries of the CCR surface impoundment (35 Ill. Adm. Code 845.210(c)).
		See Attachment A.
	1.4	State the purpose for which the CCR surface impoundment is being used.
		See Attachment B.
	1.5	How long has the CCR surface impoundment been in operation?
		See Attachment B.
	1.6	List the types of CCR that have been placed in the CCR surface impoundment.
		See Attachment B.

Construction History (Continued)	1.7	List name of the watershed within which the CCR surface impoundment is located.	
		See Attachment B.	
	1.8	Size in acres of the watershed within which the CCR surface impoundment is located.	
		See Attachment B.	
	1.9	Check the corresponding box to indicate that you have attached the following:	
		☑	Description of the physical and engineering properties of the foundation and abutment materials on which the CCR surface impoundment is constructed.
		☑	Description 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.
		☑	Describe the method of site preparation and construction of each zone of the CCR surface impoundment.
		☑	A listing of the approximate dates of construction of each successive stage of construction of the CCR surface impoundment.
		☑	Drawing satisfying the requirements of 35 Ill. Adm. Code 845.220(a)(1)(F).
		☑	Description of the type, purpose, and location of existing instrumentation.
		☑	Area capacity curves for the CCR Impoundment.
		☑	Description of each spillway and diversion design features and capacities and provide the calculations used in their determination.
		☑	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: ANALYSIS OF CHEMICAL CONSTITUENTS (35 Ill. Adm. Code 845.230(d)(2)(B))			
Constituents	2.1	Check the corresponding boxes to indicate you have attached the following:	
		☑	An analysis of the chemical constituents found within the CCR to be placed in the CCR surface impoundment.
		☑	An analysis of the chemical constituents of all waste streams, chemical additives and sorbent materials entering or contained in the CCR surface impoundment.

SECTION 3: DEMONSTRATIONS AND CERTIFICATIONS (35 Ill. Adm. Code 845.230(d)(2)(D))

Demonstrations	3.1	Indicate whether you have attached a demonstration that the CCR surface impoundment, as built, meets, or an explanation of how the CCR surface impoundments fails to meet, the location standards in the following sections:				
		35 Ill. Adm. Code 845.300 (Placement Above the Uppermost Aquifer)	☐	Demonstration	☑	Explanation
		35 Ill. Adm. Code 845.310 (Wetlands)	☑	Demonstration	☐	Explanation
		35 Ill. Adm. Code 845.320 (Fault Areas)	☑	Demonstration	☐	Explanation
		35 Ill. Adm. Code 845.330 (Seismic Impact Zones)	☑	Demonstration	☐	Explanation
		35 Ill. Adm. Code 845.340 (Unstable Areas and Floodplains)	☑	Demonstration	☐	Explanation

SECTION 4: ATTACHMENTS

Attachments	4.1	Check the corresponding boxes to indicate that you have attached the following:	
		☑	Evidence that the permanent markers required by 35 Ill. Adm. Code 845.130 have been installed.
		☑	Documentation that the CCR surface impoundment, if not incised, will be operated and maintained with one of the forms of slope protection specified in 35 Ill. Adm. Code 845.430.
		☑	Initial Emergency Action Plan and accompanying certification required by 35 Ill. Adm. Code 845.520(e).
		☑	Fugitive dust control plan and accompanying certification required by 35 Ill. Adm. Code 845.500(b)(7).
		☐	Preliminary written closure plan as specified in 35 Ill. Adm. Code 845.720(a).
		☑	Initial written post-closure care plan as specified in 35 Ill. Adm. Code 845.780(d), if applicable.
		☑	A certification as specified in 35 Ill. Adm. Code 845.400(h), or a statement that the CCR surface impoundment does not have a liner than meets the requirements of 35 Ill. Adm. Code 845.400(b) or (c).
		☑	History of known exceedances of the groundwater protection standards in 35 Ill. Adm. Code 845.600, and any corrective action taken to remediate the groundwater.
		☑	Safety and health plan, as required by 35 Ill. Adm. Code 845.530.
		☑	For CCR surface impoundments required to close under 35 Ill. Adm. Code 845.700, the proposed closure priority categorization required by 35 Ill. Adm. Code 845.700(g).

SECTION 5: GROUNDWATER MONITORING

Groundwater	5.1	Check the corresponding boxes to indicate you have attached the following groundwater monitoring information:	
		☑	A hydrogeologic site characterization meeting the requirements of 35 Ill. Adm. Code 845.620.
		☑	Design and construction plans of a groundwater monitoring system meeting the requirements of 35 Ill. Adm. Code 845.630.

		☑	A groundwater sampling and analysis program that includes section of the statistical procedures to be used for evaluating groundwater monitoring data, required by 35 Ill. Adm. Code 845.640.
		☑	Proposed groundwater monitoring program that includes a minimum of eight independent samples for each background and downgradient well, required by 35 Ill. Adm. Code 845.650(b).
SECTION 6: CERTIFICATIONS			
Certifications	6.1	Check the corresponding boxes to indicate you have attached the following certifications:	
		☑	A certification that the owner or operator meets the financial assurance requirements of Subpart I, as required by 35 Ill. Adm. Code 845.230(d)(2)(N).
		☑	Hazard potential classification assessment and accompanying certifications required by 35 Ill. Adm. Code 845.440(a)(2).
		☑	Structural stability assessment and accompanying certification, required by 35 Ill. Adm. Code 845.450(c).
		☑	Safety factor assessment and accompanying certification, as required by 35 Ill. Adm. Code 845.460(b).
		☑	Inflow design flood control system plan and accompanying certification, as required by 35 Ill. Adm. Code 845.510(c)(3).

ATTACHMENT A

Land Description of the Duck Creek Power Plant
GMF Pond Facility Boundary
39.42 Acres

Part of the Northwest Quarter of Section 18, Township 6 North, Range 5 East of the Fourth Principal Meridian, Fulton County, Illinois and being more particularly described as follows:

Commencing at the Four Way Township Corner Being the same as the Southeast corner of Section 36 T. 6 N., R. 4 E., also being the same as the Southwest corner of Section 31 T. 6 N., R. 5 E. of the Fourth Principal Meridian; thence North 0 degrees 46 minutes 44 seconds East along the Township line dividing T. 6 N., R 4 E. and T. 6 N., R. 5 E. a distance of 20,948.09 feet; thence South 88 degrees 30 minutes 55 seconds East a distance of 250.99 feet to the Point of Beginning of the Tract described herein; thence continuing South 88 degrees 30 minutes 55 seconds East a distance of 1023.8 feet; thence South 0 degrees 39 minutes 15 seconds west, a distance of 1660.38 feet; thence North 89 degrees 41 minutes 47 seconds West a distance of 808.81 feet; thence North 63 degrees 59 minutes 59 seconds West, a distance of 262.93 feet; thence North 01 degrees 29 minutes 05 seconds East a distance of 1567.77 feet to the Point of Beginning and containing 39.42 Acres.

FACILITY CORNER COORDINATES		
Point #	Northing	Easting
183	1399298.86	2345303.24
184	1399292.36	2345554.14
185	1399265.83	2346577.60
186	1397605.56	2346558.64
187	1397609.85	2345749.84
188	1397725.11	2345513.52

Luminant

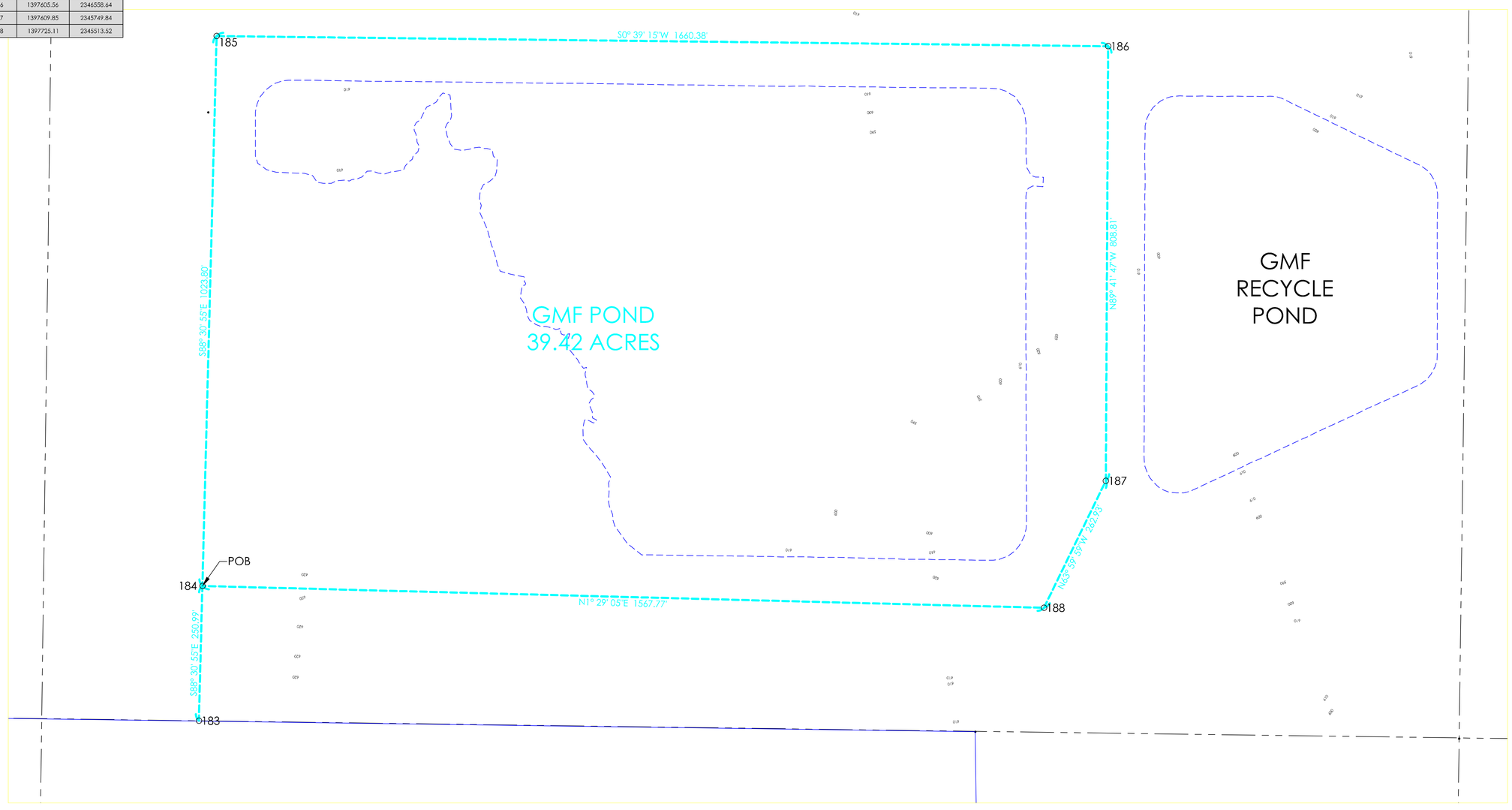
ILLINOIS POWER RESOURCES GENERATING L.L.C.
DUCK CREEK POWER PLANT

0' 100' 200'

LEGEND

- ***SECTION LINE***
- ***RESTRICTED USE BOUNDARY***
- ***APPROXIMATE DUCK CREEK POWER STATION PROPERTY BOUNDARY LINE***
- ***FACILITY BOUNDARY***
- N0° 47' 10"E 3100.48' ***RECORD BOUNDARY DIMENSIONS***
- ● ***FOUND SURVEY MARKER AS NOTED***
- ***M*** ***DENOTES MEASURED 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 MARCH 16 THROUGH JUNE 29, 2021. SURVEY COORDINATES, BEARINGS & DISTANCES ARE REFERENCED TO ILLINOIS WEST 1202 STATE PLANE COORDINATE SYSTEM NAD 1983. ELEVATIONS SHOWN HEREON ARE BASED ON NAVD 1988.



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Submissions / Revisions:		Date:
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Luminant

Project Name & Location:

DUCK CREEK
POWER PLANT
17751 N. CILCO RD.
CANTON, IL 61520

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Drawing Name:
GMF POND
BOUNDARY
EXHIBIT

Date: 9/21/2021	Project No.
Type: SITE	Drawing No. 3
Drawn By: CB	
Approved By: MG	
Scale: AS NOTED	

Land Description of the Duck Creek Power Plant
GMF Pond Facility Boundary
39.42 Acres

Part of the Northwest Quarter of Section 18, Township 6 North, Range 5 East of the Fourth Principal Meridian, Fulton County, Illinois and being more particularly described as follows:

Commencing at the Four Way Township Corner Being the same as the Southeast corner of Section 36 T. 6 N., R. 4 E., also being the same as the Southwest corner of Section 31 T. 6 N., R. 5 E. of the Fourth Principal Meridian; thence North 0 degrees 46 minutes 44 seconds East along the Township line dividing T. 6 N., R 4 E. and T. 6 N., R. 5 E. a distance of 20,948.09 feet; thence South 88 degrees 30 minutes 55 seconds East a distance of 250.99 feet to the Point of Beginning of the Tract described herein; thence continuing South 88 degrees 30 minutes 55 seconds East a distance of 1023.8 feet; thence South 0 degrees 39 minutes 15 seconds west, a distance of 1660.38 feet; thence North 89 degrees 41 minutes 47 seconds West a distance of 808.81 feet; thence North 63 degrees 59 minutes 59 seconds West, a distance of 262.93 feet; thence North 01 degrees 29 minutes 05 seconds East a distance of 1567.77 feet to the Point of Beginning and containing 39.42 Acres.

FACILITY CORNER COORDINATES		
Point #	Northing	Easting
183	1399298.86	2345303.24
184	1399292.36	2345554.14
185	1399265.83	2346577.60
186	1397605.56	2346558.64
187	1397609.85	2345749.84
188	1397725.11	2345513.52

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ILLINOIS POWER RESOURCES GENERATING L.L.C.
DUCK CREEK POWER PLANT

0' 100' 200'

LEGEND

- SECTION LINE
- RESTRICTED USE BOUNDARY
- APPROXIMATE DUCK CREEK POWER STATION PROPERTY BOUNDARY LINE
- FACILITY BOUNDARY
- N0° 47' 10"E 3100.48' RECORD BOUNDARY DIMENSIONS
- ● FOUND SURVEY MARKER AS NOTED
- M DENOTES MEASURED DIMENSION

SURVEY NOTE:
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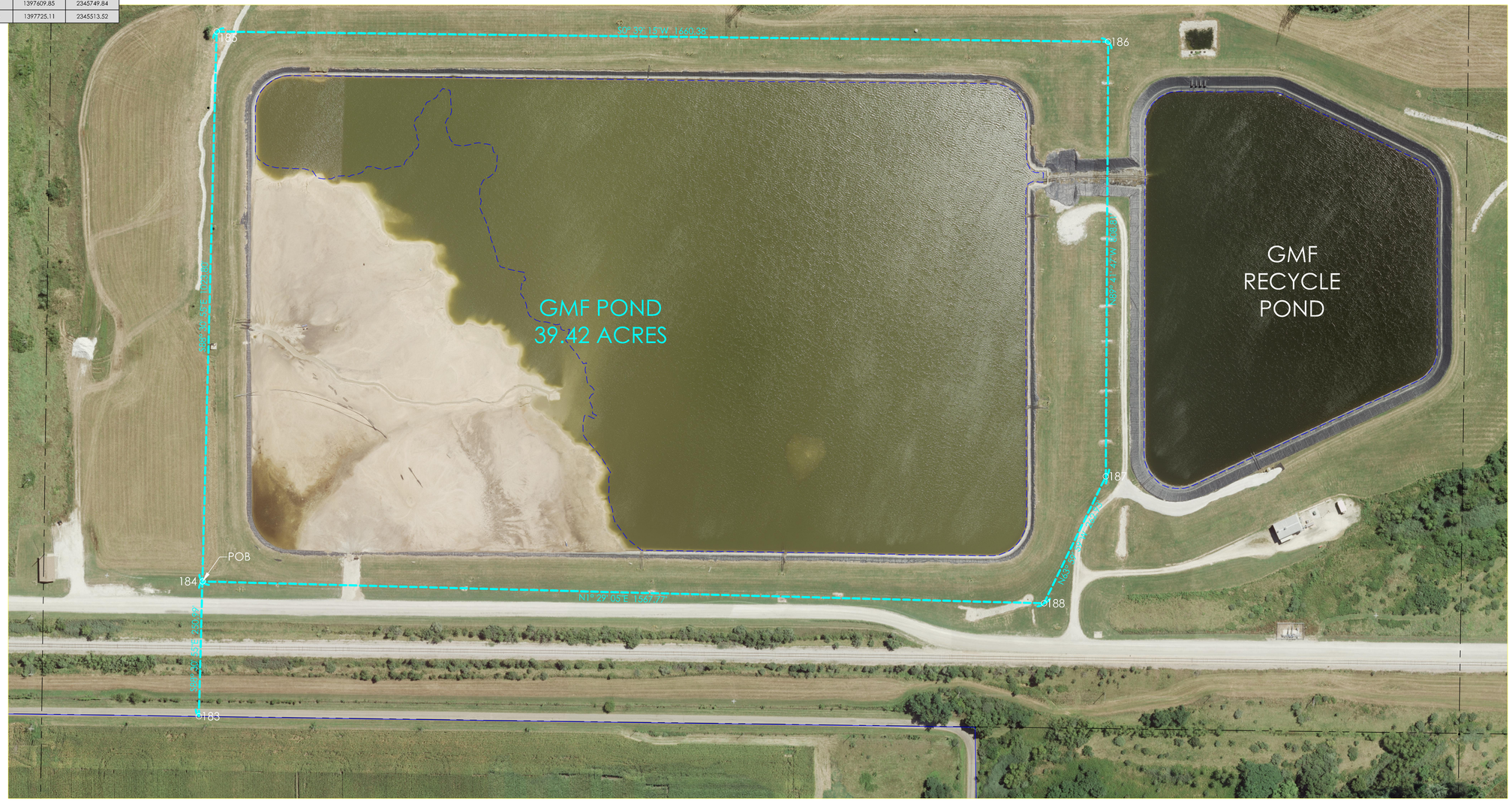

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Submissions / Revisions:		Date:
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Luminant

Project Name & Location:

DUCK CREEK
POWER PLANT
17751 N. CILCO RD.
CANTON, IL 61520

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Drawing Name:
GMF POND BOUNDARY EXHIBIT

Date: 9/21/2021	Project No.
Type: SITE	Drawing No. 4
Drawn By: CB	
Approved By: MG	
Scale: AS NOTED	

ATTACHMENT B

October 2016

Illinois Power Resources Generating, LLC
17751 North Cilco Road
Canton, IL 61520

RE: History of Construction
USEPA Final CCR Rule, 40 CFR § 257.73(c)
Duck Creek Power Station
Canton, Illinois

On behalf of Illinois Power Resources Generating, LLC, AECOM has prepared the following history of construction for the Ash Pond No. 1, Ash Pond No. 2, and GMF Pond at the Duck Creek Power Station in accordance with 40 CFR § 257.73(c). The Bottom Ash Basin is an incised pond with a storage volume of less than 20 acre-feet. A history of construction is not required for the Bottom Ash Basin as specified in § 257.73(b).

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, as reasonably and readily available (see 80 Fed. Reg. 21302, 21380 [April 17, 2015]), AECOM's site experience, and discussion with plant engineers. AECOM's document review included construction drawings, geotechnical investigations, observation reports, etc. for the Ash Pond No. 1, Ash Pond No. 2, and GMF Pond at the Duck Creek Power Station.

HISTORY OF CONSTRUCTION

§ 257.73(c)(1)(i): The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.

Owner: Illinois Power Resources Generating, LLC

Address: 1500 Eastport Plaza Drive
Collinsville, IL 62234

CCR Units: Ash Pond No. 1
Ash Pond No. 2, IDNR Dam ID No. IL50014
GMF Pond, IDNR Dam ID No. IL50573

Ash Pond No. 1 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 locations of the Ash Pond No. 1, Ash Pond No. 2, and the GMF Pond have been identified on an USGS 7-1/2 minute topographic quadrangle map in **Appendix A**.

§ 257.73(c)(1)(iii): A statement of the purpose for which the CCR unit is being used.

The following captures the purpose of each CCR unit:

- The Ash Pond No. 1 (inactive) was used to store and dispose of fly ash and bottom ash.
- The Ash Pond No. 2 (inactive) was used to store and dispose of fly ash and bottom ash and to clarify CCR contact stormwater prior to discharge in accordance with the station's Water Pollution Control Permit (#2015-EO-59369).
- The GMF Pond is being used to store and dispose of gypsum and to clarify recycled process water for plant operations.

Notice of intent to close Ash Pond No. 1 and Ash Pond No. 2 was provided in November, 2015.[1]

[1] This history of construction report was prepared on a facility-wide basis for CCR surface impoundments at the Duck Creek Power Station. The inclusion of Ash Pond No. 1 and Ash Pond No. 2 in this history of construction report does not concede and should not be construed to concede that Ash Pond No. 1 and Ash Pond No. 2 are subject to the Design Criteria or all Operating Criteria in the CCR Rule.

§ 257.73(c)(1)(iv): The name and size in acres of the watershed where the CCR unit is located.

Ash Pond No. 1, Ash Pond No. 2, and the GMF Pond are located at the western edge of the Rice Lake-Illinois River Watershed with a 12-digit Hydrologic Unit Code (HUC) of 071300030603 and a drainage area of 21,203 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.

Physical properties of the foundation materials for Ash Pond No. 1 and Ash Pond No. 2 are primarily strip-mine spoils with variable thickness overlying shale bedrock. The mine spoils consist of a mixtures of native loess and glacial till and, to a lesser extent, the underlying (primarily shale) bedrock. The loess is classified as silty low plastic clay, with a zone of high plastic clay identified in the upper few feet of the stratum. The glacial till is classified as medium stiff to stiff, silty low plastic clay with trace sand and gravel.

Physical properties of the foundation materials for the GMF Pond are (from top to bottom) native loess, glacial till, and bedrock (primarily shale). The loess is classified as silty low plastic clay, with a zone of high plastic clay identified in the upper few feet of the stratum. The glacial till is classified as medium stiff to stiff, silty low plastic clay with trace sand and gravel.

An available summary of foundation material engineering properties for Ash Pond No.1, Ash Pond No. 2, and the GMF Pond is presented in **Table 1** below. The foundation material 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	
		c' (psf)	Φ' (°)	c (psf)	Φ (°)
Loess	116	100	32	1,250	0
Glacial Till	125	200	30	1,900	0
Mine Spoils	120	100	30	250	15
Shale Bedrock	130	300	26	600	13

Ash Pond No.1, Ash Pond No. 2, and the GMF Pond are enclosed impoundments with embankments and do not have abutments.

§ 257.73(c)(1)(vi): A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of site preparation and construction of each zone of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.

The embankments of the Ash Pond No. 1 and Ash Pond No. 2 were constructed with mine spoils excavated from within the center of the existing pond footprints. The mine spoils consist of a mixtures of native loess and glacial till and, to a lesser extent, the underlying (primarily shale) bedrock. The loess is classified as silty low plastic clay, with a zone of high plastic clay identified in the upper few feet of the stratum. The glacial till is classified as medium stiff to stiff, silty low plastic clay with trace sand and gravel.

The embankments of the GMF Pond generally consists of silty, low plastic clay and generally had a stiff to very stiff consistency and appeared to be well-compacted material. The liner system within the GMF Pond consists of (from top to bottom) a 60-mil textured high density polyethylene (HDPE) geomembrane, 1-foot-thick layer of “cushion dirt”, 4-ounce geotechnical filter fabric, 1-foot-thick drainage layer, 10-ounce geotextile cushion, 60-mil textured HDPE geomembrane, a Bentomat SDN reinforced geosynthetic clay liner (GCL), and 3-foot-thick layer of compacted clay. A typical cross section profile of the liner system is shown on drawing C180-C102-8 presented in **Appendix B**.

An available summary of construction material engineering properties is presented in **Table 2** below. The construction material engineering properties are based on previous geotechnical investigations and laboratory testing.

Table 2. Summary of Construction Material Engineering Properties

Material	Unit Weight (pcf)	Effective (drained) Shear Strength Parameters		Total (undrained) Shear Strength Parameters	
		c’ (psf)	Φ’ (°)	c (psf)	Φ (°)
Liner-Cushion Material	116	0	38	660	0
Liner-Granular Drainage Layer	120	0	33	0	33
Liner-Geotextile /Geomembrane	75	100	25	100	25
Embankment Fill	116	150	32	2,150	0

The methods used for preparation and construction of Ash Pond No. 1 and Ash Pond No. 2 are not reasonably and readily available.

The site preparation work for the GMF Pond included stripping and stockpiling the topsoil. The subsoil was then excavated to approximately 5.4 feet above the proposed foundation grade and stockpiled. Temporary and permanent erosion control measures were also installed. The site was later excavated to the proposed subgrade and proof rolled to inspect for unsuitable soils. Any unsuitable soils were either removed or reworked. A sheepsfoot roller was used to compact suitable backfill material placed in 8-inch lifts. Compaction testing was performed using a nuclear density gauge at a minimum rate of one test per 10,000 cubic yards (minimum one test per lift). Backfill was compacted to at least 95% of standard proctor maximum dry density and with a moisture content of -2% to +2% of optimum. Embankment

construction was performed using similar compacting and testing techniques as for the subgrade preparation.

Prior to constructing the clay liner for the GMF Pond, two test pad liners were constructed using separate borrow material. Testing of both liners indicated that the construction practice and material used were acceptable. The full scale clay liner was constructed with fill placed in 8-inch lifts and compacted with a sheepsfoot roller. Placed fill was compacted to at least 95% of standard proctor maximum dry density and with a moisture content of optimum to +5%. Compaction testing was performed using a nuclear density gauge at a minimum rate of one test per 1,000 cubic yards (minimum one test per lift). After the minimum clay liner thickness was achieved, the surface was smooth rolled in preparation of the GCL. The GCL and lower geomembrane were then placed sequentially followed by the 10-ounce geotextile cushion. A leak detection/leachate collection and recovery system (LD/LCRS) was then installed which includes a 1-foot-thick sand drainage layer and collection pipes. The sand was graded to minimum thickness using a dozer. The LD/LCRS was completed by placing a 4-ounce geotechnical filter fabric on top of the sand. A 1-foot-thick “cushion dirt” layer was then placed using a dozer to spread general fill. The liner was completed by placing the upper geomembrane on top.

The approximate dates of each successive event stage of construction of Ash Pond No. 1, Ash Pond No. 2, and the GMF Pond are provided in **Table 3** below.

Table 3. Approximate dates of construction of each successive stage of construction.

Date	Event
1976	Ash Pond No. 1 was commissioned
1986	Ash Pond No. 2 was commissioned
2007	Surface preparation for GMF Pond began
2008-2009	Construction of GMF Pond

§ 257.73(c)(1)(vii): At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation.

Drawings that contain items pertaining to the requested information for Ash Pond No. 1, Ash Pond No. 2, and the GMF Pond are listed in **Table 4** below. Items marked as "Not Available" are items not found during review of reasonably and readily available record documentation

Table 4. List of drawings containing items pertaining to the information requested in § 257.73(c)(1)(vii).

	Ash Pond No. 1	Ash Pond No. 2	GMF Pond
Dimensional plan view (all zones)	C180-G1916-3	C180-G1916-4, C180-G1916-6	C180-C102-8 thru -11
Dimensional cross sections	C180-G1916-3	C180-G1916-7	C180-C102-12 thru -14
Foundation Improvements	C180-G1916-3	C180-G1916-7	Not Applicable
Drainage Provisions	Not Applicable	C180-G1916-9 thru -11, M-1001	C180-C102-12 thru -14 C180-C102-30 thru -31
Spillways and Outlets	C180-G1916-3	C180-G1916-8	C180-C102-15, C180-C102-29
Diversion Ditches	Not Applicable	Not Applicable	Not Applicable
Instrument Locations	Figure in Appendix C, Plate 2	Figure in Appendix C, Plate 2	Not Applicable
Slope Protection	C180-G1916-3	Not Available	C180-C102-12
Normal Operating Pool Elevation	Not Available	Not Available	Not Available
Maximum Pool Elevation	C180-G1916	C180-G1916-7	Not Available
Approximate Maximum Depth of CCR in 2016	68 feet	59 feet	25 feet

All drawings referenced in the table above can be found in **Appendix B** and **Appendix C**.

Based on the review of the drawings listed above, no natural or manmade features that could adversely affect operation of these CCR units due to malfunction or mis-operation were identified.

§ 257.73(c)(1)(viii): A description of the type, purpose, and location of existing instrumentation.

Existing instrumentation at Ash Pond No. 1 and Ash Pond No. 2 consists of open-standpipe piezometers. The purpose of the piezometers is to measure the pore water pressures within and around the CCR units. Two (2) piezometers (B-2 and B-5) were installed in 2010 and the locations are presented on Plate 2 in **Appendix C**. Five (5) additional piezometers were installed in 2010 and the locations are presented in **Appendix C**.

The GMF Pond does not contain existing instrumentation used for monitoring the operation of the CCR unit.

§ 257.73(c)(1)(ix): Area-capacity curves for the CCR unit.

Area-capacity curves for the Ash Pond No. 1 and Ash Pond No. 2 are not reasonably and readily available. The area-capacity curve for the GMF Pond is presented in **Figure 1** below. "Area-capacity curves", as defined by 40 CFR § 257.53, "means graphic curves which readily show the reservoir water surface area, in acres, at different elevations from the bottom of the reservoir to the maximum water surface, and the capacity or volume, in acre-feet, of the water contained in the reservoir at various elevations."

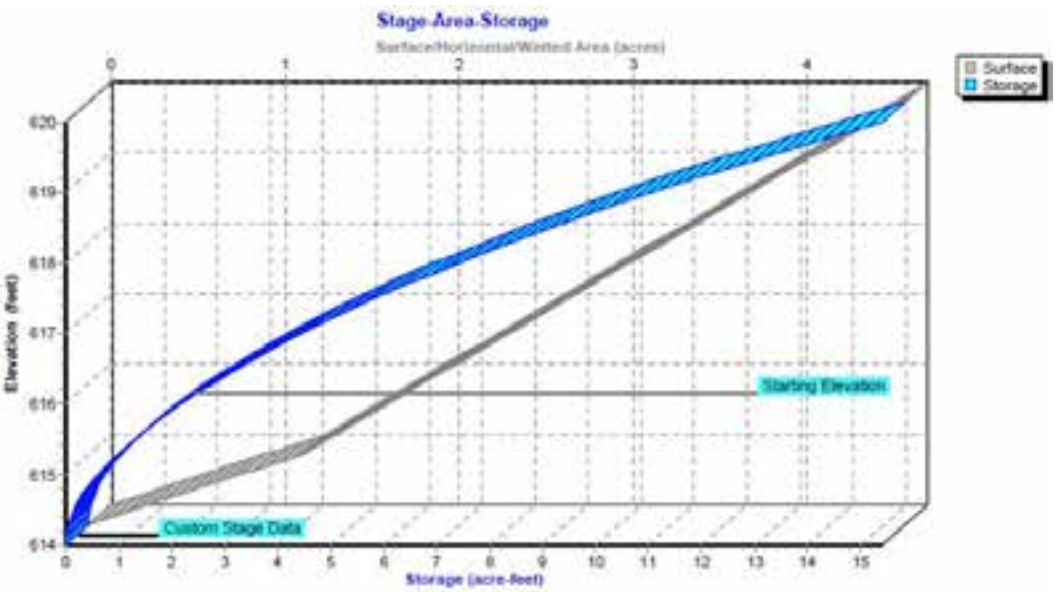


Figure 1. Area-capacity curve for GMF Pond prepared in 2016

§ 257.73(c)(1)(x): A description of each spillway and diversion design features and capacities and calculations used in their determination.

Ash Pond No. 1 does not contain an active spillway or diversion feature. Stormwater collected in Ash Pond No. 1 is manually pumped to Ash Pond No. 2 at the judgement of plant personnel. Current discharge capacity and calculation information for Ash Pond No. 1 is not reasonably and readily available.

Stormwater collected in Ash Pond No. 2 is drained via a 36-inch diameter (dia.) steel morning glory spillway, formed by 2-foot tall stacked sections, located in the northeast corner of the pond. The spillway transitions to a 36-inch dia. reinforced concrete pipe (RCP) and drains towards the return water pumphouse and discharges in accordance with the station's Water Pollution Control Permit. Current discharge capacity and calculation information for Ash Pond No. 2 is not reasonably and readily available.

The GMF Pond contains a transfer channel that discharges clear water into the GMF Recycle Pond. The transfer channel is trapezoidal in shape with 3H:1V side slopes. The channel transitions from a 16-foot bottom width at an invert elevation of 616 feet at the upstream end to a 35-foot bottom width at an invert elevation of 609 feet at the downstream end. In 2016 the discharge capacity of the GMF Pond was evaluated using HydroCAD 8.50 software modeling a 1,000-year, 24-hour rainfall event. The results of the HydroCAD 8.50 analysis are presented below in **Table 5**.

Table 5. Results of HydroCAD 8.50 analyses

	GMF Pond
Approximate Minimum Berm Elevation[1] (ft)	620.0
Approximate Emergency Spillway Elevation[1] (ft)	616.0
Starting Pool Elevation[1] (ft)	616.0
Peak Elevation[1] (ft)	618.3
Time to Peak (hr)	12.0
Surface Area (ac)	3.5
Storage[2] (ac-ft)	8.3

Notes: 1. Elevations are based on NAVD88 datum.
2. Storage given is from Starting Pool Elevation to Peak Elevation

§ 257.73(c)(1)(xi): The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.

The construction specification for Ash Pond No. 1 is located in Technical Specification Section 21, however the construction specification is not reasonably and readily available. The construction specification for the Ash Pond No. 2 is not reasonably and readily available. The construction specification for the GMF Pond is located in *Project Manual; Specification No's.: C180-C102* (presented in **Appendix D**).

The provisions for surveillance, general maintenance, and repair of the GMF Pond are presented in **Appendix E**.

The operations and maintenance plans for Ash Pond No. 1, Ash Pond No. 2, and GMF Pond are currently either being generated or being revised by Illinois Power Resources Generating,

LLC. This section will be updated when the new operations and maintenance plans are available.

§ 257.73(c)(1)(xii): Any record or knowledge of structural instability of the CCR unit.

There is no record or knowledge of structural instability of Ash Pond No. 1, Ash Pond No. 2, and the GMF Pond at Duck Creek 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

REFERENCES

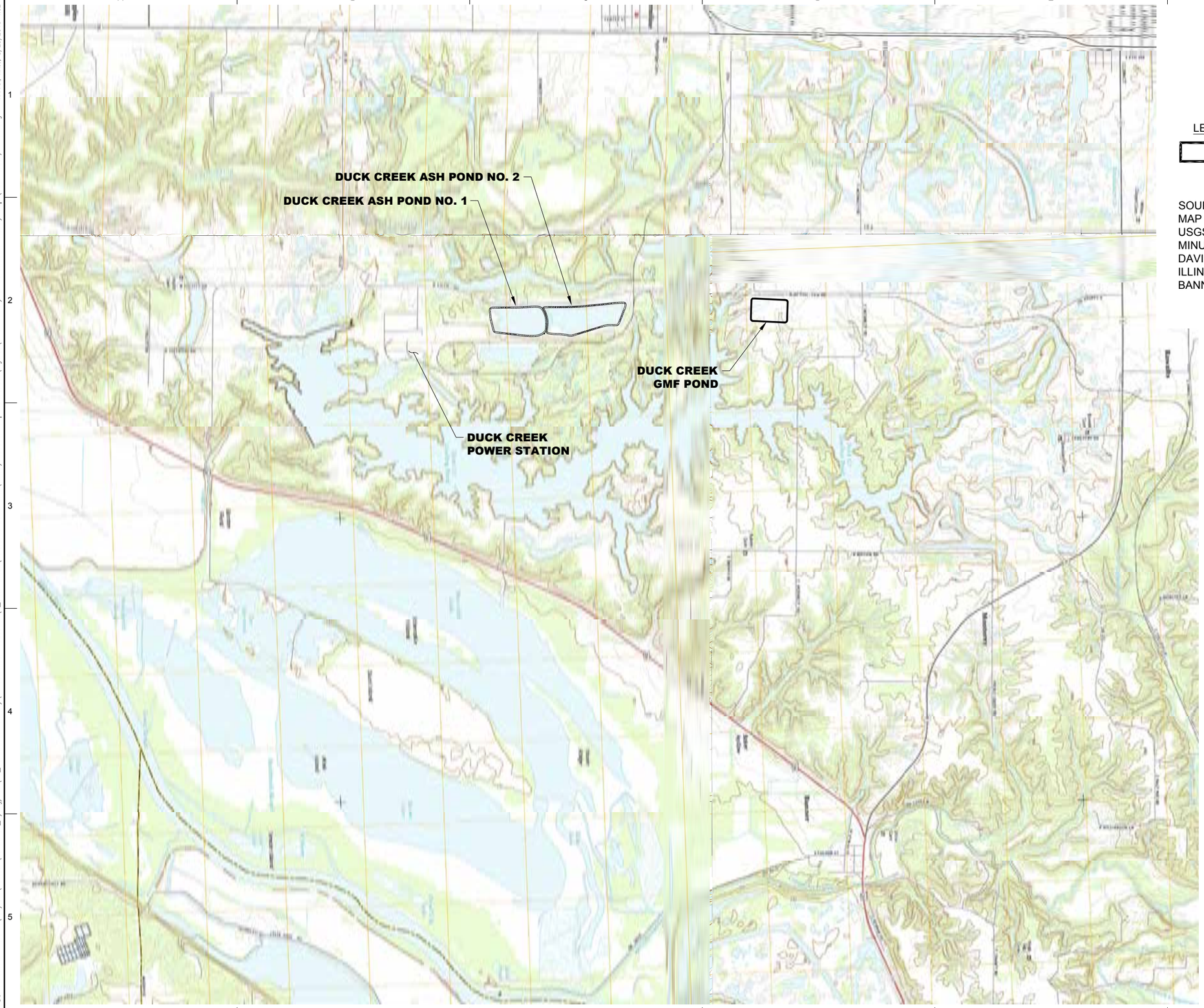
United States Environmental Protection Agency (USEPA). (2015). *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule.* 40 CFR Parts 257 and 261, 80 Fed. Reg. 21302, 21380 April 17, 2015.

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: Duck Creek Power Station Drawings
Appendix C: Duck Creek Power Station Boring and Piezometer Locations
Appendix D: Project Manual; Specification No's.: C180-C102 (excerpt)
Appendix E: Operation and Maintenance Manual, Duck Creek Energy Center, Gypsum Management Facility

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 SAINT DAVID ILLINOIS, DUCK CREEK ISLAND ILLINOIS, CANTON ILLINOIS AND BANNOR ILLINOIS, REVISED 2015.

QUADRANGLE LOCATION

0 2000 4000 6000
SCALE IN FEET

AECOM
1001 Highlands Plaza Drive, Suite 300
St. Louis, Mo. 63110
314 429-0100 (phone)
314-429-0462 (fax)

ILLINOIS POWER RESOURCES GENERATING, LLC
17751 North CILCO Rd.,
Canton, IL 61520

HISTORY OF CONSTRUCTION

DUCK CREEK POWER STATION
CANTON, 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" = 2000'
ACAD VER:	2014

SHEET TITLE

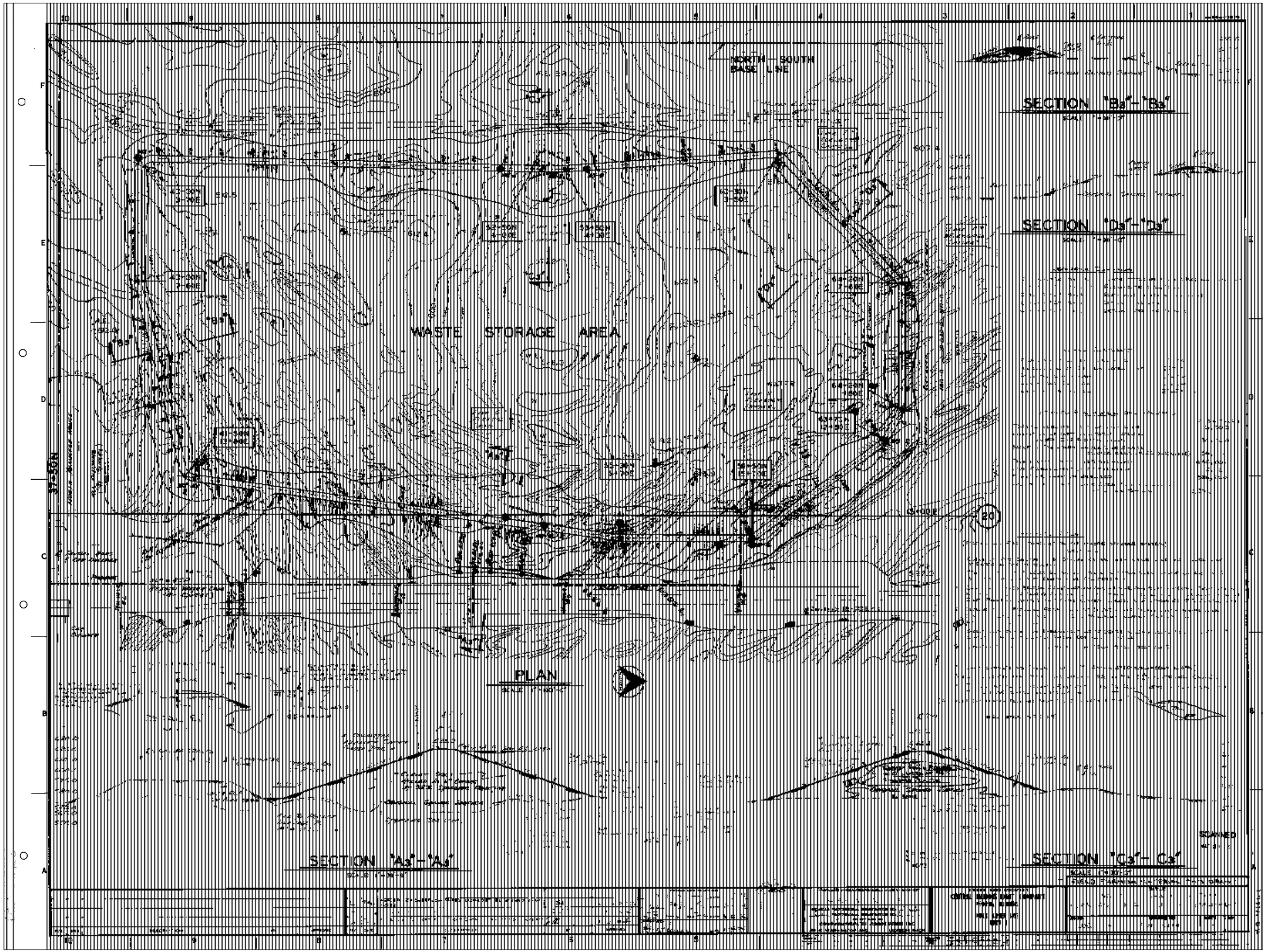
HISTORY OF CONSTRUCTION VICINITY MAP

01

AECOM DRAWING PATH: P:\Projects\Geotech\60428794_DynegyCCR\13_Construction History\04 Technical Production\2_Duck Creek\Reference Documents\Vicinity Location Map References\Figures\C-01 History of Construction Vicinity Map (Duck Creek) -MUN.dwg NANAK, MATT, 8/23/2016 4:02 PM

Appendix B: Duck Creek Power Station Drawings

1. "Waste Storage System, Plan and Details of Dike Embankment", Drawing No. C180-G1916-3, Revision D, 13 February, 1975, Commonwealth Associates Inc.
2. "Waste Disposal System, Site Plan", Drawing No. C180-G1916-4, Revision C, 16 October, 1984, Commonwealth Associates Inc.
3. "Waste Disposal Area II, Site Plan", Drawing No. C180-G1916-6, Revision G, 16 October, 1984, Commonwealth Associates Inc.
4. "Waste Disposal System, Dike Sections and Details", Drawing No. C180-G1916-7, Revision D, 16 October, 1984, Commonwealth Associates Inc.
5. "Waste Disposal System, Inlet and Outlet Details", Drawing No. C180-G1916-8, Revision E, 16 October, 1984, Commonwealth Associates Inc.
6. "Waste Disposal Area II, Outlet Pipe Plan & Profile", Drawing No. C180-G1916-9, Revision E, 11 October, 1984, Commonwealth Associates Inc.
7. "Waste Disposal System, Pipe Profile and Details", Drawing No. C180-G1916-10, Revision E, 10 October, 1984, Commonwealth Associates Inc.
8. "Waste Disposal System, Miscellaneous Details", Drawing No. C180-G1916-11, Revision E, 10 October, 1984, Commonwealth Associates Inc.
9. "Pipe Plan & Profile, Recycle Pond Bypass", Drawing No. M-1001, Revision 0, 30 July, 2004, Sargent & Lundy LLC.
10. "Gypsum Stack – Foundation Grade", Drawing No. C180-C102-8, Revision 6, 5 March, 2009, Hanson Professional Services, Inc.
11. "Gypsum Stack – Clay Layer Grade", Drawing No. C180-C102-9, Revision 4, 5 March, 2009, Hanson Professional Services, Inc.
12. "Gypsum Stack – LD/LCRS Drainage Layer Grade", Drawing No. C180-C102-10, Revision 6, 5 March, 2009, Hanson Professional Services, Inc.
13. "PWRS-Ring Drain System Cushion Dirt Layer Grade", Drawing No. C180-C102-11, Revision 6, 5 March, 2009, Hanson Professional Services, Inc.
14. "PWRS-Ring Drain Details", Drawing No. C180-C102-12, Revision 5, 5 March, 2009, Hanson Professional Services, Inc.
15. "PWRS-Ring Drain Details", Drawing No. C180-C102-13, Revision 2, 5 March, 2009, Hanson Professional Services, Inc.
16. "LD/LCRS Sections & Details", Drawing No. C180-C102-14, Revision 3, 5 March, 2009, Hanson Professional Services, Inc.
17. "Recycle Pond Plan", Drawing No. C180-C102-15, Revision 5, 5 March, 2009, Hanson Professional Services, Inc.
18. "Miscellaneous Details", Drawing No. C180-C102-29, Revision 2, 5 March, 2009, Hanson Professional Services, Inc.
19. "LD/LCRS Underdrain Dewatering System-Seep 1", Drawing No. C180-C102-30, Revision 2, 5 March, 2009, Hanson Professional Services, Inc.
20. "LD/LCRS Underdrain Dewatering System-Seep 2", Drawing No. C180-C102-31, Revision 2, 5 March, 2009, Hanson Professional Services, Inc.


NORTH - SOUTH
BASE LINE
SECTION "B3"- "B3"
SECTION "D3"- "D3"
WASTE STORAGE AREA
PLAN
SECTION "A3"- "A3"
SECTION "C3"- C3"
SCANNED

GENERAL NOTES

1) SITE SURVEY FROM TERRAIN DETAIL SURVEY MADE ON OCTOBER [illegible] (BOMMAAN) [illegible]

2) THE WASTE DISPOSAL AREA 1 RECYCLE POND AND THE TOMBSTONE FILL AREAS, WHICH AREAS CONTAIN EXCAVATED SHALL BE CLEARED FROM TRUNK SLABS BEFORE WORK.

3) ALL SUBGRADES SHALL BE APPROVED BY THE OWNERS REPRESENTATIVE PRIOR TO THE PLACEMENT OF FILL.

4) ALL DIKE EMBANKMENTS SHALL BE COMPACTED TO 95% OF MAXIMUM DENSITY AS DESCRIBED BY ASTM D 698.

5) ALL BULDOZED FILL AREAS SHALL BE COMPACTED TO 85% OF MAXIMUM DENSITY AS OBTAINED BY ASTM D 698 BULDOZED FILL SHALL BE PLACED IN THIN LIFTS FROM DEPOSIT AREA OUT TOWARDS THE LARGE STONES IN ORDER TO BURY THE LARGE STONES IN THE FILL.

6) FILL SLOPES, EXCEPT FILL SHALL BE AS FOLLOWS.

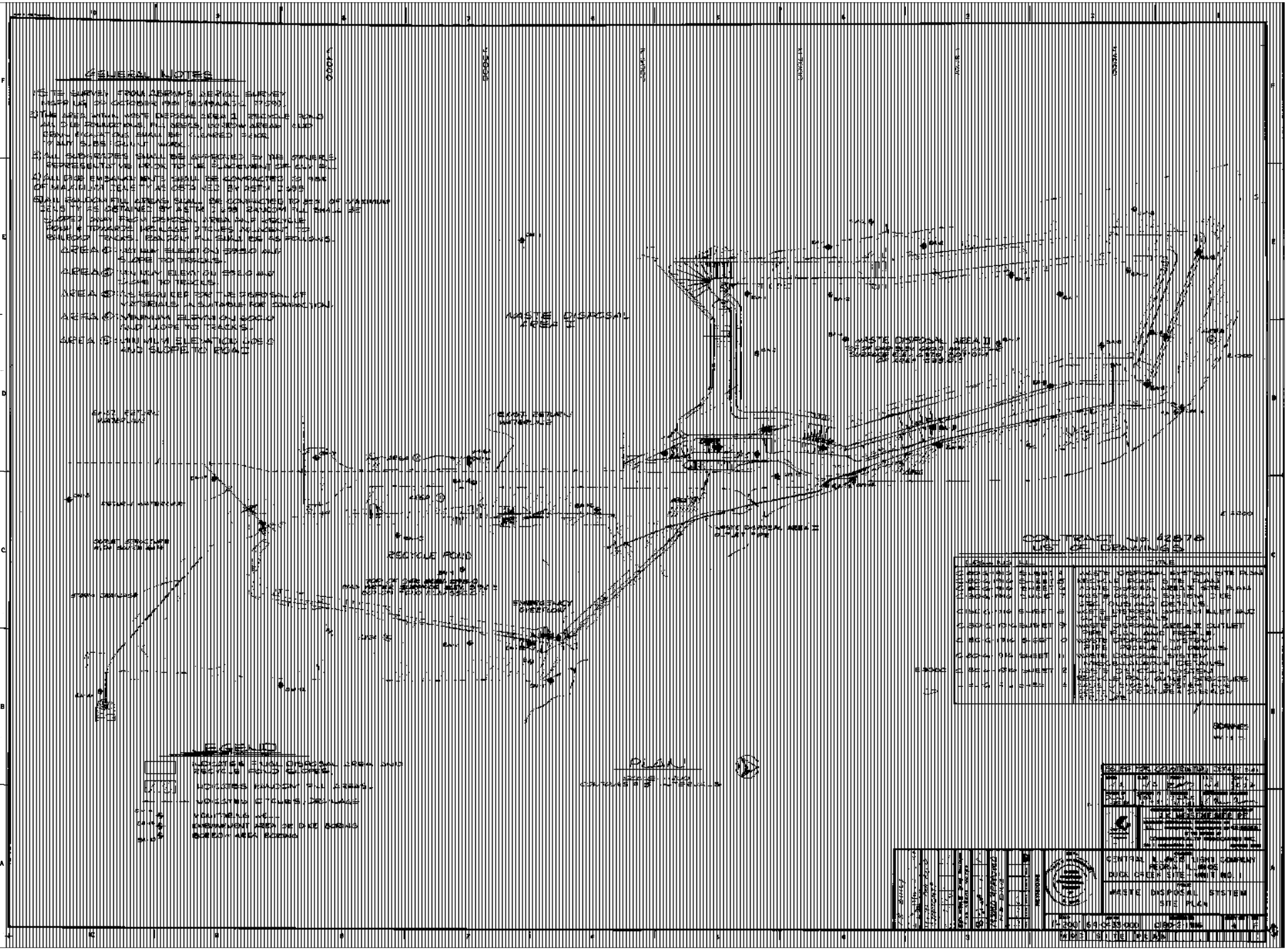
AREA A: MINIMUM ELEVATION 2850 AND SLOPE TO TRUCKS.

AREA B: MINIMUM ELEVATION 2850 AND SLOPE TO TRUCKS.

AREA C: IS REQUIRED FOR DISPOSAL OF MATERIALS NOT SUITABLE FOR COMPACTION.

AREA D: MINIMUM ELEVATION 2850 AND SLOPE TO TRUCKS.

AREA E: MINIMUM ELEVATION 2850 AND SLOPE TO ROAD.


WASTE DISPOSAL AREA 1
WASTE DISPOSAL AREA II
RECYCLE POND
EXISTING DIKE
EXISTING DIKE
EXISTING DIKE

WASTE AREA I

WASTE AREA II

LEGEND

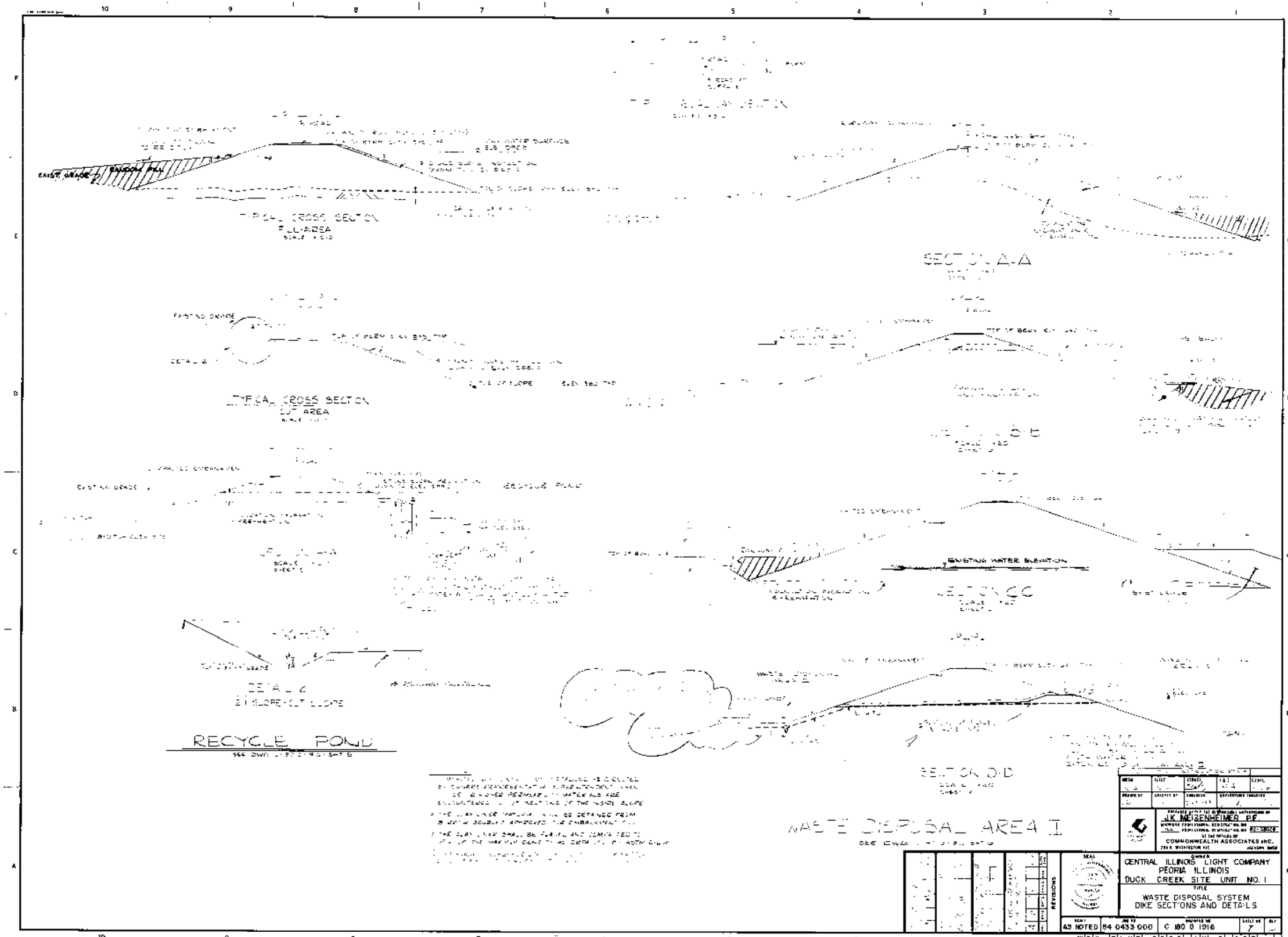
SECTION B-B

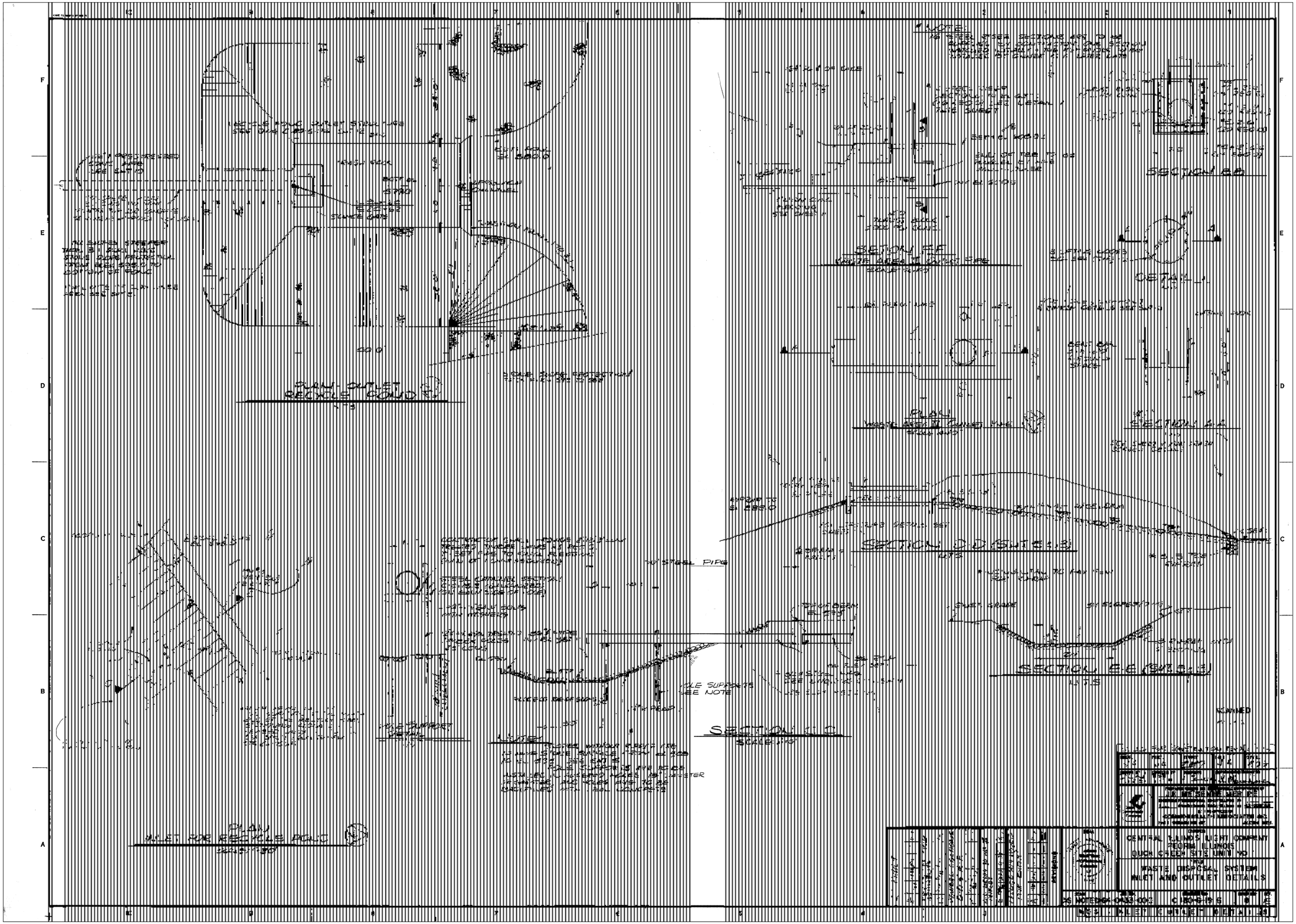
SCANNED

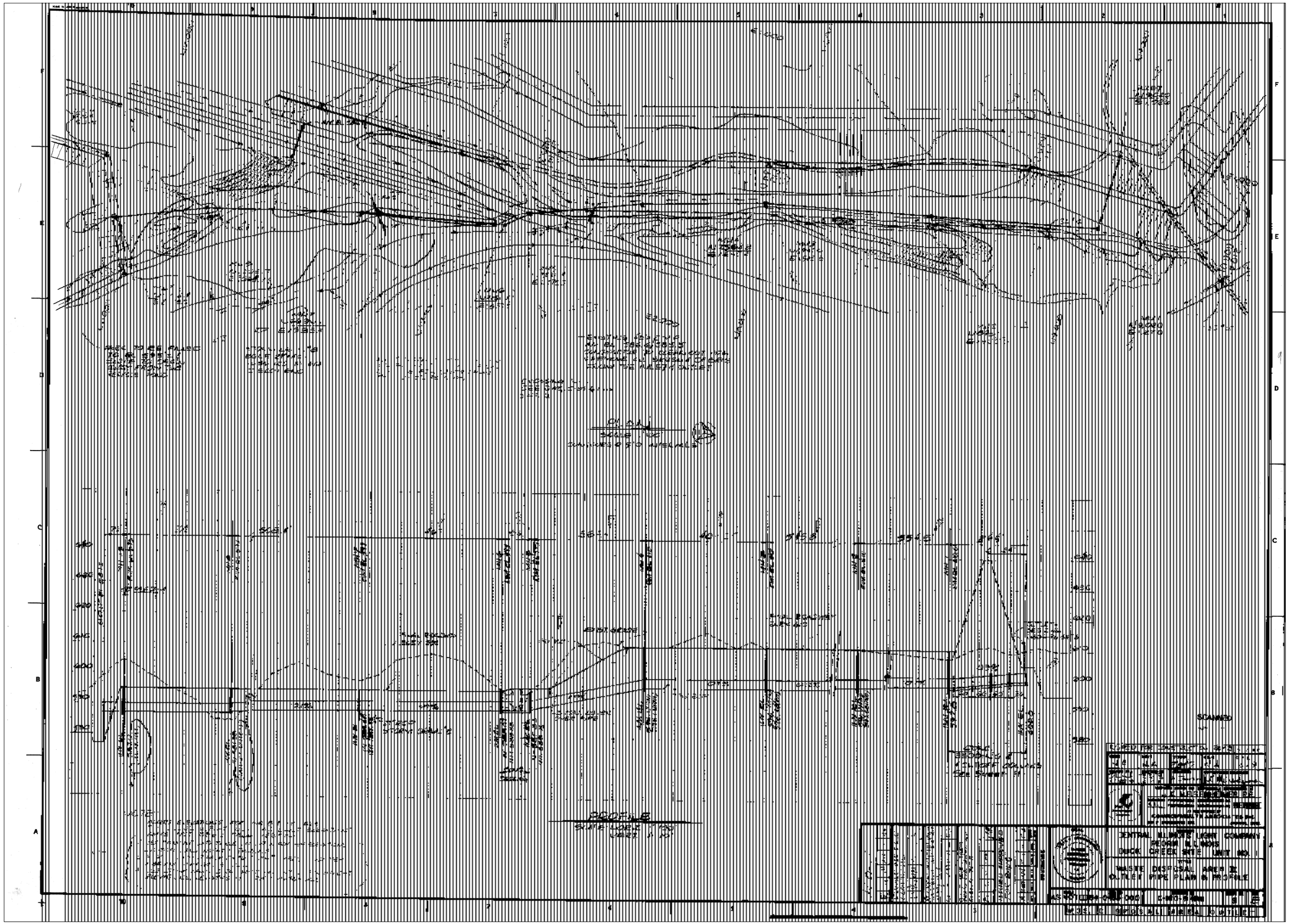
CENTRAL ILLINOIS LIGHT COMPANY
PEORIA ILLINOIS
DUCK CREEK SITE UNIT NO. 1

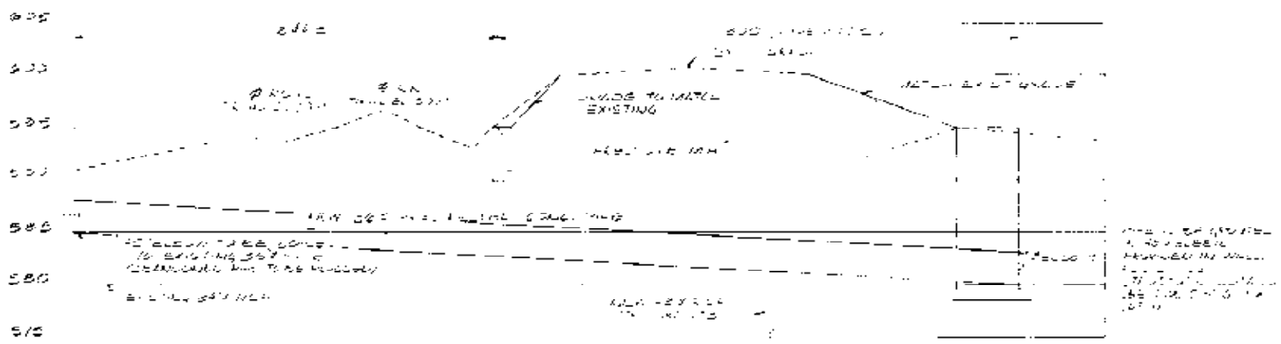
WASTE DISPOSAL AREA II
SITE PLAN

DATE 1/20/84 SCALE 1"=100' CHECKED BY

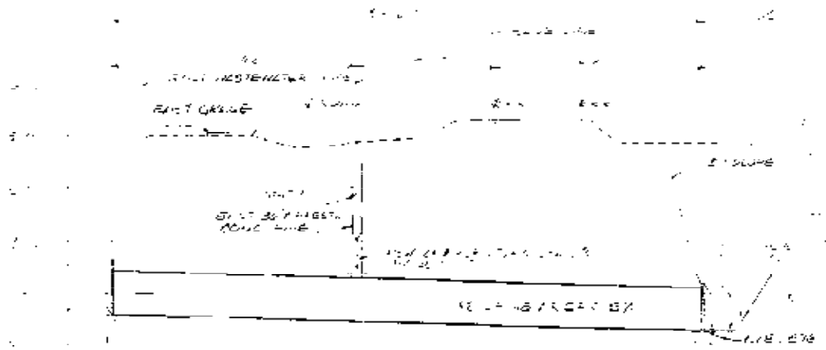

EXIST GRADE
TYPICAL CROSS SECTION
FILL AREA
TYPICAL CROSS SECTION
CUT AREA
DETAIL C
RECYCLE POND
SECTION A-A
SECTION B-B
EXISTING WATER ELEVATION
SECTION C-C
SECTION D-D
WASTE DISPOSAL AREA I
REVISIONS
SEAL
JK MEISENHEIMER P.E.
COMMONWEALTH ASSOCIATES INC.
OWNER
CENTRAL ILLINOIS LIGHT COMPANY
PEORIA ILLINOIS
DUCK CREEK SITE UNIT NO. 1
TITLE
WASTE DISPOSAL SYSTEM
DIKE SECTIONS AND DETAILS
AS NOTED
84 0433 000
C 180 0 1916
7
WDS DIKE SECTIONS & DETAILS


PLAN
OUTLET RECYCLE POND
SECTION A-A
SECTION B-B
SECTION C-C
SECTION D-D (SHEET 2)
SECTION E-E (SHEET 2)
DETAIL
PLAN
INLET RECYCLE POND
STEEL PIPE
SCANNED
CENTRAL ILLINOIS LIGHT COMPANY
PEORIA ILLINOIS
DUCK CREEK SITE UNIT #2
WASTE DISPOSAL SYSTEM
INLET AND OUTLET DETAILS

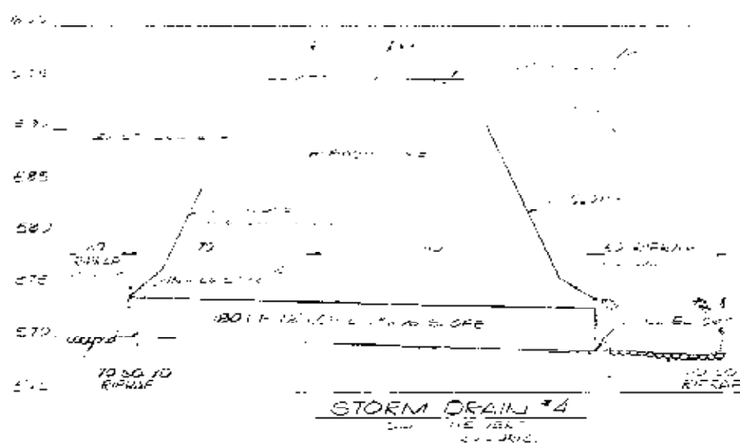

PLAN
SCALE 1:20
DRAWINGS TO WHERALS
PROFILE
SCALE 1:20
SCANNED
CENTRAL ILLINOIS LIGHT COMPANY
PEORIA, ILLINOIS
DUCK CREEK SITE UNIT NO. 1
WASTE DISPOSAL AREA II
OUTLET PIPE PLAN & PROFILE



RECALL POND RETAINING WALL PROFILE



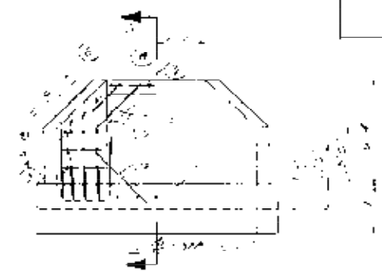
STORM DRAIN #2



STORM DRAIN #4

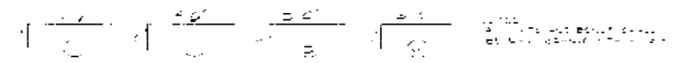
STORM DRAIN DATA

PLAN



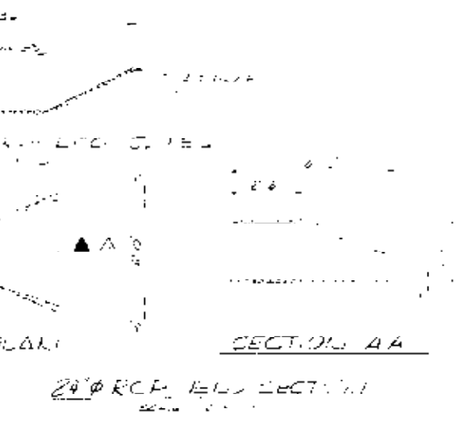
SECTION AA

TYPICAL HEADWALL DETAILS



BELL CAP DETAILS

BAR SCHEDULE



PLAN

SECTION AA

24" ϕ RCP HELD SECTION

REVISIONS

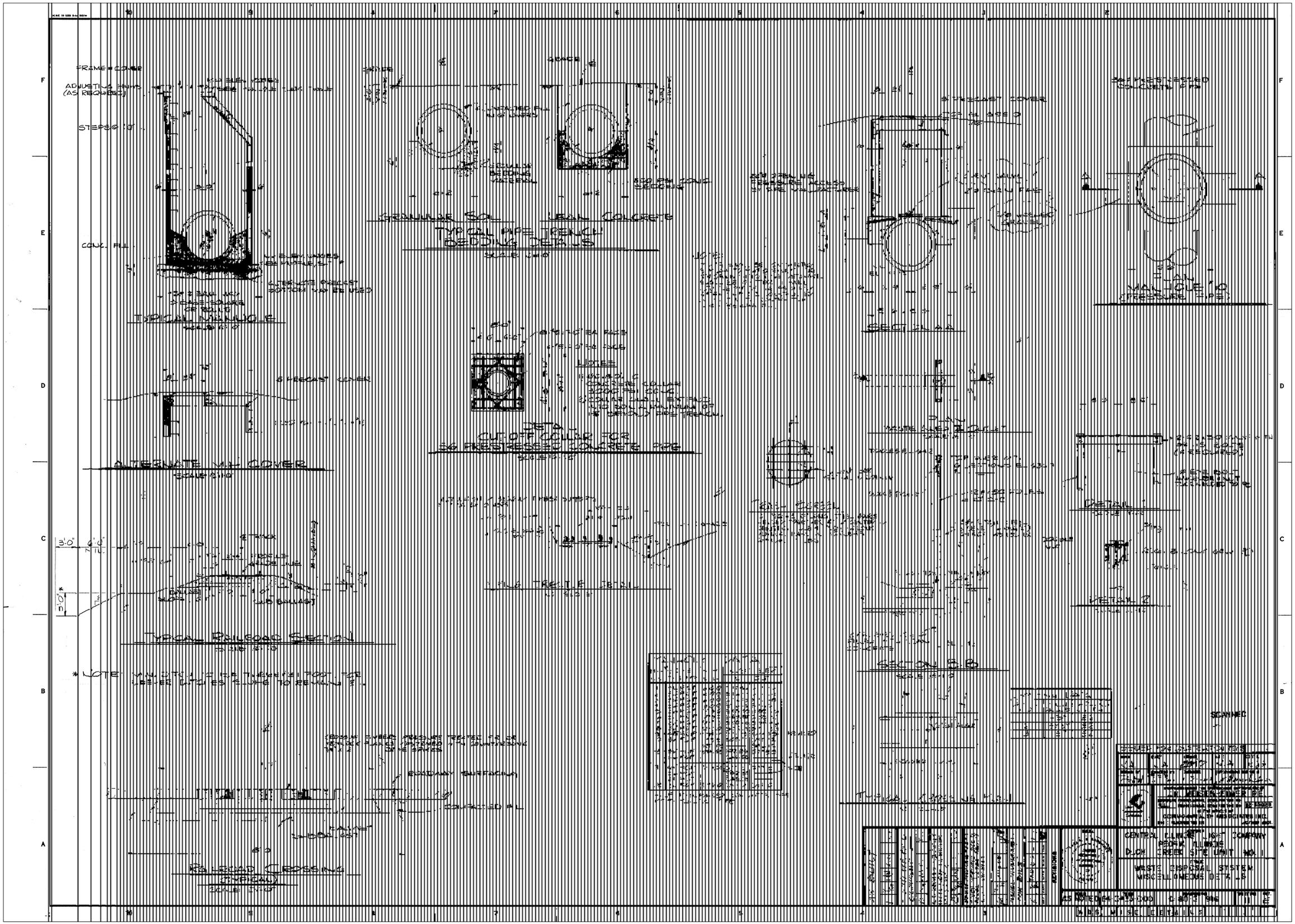
PROFESSIONAL ENGINEER (IN RESPONSIBLE CHARGE OF) J.K. NEISENHEMER P.E.
REGISTRATION NO. 62-33026
COMMONWEALTH ASSOCIATES INC.

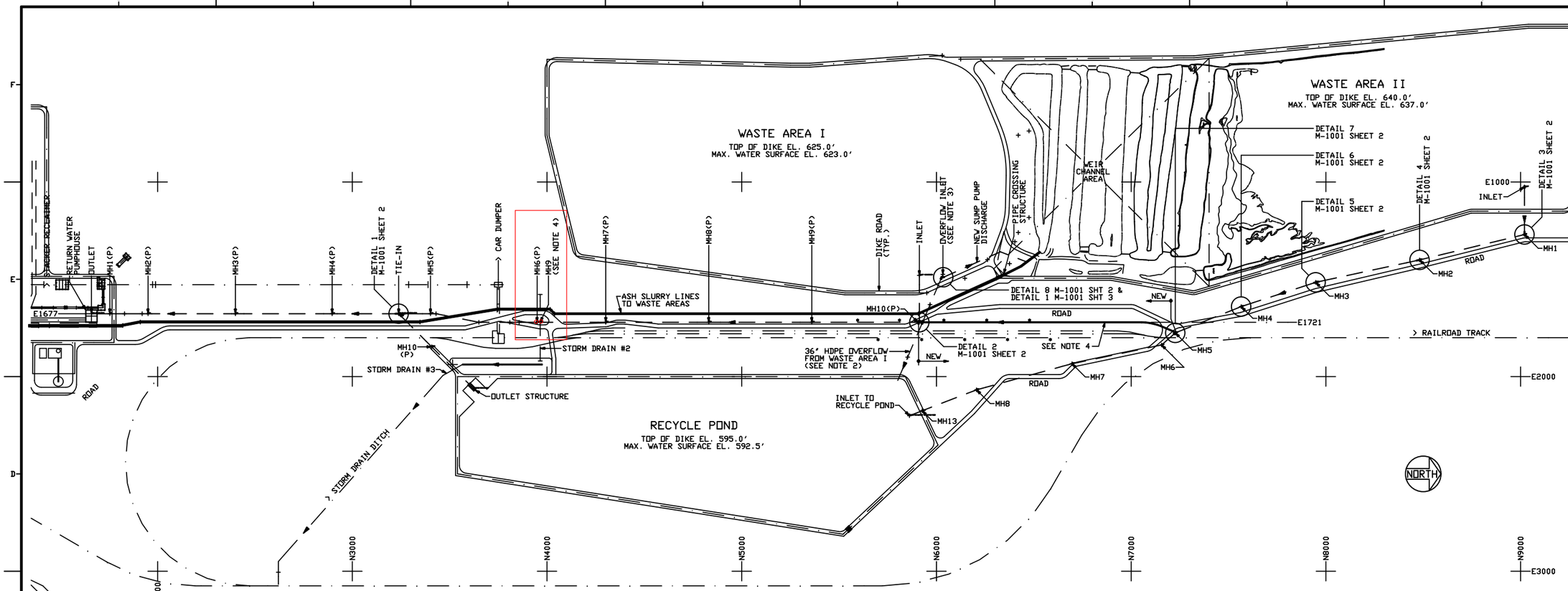
CENTRAL ILLINOIS LIGHT COMPANY
PEORIA ILLINOIS
DUCK CREEK SITE UNIT NO. 1

WASTE DISPOSAL SYSTEM
PIPE PROFILE AND DETAILS

SCALE	JOB NO	DRAWING NO	SHEET NO	REV
AS NOTED	64 0433-000	C 180 S 1016	10	E

WDS PIPE PROFILES (8) DETAIL


FRAME & COVER
ADJUSTING RING (AS REQUIRED)
STEPS @ 12"
CONC. FILL
TYPICAL MANHOLE
GRANULAR SOIL
LEAN CONCRETE
TYPICAL PIPE TRENCH BEDDING DETAILS
SECTION A-A
VALVE NO. 10 (PRESSURE PIPE)
PRECAST COVER
ALTERNATE MH COVER
CUTOFF COLLAR FOR 36" PRESTRESSED CONCRETE PIPE
TYPICAL RAILROAD SECTION
RAILROAD CROSSING
DETAIL
DETAIL 2
SECTION B-B
SCHMEC
CENTRAL LINCOLN WATER COMPANY
PEORIA, ILLINOIS
DICK CREEK SITE UNIT NO. 1
WASTE DISPOSAL SYSTEM
MISCELLANEOUS DETAILS
AS NOTED
MISC. DETAILS



PLAN

REFERENCE DRAWINGS:

1. EXISTING PIPE ROUTE FROM WASTE AREA I INLET TO RETURN WATER PUMPHOUSE PER DRAWING C180-G1929 SHEET 1 AND 'INTERPACE' PIPE LAYING SCHEDULE SB-74-26.

2. EXISTING PIPE ROUTE FROM RECYCLE POND OUTLET STRUCTURE TO TIE-IN POINT TO ORIGINAL RETURN LINE AND FROM WASTE AREA II INLET TO RECYCLE POND PER DRAWING C180-G-1916 SHEETS 5 AND 9 RESPECTIVELY.

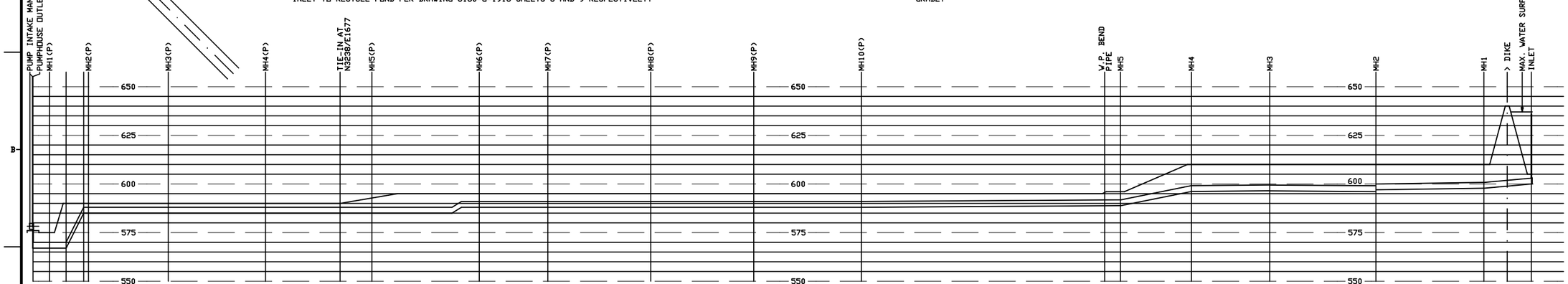
NOTES:

1. MANHOLES (MH) WITH PRESSURE ACCESS HATCHES INDICATED WITH A (P).

2. EXISTING OVERFLOW PIPE TO BE ABANDONED AS PART OF THE RETIREMENT OF WASTE AREA I. PIPE SECTION TO BE CUT OUT TO ALLOW FOR THE INSTALLATION OF THE WASTE WATER RETURN LINE FROM WASTE AREA II; BOTH ENDS IN THE EXCAVATION TO BE CAPPED.

3. OVERFLOW OUTLET REUSED BY CUTTING INTO THE OVERFLOW PIPE INSIDE OF THE DIKE ROAD AND INSTALLING A NEW HDPE SUMP. DISCHARGE FROM SUMP PUMP ROUTED TO PIPE CROSSING STRUCTURE AT WASTE AREA II.

4. HDPE PIPE ALTERNATE MAY TRANSITION FROM UNDERGROUND CONNECTION AND MAY BE ROUTED ON GRADE; ROAD CROSSINGS SHALL BE BELOW GRADE.



PROFILE

SCALES: HORIZONTAL 1'= 200' / VERTICAL 1'= 20'

ANY MODIFICATION OR ADDITION TO THIS DRAWING BY AN ORGANIZATION OTHER THAN SARGENT & LUNDY IS NOT THE RESPONSIBILITY OF SARGENT & LUNDY

FILE I.D.: M1001 01.DGN

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
0	07/30/04	J.ALCANTARA	M.MAZZAFERRO		FOR RECORD/SENT TO CLIENT	

SCALE: 1'=200'

PROJECT NUMBER: 11478-006

PIPE PLAN & PROFILE RECYCLE POND BYPASS

DUCK CREEK SITE
UNIT 1
CANTON, ILLINOIS
AMEREN CILCO

Sargent & Lundy

DRAWING NO. M-1001 REV. 0

SHEET 1 OF

CONTROL POINT NUMBER	GRID COORDINATES NORTHING	GRID COORDINATES EASTING	TOP OF FOUNDATION ELEVATION DESIGN	TOP OF FOUNDATION ELEVATION RECORD
F0101	16094.44	600.00	591.92	591.92
F0102	16129.48	600.00	601.93	601.72
F0103	16171.72	600.00	614.00	613.76
F0104	16181.80	600.00	614.00	613.93
F0105	16181.80	600.00	618.50	618.41
F0106	16207.05	600.00	618.50	618.41
F0107	16212.82	599.97	616.81	617.46
F0201	16093.44	700.00	591.63	591.43
F0202	16128.99	700.00	601.78	601.57
F0203	16171.75	700.00	614.00	613.66
F0204	16181.83	700.00	614.00	613.83
F0205	16181.83	700.00	618.50	618.45
F0206	16207.08	700.00	618.50	618.39
F0207	16214.65	699.99	616.33	616.08
F0301	16095.59	800.00	592.23	592.10
F0302	16130.09	800.00	602.09	601.78
F0303	16171.78	800.00	614.00	613.92
F0304	16181.86	800.00	614.00	613.80
F0305	16181.86	800.00	618.50	618.40
F0306	16207.11	800.00	618.50	618.36
F0307	16231.93	800.00	611.41	613.77
F0401	16097.41	884.70	592.75	592.62
F0402	16131.01	884.69	602.34	601.96
F0403	16171.81	884.68	614.00	613.88
F0404	16181.89	884.67	614.00	613.95
F0405	16181.89	884.67	618.50	618.46
F0406	16207.14	884.67	618.50	618.49
F0407	16233.79	884.62	610.88	611.16
F0501	16084.47	897.40	592.72	592.61
F0502	16084.09	931.08	602.34	601.98
F0503	16083.63	971.90	614.00	613.82
F0504	16083.52	981.98	614.00	613.99
F0505	16083.52	981.98	618.50	618.42
F0506	16083.24	1007.23	618.50	618.27
F0507	16082.98	1032.66	611.24	612.16
F0601	16000.00	894.01	592.01	591.89
F0602	16000.00	928.91	601.99	601.71
F0603	16000.00	970.96	614.00	613.85
F0604	16000.00	981.05	614.00	613.91
F0605	16000.00	981.05	618.50	618.35
F0606	16000.00	1006.30	618.50	618.19
F0607	15999.99	1027.93	612.32	614.31
F0701	15900.00	889.98	591.18	591.13
F0702	15900.00	926.34	601.57	601.53
F0703	15900.00	969.85	614.00	613.72
F0704	15900.00	979.93	614.00	613.97
F0705	15900.00	979.93	618.50	618.32
F0706	15900.00	1005.18	618.50	618.28
F0707	15900.00	1090.84	594.03	610.36
F0801	15800.00	885.96	590.35	590.35
F0802	15800.00	923.77	601.15	601.09
F0803	15800.00	968.73	614.00	613.77
F0804	15800.00	978.81	614.00	613.82
F0805	15800.00	978.81	618.50	618.32
F0806	15800.00	1004.06	618.50	618.35
F0807	15799.99	1029.78	611.15	611.95
F0901	15700.00	881.93	589.52	589.33
F0902	15700.00	921.20	600.74	600.58
F0903	15700.00	967.62	614.00	613.65
F0904	15700.00	977.70	614.00	613.93
F0905	15700.00	977.70	618.50	618.36
F0906	15700.00	1002.95	618.50	618.42
F0907	15700.00	1023.57	612.50	613.54
F1001	15600.00	874.33	587.67	587.28
F1002	15600.00	918.63	600.32	600.30
F1003	15600.00	966.50	614.00	613.79
F1004	15600.00	976.58	614.00	613.81
F1005	15600.00	976.58	618.50	618.43
F1006	15600.00	1001.83	618.50	618.42
F1007	15600.00	1020.54	613.15	613.94
F1101	15500.00	866.73	585.81	585.69
F1102	15500.00	916.06	599.91	599.75
F1103	15500.00	965.38	614.00	613.70
F1104	15500.00	975.46	614.00	613.81
F1105	15500.00	975.46	618.50	618.40
F1106	15500.00	1000.72	618.50	618.37
F1107	15500.02	1020.41	612.87	613.37
F1201	15400.00	862.70	584.98	584.93
F1202	15400.00	913.48	599.49	599.29
F1203	15400.00	964.27	614.00	613.73
F1204	15400.00	974.35	614.00	613.78
F1205	15400.00	974.35	618.50	618.32
F1206	15400.00	999.60	618.50	618.32
F1207	15399.98	1028.62	610.20	611.46
F1301	15300.00	858.67	584.15	583.89
F1302	15300.00	910.91	599.08	598.88
F1303	15300.00	963.15	614.00	613.76
F1304	15300.00	973.23	614.00	613.83
F1305	15300.00	973.23	618.50	618.38
F1306	15300.00	998.48	618.50	618.12
F1307	15300.00	1032.07	608.91	610.62
F1401	15200.00	854.65	583.32	583.20
F1402	15200.00	908.34	598.66	598.57
F1403	15200.00	962.03	614.00	613.76
F1404	15200.00	972.12	614.00	613.80
F1405	15200.00	972.12	618.50	618.27
F1406	15200.00	997.37	618.50	618.45
F1407	15199.99	1026.69	610.12	611.00
F1501	15100.00	850.62	582.49	582.35
F1502	15100.00	905.77	598.24	598.08
F1503	15100.00	960.92	614.00	613.65
F1504	15100.00	971.00	614.00	613.79
F1505	15100.00	971.00	618.50	618.43
F1506	15100.00	996.25	618.50	618.33
F1507	15099.99	1029.67	608.96	611.29
F1601	15000.00	846.59	581.66	581.56
F1602	15000.00	903.20	597.83	597.75
F1603	15000.00	959.80	614.00	613.69
F1604	15000.00	969.88	614.00	613.88
F1605	15000.00	969.88	618.50	618.37
F1606	15000.00	995.13	618.50	618.28
F1607	15000.03	1043.53	604.67	611.24
F1701	14900.00	842.57	580.83	580.78
F1702	14900.00	900.63	597.41	597.33
F1703	14900.00	958.69	614.00	613.84
F1704	14900.00	968.77	614.00	613.82
F1705	14900.00	968.77	618.50	618.39
F1706	14900.00	994.02	618.50	618.33
F1707	14900.00	1028.15	608.75	611.74
F1801	14813.44	839.08	580.21	579.97
F1802	14782.32	869.87	589.00	588.95
F1803	14781.16	957.36	614.00	613.89
F1804	14781.02	967.44	614.00	613.98
F1805	14781.02	967.44	618.50	618.33
F1806	14780.69	992.69	618.50	618.30
F1807	14780.28	1021.68	610.22	612.15
F1901	14813.44	839.08	580.21	579.95
F1902	14782.32	869.87	589.00	588.94
F1903	14694.82	870.06	614.00	613.79
F1904	14684.74	870.09	614.00	613.82
F1905	14684.74	870.09	618.50	618.35
F1906	14659.49	870.14	618.50	618.28
F1907	14631.04	870.23	610.37	618.75
F2001	14814.22	800.00	579.88	579.87
F2002	14754.51	800.00	596.94	596.83
F2003	14694.80	800.00	614.00	613.87
F2004	14694.72	800.00	614.00	613.81
F2005	14684.72	800.00	618.50	618.21
F2006	14659.47	800.00	618.50	618.43
F2007	14625.16	799.98	608.69	617.10
F2101	14816.20	700.00	579.31	579.28
F2102	14755.49	700.00	596.65	596.51
F2103	14694.78	700.00	614.00	613.87
F2104	14684.70	700.00	614.00	613.87
F2105	14684.70	700.00	618.50	618.46
F2106	14659.45	700.00	618.50	618.31
F2107	14604.09	699.98	602.68	617.45
F2201	14815.21	600.00	579.59	579.48
F2202	14754.98	600.00	596.79	596.47
F2203	14694.76	600.00	614.00	613.77
F2204	14684.68	600.00	614.00	613.90
F2205	14684.68	600.00	618.50	618.48
F2206	14659.43	600.00	618.50	618.47
F2207	14816.86	600.00	606.34	617.52
F2301	14813.75	500.00	580.00	579.84
F2302	14754.25	500.00	597.00	596.67
F2303	14694.74	500.00	614.00	613.66
F2304	14684.66	500.00	614.00	613.68
F2305	14684.66	500.00	618.50	618.35
F2306	14659.41	500.00	618.50	618.47
F2307	14628.55	499.97	609.69	617.85
F2401	14815.70	400.00	579.43	579.29
F2402	14755.21	400.00	596.72	596.41
F2403	14694.72	400.00	614.00	613.71
F2404	14684.64	400.00	614.00	613.74
F2405	14684.64	400.00	618.50	618.37
F2406	14659.39	400.00	618.50	618.39
F2407	14575.59	399.99	594.55	611.78
F2501	14815.59	300.00	579.46	579.37
F2502	14755.14	300.00	596.73	596.50
F2503	14694.70	300.00	614.00	613.66
F2504	14684.62	300.00	614.00	613.78
F2505	14684.62	300.00	618.50	618.43
F2506	14659.37	300.00	618.50	618.19
F2507	14620.64	299.98	607.44	616.64
F2601	14813.56	200.00	580.03	579.89
F2602	14754.12	200.00	597.02	596.76
F2603	14694.68	200.00	614.00	613.71
F2604	14684.60	200.00	614.00	613.92
F2605	14684.60	200.00	618.50	618.35
F2606	14659.35	200.00	618.50	618.27
F2607	14631.96	199.98	610.68	617.40
F2701	14812.67	156.13	580.28	580.17
F2702	14782.16	125.21	589.00	588.97
F2703	14694.66	125.04	614.00	613.79
F2704	14684.58	125.02	614.00	613.79
F2705	14684.58	125.02	618.50	618.43
F2706	14659.33	124.97	618.50	618.20
F2707	14635.10	124.92	611.57	614.44
F2801	14812.67	156.13	580.28	580.21
F2802	14782.16	125.21	589.00	588.96
F2803	14763.14	37.72	614.00	613.81
F2804	14763.25	27.64	614.00	613.79
F2805	14763.25	27.64	618.50	618.42
F2806	14763.53	2.39	618.50	618.22
F2807	14783.96	-34.35	608.00	610.18
F2901	14900.00	154.79	581.00	581.00
F2902	14900.00	97.03	597.50	597.36
F2903	14900.00	39.27	614.00	613.93
F2904	14900.00	29.19	614.00	613.98
F2905	14900.00	29.19	618.50	618.11
F2906	14900.00	3.94	618.50	618.45
F3001	15000.00	-23.80	610.57	613.06
F3002	15000.00	153.27	581.81	581.73
F3003	15000.00	96.94	597.91	597.64
F3004	15000.00	40.61	614.00	613.86
F3005	15000.00	30.53	614.00	613.95
F3006	15000.00	30.53	618.50	618.43
F3101	15100.00	151.74	582.63	582.56
F3102	15100.00	96.84	598.32	598.32
F3103	15100.00	41.94	614.00	613.93
F3104	15100.00	31.86	614.00	613.87
F3105	15100.00	31.86	618.50	618.29
F3106	15100.00	6.61	618.50	618.15
F3107	15100.02	-8.95	614.06	614.92
F3201	15200.00	150.22	583.45	583.22
F3202	15200.00	96.75	598.72	598.64
F3203	15200.00	43.28	614.00	613.96
F3204	15200.00	33.19	614.00	613.93
F3205	15200.00	33.19	618.50	618.39
F3206	15200.00	7.94	618.50	618.30
F3207	15199.98	-7.68	614.03	615.32
F3301	15300.00	148.69	584.26	584.18
F3302	15300.00	96.65	599.13	599.11
F3303	15300.00	44.61	614.00	613.96
F3304	15300.00	34.53	614.00	613.96
F3305	15300.00	34.53	618.50	618.32
F3306	15300.00	9.28	618.50	618.15
F3307	15300.02	-5.09	614.39	615.54
F3401	15400.00	147.17	585.08	584.94
F3402	15400.00	96.55	599.54	599.46
F3403	15400.00	45.94	614.00	613.92
F3404	15400.00	35.86	614.00	613.89
F3405	15400.00	35.86	618.50	618.35
F3406	15400.00	10.61	618.50	618.30
F3407	15299.99	-4.81	614.10	615.48
F3501	15500.00	145.64	585.90	585.79
F3502	15500.00	96.46	599.95	599.88
F3503	15500.00	47.28	614.00	613.88
F3504	15500.00	37.19	614.00	613.95
F3505	15500.00	37.19	618.50	618.35
F3506	15500.00	11.94	618.50	618.28
F3601	15600.00	144.06	587.74	587.67
F3602	15600.00	96.36	600.36	600.28
F3603	15600.00	48.61	614.00	613.87
F3604	15600.00	38.53	614.00	613.95
F3605	15600.00	38.53	618.50	618.43
F3606	15600.00	13.28	618.50	618.13
F3607	15600.01	0.68	614.90	617.26
F3701	15700.00	135.44	589.57	589.38
F3702	15700.00	96.29	600.77	600.75
F3703	15700.00	49.94	614.00	613.94
F3704	15700.00	39.86	614.00	613.84
F3705	15700.00	39.86	618.50	618.31
F3706	15700.00	14.61	618.50	618.16
F3707	15699.99	6.05	616.06	618.25
F3801	15800.00	133.92	590.39	590.28
F3802	15800.00	96.17	601.17	600.92
F3803	15800.00	51.28	614.00	613.73
F3804	15800.00	41.20	614.00	613.78
F3805	15800.00	41.20	618.50	618.39
F3806	15800.00	15.94	618.50	618.48
F3807	15799.99	13.41	617.77	619.70
F3901	15900.00	132.39	591.21	591.17
F3902	15900.00	96.07	601.58	601.40
F3903	15900.00	42.61	614.00	613.83
F3904	15900.00	42.53	614.00	613.99
F3905	15900.00	42.53	618.50	618.41
F3906	15900.00	17.28	618.50	618.27
F3907	15899.97	14.63	619.26	620.26
F4001	16000.00	130.87	592.02	591.82
F4003	16000.00	95.98	601.99	601.75
F4004	16000.00	53.94	614.00	613.93
F4005	16000.00	43.86	614.00	613.91
F4006	16000.00	43.86	618.50	618.37
F4007	15999.98	18.61	618.50	618.28
F4101	16084.55	13.17	620.06	620.37
F4102	16085.00	129.59	592.71	592.70
F4103	16085.54	95.91	602.34	602.23
F4104	16085.68	55.08	614.00	613.89
F4105	16085.68	45.00	614.00	613.91
F4106	16085.68	45.00	618.50	618.34
F4107	16086.02	19.76	618.50	618.11
F4201	16086.02	13.77	620.21	620.54
F4202	16097.17	142.27	592.74	592.52
F4203	16130.77	142.26	602.34	602.02
F4204	16171.58	142.25	614.00	613.64
F4205	16181.66	142.25	614.00	613.89
F4206	16181.66	142.25	618.50	618.49
F4207	16206.91	142.24	618.50	618.30
F4301	16214.67	142.24	616.28	619.55
F4302	16095.97	200.00	592.39	592.38
F4303	16130.18	200.00	602.17	601.94
F4304	16171.60	200.00	614.00	613.94
F4305	16181.68	200.00	614.00	613.93
F4306	16206.93	200.00	618.50	618.44
F4307	16223.64	199.97	613.72	618.76
F4401	16093.88	300.00	591.79	591.57
F4402	16129.15	300.00	601.86	601.47
F4403	16171.63	300.00	614.00	613.88
F4404	16181.71	300.00	614.00	613.82
F4405	16181.71	300.00	618.50	618.42
F4406	16206.96	300.00	618.50	618.45
F4407	16223.86	300.00	613.66	618.51
F4501	16093.81	400.00	591.76	591.75
F4502	16129.13	400.00	601.85	601.64
F4503	16171.66	400.00	614.00	613.61
F4504	16181.74	400.00	614.00	613.62
F4505	16181.74	400.00	618.50	618.41
F4506	16206.99	400.00	618.50	618.48
F4507	16219.15	400.02	615.01	618.75
F4601	16095.96	500.00	592.36	592.32
F4602	16130.22	500.00	602.15	601.93
F4603	16171.69	500.00	614.00	613.80
F4604	16181.77	500.00	614.00	613.86
F4605	16181.77	500.00	618.50	618.39
F4606	16207.02	500.00	618.50	618.42
F4607	16214.87	500.01	616.27	617.97
F5301	14900.00	352.42	579.83	579.50
F5302	15000.00	352.42	580.64	580.45
F5303	15100.00	352.42	581.45	581.24
F5304	15200.00	352.42	582.26	582.22
F5305	15300.00	352.42	583.06	582.98
F5306	15400.00	352.42	583.87	583.69
F5307	15500.00	352.42	584.68	584.44
F5308	15600.00	352.42	586.49	586.24
F5309	15700.00	352.42	588.30	588.08
F5310	15800.00	352.42	589.10	588.95
F5311	15900.00	352.42	589.91	589.89
F5312	16000.00	352.42	590.72	590.64
F5313	14900.00	513.35	580.78	580.38
F5314	15000.00	513.35	581.59	581.25
F5315	15100.00	513.35	582.40	582.32
F5316	15200.00	513.35	583.21	583.08
F5317	15300.00	513.35	584.01	584.00
F5318	15400.00	513.35	584.82	584.74
F5319	15500.00	513.35	585.63	585.53
F5320	15600.00	513.35	587.44	587.26
F5321	15700.00	513.35	589.24	589.05
F5322	15800.00	513.35	590.05	589.78
F5323	15900.00	513.35	590.86	590.62
F5324	16000.00	513.35	591.67	591.39
F5325	14900.00	674.29	579.83	579.69
F5326	15000.00	674.29	580.64	580.47
F5327	15100.00	674.29	581.45	581.42
F5328	15200.00	674.29	582.26	582.06
F5329	15300.00	674.29	583.07	582.93
F5330	15400.00	674.29	583.87	583.78
F5331	15500.00	674.29	584.68	584.50
F5332	15600.00	674.29	585.49	585.22
F5333	15700.00	674.29	586.29	586.07
F5334	15800.00	674.29	587.10	586.93
F5335	15900.00	674.29	587.91	587.77
F5336	16000.00	674.29	588.72	588.49
FB01	15500.00	200.00	583.87	583.83
FB02	15500.00	300.00	583.87	583.83
FB03	15500.00	400.00	583.87	583.83
FB04	15500.00	500.00	583.87	583.83
FB05	15500.00	600.00	583.87	583.83
FB06	15500.00	700.00	583.87	583.83
FB07	15500.00	800.00	583.87	583.83
FB08	15500.00	900.00	583.87	583.83
FB09	15500.00	1000.00	583.87	583.83
FB10	15500.00	1100.00	583.87	583.83
FB11	15500.00	1200.00	583.87	583.83
FB12	15500.00	1300.00	583.87	583.83
FB13	15500.00	1400.00	583.87	583.83
FB14	15500.00	1500.00	583.87	583.83
FB15	15500.00	1600.00	583.87	583.83
FB16	15500.00	1700.00	583.87	583.83
FB17	15500.00	1800.00	583.87	583.83
FB18	15500.00	1900.00	583.87	583.83
FB19	15500.00	2000.00	583.87	583.83
FB20	15500.00	2100.00	583.87	583.83
FB21	15500.00	2200.00	583.87	583.83
FB22	15500.00	2300.00	583.87	583.83
FB23	15500.00	2400.00	583.87	583.83
FB24	15500.00	2500.00	583.87	583.83
FB25	15500.00	2600.00	583.87	583.83
FB26	15500.00	2700.00	583.87	583.83
FB27	15500.00	2800.00	583.87	583.83
FB28	15500.00	2900.00	583.87	583.83
FB29	15500.00	3000.00	583.87	583.83
FB30	15400.00	674.29	583.87	583.66
FB31	15500.00	674.29	584.68	584.50
FB32	15600.00	674.29	586.49	586.28
FB33	15700.00	674.29	588.30	588.21
FB34	15800.00	674.29	589.10	588.95
FB35	15900.00	674.29	589.91	589.81
FB36	16000.00	674.29	590.72	590.51
FG01	14900.00	200.00	580.73	580.50
FG02	15000.00	200.00	581.54	581.17
FG03	15100.00	200.00	582.35	582.15
FG04	15200.00	200.00	583.15	583.01
FG05	15300.00	200.00	583.96	583.91
FG06	15400.00	200.00	584.77	584.43
FG07	15500.00	200.00	585.58	585.40
FG08	15600.00	200.00	587.39	587.18
FG09	15700.00	200.00	589.19	589.14
FG10	15800.00	200.00	590.00	589.85
FG11	15900.00	200.00	590.81	590.59
FG12	16000.00	200.00	591.62	591.40
FG13	14900.00	300.00	580.14	580.01
FG14	15000.00	300.00	580.95	580.68
FG15	15100.00	300.00	581.76	581.61
FG16	15200.00	300.00	582.57	582.52
FG17	15300.00	300.00	583.37	583.29
FG18	15400.00	300.00	584.18	584.10
FG19	15500.00	300.00	584.99	584.80
FG20	15600.00	300.00	586.80	586.62
FG21	15700.00	300.00	588.60	588.48
FG22	15800.00	300.00	589.41	589.33
FG23	15900.00	300.00	590.22	590.13
FG24	16000.00	300.00	591.03	591.03
FG25	14900.00	400.00	580.11	580.11
FG26	15000.00	400.00	580.92	580.78
FG27	15100.00	400.00	581.73	581.55
FG28	15200.00	400.00	582.54	582.42
FG29	15300.00	400.00	583.34	583.21
FG30	15400.00	400.00	584.15	584.05
FG31	15500.00	400.00	584.96	584.74
FG32	15600.00	400.00	586.77	586.65
FG33	15700.00	400.00	588.58	588.49
FG34	15800.00	400.00	589.38	589.32
FG35	15900.00	400.00	590.19	590.14
FG36	16000.00	400.00	591.00	590.87
FG37	14900.00	500.00	580.70	580.46
FG38	15000.00	500.00	581.51	581.30
FG39	15100.00	500.00	582.32	582.10
FG40	15200.00	500.00	583.13	583.07
FG41	15300.00	500.00	583.93	583.81
FG42	15400.00	500.00	584.74	584.39
FG43	15500.00	500.00	585.55	585.47
FG44	15600.00	500.00	587.36	587.35
FG45	15700.00	500.00	589.17	588.77
FG46	15800.00	500.00	589.97	589.84
FG47	15900.00	500.00	590.78	590.72
FG48	16000.00	500.00	591.59	591.28
FG49	14900.00	600.00	580.27	580.18
FG50	15000.00	600.00	581.08	580.89
FG51	15100.00	600.00	581.89	581.71
FG52	15200.00	600.00	582.70	582.56
FG53	15300.00	600.00	583.50	583.45
FG54	15400.00	600.00	584.31	584.25
FG55	15500.00	600.00	585.12	584.75
FG56	15600.00	600.00	585.93	585.75
FG57	15700.00	600.00	588.73	588.52
FG58	15800.00	600.00	589.54	589.41
FG59	15900.00	600.00	590.35	590.27
FG60	16000.00	600.00	591.16	590.91
FG61	14900.00	700.00	579.99	579.83
FG62	15000.00	700.00	580.79	580.64
FG63	15100.00	700.00	581.60	581.34
FG64	15200.00	700.00	582.41	582.31
FG65	15300.00	700.00	583.22	583.05
FG66	15400.00	700.00	584.02	583.64
FG67	15500.00	700.00	584.83	584.58
FG68	15600.00	700.00	585.64	585.37
FG69	15700.00	700.00	588.45	588.13
FG70	15800.00	700.00	589.26	588.99
FG71	15900.00	700.00	590.06	589.98
FG72	16000.00	700.00	590.87	590.75
FG73	14900.00	800.00	580.57	580.46
FG74	15000.00	800.00	581.38	581.22
FG75	15100.00	800.00	582.19	582.05
FG76	15200.00	800.00	583.00	582.86
FG77	15300.00	800.00	583.81	583.66
FG78	15400.00	800.00	584.61	584.46
FG79	15500.00	800.00	585.42	585.34
FG80	15600.00	800.00	587.23	587.14
FG81	15700.00	800.00	589.04	588.70
FG82	15800.00	800.00	589.84	589.50
FG83	15900.00	800.00	590.65	590.50
FG84	16000.00	800.00	591.46	591.42

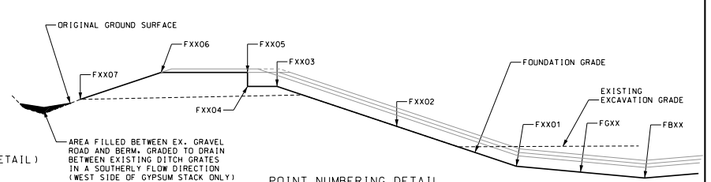
NOTE: RECORD ELEVATIONS AND LAYER THICKNESSES BASED ON A COMPILATION OF RECORD SURVEY DATA PROVIDED BY MAURER-STUTZ, INC. THIS RECORD SURVEY PROVIDED BY MAURER-STUTZ, INC., IS CONTAINED ELSEWHERE IN THIS ACCEPTANCE REPORT.

TYPICAL POINT NUMBER LOCATION

FB 00 — GRID POINT NUMBER — FOUNDATION GRADE (BREAK POINT)

FG 00 — GRID POINT NUMBER — FOUNDATION GRADE

F 00 00 — POINT NUMBER (SEE POINT NUMBERING DETAIL) — CONTROL LINE NUMBER — FOUNDATION GRADE



POINT NUMBERING DETAIL

AEG CAD GENERATED
DO NOT REVISE MANUALLY

REFER TO OTHER PLAN SHEETS FOR STANDARD LEGEND

CONTROL POINT NUMBER	GRID COORDINATES NORTHING	GRID COORDINATES EASTING	TOP OF CLAY LAYER DESIGN	TOP OF CLAY LAYER RECORD	CLAY LAYER THICKNESS
S0101	16094.01	600.00	594.92	595.29	3.4
S0102	16131.93	600.00	605.75	605.94	3.4
S0103	16176.55	600.00	618.50	618.66	4.8
S0201	16093.01	700.00	594.62	595.01	3.6
S0202	16131.96	700.00	605.75	605.83	3.3
S0203	16176.58	700.00	618.50	618.59	4.8
S0301	16095.16	800.00	595.23	595.72	3.6
S0302	16132.64	800.00	605.94	606.02	3.4
S0303	16176.61	800.00	618.50	618.68	4.8
S0401	16096.98	884.70	595.74	596.05	3.4
S0402	16133.97	884.69	606.31	606.33	3.4
S0403	16176.64	884.68	618.50	618.70	4.8
S0501	16084.47	896.97	595.71	596.24	3.6
S0502	16084.06	934.06	606.31	606.41	3.5
S0503	16083.58	976.73	618.50	618.65	4.7
S0601	16000.00	893.58	595.01	595.08	3.2
S0602	16000.00	931.11	605.73	605.74	3.3
S0603	16000.00	975.79	618.50	618.51	4.6
S0701	15900.00	889.55	594.18	594.28	3.2
S0702	15900.00	928.54	605.32	605.41	3.1
S0703	15900.00	974.68	618.50	618.50	4.7
S0801	15800.00	885.53	593.35	593.44	3.1
S0802	15800.00	925.97	604.90	604.98	3.2
S0803	15800.00	973.56	618.50	618.55	4.8
S0901	15700.00	881.50	592.52	592.61	3.3
S0902	15700.00	923.40	604.49	604.57	3.2
S0903	15700.00	972.45	618.50	618.57	4.8
S1001	15600.00	873.90	590.66	590.75	3.5
S1002	15600.00	920.83	604.07	604.16	3.2
S1003	15600.00	971.33	618.50	618.51	4.7
S1101	15500.00	866.30	588.81	588.90	3.2
S1102	15500.00	918.26	603.66	603.72	3.2
S1103	15500.00	970.21	618.50	618.50	4.7
S1201	15400.00	862.27	587.98	588.08	3.2
S1202	15400.00	915.68	603.24	603.30	3.3
S1203	15400.00	969.10	618.50	618.51	4.8
S1301	15300.00	858.25	587.15	587.19	3.3
S1302	15300.00	913.11	602.82	602.89	3.3
S1303	15300.00	967.98	618.50	618.51	4.7
S1401	15200.00	854.22	586.32	586.41	3.2
S1402	15200.00	910.54	602.41	602.41	3.1
S1403	15200.00	966.87	618.50	618.51	4.7
S1501	15100.00	850.19	585.49	585.59	3.2
S1502	15100.00	907.97	601.99	602.01	3.2
S1503	15100.00	965.75	618.50	618.52	4.8
S1601	15000.00	846.17	584.65	584.73	3.2
S1602	15000.00	905.40	601.58	601.65	3.2
S1603	15000.00	964.63	618.50	618.57	4.8
S1701	14900.00	842.14	583.82	584.08	3.3
S1702	14900.00	903.35	601.31	601.39	3.2
S1703	14900.00	963.52	618.50	618.50	4.7
S1801	14813.86	838.67	583.11	583.51	3.5
S1802	14782.32	869.87	592.12	592.18	3.1
S1803	14781.09	962.19	618.50	618.54	4.6
S1901	14813.86	838.67	583.11	583.51	3.5
S1902	14782.32	869.87	592.12	592.16	3.1
S1903	14689.99	870.07	618.50	618.52	4.7
S2001	14814.62	800.00	582.89	582.96	3.1
S2002	14752.10	800.00	600.75	600.82	3.2
S2003	14689.97	800.00	618.50	618.58	4.7
S2101	14816.61	700.00	582.31	582.51	3.2
S2102	14752.08	700.00	600.75	600.80	3.2
S2103	14689.95	700.00	618.50	618.56	4.6
S2201	14815.61	600.00	582.59	582.75	3.3
S2202	14752.06	600.00	600.75	600.76	3.3
S2203	14689.93	600.00	618.50	618.50	4.7
S2301	14814.16	500.00	583.00	583.15	3.3
S2302	14752.03	500.00	600.75	600.78	3.4
S2303	14689.91	500.00	618.50	618.52	4.9
S2401	14816.11	400.00	582.44	582.87	3.6
S2402	14752.01	400.00	600.75	600.77	3.3
S2403	14689.89	400.00	618.50	618.51	4.8
S2501	14815.99	300.00	582.46	582.58	3.2
S2502	14751.99	300.00	600.75	600.78	3.3
S2503	14689.87	300.00	618.50	618.52	4.8
S2601	14813.97	200.00	583.04	583.13	3.2
S2602	14751.57	200.00	600.86	600.86	3.2
S2603	14689.85	200.00	618.50	618.53	4.7
S2701	14813.09	156.55	583.29	583.56	3.4
S2702	14782.16	125.21	592.12	592.22	3.1
S2703	14689.83	125.03	618.50	618.52	4.7
S2801	14813.09	156.55	583.29	583.54	3.4
S2802	14782.16	125.21	592.12	592.20	3.1
S2803	14783.19	32.89	618.50	618.51	4.7
S2901	14900.00	155.22	583.99	584.23	3.2
S2902	14900.00	94.62	601.31	601.36	3.2
S2903	14900.00	34.44	618.50	618.51	4.6
S3001	15000.00	153.70	584.81	584.85	3.1
S3002	15000.00	94.74	601.66	601.72	3.3
S3003	15000.00	35.78	618.50	618.55	4.6
S3101	15100.00	152.17	585.63	585.72	3.2
S3102	15100.00	94.64	602.06	602.09	3.0
S3103	15100.00	37.11	618.50	618.51	4.6
S3201	15200.00	150.65	586.45	586.54	3.3
S3202	15200.00	94.55	602.47	602.47	3.1
S3203	15200.00	38.44	618.50	618.57	4.6
S3301	15300.00	149.12	587.26	587.46	3.3
S3302	15300.00	94.45	602.88	602.93	3.0
S3303	15300.00	39.78	618.50	618.51	4.5
S3401	15400.00	147.60	588.08	588.26	3.3
S3402	15400.00	94.35	603.29	603.37	3.1
S3403	15400.00	41.11	618.50	618.51	4.6
S3501	15500.00	146.07	588.90	588.93	3.1
S3502	15500.00	94.26	603.70	603.69	3.1
S3503	15500.00	42.45	618.50	618.49	4.6
S3601	15600.00	140.97	590.73	590.85	3.2
S3602	15600.00	94.16	604.11	604.16	3.1
S3603	15600.00	43.78	618.50	618.50	4.6
S3701	15700.00	135.87	592.57	592.65	3.3
S3702	15700.00	94.07	604.51	604.53	3.0
S3703	15700.00	45.11	618.50	618.49	4.6
S3801	15800.00	134.35	593.39	593.44	3.2
S3802	15800.00	93.97	604.92	604.99	3.4
S3803	15800.00	46.45	618.50	618.50	4.7
S3901	15900.00	132.82	594.20	594.71	3.5
S3902	15900.00	93.87	605.33	605.43	3.3
S3903	15900.00	47.78	618.50	618.54	4.6

CONTROL POINT NUMBER	GRID COORDINATES NORTHING	GRID COORDINATES EASTING	TOP OF CLAY LAYER DESIGN	TOP OF CLAY LAYER RECORD	CLAY LAYER THICKNESS
S4001	16000.00	131.30	595.02	595.38	3.6
S4002	16000.00	93.78	605.74	605.83	3.3
S4003	16000.00	49.11	618.50	618.58	4.7
S4101	16084.55	130.01	595.71	596.11	3.4
S4102	16085.04	92.92	606.31	606.49	3.3
S4103	16085.61	50.25	618.50	618.66	4.8
S4201	16095.74	142.27	595.74	596.24	3.7
S4202	16133.75	142.26	606.31	606.47	3.5
S4203	16176.41	142.25	618.50	618.70	4.9
S4301	16095.54	200.00	595.39	595.74	3.4
S4302	16132.87	200.00	606.05	606.20	3.4
S4303	16176.43	200.00	618.50	618.61	4.7
S4401	16093.45	300.00	594.78	595.08	3.5
S4402	16131.83	300.00	605.75	605.94	3.5
S4403	16176.46	300.00	618.50	618.64	4.8
S4501	16093.38	400.00	594.75	595.01	3.3
S4502	16131.81	400.00	605.75	605.91	3.4
S4503	16176.49	400.00	618.50	618.68	5.1
S4601	16095.53	500.00	595.36	595.55	3.2
S4602	16131.90	500.00	605.75	605.92	3.4
S4603	16176.52	500.00	618.50	618.59	4.8
S4701	16093.68	600.00	595.62	595.85	3.2
S4702	16131.99	600.00	605.75	605.94	3.4
S4703	16176.55	600.00	618.50	618.66	4.8
S4801	16093.83	700.00	595.89	596.09	3.3
S4802	16131.83	700.00	605.75	605.94	3.5
S4803	16176.46	700.00	618.50	618.64	4.8
S4901	16093.98	800.00	595.95	596.15	3.3
S4902	16131.87	800.00	605.75	605.91	3.4
S4903	16176.49	800.00	618.50	618.68	5.1
S5001	16095.53	500.00	595.36	595.55	3.2
S5002	16131.90	500.00	605.75	605.92	3.4
S5003	16176.52	500.00	618.50	618.59	4.8
S5101	14900.00	352.42	582.83	582.85	3.4
S5102	15000.00	352.42	583.64	583.71	3.3
S5103	15100.00	352.42	584.45	584.49	3.3
S5104	15200.00	352.42	585.26	585.32	3.1
S5105	15300.00	352.42	586.06	586.06	3.1
S5106	15400.00	352.42	586.87	586.97	3.3
S5107	15500.00	352.42	587.68	587.76	3.3
S5108	15600.00	352.42	589.49	589.54	3.3
S5109	15700.00	352.42	591.30	591.31	3.2
S5110	15800.00	352.42	592.10	592.20	3.3
S5111	15900.00	352.42	592.91	593.03	3.1
S5112	16000.00	352.42	593.72	593.88	3.2
S5113	14900.00	513.35	583.78	583.86	3.5
S5114	15000.00	513.35	584.59	584.66	3.4
S5115	15100.00	513.35	585.40	585.41	3.1
S5116	15200.00	513.35	586.21	586.26	3.2
S5117	15300.00	513.35	587.01	587.04	3.0
S5118	15400.00	513.35	587.82	587.86	3.1
S5119	15500.00	513.35	588.63	588.65	3.1
S5120	15600.00	513.35	590.44	590.55	3.3
S5121	15700.00	513.35	592.24	592.26	3.2
S5122	15800.00	513.35	593.05	593.14	3.4
S5123	15900.00	513.35	593.86	593.91	3.3
S5124	16000.00	513.35	594.67	594.85	3.5
S5125	14900.00	674.29	582.83	582.91	3.2
S5126	15000.00	674.29	583.64	583.72	3.3
S5127	15100.00	674.29	584.45	584.47	3.1
S5128	15200.00	674.29	585.26	585.35	3.3
S5129	15300.00	674.29	586.07	586.09	3.2
S5130	15400.00	674.29	586.87	586.95	3.3
S5131	15500.00	674.29	587.68	587.75	3.3
S5132	15600.00	674.29	589.49	589.59	3.3
S5133	15700.00	674.29	591.30	591.34	3.1
S5134	15800.00	674.29	592.10	592.19	3.2
S5135	15900.00	674.29	592.91	592.92	3.1
S5136	16000.00	674.29	593.72	593.94	3.4
S5201	14900.00	200.00	583.73	583.84	3.3
S5202	15000.00	200.00	584.54	584.56	3.4
S5203	15100.00	200.00	585.35	585.42	3.3
S5204	15200.00	200.00	586.15	586.21	3.2
S5205	15300.00	200.00	586.96	587.04	3.1
S5206	15400.00	200.00	587.77	587.81	3.4
S5207	15500.00	200.00	588.58	588.66	3.3
S5208	15600.00	200.00	590.39	590.43	3.3
S5209	15700.00	200.00	592.19	592.26	3.1
S5210	15800.00	200.00	593.00	593.07	3.2
S5211	15900.00	200.00	593.81	594.03	3.4
S5212	16000.00	200.00	594.62	594.69	3.3
S5213	14900.00	300.00	583.14	583.21	3.2
S5214	15000.00	300.00	583.95	584.05	3.4
S5215	15100.00	300.00	584.76	584.77	3.2
S5216	15200.00	300.00	585.57	585.67	3.1
S5217	15300.00	300.00	586.37	586.41	3.1
S5218	15400.00	300.00	587.18	587.22	3.1
S5219	15500.00	300.00	587.99	588.09	3.3
S5220	15600.00	300.00	589.80	589.81	3.2
S5221	15700.00	300.00	591.60	591.65	3.2
S5222	15800.00	300.00	592.41	592.45	3.1
S5223	15900.00	300.00	593.22	593.41	3.3
S5224	16000.00	300.00	594.03	594.10	3.1
S5225	14900.00	400.00	583.11	583.23	3.1
S5226	15000.00	400.00	583.92	584.00	3.2
S5227	15100.00	400.00	584.73	584.75	3.2
S5228	15200.00	400.00	585.54	585.61	3.2
S5229	15300.00	400.00	586.34	586.35	3.1
S5230	15400.00	400.00	587.15	587.23	3.2
S5231	15500.00	400.00	587.96	588.05	3.3
S5232	15600.00	400.00	589.77	589.80	3.1
S5233	15700.00	400.00	591.58	591.64	3.1
S5234	15800.00	400.00	592.38	592.45	3.1
S5235	15900.00	400.00	593.19	593.26	3.1
S5236	16000.00	400.00	594.00	594.07	3.2
S5237	14900.00	500.00	583.70	583.77	3.3
S5238	15000.00	500.00	584.51	584.58	3.3
S5239	15100.00	500.00	585.32	585.36	3.3
S5240	15200.00	500.00	586.13	586.19	3.1
S5241	15300.00	500.00	586.93	586.95	3.1
S5242	15400.00	500.00	587.74	587.82	3.4
S5243	15500.00	500.00	588.55	588.60	3.1
S5244	15600.00	500.00	590.36	590.43	3.1
S5245	15700.00	500.00	592.17	592.23	3.5
S5246	15800.00	500.00	592.97	593.05	3.2
S5247	15900.00	500.00	593.78	593.79	3.1
S5248	16000.00	500.00	594.59	594.83	3.6
S5249	14900.00	600.00	583.27	583.37	3.2
S5250	15000.00	600.00	584.08	584.17	3.3
S5251	15100.00	600.00	584.89	584.95	3.2
S5252	15200.00	600.00	585.70	585.70	3.1
S5253	15300.00	600.00	586.50	586.50	3.0
S5254	15400.00	600.00	587.31	587.39	3.1
S5255	15500.00	600.00	588.12	588.18	3.4
S5256	15600.00	600.00	589.93	590.03	3.3
S5257	15700.00	600.00	591.73	591.81	3.3
S5258	15800.00	600.00	592.54	592.57	3.2
S5259	15900.00	600.00	593.35	593.44	3.2
S5260	16000.00	600.00	594.16	594.43	3.5

CONTROL POINT NUMBER	GRID COORDINATES NORTHING	GRID COORDINATES EASTING	TOP OF CLAY LAYER DESIGN	TOP OF CLAY LAYER RECORD	CLAY LAYER THICKNESS
SG61	14900.00	700.00	582.99	582.99	3.2
SG62	15000.00	700.00	583.79	583.88	3.4
SG63	15100.00	700.00	584.60	584.62	3.3
SG64	15200.00	700.00	585.41	585.45	3.1
SG65	15300.00	700.00	586.22	586.24	3.2
SG66	15400.00	700.00	587.02	587.09	3.5
SG67	15500.00	700.00	587.83	587.92	3.3
SG68	15600.00	700.00	589.64	589.73	3.4
SG69	15700.00	700.00	591.45	591.50	3.4
SG70	15800.00	700.00	592.26	592.34	3.4
SG71	15900.00	700.00	593.06	593.07	3.1
SG72	16000.00	700.00	593.87	594.03	3.3
SG73	14900.00	800.00	583.57	583.57	3.1
SG74	15000.00	800.00	584.38	584.45	3.2
SG75	15100.00	800.00	585.19	585.20	3.2
SG76	15200.00	800.00	586.00	586.00	3.1
SG77	15300.00	800.00	586.81	586.82	3.2
SG78	15400.00	800.00	587.61	587.70	3.2
SG79	15500.00	800.00	588.42	588.52	3.2
SG80	15600.00	800.00	590.23	590.29	3.1
SG81	15700.00	800.00	592.04	592.13	3.4
SG82	15800.00	800.00	592.84	592.90	3.4
SG83	15900.00	800.00	593.65	593.69	3.2
SG84	16000.00	800.00	594.46	594.76	3.3

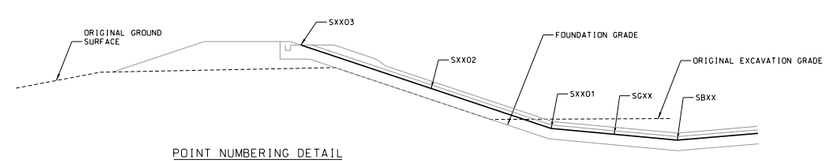
NOTE: RECORD ELEVATIONS AND LAYER THICKNESSES BASED ON A COMPILATION OF RECORD SURVEY DATA PROVIDED BY MAURER-STUTZ, INC. THIS RECORD SURVEY PROVIDED BY MAURER-STUTZ, INC., IS CONTAINED ELSEWHERE IN THIS ACCEPTANCE REPORT.

TYPICAL POINT NUMBER LOCATION

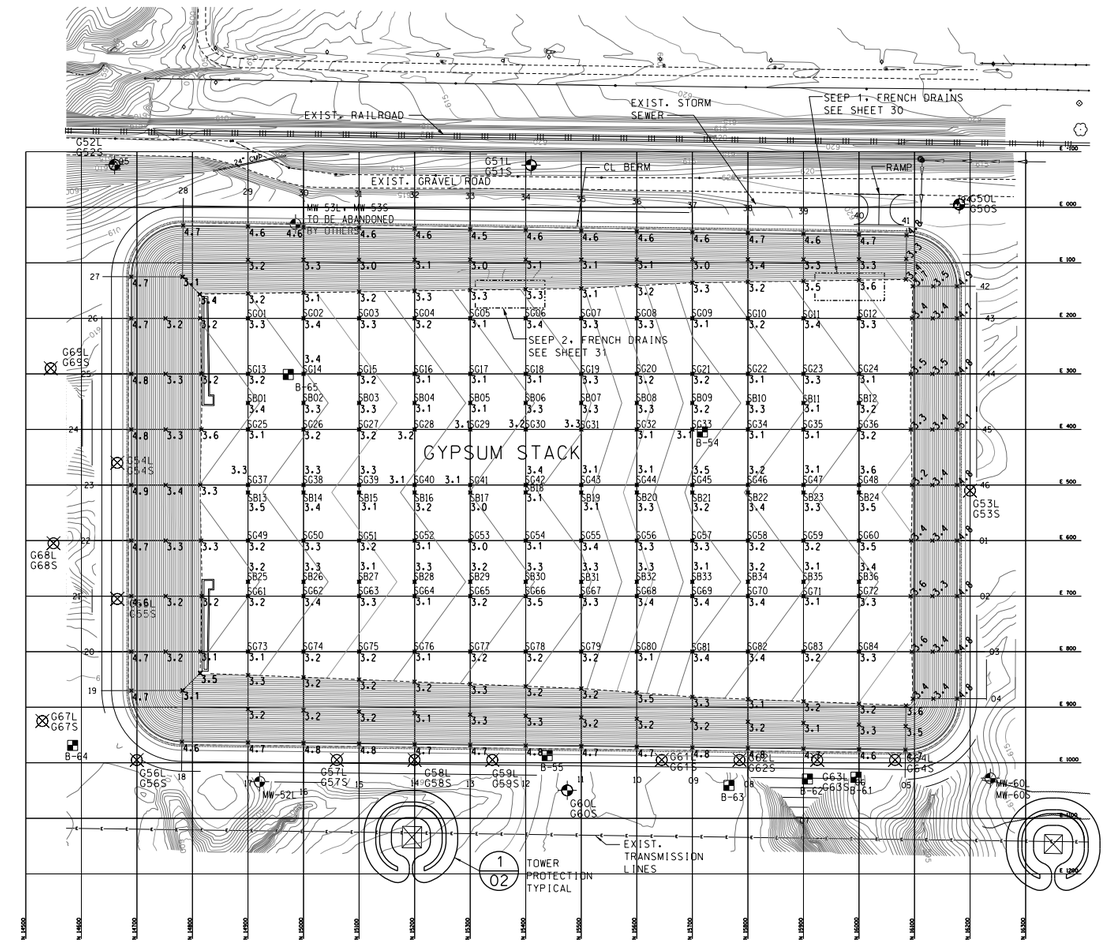
SB 00
- GRID POINT NUMBER
- CLAY LAYER GRADE (BREAK POINT)

SG 00
- GRID POINT NUMBER
- CLAY LAYER GRADE

S 00 00
- POINT NUMBER (SEE POINT NUMBERING DETAIL)
- CONTROL LINE NUMBER
- CLAY LAYER GRADE



POINT NUMBERING DETAIL



STANDARD LEGEND

(ALL SYMBOLS MAY NOT BE USED ON EACH PLAN)

- ORIGINAL CONTOURS
- FENCELINE
- TRANSMISSION TOWER
- OVERHEAD ELECTRIC
- LIMITS OF VEGETATION
- GRAVEL ROAD
- RAILROAD
- STORM SEWER
- CONTROL POINT
- NEW CONTOURS
- LD/LCRS COLLECTION PIPE
- GEONET
- MW-53L MONITORING WELL
- B-55 BORING
- G69L FUTURE GROUNDWATER MONITORING WELL
- 4" DIA. PERFORATED DRAINAGE PIPING
- 6" DIA. OUTFALL PIPING
- 3.1 CLAY LAYER THICKNESS (IN FEET)

0' 100' 200'
SCALE: 1" = 100'

AEG CAD GENERATED
DO NOT REVISE MANUALLY

LAYOUT	SMB	05-08-07
DRAWN	SKB	03-05-08
REVIEWED		

DRAWING RECORD

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
0	02-21-08	SKB	SMB	SMB	ISSUED FOR BIDDING - NOT FOR CONSTRUCTION
1	03-05-08	SKB	SMB	SMB	REVISED POINT NO. DETAIL - ISSUED FOR BIDDING - NOT FOR CONSTRUCTION
2	04-11-08	SKB	SMB	SMB	ISSUED FOR CONSTRUCTION
3	08-29-08	DBH	SMB	SMB	RAISE BOTTOM ELEV. OF NORTH 400' OF CELL-UPDATE CONTOURS & POINT TABLE
4	03-05-09	SKB	ADC	SMB	ISSUED FOR RECORD DRAWING

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
-	-	-	-	-	-

HANSON
Hanson Professional Services Inc.
1525 South Sixth Street
Springfield, Illinois 62703-2886
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Illinois Licensed Professional Service Corporation #184-001064
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SCALE -
DRAFTER -
DATE 03-26-09

RECORD DRAWING

FILE NO. -C180-C102-09.dgn

DRAWING TITLE

GYPSUM STACK - CLAY LAYER GRADE

GYPSUM MANAGEMENT FACILITY
FULTON COUNTY, ILLINOIS
DUCK CREEK POWER STATION UNIT NO. -

Ameren Energy. Resources Generating

DRAWING NUMBER C180-C102 REV. 4

SHEET NO. 09 OF 33

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PAGE NO. -10

C180-C102

CONTROL POINT NUMBER	GRID COORDINATES NORTHING	GRID COORDINATES EASTING	TOP OF DRAINAGE DESIGN	TOP OF DRAINAGE RECORD	DRAINAGE LAYER THICKNESS	CONTROL POINT NUMBER	GRID COORDINATES NORTHING	GRID COORDINATES EASTING	TOP OF DRAINAGE DESIGN	TOP OF DRAINAGE RECORD	DRAINAGE LAYER THICKNESS	CONTROL POINT NUMBER	GRID COORDINATES NORTHING	GRID COORDINATES EASTING	TOP OF DRAINAGE DESIGN	TOP OF DRAINAGE RECORD	DRAINAGE LAYER THICKNESS
D0100	16093.86	600.00	595.92	596.32	1.0	D4001	16000.00	131.44	596.02	596.39	1.0	DG61	14900.00	700.00	583.99	584.10	1.1
D0102	16131.65	600.00	606.71	606.92	0.9	D4002	16000.00	94.05	606.70	606.83	1.0	DG62	15000.00	700.00	584.79	584.95	1.1
D0103	16172.91	600.00	618.50	618.67	1.0	D4003	16000.00	52.75	618.50	618.59	1.0	DG63	15100.00	700.00	585.60	585.77	1.1
D0201	16092.87	700.00	595.62	596.04	1.0	D4101	16084.54	130.16	596.71	597.11	1.0	DG64	15200.00	700.00	586.41	586.61	1.2
D0202	16131.68	700.00	606.71	606.88	1.1	D4102	16085.04	93.19	607.27	607.46	1.0	DG65	15300.00	700.00	587.22	587.41	1.2
D0203	16172.94	700.00	618.50	618.70	1.1	D4103	16085.56	53.89	618.50	618.69	1.0	DG66	15400.00	700.00	588.02	588.19	1.1
D0301	16095.02	800.00	596.23	596.74	1.0	D4201	16096.59	142.27	596.74	597.31	1.1	DG67	15500.00	700.00	588.83	589.00	1.1
D0302	16132.36	800.00	606.90	607.10	1.1	D4202	16133.47	142.26	607.27	607.50	1.0	DG68	15600.00	700.00	590.64	590.79	1.0
D0303	16172.97	800.00	618.50	618.71	1.1	D4203	16172.77	142.25	618.50	618.78	1.1	DG69	15700.00	700.00	592.45	592.57	1.1
D0401	16096.83	884.70	596.74	597.14	1.1	D4301	16095.39	200.00	596.39	596.84	1.1	DG70	15800.00	700.00	593.26	593.42	1.1
D0402	16133.70	884.69	607.27	607.31	1.0	D4302	16132.59	200.00	607.02	607.27	1.1	DG71	15900.00	700.00	594.06	594.22	1.1
D0403	16173.00	884.68	618.50	618.72	1.0	D4303	16172.79	200.00	618.50	618.67	1.1	DG72	16000.00	700.00	594.87	595.07	1.0
D0501	16084.47	896.82	596.71	597.34	1.1	D4401	16093.30	300.00	595.78	596.21	1.1	DG73	14900.00	800.00	584.57	584.70	1.1
D0502	16084.06	933.79	607.27	607.40	1.0	D4402	16131.56	300.00	606.71	606.93	1.1	DG74	15000.00	800.00	585.38	585.57	1.1
D0503	16083.62	973.09	618.50	618.69	1.0	D4403	16172.82	300.00	618.50	618.73	1.1	DG75	15100.00	800.00	586.19	586.39	1.2
D0601	16000.00	893.44	596.01	596.18	1.1	D4501	16093.23	400.00	595.75	596.06	1.1	DG76	15200.00	800.00	587.00	587.08	1.1
D0602	16000.00	930.84	606.70	606.89	1.2	D4502	16131.59	400.00	606.71	606.88	1.0	DG77	15300.00	800.00	587.81	587.98	1.2
D0603	16000.00	972.15	618.50	618.58	1.1	D4503	16172.85	400.00	618.50	618.72	1.1	DG78	15400.00	800.00	588.61	588.73	1.0
D0701	15900.00	889.41	595.18	595.38	1.1	D4601	16095.39	500.00	596.36	596.65	1.1	DG79	15500.00	800.00	589.42	589.59	1.1
D0702	15900.00	928.27	606.28	606.46	1.1	D4602	16131.62	500.00	606.71	606.93	1.0	DG80	15600.00	800.00	591.23	591.41	1.1
D0703	15900.00	971.04	618.50	618.56	1.0	D4603	16172.88	500.00	618.50	618.65	1.1	DG81	15700.00	800.00	593.04	593.17	1.0
D0801	15800.00	885.38	594.35	594.55	1.1	DB01	14900.00	352.42	583.83	583.91	1.1	DG82	15800.00	800.00	593.84	594.02	1.1
D0802	15800.00	925.70	605.86	606.04	1.1	DB02	15000.00	352.42	584.64	584.81	1.1	DG83	15900.00	800.00	594.65	594.84	1.1
D0803	15800.00	969.92	618.50	618.56	1.0	DB03	15100.00	352.42	585.45	585.60	1.1	DG84	16000.00	800.00	595.46	595.81	1.0
D0901	15700.00	881.36	593.52	593.70	1.1	DB04	15200.00	352.42	586.26	586.37	1.0						
D0902	15700.00	923.12	605.45	605.55	1.0	DB05	15300.00	352.42	587.06	587.23	1.2						
D0903	15700.00	968.81	618.50	618.61	1.0	DB06	15400.00	352.42	587.87	588.05	1.1						
D1001	15600.00	873.76	591.66	591.85	1.1	DB07	15500.00	352.42	588.68	588.84	1.1						
D1002	15600.00	920.55	605.03	605.16	1.1	DB08	15600.00	352.42	590.49	590.65	1.1						
D1003	15600.00	967.69	618.50	618.67	1.1	DB09	15700.00	352.42	592.30	592.52	1.0						
D1101	15500.00	866.16	589.81	589.95	1.1	DB10	15800.00	352.42	593.10	593.22	1.0						
D1102	15500.00	917.98	604.62	604.70	1.0	DB11	15900.00	352.42	593.91	594.11	1.1						
D1103	15500.00	966.57	618.50	618.50	1.0	DB12	16000.00	352.42	594.72	594.92	1.0						
D1201	15400.00	862.13	588.98	589.17	1.1	DB13	14900.00	513.35	584.78	584.95	1.1						
D1202	15400.00	915.41	604.20	604.28	1.0	DB14	15000.00	513.35	585.59	585.76	1.1						
D1203	15400.00	965.46	618.50	618.53	1.0	DB15	15100.00	513.35	586.40	586.60	1.2						
D1301	15300.00	858.10	588.15	588.33	1.1	DB16	15200.00	513.35	587.21	587.41	1.1						
D1302	15300.00	912.84	603.79	603.94	1.1	DB17	15300.00	513.35	588.01	588.20	1.2						
D1303	15300.00	964.34	618.50	618.62	1.1	DB18	15400.00	513.35	588.82	588.97	1.1						
D1401	15200.00	854.08	587.32	587.44	1.0	DB19	15500.00	513.35	589.63	589.79	1.1						
D1402	15200.00	910.27	603.37	603.53	1.1	DB20	15600.00	513.35	591.44	591.61	1.1						
D1403	15200.00	963.22	618.50	618.61	1.1	DB21	15700.00	513.35	593.24	593.40	1.1						
D1501	15100.00	850.05	586.49	586.59	1.0	DB22	15800.00	513.35	594.05	594.21	1.1						
D1502	15100.00	907.70	602.95	603.09	1.1	DB23	15900.00	513.35	594.86	594.99	1.1						
D1503	15100.00	962.11	618.50	618.58	1.1	DB24	16000.00	513.35	595.67	595.85	1.0						
D1601	15000.00	846.02	585.65	585.79	1.1	DB25	14900.00	674.29	583.83	584.03	1.1						
D1602	15000.00	905.12	602.54	602.69	1.1	DB26	15000.00	674.29	584.64	584.80	1.1						
D1603	15000.00	960.99	618.50	618.61	1.1	DB27	15100.00	674.29	585.45	585.58	1.1						
D1701	14900.00	842.00	584.82	585.04	1.0	DB28	15200.00	674.29	586.26	586.38	1.0						
D1702	14900.00	903.07	602.27	602.39	1.0	DB29	15300.00	674.29	587.07	587.24	1.1						
D1703	14900.00	959.88	618.50	618.70	1.2	DB30	15400.00	674.29	587.87	588.04	1.1						
D1801	14814.00	838.53	584.11	584.50	1.0	DB31	15500.00	674.29	588.68	588.85	1.1						
D1802	14782.32	869.87	593.16	593.36	1.1	DB32	15600.00	674.29	590.49	590.62	1.0						
D1803	14781.03	958.55	618.50	618.58	1.0	DB33	15700.00	674.29	592.30	592.36	1.0						
D1901	14814.00	838.53	584.11	584.54	1.0	DB34	15800.00	674.29	593.10	593.24	1.0						
D1902	14782.32	869.87	593.16	593.36	1.1	DB35	15900.00	674.29	593.91	594.00	1.1						
D1903	14693.63	870.07	618.50	618.62	1.1	DB36	16000.00	674.29	594.72	594.96	1.0						
D2001	14814.76	800.00	583.89	584.06	1.1	DG01	14900.00	200.00	584.73	584.87	1.0						
D2002	14752.37	800.00	601.71	601.84	1.1	DG02	15000.00	200.00	585.54	585.71	1.2						
D2003	14693.61	800.00	618.50	618.65	1.1	DG03	15100.00	200.00	586.35	586.53	1.1						
D2101	14816.75	700.00	583.31	583.61	1.1	DG04	15200.00	200.00	587.15	587.33	1.1						
D2102	14752.35	700.00	601.71	601.84	1.1	DG05	15300.00	200.00	587.96	588.14	1.1						
D2103	14693.59	700.00	618.50	618.65	1.2	DG06	15400.00	200.00	588.77	588.97	1.2						
D2201	14815.75	600.00	583.59	583.79	1.0	DG07	15500.00	200.00	589.58	589.78	1.1						
D2202	14752.33	600.00	601.71	601.85	1.1	DG08	15600.00	200.00	591.39	591.58	1.2						
D2203	14693.57	600.00	618.50	618.52	1.0	DG09	15700.00	200.00	593.19	593.28	1.0						
D2301	14814.30	500.00	584.00	584.18	1.0	DG10	15800.00	200.00	594.00	594.10	1.0						
D2302	14752.31	500.00	601.71	601.82	1.1	DG11	15900.00	200.00	594.81	595.05	1.0						
D2303	14693.55	500.00	618.50	618.68	1.1	DG12	16000.00	200.00	595.62	595.76	1.1						
D2401	14816.25	400.00	583.44	583.86	1.0	DG13	14900.00	300.00	584.14	584.23	1.0						
D2402	14752.29	400.00	601.71	601.85	1.1	DG14	15000.00	300.00	584.95	585.15	1.1						
D2403	14693.53	400.00	618.50	618.68	1.2	DG15	15100.00	300.00	585.76	585.94	1.2						
D2501	14816.13	300.00	583.46	583.64	1.0	DG16	15200.00	300.00	586.57	586.77	1.1						
D2502	14752.27	300.00	601.71	601.90	1.1	DG17	15300.00	300.00	587.37	587.56	1.1						
D2503	14693.51	300.00	618.50	618.67	1.0	DG18	15400.00	300.00	588.18	588.35	1.1						
D2601	14814.10	200.00	584.04	584.16	1.0	DG19	15500.00	300.00	588.99	589.17	1.1						
D2602	14751.84	200.00	601.83	601.97	1.1	DG20	15600.00	300.00	590.80	590.90	1.1						
D2603	14693.49	200.00	618.50	618.67	1.1	DG21	15700.00	300.00	592.60	592.80	1.1						
D2701	14813.23	156.69	584.29	584.61	1.1	DG22	15800.00	300.00	593.41	593.62	1.2						
D2702	14782.16	125.21	593.16	593.32	1.1	DG23	15900.00	300.00	594.22	594.44	1.0						
D2703	14693.47	125.04	618.50	618.68	1.1	DG24	16000.00	300.00	595.03	595.14	1.0						
D2801	14813.23	156.69	584.29	584.61	1.1	DG25	14900.00	400.00	584.11	584.27	1.0						
D2802	14782.16	125.21	593.16	593.32	1.1	DG26	15000.00	400.00	584.92	585.08	1.1						
D2803	14783.15	36.53	618.50	618.67	1.2	DG27	15100.00	400.00	585.73	585.87	1.1						
D2901	14900.00	155.37	584.99	585.36	1.1	DG28	15200.00	400.00	586.54	586.69	1.1						
D2902	14900.00	94.89	602.27	602.46	1.1	DG29	15300.00	400.00	587.34	587.46	1.1						
D2903	14900.00	38.08	618.50	618.63	1.1	DG30	15400.00	400.00	588.15	588.32	1.1						
D3001	15000.00	153.84	585.81	585.95	1.1	DG31	15500.00	400.00	588.96	589.12	1.1						
D3002	15000.00	95.01	602.62	602.78	1.1	DG32	15600.00	400.00	590.77	590.89	1.1						
D3003	15000.00	39.42	618.50	618.61	1.0	DG33	15700.00	400.00	592.58	592.71	1.1						
D3101	15100.00	152.32	586.63	586.81	1.1	DG34	15800.00	400.00	593.38	593.57	1.1						
D3102	15100.00	94.92	603.03	603.16	1.1	DG35	15900.00	400.00	594.19	594.38	1.1						
D3103	15100.00	40.75	618.50	618.68	1.2	DG36	16000.00	400.00	595.00	595.25	1.2						
D3201	15200.00	150.79	587.44	587.64	1.1	DG37	14900.00	500.00	584.70	584.87	1.1						
D3202	15200.00	94.82	603.43	603.55	1.1	DG38	15000.00	500.00	585.51	585.65	1.1						
D3203	15200.00	42.09	618.50	618.70	1.1	DG39	15100.00	500.00	586.32	586.43	1.1						
D3301	15300.00	149.26	588.26	588.52	1.0	DG40	15200.00	500.00	587.13	587.31	1.1						
D3302	15300.00	94.72	603.84	603.97	1.1	DG41	15300.00	500.00	587.93	588.11	1.2						
D3303	15300.00	43.42	618.50	618.63	1.1	DG42	15400.00	500.00	588.74	588.89	1.1						
D3401	15400.00	147.74	589.08	589.38	1.1	DG43	15500.00	500.00	589.55	589.73	1.1						
D3402	15400.00	94.63	604.25	604.38	1.1	DG44	15600.00	500.00	591.36	591.49	1.1						
D3403	15400.00	44.75	618.50	618.66	1.1	DG45	15700.00	500.00	593.17	593.34	1.1						
D3501	15500.00	146.21	589.89	590.06	1.1	DG46	15800.00	500.00	593.97	594.11	1.1						
D3502	15500.00	94.53	604.66	604.75	1.1	DG47	15900.00	500.00	594.78	594.94	1.2						
D3503	15500.00	46.09	618.50	618.61	1.1	DG48	16000.00	500.00	595.59	595.85	1.0						
D3601	15600.00	141.11	591.73	591.95	1.1	DG49	14900.00	600.00	584.27	584.45	1.1						
D3602	15600.00	94.44	605.07	605.18	1.1	DG50	15000.00	600.00	585.08	585.24	1.1						
D3603	15600.00	47.42	618.50	618.64	1.1	DG51	15100.00	600.00	585.89	586.06	1.1						
D3701	15700.00	136.02	593.57	593.77	1.1	DG52	15200.00	600.00	586.70	586.86	1.2						
D3702	15700.00	94.34	605.48	605.53	1.0	DG53	15300.00	600.00	587.51	587.67	1.2						
D3703	15700.00	48.75	618.50	618.60	1.1	DG54	15400.00	600.00	588.31	588.47	1.1						
D3801	15800.00	134.49	594.39	594.47	1.0	DG55	15500.00	600.00	589.12	589.30	1.1						
D3802	15800.00	94.24	605.88	605.98	1.0	DG56	15600.00	600.00	590.93	591.09	1.1						
D3803	15800.00	50.09	618.50	618.58	1.0	DG57	15700.00	600.00	592.73	592.90	1.1						
D3901	15900.00	132.96	595.20	595.94	1.2	DG58	15800.00	600.00	593.54	593.66	1.1						
D3902	15900.00	94.15	606.29	606.39	1.0	DG59	15900.00	600.00	594.35	594.45	1.0						
D3903	15900.00	51.42	618.50	618.54	1.0	DG60	16000.00	600.00	595.16	595.52	1.1						

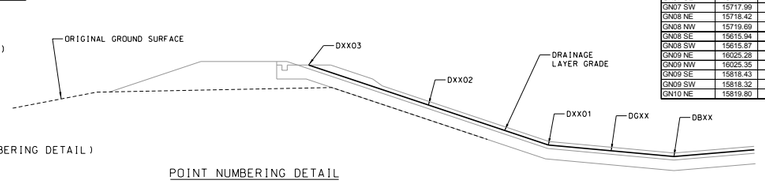
NOTE: RECORD ELEVATIONS AND LAYER THICKNESSES BASED ON A COMPILATION OF RECORD SURVEY DATA PROVIDED BY MAURER-STUTZ, INC. THIS RECORD SURVEY PROVIDED BY MAURER-STUTZ, INC., IS CONTAINED ELSEWHERE IN THIS ACCEPTANCE REPORT.

TYPICAL POINT NUMBER LOCATION

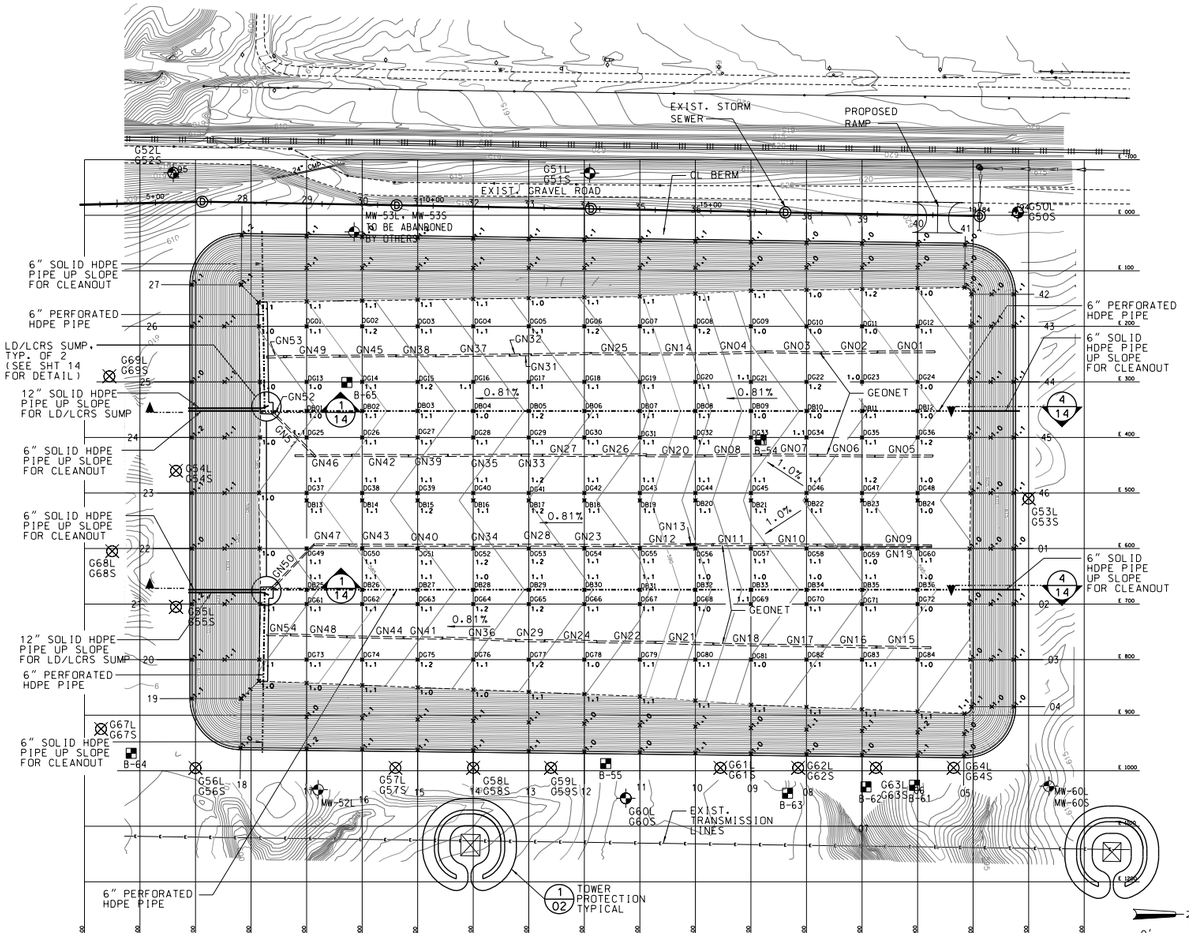
DB 00 — GRID POINT NUMBER — DRAINAGE LAYER GRADE (BREAK POINT)

DG 00 — GRID POINT NUMBER — DRAINAGE LAYER GRADE

D 00 00 — POINT NUMBER (SEE POINT NUMBERING DETAIL) — CONTROL LINE NUMBER — DRAINAGE LAYER GRADE



POINT NUMBERING DETAIL



GEONET COORDINATES (AS SURVEYED BY MAURER-STUTZ, INC. OCT. 16, 2008 THRU NOV. 09, 2008))

MSI Point #	Northing	Easting	Elevation
GN01 NE	16031.54	247.52	594.68
GN01 NW	16031.29	244.17	594.67
GN01 SE	15926.87	247.82	593.88
GN01 SW	15927.72	244.24	593.84
GN02 NE	15928.44	248.25	593.86
GN02 NW	15928.47	244.45	593.89
GN02 SE	15826.49	249.75	593.09
GN02 SW	15826.90	245.83	593.03
GN03 NE	15827.58	249.31	593.11
GN03 NW	15827.56	245.97	593.11
GN03 SE	15724.79	247.49	592.19
GN03 SW	15725.54	244.14	592.19
GN04 NE	15726.76	247.64	592.22
GN04 NW	15726.53	244.25	592.23
GN04 SE	15624.04	250.74	590.71
GN04 SW	15623.67	247.37	590.64
GN05 NE	16027.25	435.11	594.51
GN05 NW	16028.07	431.72	594.59
GN05 SE	15922.82	435.53	593.71
GN05 SW	15922.46	432.03	593.76
GN06 NE	15923.21	435.36	593.79
GN06 NW	15923.77	432.01	593.83
GN06 SE	15819.28	433.87	592.79
GN06 SW	15819.45	430.55	592.82
GN07 NE	15820.73	433.82	592.78
GN07 NW	15820.49	430.32	592.79
GN07 SE	15717.44	433.09	591.93
GN07 SW	15717.99	429.43	591.88
GN08 NE	15718.42	433.40	591.89
GN08 NW	15719.69	429.72	591.92
GN08 SE	15615.94	434.80	590.33
GN08 SW	15615.87	431.37	590.35
GN09 NE	16025.28	596.65	594.63
GN09 NW	16025.35	593.25	594.70
GN09 SE	15818.43	595.37	592.90
GN09 SW	15818.32	592.16	592.92
GN10 NE	15819.80	595.64	592.86

MSI Point #	Northing	Easting	Elevation
GN10 NW	15820.24	592.11	592.92
GN10 SE	15722.77	594.71	592.16
GN10 SW	15722.89	591.21	592.17
GN11 NE	15724.17	594.85	592.15
GN11 NW	15724.23	591.29	592.13
GN11 SE	15629.65	595.03	590.66
GN11 SW	15629.87	591.23	590.77
GN12 NE	15632.28	595.03	590.67
GN12 NW	15632.86	591.56	590.85
GN12 SE	15451.68	596.23	587.71
GN12 SW	15451.35	592.15	587.70
GN13 NE	15605.74	593.03	590.43
GN13 NW	15599.46	590.51	590.32
GN13 SE	15583.49	594.48	589.98
GN13 SW	15583.20	591.39	590.09
GN14 NE	15624.25	250.96	590.79
GN14 NW	15624.41	247.74	590.72
GN14 SE	15517.29	251.54	588.81
GN14 SW	15517.13	248.02	588.93
GN15 NE	16023.98	780.10	594.76
GN15 NW	16023.87	776.59	594.74
GN15 SE	15924.36	778.84	593.99
GN15 SW	15924.38	775.56	594.00
GN16 NE	15927.03	779.12	594.02
GN16 NW	15927.24	775.19	594.00
GN16 SE	15827.80	777.22	592.97
GN16 SW	15827.73	773.53	593.04
GN17 NE	15830.61	777.06	593.00
GN17 NW	15830.44	773.72	593.10
GN17 SE	15730.92	775.62	592.32
GN17 SW	15731.18	772.17	592.22
GN18 NE	15731.53	775.87	592.31
GN18 NW	15731.95	772.39	592.28
GN18 SE	15631.43	773.88	590.69
GN18 SW	15631.16	770.26	590.80
GN19 NE	16025.38	598.28	594.62
GN19 NW	16024.98	595.88	594.71

MSI Point #	Northing	Easting	Elevation
GN19 SE	15838.81	598.82	592.95
GN19 SW	15831.46	595.63	592.99
GN20 NE	15617.61	434.97	590.48
GN20 NW	15617.55	431.59	590.41
GN20 SE	15510.69	434.63	588.58
GN20 SW	15511.01	431.12	588.61
GN21 NE	15633.12	773.95	590.75
GN21 NW	15633.24	770.09	590.87
GN21 SE	15526.36	770.82	588.81
GN21 SW	15526.55	766.84	588.94
GN22 NE	15528.76	770.34	588.89
GN22 NW	15528.77	767.03	589.01
GN22 SE	15422.07	769.78	587.75
GN22 SW	15421.99	766.33	587.66
GN23 NW	15453.29	592.84	587.86
GN23 NE	15453.28	596.50	587.92
GN24 NW	15422.97	765.40	587.78
GN24 NE	15423.07	769.15	587.83
GN24 SE	15327.62	767.72	587.11
GN24 SW	15327.97	764.02	586.94
GN23 SE	15346.02	595.83	587.31
GN23 SW	15345.82	592.13	587.31
GN25 NW	15518.48	247.99	588.99
GN25 NE	15518.60	251.22	588.81
GN25 SW	15410.27	247.61	587.78
GN25 SE	15409.83	251.05	587.63
GN26 NW	15512.37	429.11	588.64
GN26 NE	15512.63	432.65	588.59
GN26 SE	15416.67	434.44	587.53
GN26 SW	15416.87	431.04	587.52
GN27 NE	15417.98	434.48	587.68
GN27 NW	15417.81	431.10	587.66
GN27 SE	15324.00	433.85	586.82
GN27 SW	15324.22	430.17	586.74
GN28 NE	15348.32	595.83	587.17
GN28 NW	15348.50	592.19	587.14
GN28 SE	15280.49	595.53	586.49

MSI Point #	Northing	Easting	Elevation
GN28 SW	15280.81	592.02	586.50
GN29 NE	15329.00	768.16	586.87
GN29 NW	15329.37	764.66	586.88
GN29 SE	15275.78	767.33	586.47
GN29 SW	15275.65	763.68	586.43
GN30 NE	15413.16	250.66	587.69
GN30 NW	15413.20	247.14	587.73
GN30 SE	15303.26	252.85	586.68
GN30 SW	15303.99	249.39	586.72
GN31 NE	15304.78	252.93	586.65
GN31 NW	15305.07	249.40	586.69
GN31 SE	15283.42	252.82	586.67
GN31 SW	15283.58	249.45	586.64
GN32 NE	15284.07	252.89	586.68
GN32 NW	15284.26	249.47	586.72
GN32 SE	15264.76	253.73	586.42
GN32 SW	15264.61	250.34	586.47
GN33 NE	15325.03	433.92	586.83
GN33 NW	15325.35	430.48	586.84
GN33 SE	15285.46	433.71	586.42
GN33 SW	15285.75	430.05	586.39
GN34 NE	15281.57	595.92	586.47
GN34 NW	15281.56	592.20	586.49
GN34 SE	15147.45	595.83	585.37
GN34 SW	15147.56	592.50	585.43
GN35 NE	15286.92	433.49	586.51
GN35 NW	15287.52	430.21	586.48
GN35 SE	15153.79	434.44	585.52
GN35 SW	15153.69	430.90	585.54
GN36 NE	15277.72	766.98	586.58
GN36 NW	15277.69	763.85	586.54
GN36 SE	15143.59	762.46	585.40
GN36 SW	15144.03	759.10	585.42
GN37 NE	15266.60	253.18	586.50
GN37 NW	15266.46	249.73	586.57
GN37 SE	15132.02	254.75	585.29
GN37 SW	15132.27	251.11	585.32

MSI Point #	Northing	Easting	Elevation
GN38 NE	15133.08	254.33	585.31
GN38 NW	15132.85	251.37	585.37
GN38 SE	15060.30	254.72	584.76
GN38 SW	15060.41	251.60	584.86
GN39 NE	15155.35	434.02	585.54
GN39 NW	15155.43	430.31	585.54
GN39 SE	15083.15	434.97	584.96
GN39 SW	15082.88	431.25	584.93
GN40 NE	15149.50	595.99	585.39
GN40 NW	15149.77	592.33	585.44
GN40 SE	15077.26	595.93	584.91
GN40 SW	15077.23	592.28	584.92
GN41 NE	15145.81	763.07	585.41
GN41 NW	15145.86	759.40	585.44
GN41 SE	15073.33	762.40	584.84

CONTROL POINT NUMBER	GRID COORDINATES NORTHING	GRID COORDINATES EASTING	TOP OF CUSHION DIRT DESIGN	TOP OF CUSHION DIRT RECORD	CUSHION DIRT
C0101	16093.72	600.00	596.91	597.36	1.0
C0102	16144.85	600.00	611.53	611.82	1.1
C0103	16149.88	600.00	614.00	614.30	2.1
C0104	16165.63	600.00	618.50	618.74	2.1
C0201	16092.72	700.00	596.62	597.10	1.1
C0202	16144.91	700.00	611.53	611.82	1.1
C0203	16149.91	700.00	614.00	614.24	2.0
C0204	16165.66	700.00	618.50	618.74	2.0
C0301	16094.87	800.00	597.23	597.82	1.1
C0302	16144.94	800.00	611.53	611.75	1.0
C0303	16149.94	800.00	614.00	614.29	2.1
C0304	16165.69	800.00	618.50	618.78	2.1
C0401	16096.68	884.70	597.74	598.24	1.1
C0402	16144.96	884.71	611.53	611.79	1.2
C0403	16149.96	884.70	614.00	614.23	2.1
C0404	16165.72	884.69	618.50	618.74	2.1
C0501	16084.47	896.68	597.71	598.41	1.1
C0502	16083.93	945.11	611.56	611.85	1.2
C0503	16083.88	950.06	614.00	614.25	2.1
C0504	16083.70	965.81	618.50	618.69	2.0
C0601	16000.00	893.29	597.01	597.27	1.1
C0602	16000.00	944.12	611.53	611.82	1.2
C0603	16000.00	949.12	614.00	614.24	2.1
C0604	16000.00	964.87	618.50	618.72	2.1
C0701	15900.00	889.27	596.18	596.47	1.1
C0702	15900.00	943.00	611.53	611.82	1.2
C0703	15900.00	948.01	614.00	614.29	2.2
C0704	15900.00	963.76	618.50	618.70	2.1
C0801	15800.00	885.24	595.35	595.60	1.0
C0802	15800.00	941.89	611.53	611.80	1.1
C0803	15800.00	946.89	614.00	614.26	2.1
C0804	15800.00	962.64	618.50	618.78	2.2
C0901	15700.00	881.21	594.52	594.81	1.1
C0902	15700.00	940.77	611.53	611.82	1.2
C0903	15700.00	945.77	614.00	614.26	2.1
C0904	15700.00	961.53	618.50	618.80	2.2
C1001	15600.00	873.61	592.66	592.94	1.1
C1002	15600.00	939.66	611.53	611.76	1.1
C1003	15600.00	944.66	614.00	614.25	2.1
C1004	15600.00	960.41	618.50	618.73	2.0
C1101	15500.00	866.01	590.81	591.07	1.1
C1102	15500.00	938.54	611.53	611.82	1.2
C1103	15500.00	943.54	614.00	614.26	2.2
C1104	15500.00	959.29	618.50	618.78	2.3
C1201	15400.00	861.99	589.98	590.25	1.1
C1202	15400.00	937.42	611.53	611.82	1.2
C1203	15400.00	942.42	614.00	614.29	2.2
C1204	15400.00	958.18	618.50	618.73	2.2
C1301	15300.00	857.96	589.15	589.38	1.1
C1302	15300.00	936.31	611.53	611.79	1.1
C1303	15300.00	941.31	614.00	614.23	2.1
C1304	15300.00	957.06	618.50	618.75	2.1
C1401	15200.00	853.93	588.32	588.57	1.1
C1402	15200.00	935.19	611.53	611.82	1.2
C1403	15200.00	940.19	614.00	614.25	2.1
C1404	15200.00	955.94	618.50	618.78	2.3
C1501	15100.00	849.91	587.48	587.77	1.2
C1502	15100.00	934.07	611.53	611.81	1.1
C1503	15100.00	939.07	614.00	614.27	2.2
C1504	15100.00	954.83	618.50	618.78	2.2
C1601	15000.00	845.88	586.65	586.96	1.2
C1602	15000.00	932.96	611.53	611.81	1.1
C1603	15000.00	937.96	614.00	614.26	2.1
C1604	15000.00	953.71	618.50	618.72	2.1
C1701	14900.00	841.85	585.82	586.02	1.0
C1702	14900.00	931.84	611.53	611.82	1.1
C1703	14900.00	936.84	614.00	614.29	2.1
C1704	14900.00	952.60	618.50	618.71	2.0
C1801	14814.14	838.40	585.11	585.38	0.9
C1802	14781.51	930.52	611.53	611.79	1.1
C1803	14781.45	935.52	614.00	614.20	2.1
C1804	14781.24	951.27	618.50	618.77	2.2
C1901	14814.14	838.40	585.11	585.40	0.9
C1902	14721.66	870.00	611.53	611.75	1.1
C1903	14716.66	870.01	614.00	614.25	2.1
C1904	14700.91	870.05	618.50	618.76	2.1
C2001	14814.90	800.00	584.89	585.18	1.1
C2002	14721.64	800.00	611.53	611.82	1.1
C2003	14716.64	800.00	614.00	614.25	2.1
C2004	14700.89	800.00	618.50	618.71	2.1
C2101	14816.88	700.00	584.31	584.59	1.0
C2102	14721.62	700.00	611.53	611.80	1.1
C2103	14716.62	700.00	614.00	614.21	2.1
C2104	14700.87	700.00	618.50	618.72	2.0
C2201	14815.89	600.00	584.59	584.83	1.0
C2202	14721.60	600.00	611.53	611.81	1.2
C2203	14716.60	600.00	614.00	614.20	2.1
C2204	14700.85	600.00	618.50	618.70	2.2
C2301	14814.43	500.00	585.00	585.22	1.0
C2302	14721.58	500.00	611.53	611.81	1.1
C2303	14716.58	500.00	614.00	614.29	2.2
C2304	14700.83	500.00	618.50	618.76	2.1
C2401	14816.38	400.00	584.44	584.96	1.1
C2402	14721.56	400.00	611.53	611.77	1.1
C2403	14716.56	400.00	614.00	614.23	2.1
C2404	14700.81	400.00	618.50	618.71	2.1
C2501	14816.27	300.00	584.47	584.76	1.1
C2502	14721.54	300.00	611.53	611.78	1.2
C2503	14716.54	300.00	614.00	614.23	2.1
C2504	14700.79	300.00	618.50	618.74	2.2
C2601	14814.24	200.00	585.04	585.25	1.0
C2602	14721.52	200.00	611.53	611.78	1.1
C2603	14716.52	200.00	614.00	614.25	2.1
C2604	14700.77	200.00	618.50	618.72	2.1
C2701	14813.37	156.83	585.29	585.66	1.0
C2702	14721.50	125.09	611.53	611.75	1.1
C2703	14716.50	125.09	614.00	614.24	2.1
C2704	14700.75	125.05	618.50	618.70	2.1
C2801	14813.37	156.83	585.29	585.68	1.0
C2802	14782.84	64.56	611.53	611.79	1.1
C2803	14782.89	59.56	614.00	614.21	2.0
C2804	14783.07	43.81	618.50	618.68	2.0
C2901	14900.00	155.51	585.99	586.42	1.1
C2902	14900.00	66.12	611.53	611.82	1.2
C2903	14900.00	61.12	614.00	614.23	2.1
C2904	14900.00	45.37	618.50	618.74	2.1
C3001	15000.00	153.98	586.81	587.08	1.1
C3002	15000.00	67.45	611.53	611.75	1.1
C3003	15000.00	62.45	614.00	614.23	2.1
C3004	15000.00	46.70	618.50	618.78	2.2
C3101	15100.00	152.46	587.63	587.91	1.1
C3102	15100.00	68.79	611.53	611.81	1.1
C3103	15100.00	63.79	614.00	614.25	2.1
C3104	15100.00	48.03	618.50	618.77	2.1
C3201	15200.00	150.93	588.44	588.66	1.0
C3202	15200.00	70.12	611.53	611.81	1.1
C3203	15200.00	65.12	614.00	614.23	2.0
C3204	15200.00	49.37	618.50	618.71	2.0
C3301	15300.00	149.41	589.26	589.61	1.1
C3302	15300.00	71.45	611.53	611.77	1.1
C3303	15300.00	66.45	614.00	614.25	2.1
C3304	15300.00	50.70	618.50	618.74	2.1
C3401	15400.00	147.88	590.08	590.46	1.1
C3402	15400.00	72.79	611.53	611.79	1.1
C3403	15400.00	67.79	614.00	614.22	2.1
C3404	15400.00	52.03	618.50	618.66	2.0
C3501	15500.00	146.36	590.89	591.14	1.1
C3502	15500.00	74.12	611.53	611.77	1.1
C3503	15500.00	69.12	614.00	614.24	2.1
C3504	15500.00	53.37	618.50	618.62	2.0
C3601	15600.00	141.26	592.73	592.98	1.0
C3602	15600.00	75.45	611.53	611.78	1.1
C3603	15600.00	70.45	614.00	614.25	2.1
C3604	15600.00	54.70	618.50	618.68	2.0
C3701	15700.00	136.16	594.57	594.81	1.0
C3702	15700.00	76.79	611.53	611.77	1.2
C3703	15700.00	71.79	614.00	614.27	2.2
C3704	15700.00	56.03	618.50	618.61	2.0
C3801	15800.00	134.63	595.39	595.65	1.2
C3802	15800.00	78.12	611.53	611.80	1.2
C3803	15800.00	73.12	614.00	614.26	2.2
C3804	15800.00	57.37	618.50	618.61	2.0
C3901	15900.00	133.11	596.20	596.94	1.0
C3902	15900.00	79.45	611.53	611.81	1.2
C3903	15900.00	74.45	614.00	614.25	2.2
C3904	15900.00	58.70	618.50	618.67	2.1
C4001	16000.00	131.58	597.02	597.43	1.0
C4002	16000.00	80.79	611.53	611.83	1.2
C4003	16000.00	75.79	614.00	614.30	2.2
C4004	16000.00	60.03	618.50	618.71	2.1
C4101	16084.54	130.31	597.71	598.14	1.0
C4102	16085.19	81.93	611.53	611.80	1.1
C4103	16085.25	76.93	614.00	614.24	2.1
C4104	16085.46	61.17	618.50	618.76	2.1
C4201	16096.44	142.27	597.74	598.33	1.0
C4202	16144.74	142.26	611.53	611.83	1.1
C4203	16149.74	142.26	614.00	614.26	2.0
C4204	16165.49	142.25	618.50	618.81	2.0
C4301	16095.25	200.00	597.39	597.91	1.1
C4302	16144.76	200.00	611.53	611.78	1.0
C4303	16149.76	200.00	614.00	614.26	2.0
C4304	16165.51	200.00	618.50	618.77	2.1
C4401	16093.16	300.00	596.78	597.28	1.1
C4402	16144.79	300.00	611.53	611.80	1.0
C4403	16149.79	300.00	614.00	614.21	2.0
C4404	16165.54	300.00	618.50	618.79	2.1
C4501	16093.09	400.00	596.75	597.07	1.0
C4502	16144.82	400.00	611.53	611.79	1.1
C4503	16149.82	400.00	614.00	614.25	2.0
C4504	16165.57	400.00	618.50	618.78	2.0
C4601	16095.24	500.00	597.36	597.71	1.1
C4602	16144.85	500.00	611.53	611.80	1.1
C4603	16149.85	500.00	614.00	614.22	2.0
C4604	16165.60	500.00	618.50	618.76	2.1
C801	14900.00	352.42	584.83	585.07	1.2
CB02	15000.00	352.42	585.64	585.91	1.1
CB03	15100.00	352.42	586.45	586.72	1.1
CB04	15200.00	352.42	587.26	587.53	1.2
CB05	15300.00	352.42	588.06	588.29	1.1
CB06	15400.00	352.42	588.87	589.10	1.1
CB07	15500.00	352.42	589.68	589.97	1.1
CB08	15600.00	352.42	591.49	591.72	1.1
CB09	15700.00	352.42	593.30	593.51	1.2
CB10	15800.00	352.42	594.10	594.35	1.1
CB11	15900.00	352.42	594.91	595.17	1.1
CB12	16000.00	352.42	595.72	596.00	1.1
CB13	14900.00	513.35	585.78	586.01	1.1
CB14	15000.00	513.35	586.59	586.80	1.0
CB15	15100.00	513.35	587.40	587.68	1.1
CB16	15200.00	513.35	588.21	588.46	1.1
CB17	15300.00	513.35	589.01	589.30	1.1
CB18	15400.00	513.35	589.82	589.99	1.0
CB19	15500.00	513.35	590.63	590.92	1.1
CB20	15600.00	513.35	592.44	592.65	1.0
CB21	15700.00	513.35	594.24	594.54	1.1
CB22	15800.00	513.35	595.05	595.28	1.1
CB23	15900.00	513.35	595.86	596.16	1.2
CB24	16000.00	513.35	596.67	596.84	1.0
CB25	14900.00	674.29	584.83	585.12	1.1
CB26	15000.00	674.29	585.64	585.88	1.1
CB27	15100.00	674.29	586.45	586.73	1.1
CB28	15200.00	674.29	587.26	587.43	1.0
CB29	15300.00	674.29	588.07	588.35	1.1
CB30	15400.00	674.29	588.87	589.18	1.1
CB31	15500.00	674.29	589.68	589.93	1.1
CB32	15600.00	674.29	591.49	591.74	1.1
CB33	15700.00	674.29	593.30	593.51	1.1
CB34	15800.00	674.29	594.10	594.32	1.1
CB35	15900.00	674.29	594.91	595.15	1.1
CB36	16000.00	674.29	595.72	596.01	1.0
CG01	14900.00	200.00	585.73	585.97	1.1
CG02	15000.00	200.00	586.54	586.80	1.1
CG03	15100.00	200.00	587.35	587.59	1.1
CG04	15200.00	200.00	588.15	588.45	1.1
CG05	15300.00	200.00	588.96	589.15	1.0
CG06	15400.00	200.00	589.77	590.03	1.1
CG07	15500.00	200.00	590.58	590.79	1.0
CG08	15600.00	200.00	592.39	592.62	1.0
CG09	15700.00	200.00	594.19	594.49	1.2
CG10	15800.00	200.00	595.00	595.25	1.1
CG11	15900.00	200.00	595.81	596.13	1.1
CG12	16000.00	200.00	596.62	596.82	1.1
CG13	14900.00	300.00	585.14	585.35	1.1
CG14	15000.00	300.00	585.95	586.21	1.1
CG15	15100.00	300.00	586.76	587.03	1.1
CG16	15200.00	300.00	587.57	587.86	1.1
CG17	15300.00	300.00	588.37	588.67	1.1
CG18	15400.00	300.00	589.18	589.41	1.1
CG19	15500.00	300.00	589.99	590.25	1.1
CG20	15600.00	300.00	591.80	592.04	1.1
CG21	15700.00	300.00	593.60	593.86	1.1
CG22	15800.00	300.00	594.41	594.67	1.0
CG23	15900.00	300.00	595.22	595.45	1.0
CG24	16000.00	300.00	596.03	596.27	1.1
CG25	14900.00	400.00	585.11	585.36	1.1
CG26	15000.00	400.00	585.92	586.15	1.1
CG27	15100.00	400.00	586.73	587.01	1.1
CG28	15200.00	400.00	587.54	587.78	1.1
CG29	15300.00	400.00	588.34	588.58	1.1
CG30	15400.00	400.00	589.15	589.40	1.1
CG31	15500.00	400.00	589.96	590.20	1.1
CG32	15600.00	400.00	591.77	592.03	1.1
CG33	15700.00	400.00	593.58	593.74	1.0
CG34	15800.00	400.00	594.38	594.62	1.0
CG35	15900.00	400.00	595.19	595.41	1.0
CG36	16000.00	400.00	596.00	596.27	1.0
CG37	14900.00	500.00	585.70	586.00	1.1
CG38	15000.00	500.00	586.51	586.75	1.1
CG39	15100.00	500.00	587.32	587.59	1.2
CG40	15200.00	500.00	588.13	588.34	1.0
CG41	15300.00	500.00	588.93	589.21	1.1
CG42	15400.00	500.00	589.74	590.01	1.1
CG43	15500.00	500.00	590.55	590.81	1.1
CG44	15600.00	500.00	592.36	592.65	1.2
CG45	15700.00	500.00	594.17	594.43	1.1
CG46	15800.00	500.00	594.97	595.22	1.1
CG47	15900.00	500.00	595.78	595.97	1.0
CG48	16000.00	500.00	596.59	596.89	1.0
CG49	14900.00	600.00	585.27	585.53	1.1
CG50	15000.00	600.00	586.08	586.34	1.1
CG51	15100.00	600.00	586.89	587.16	1.1
CG52	15200.00	600.00	587.70	587.97	1.1
CG53	15300.00	600.00	588.50	588.78	1.1
CG54	15400.00	600.00	589.31	589.59	1.1
CG55	15500.00	600.00	590.12	590.35	1.0
CG56	15600.00	600.00	591.93	592.23	1.0
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CG58	15800.00	600.00	594.54	594.82	1.2
CG59	15900.00	600.00	595.35	595.59	1.1
CG60	16000.00	600.00	596.16	596.52	1.0
CG61	14900.00	700.00	584.96	585.21	1.1
CG62	15000.00	700.00	585.79	585.98	1.0
CG63	15100.00	700.00	586.60	586.86	1.1
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CG67	15500.00	700.00	589.83	590.12	1.1
CG68	15600.00	700.00	591.64	591.85	1.1
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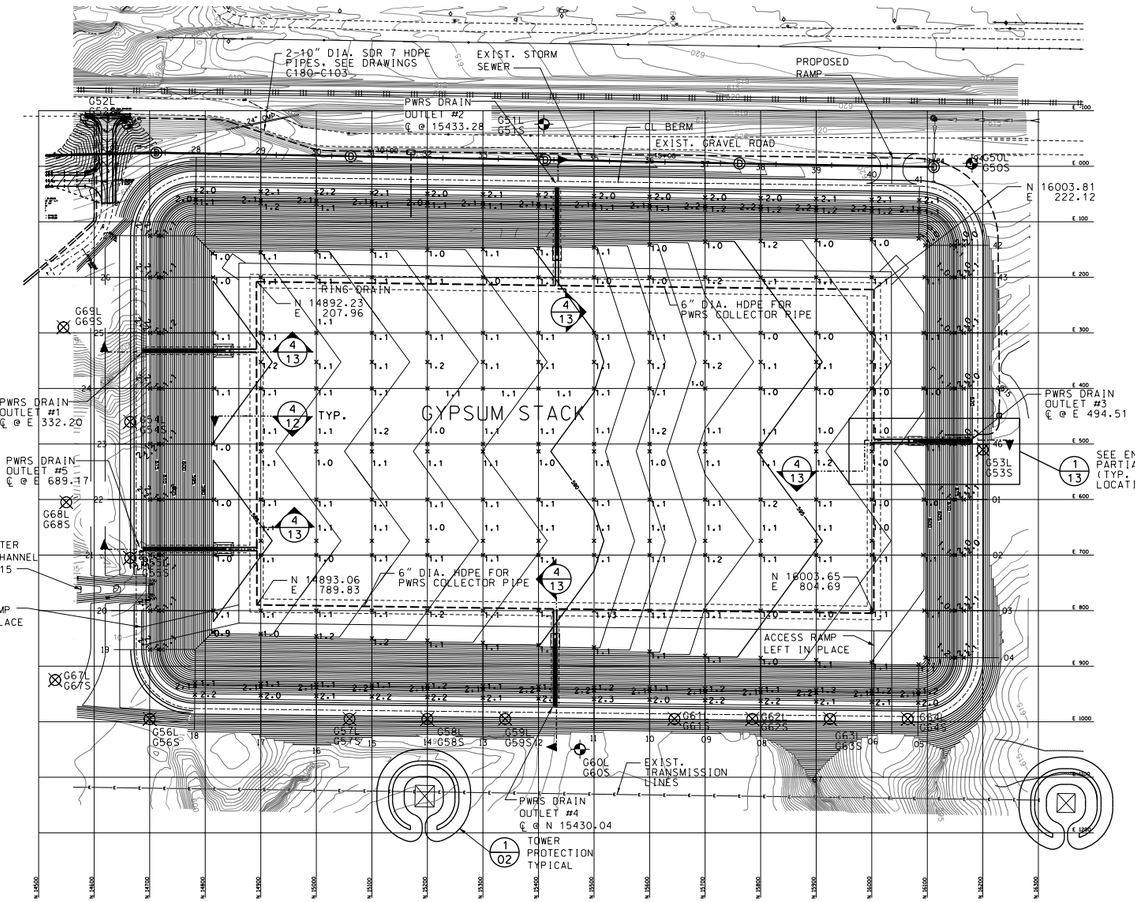
CG70	15800.00	700.00	594.26	594.52	1.1
CG71	15900.00	700.00	595.06	595.32	1.1
CG72	16000.00	700.00	595.87	596.17	1.1
CG73	14900.00	800.00	585.57	585.81	1.1
CG74	15000.00	800.00	586.38	586.66	1.1
CG75	15100.00	800.00	587.19	587.44	1.1
CG76	15200.00	800.00	588.00	588.27	1.2
CG77	15300.00	800.00	588.81	589.10	1.1
CG78	15400.00	800.00	589.61	589.80	1.1
CG79	15500.00	800.00	590.42	590.72	1.1
CG80	15600.00	800.00	592.23	592.52	1.1
CG81	15700.00	800.00	594.04	594.31	1.1
CG82	15800.00	800.00	594.84	595.06	1.0
CG83	15900.00	800.00	595.65	595.88	1.0
CG84	16000.00	800.00	596.46	596.87	1.1

NOTE: RECORD ELEVATIONS AND LAYER THICKNESSES BASED ON A COMPILATION OF RECORD SURVEY DATA PROVIDED BY MAURER-STUTZ, INC. THIS RECORD SURVEY PROVIDED BY MAURER-STUTZ, INC., IS CONTAINED ELSEWHERE IN THIS ACCEPTANCE REPORT.



STANDARD LEGEND

(ALL SYMBOLS MAY NOT BE USED ON EACH PLAN)

650	ORIGINAL CONTOURS	650	NEW CONTOURS
X—X—X—X	FENCELINE		LD/LCRS COLLECTION PIPE
	TRANSMISSION TOWER		GEONET
	OVERHEAD ELECTRIC	MW-53L	MONITORING WELL
	LIMITS OF VEGETATION	B-55	BORING
	GRAVEL ROAD	G69L	FUTURE GROUNDWATER MONITORING WELL
	RAILROAD		4" DIA. PERFORATED DRAINAGE PIPING
	STORM SEWER		6" DIA. OUTFALL PIPING
	CONTROL POINT	1.1	CUSHION DIRT LAYER THICKNESS (IN FEET)
			RING DRAIN SAND LIMITS
			CONSTRUCTION ROAD LIMITS

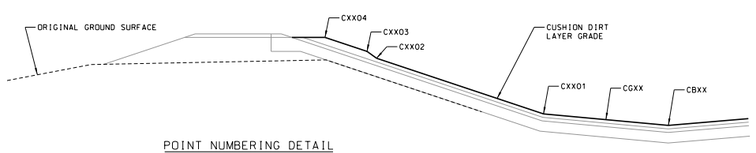
0' 100' 200'
SCALE: 1" = 100'

TYPICAL POINT NUMBER LOCATION

CB 00
- GRID POINT NUMBER
- CUSHION LAYER GRADE (BREAK POINT)

CG 00
- GRID POINT NUMBER
- CUSHION LAYER GRADE

C 00 00
- POINT NUMBER (SEE POINT NUMBERING DETAIL)
- CONTROL LINE NUMBER
- CUSHION LAYER GRADE



POINT NUMBERING DETAIL

AEG CAD GENERATED
DO NOT REVISE MANUALLY

DRAWING RECORD

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
0	02-22-08	SKB	SMB	SMB	ISSUED FOR BIDDING - NOT FOR CONSTRUCTION
1	03-05-08	SKB	SMB	SMB	REVISED CONTOURS / TABLE - ISSUED FOR BIDDING - NOT FOR CONSTRUCTION
2	04-11-08	SKB	SMB	SMB	ISSUED FOR CONSTRUCTION
3	10-14-08	TJL	DBH	SMB	REVISED GRADING TABLE AND CONTOURS FOR 2 FT. FOUNDATION GRADE RAISE FOR THE NORTH 400' OF THE GYPSUM STACK FLOOR
4	11-17-08	DBH	DBH	SMB	ADDED CENTERLINE COORDINATES FOR PWRS DRAIN LOCATIONS
5	02-09-09	DBH	SKB	SMB	RELOCATE SOUTH RING DRAIN ALIGNMENT 30' NORTH
6	03-05-09	SKB	ADC	SMB	ISSUED FOR RECORD DRAWING

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
-	-	-	-	-	

LAYOUT KIM 05-10-07
DRAWN SKB 03-05-08
REVIEWED

30x42

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SCALE -
DRAFTER -
DATE 03-26-09

RECORD DRAWING

FILE NO. -C180-C102-11.dgn

DRAWING TITLE
PWRS-RING DRAIN SYSTEM CUSHION DIRT LAYER GRADE

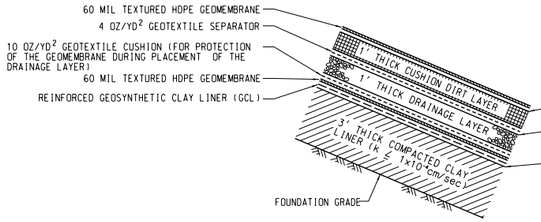
GYPSUM MANAGEMENT FACILITY
FULTON COUNTY, ILLINOIS
DUCK CREEK POWER STATION UNIT NO. -

Ameren Energy. Resources Generating

DRAWING NUMBER C180-C102 REV. 6

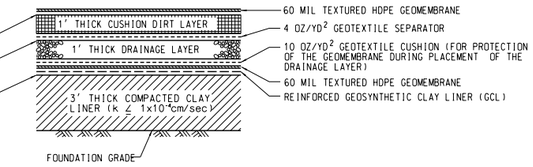
SHEET NO. 11 OF 33

Brand09939
Brand09939
\\N03\jobs\03\5000\Gypsum Stack\CADD\Sheets\C180-C102-11.dgn



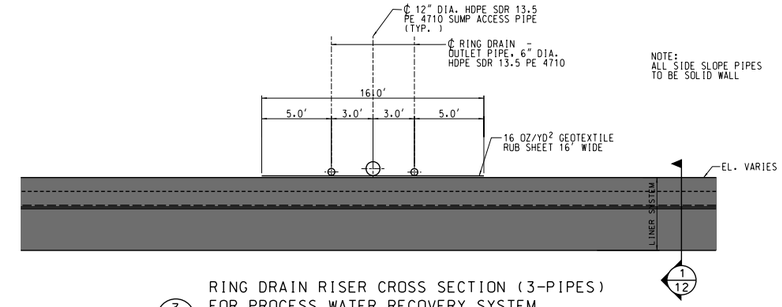
1/12 SIDE SLOPE LINER SYSTEM
NTS

NOTE: LEACHATE COLLECTION SYSTEM NOT SHOWN

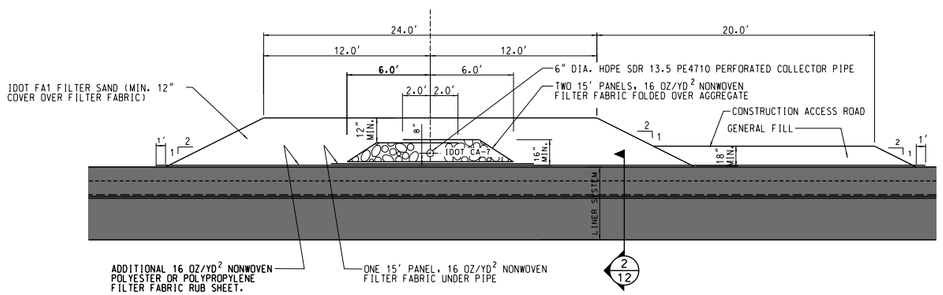


2/12 BOTTOM LINER SYSTEM
NTS

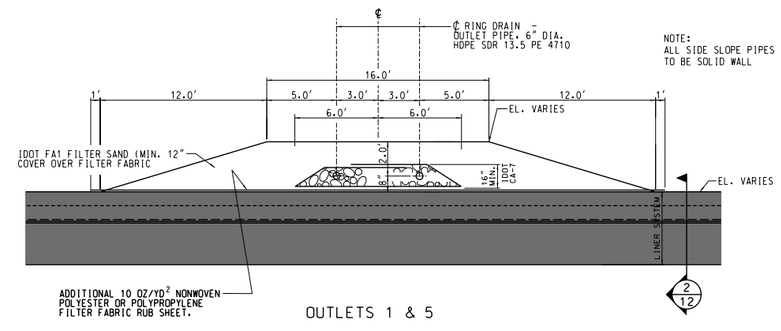
NOTE: LEACHATE COLLECTION SYSTEM NOT SHOWN



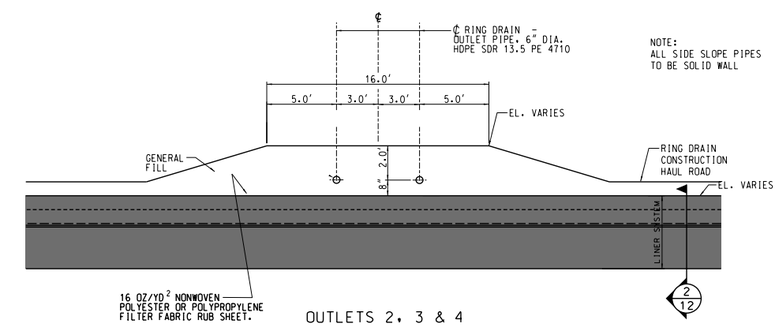
3/12 RING DRAIN RISER CROSS SECTION (3-PIPES) FOR PROCESS WATER RECOVERY SYSTEM
SCALE: 1" = 4'
NOTE: LEACHATE COLLECTION SYSTEM NOT SHOWN



4/12 RING DRAIN COLLECTOR CROSS SECTION FOR PROCESS WATER RECOVERY SYSTEM
SCALE: 1" = 4'
NOTE: LEACHATE COLLECTION SYSTEM NOT SHOWN

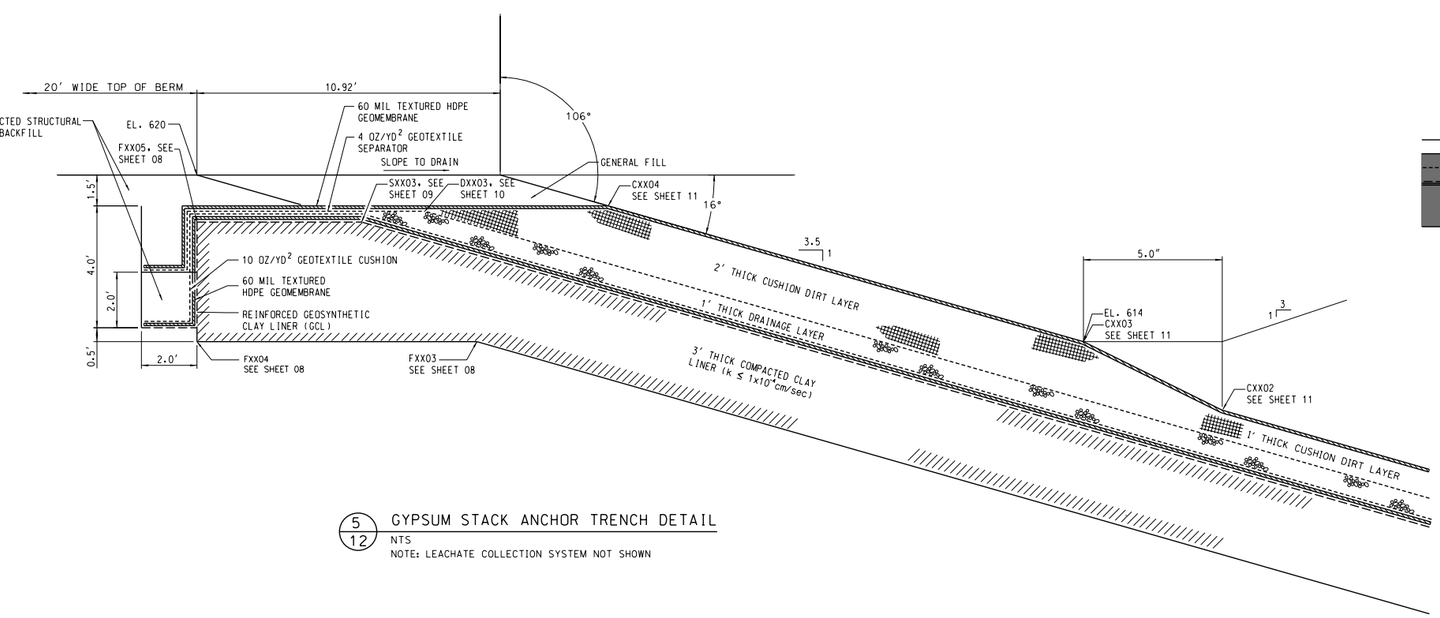


OUTLETS 1 & 5



OUTLETS 2, 3 & 4

6/12 PIPES BETWEEN RING DRAIN AND RISERS FOR PROCESS WATER RECOVERY SYSTEM
SCALE: 1" = 4'
NOTE: LEACHATE COLLECTION SYSTEM NOT SHOWN



5/12 GYPSUM STACK ANCHOR TRENCH DETAIL
NTS
NOTE: LEACHATE COLLECTION SYSTEM NOT SHOWN

AEG CAD GENERATED
DO NOT REVISE MANUALLY

DRAWING RECORD

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
0	02-22-08	SKB	SMB	SMB	ISSUED FOR BIDDING - NOT FOR CONSTRUCTION
1	03-05-08	SKB	SMB	SMB	REVISED DETAIL 5 - ISSUED FOR BIDDING - NOT FOR CONSTRUCTION
2	04-11-08	SKB	SMB	SMB	ISSUED FOR CONSTRUCTION
3	9-19-08	TCJ	RWH	RWH	ADDED LEACHATE COLLECTION NOTE TO ALL DETAILS
4	02-12-09	SKB	SMB	SMB	REVISED DETAIL 6
5	03-05-09	SKB	JMM	-	ISSUED FOR RECORD DRAWING BY HANSON

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
-	-	-	-	-	

LAYOUT	KNK	05-15-07
DRAWN	SKB	03-05-08
REVIEWED		

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SCALE -
DRAFTER -
DATE 03-26-09

RECORD DRAWING
FILE NO. -C180-C102-12.dgn

DRAWING TITLE
PWRS - RING DRAIN DETAILS

GYPSUM MANAGEMENT FACILITY
FULTON COUNTY, ILLINOIS
DUCK CREEK POWER STATION UNIT NO. -

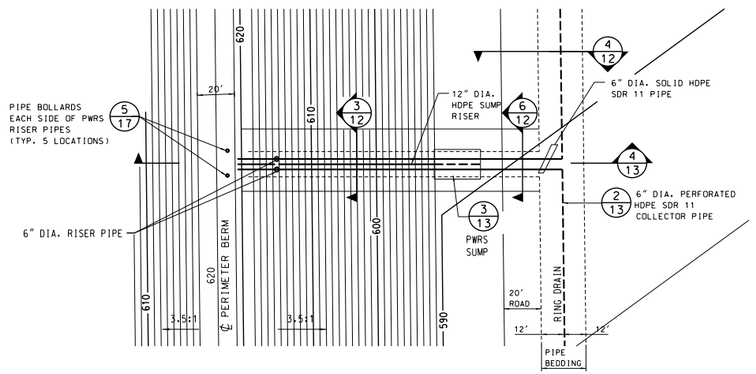
Ameren Energy. Resources Generating

DRAWING NUMBER C180-C102 REV. 5
SHEET NO. 12 OF 33

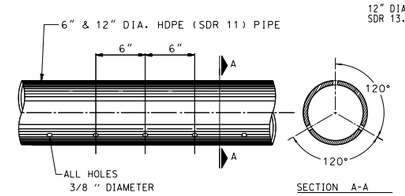
Brand09939
Date04/02/09
\\03jobs\03s500\Gypsum Stack\CADD\Sheets\C180-C102-12.dgn

PERFORATED PIPE

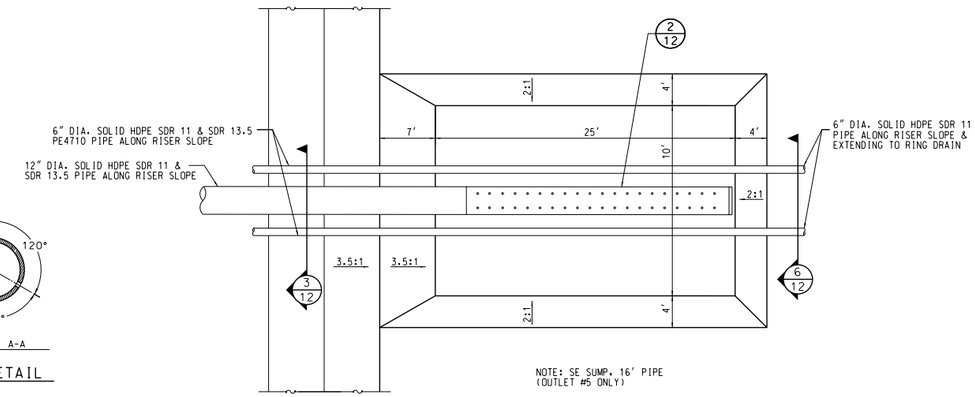
SOLID PIPE



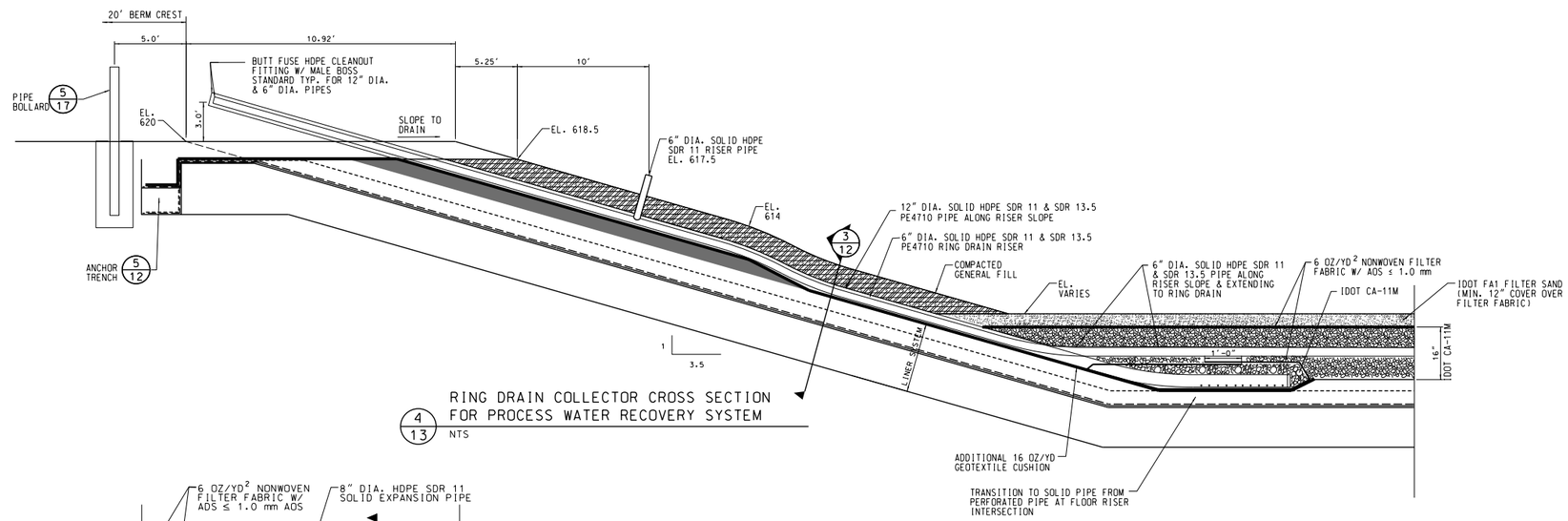
1/13 PROCESS WATER RECOVERY SYSTEM - PARTIAL PLAN (TYP. 5 LOCATIONS)
SCALE: 1"=30'



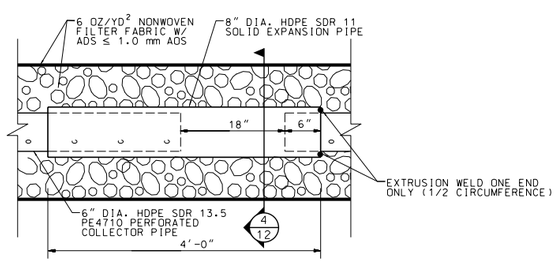
2/13 RING DRAIN COLLECTOR PIPE DETAIL
NTS



3/13 PWRS SUMP PLAN
NTS



4/13 RING DRAIN COLLECTOR CROSS SECTION FOR PROCESS WATER RECOVERY SYSTEM
NTS



5/13 RING DRAIN COLLECTOR PIPE EXPANSION UNION
NTS

NOTE:
INSTALL EXPANSION UNION EVERY 100 FT OF 6" DIA. PERFORATED COLLECTOR PIPE

NOTE:
RING DRAIN COLLECTOR PIPES ARE PERFORATED.
RING DRAIN RISER PIPES ARE NOT PERFORATED.

AEG CAD GENERATED
DO NOT REVISE MANUALLY

DRAWING RECORD

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
0	02-22-08	SKB	SMB	SMB	ISSUED FOR BIDDING - NOT FOR CONSTRUCTION
1	04-11-08	SKB	SMB	SMB	ISSUED FOR CONSTRUCTION
2	-	SKB	JDM	-	ISSUED FOR RECORD DRAWING

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
-	-	-	-	-	

LAYOUT 05/15/07
DRAWN SKB 04-15-09
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RECORD DRAWING

FILE NO. C180-C102-13.dgn

DRAWING TITLE

PWRS - RING DRAIN DETAILS

GYPSUM MANAGEMENT FACILITY
FULTON COUNTY, ILLINOIS
DUCK CREEK POWER STATION UNIT NO. -

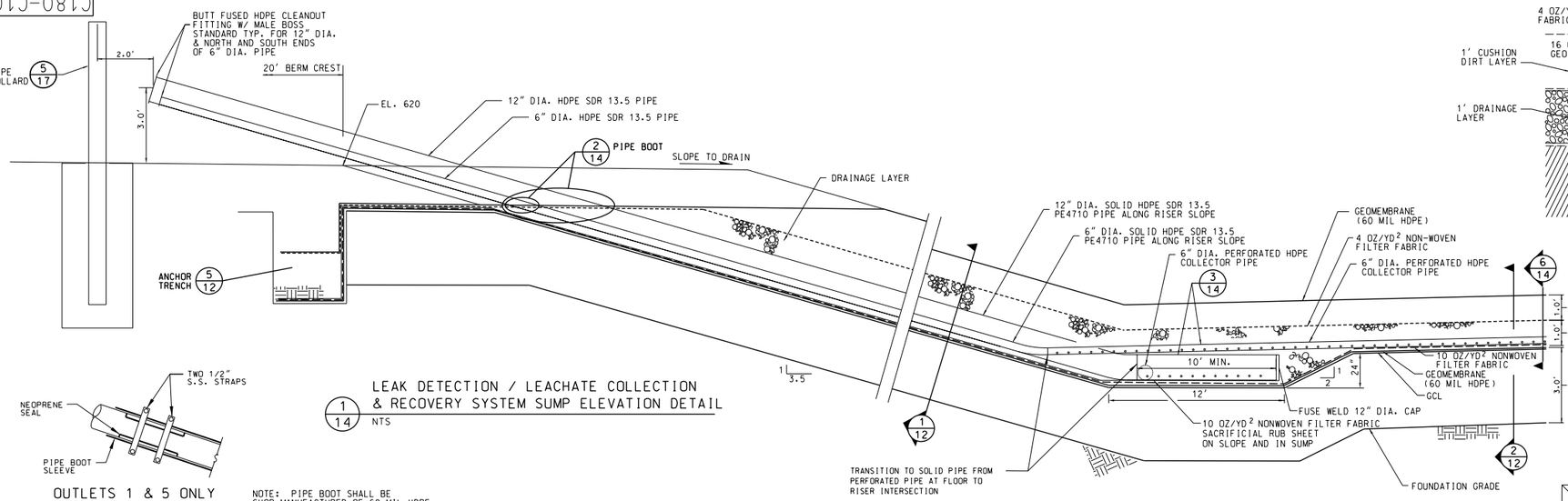
SCALE -
DRAFTER -
DATE 03-26-09

Ameren Energy. Resources Generating

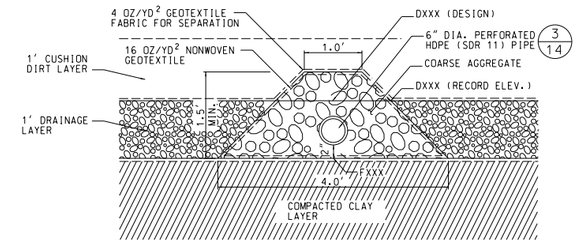
DRAWING NUMBER C180-C102
REV. 2
SHEET NO. 13 OF 33

30x42

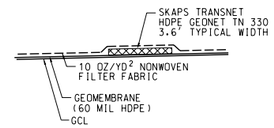
Brand0039
Brand0039
/V03/data/03x50/0/0/gydgm Stock\CADD\Sheets\C180-C102-13.dgn



1/14 LEAK DETECTION / LEACHATE COLLECTION & RECOVERY SYSTEM SUMP ELEVATION DETAIL
NTS



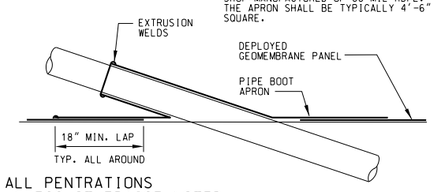
6/14 LD/LCRS COLLECTOR PIPE
NTS



7/14 STRIP DRAIN DETAIL
NTS

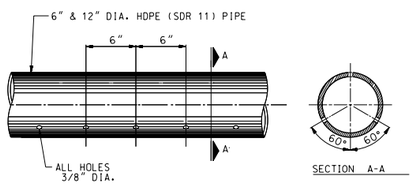
OUTLETS 1 & 5 ONLY

NOTE: PIPE BOOT SHALL BE SHOP-MANUFACTURED OF 60 MIL HDPE. THE APRON SHALL BE TYPICALLY 4'-6" SQUARE.

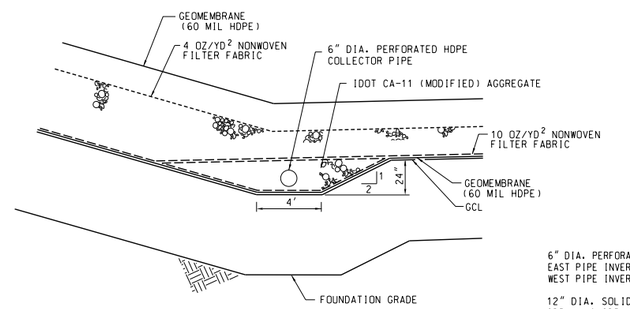


ALL PENTRATIONS UNLESS OTHERWISE NOTED

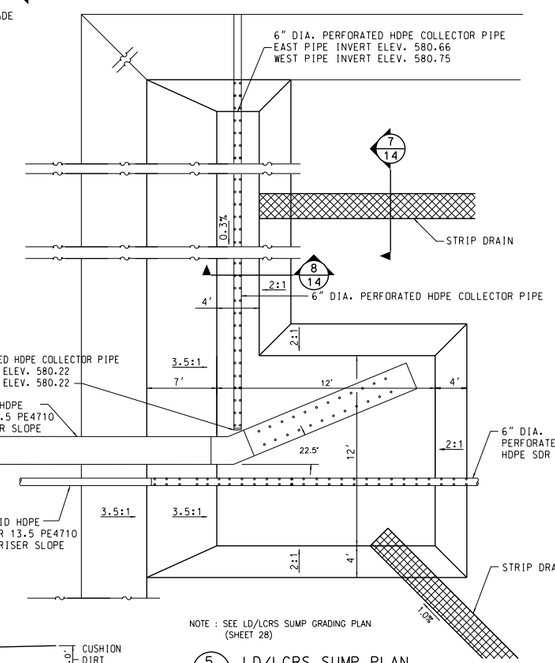
2/14 LINER PENETRATION DETAIL
NTS



3/14 PERFORATED LEACHATE COLLECTION PIPE
NTS

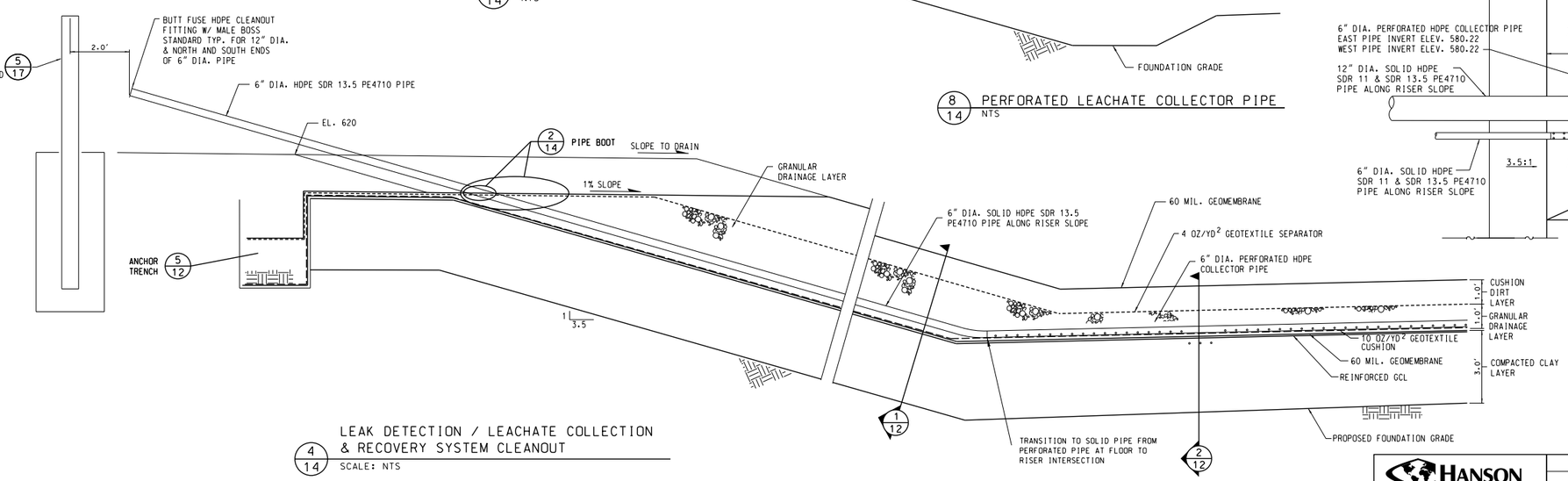


8/14 PERFORATED LEACHATE COLLECTOR PIPE
NTS



NOTE : SEE LD/LCRS SUMP GRADING PLAN (SHEET 28)

5/14 LD/LCRS SUMP PLAN
NTS



4/14 LEAK DETECTION / LEACHATE COLLECTION & RECOVERY SYSTEM CLEANOUT
SCALE: NTS

AEG CAD GENERATED
DO NOT REVISE MANUALLY

DRAWING RECORD

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
0	02-22-08	SKB	SMB	SMB	ISSUED FOR BIDDING - NOT FOR CONSTRUCTION
1	04-11-08	SKB	SMB	SMB	ISSUED FOR CONSTRUCTION
2	10-10-08	TCJ	DBH	SMB	MODIFIED LD/LCRS SUMP PLAN
3	03-05-09	SKB	JMM	-	ISSUED FOR RECORD DRAWING BY HANSON

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
-	-	-	-	-	-

LAYOUT		
DRAWN	SKB	04-16-09
REVIEWED	KNK	05-15-07

30x42

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SCALE -
DRAFTER -
DATE 03-26-09

RECORD DRAWING

FILE NO. -C180-C102-14.dgn

DRAWING TITLE

LD/LCRS SECTIONS & DETAILS

GYPSUM MANAGEMENT FACILITY
FULTON COUNTY, ILLINOIS
DUCK CREEK POWER STATION UNIT NO. -

Ameren Energy. Resources Generating

DRAWING NUMBER C180-C102 REV. 3

SHEET NO. 14 OF 33

Brand0039
Brand0039
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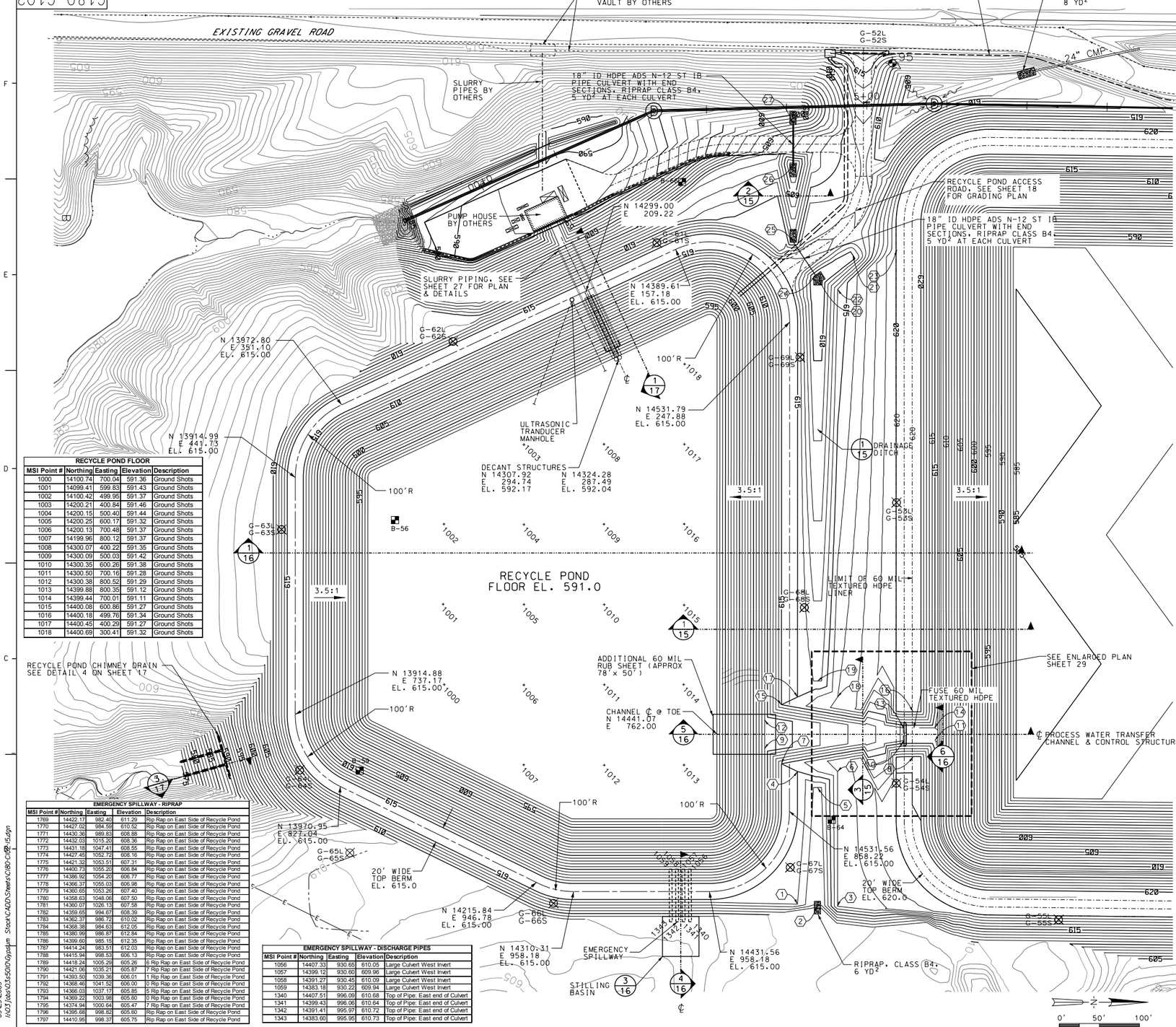
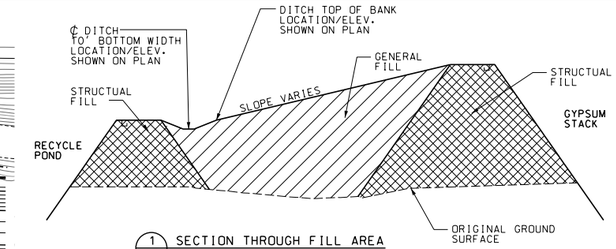
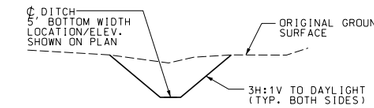
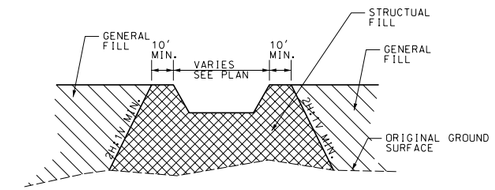




1/15 SECTION THROUGH FILL AREA
NTS



2/15 SECTION THROUGH DITCH
NTS



3/15 SECTION THROUGH FILL AREA
NTS

RECYCLE POND FLOOR				
MSI Point #	Northing	Easting	Elevation	Description
1000	14100.74	700.04	591.36	Ground Shots
1001	14099.41	599.83	591.43	Ground Shots
1002	14100.42	499.95	591.37	Ground Shots
1003	14200.21	400.84	591.46	Ground Shots
1004	14200.15	500.40	591.44	Ground Shots
1005	14200.25	600.17	591.32	Ground Shots
1006	14200.13	700.48	591.37	Ground Shots
1007	14199.96	800.12	591.37	Ground Shots
1008	14300.07	400.22	591.35	Ground Shots
1009	14300.09	500.03	591.42	Ground Shots
1010	14300.35	600.26	591.38	Ground Shots
1011	14300.50	700.16	591.28	Ground Shots
1012	14300.38	800.52	591.29	Ground Shots
1013	14399.88	800.35	591.12	Ground Shots
1014	14399.44	700.01	591.11	Ground Shots
1015	14400.08	600.86	591.27	Ground Shots
1016	14400.18	499.76	591.34	Ground Shots
1017	14400.45	400.29	591.27	Ground Shots
1018	14400.69	300.41	591.32	Ground Shots

EMERGENCY SPILLWAY - RIPRAP				
MSI Point #	Northing	Easting	Elevation	Description
1769	14422.17	982.40	611.29	Rip Rap on East Side of Recycle Pond
1770	14427.02	984.59	610.52	Rip Rap on East Side of Recycle Pond
1771	14430.36	989.83	608.88	Rip Rap on East Side of Recycle Pond
1772	14432.03	1015.20	608.36	Rip Rap on East Side of Recycle Pond
1773	14431.18	1047.41	608.55	Rip Rap on East Side of Recycle Pond
1774	14427.45	1052.72	608.16	Rip Rap on East Side of Recycle Pond
1775	14421.32	1053.51	607.31	Rip Rap on East Side of Recycle Pond
1776	14400.73	1055.20	606.84	Rip Rap on East Side of Recycle Pond
1777	14386.92	1054.20	606.77	Rip Rap on East Side of Recycle Pond
1778	14366.37	1055.03	606.98	Rip Rap on East Side of Recycle Pond
1779	14360.65	1053.26	607.40	Rip Rap on East Side of Recycle Pond
1780	14358.63	1048.06	607.50	Rip Rap on East Side of Recycle Pond
1781	14360.07	1026.13	607.58	Rip Rap on East Side of Recycle Pond
1782	14359.65	994.67	608.39	Rip Rap on East Side of Recycle Pond
1783	14362.37	986.72	610.02	Rip Rap on East Side of Recycle Pond
1784	14368.38	984.63	612.05	Rip Rap on East Side of Recycle Pond
1785	14380.99	986.87	612.84	Rip Rap on East Side of Recycle Pond
1786	14399.60	985.15	612.35	Rip Rap on East Side of Recycle Pond
1787	14414.24	983.51	612.03	Rip Rap on East Side of Recycle Pond
1788	14415.94	998.53	606.13	Rip Rap on East Side of Recycle Pond
1789	14418.24	1005.29	605.26	6 Rip Rap on East Side of Recycle Pond
1790	14421.06	1035.21	605.87	7 Rip Rap on East Side of Recycle Pond
1791	14393.50	1039.36	606.01	1 Rip Rap on East Side of Recycle Pond
1792	14368.46	1041.52	606.00	0 Rip Rap on East Side of Recycle Pond
1793	14366.03	1037.17	605.85	5 Rip Rap on East Side of Recycle Pond
1794	14369.22	1003.98	605.60	0 Rip Rap on East Side of Recycle Pond
1795	14374.94	1000.64	605.47	7 Rip Rap on East Side of Recycle Pond
1796	14395.68	998.82	605.60	Rip Rap on East Side of Recycle Pond
1797	14410.95	998.37	605.75	Rip Rap on East Side of Recycle Pond

EMERGENCY SPILLWAY - DISCHARGE PIPES				
MSI Point #	Northing	Easting	Elevation	Description
1056	14407.33	930.65	610.05	Large Culvert West Invert
1057	14399.12	930.60	609.96	Large Culvert West Invert
1058	14391.27	930.45	610.09	Large Culvert West Invert
1059	14383.18	930.22	609.94	Large Culvert West Invert
1340	14407.51	996.09	610.68	Top of Pipe: East end of Culvert
1341	14399.43	996.06	610.64	Top of Pipe: East end of Culvert
1342	14391.41	995.97	610.72	Top of Pipe: East end of Culvert
1343	14383.60	995.95	610.73	Top of Pipe: East end of Culvert

STANDARD LEGEND

(ALL SYMBOLS MAY NOT BE USED ON EACH PLAN)

- 650 — ORIGINAL CONTOURS
- X—X—X—X — FENCELINE
- TRANSMISSION TOWER
- OVERHEAD ELECTRIC
- LIMITS OF VEGETATION
- GRAVEL ROAD
- RAILROAD
- STORM SEWER
- CONTROL POINT
- 650 — NEW CONTOURS
- LD/LCRS COLLECTION PIPE
- GEONET
- MW-53L — MONITORING WELL
- B-55 — BORING
- G69L — FUTURE GROUNDWATER MONITORING WELL
- 4" DIA. PERFORATED DRAINAGE PIPING
- 6" DIA. OUTFALL PIPING
- +1001 — POINT SURVEYED BY MAUERER-STUTZ, INC.

GRADING TABLE				
POINT NUMBER	DESCRIPTION	NORTHING	EASTING	ELEVATION OR INVERT
1	DITCH TOP OF BANK	14,541.49	973.94	614.00
2	CENTERLINE OF DITCH	14,566.49	975.25	612.00
3	DITCH TOP OF BANK	14,591.49	976.56	617.00
4	DITCH TOP OF BANK	14,541.55	808.45	615.00
5	CENTERLINE OF DITCH	14,566.54	828.46	613.00
6	DITCH TOP OF BANK	14,591.55	808.47	617.00
7	PWTC TOP OF BANK	14,521.55	798.85	615.00
8	PWTC TOP OF BANK	14,685.65	790.09	620.00
9	PWTC BOTTOM	14,500.57	780.02	609.00
10	PWTC BOTTOM	14,673.64	770.09	614.00
11	PWTC BOTTOM	14,712.97	770.10	614.00
12	PWTC BOTTOM	14,500.57	744.02	609.00
13	PWTC BOTTOM	14,673.64	754.09	614.00
14	PWTC BOTTOM	14,712.98	754.10	614.00
15	PWTC TOP OF BANK	14,521.58	725.21	615.00
16	PWTC TOP OF BANK	14,685.63	734.09	620.00
17	DITCH TOP OF BANK	14,541.59	715.67	615.00
18	DITCH TOP OF BANK	14,591.59	715.69	617.00
19	CENTERLINE OF DITCH	14,566.59	695.68	614.00
20	CENTERLINE OF DITCH	14,566.78	193.68	609.00
21	CENTERLINE OF DITCH	14,610.57	164.41	610.00
22	DITCH TOP OF BANK	14,591.78	207.04	614.00
23	DITCH TOP OF BANK	14,665.51	157.75	620.00
24	CENTERLINE OF CULVERT	14,564.00	189.52	609.00
25	CENTERLINE OF DITCH/CULVERT	14,536.22	147.95	608.90
26	CENTERLINE OF DITCH/CULVERT	14,536.22	51.05	602.50
27	CENTERLINE OF CULVERT	14,536.22	1.05	602.30

NOTE: PWTC = PROCESS WATER TRANSFER CHANNEL

NOTES:

1. CONTOURS SHOWN IN RECYCLE POND REPRESENT TOP OF LINER.
2. THE PROPERTY IS LOCATED IN SECTION 18, TOWNSHIP 6 NORTH, RANGE 5 EAST, 4TH P.M., FULTON COUNTY, ILLINOIS.

AEG CAD GENERATED
DO NOT REVISE MANUALLY

DRAWING RECORD

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
0	02-22-08	SKB	SMB	SMB	ISSUED FOR BIDDING - NOT FOR CONSTRUCTION
1	03-05-08	SKB	SMB	SMB	ADDED SLURRY PIPING - ISSUED FOR BIDDING - NOT FOR CONSTRUCTION
2	04-11-08	SKB	SMB	SMB	ISSUED FOR CONSTRUCTION
3	09-29-08	DBH	SMB	SMB	REVISED COORDINATES FOR PROCESS WATER CONTROL STRUCTURE
4	12-19-08	TCJ			REVISED CHIMNEY DRAIN
5	03-05-09	SKB	JMM	-	ISSUED FOR RECORD DRAWING BY HANSON

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
-	-	-	-	-	-

LAYOUT SMB 05/08/07
DRAWN SKB 04-16-09
REVIEWED

30x42

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SCALE -
DRAFTER -
DATE 03-26-09

RECORD DRAWING
FILE NO. -C180-C102-I5.dgn

DRAWING TITLE
RECYCLE POND PLAN

GYPSUM MANAGEMENT FACILITY
FULTON COUNTY, ILLINOIS
DUCK CREEK POWER STATION UNIT NO. -

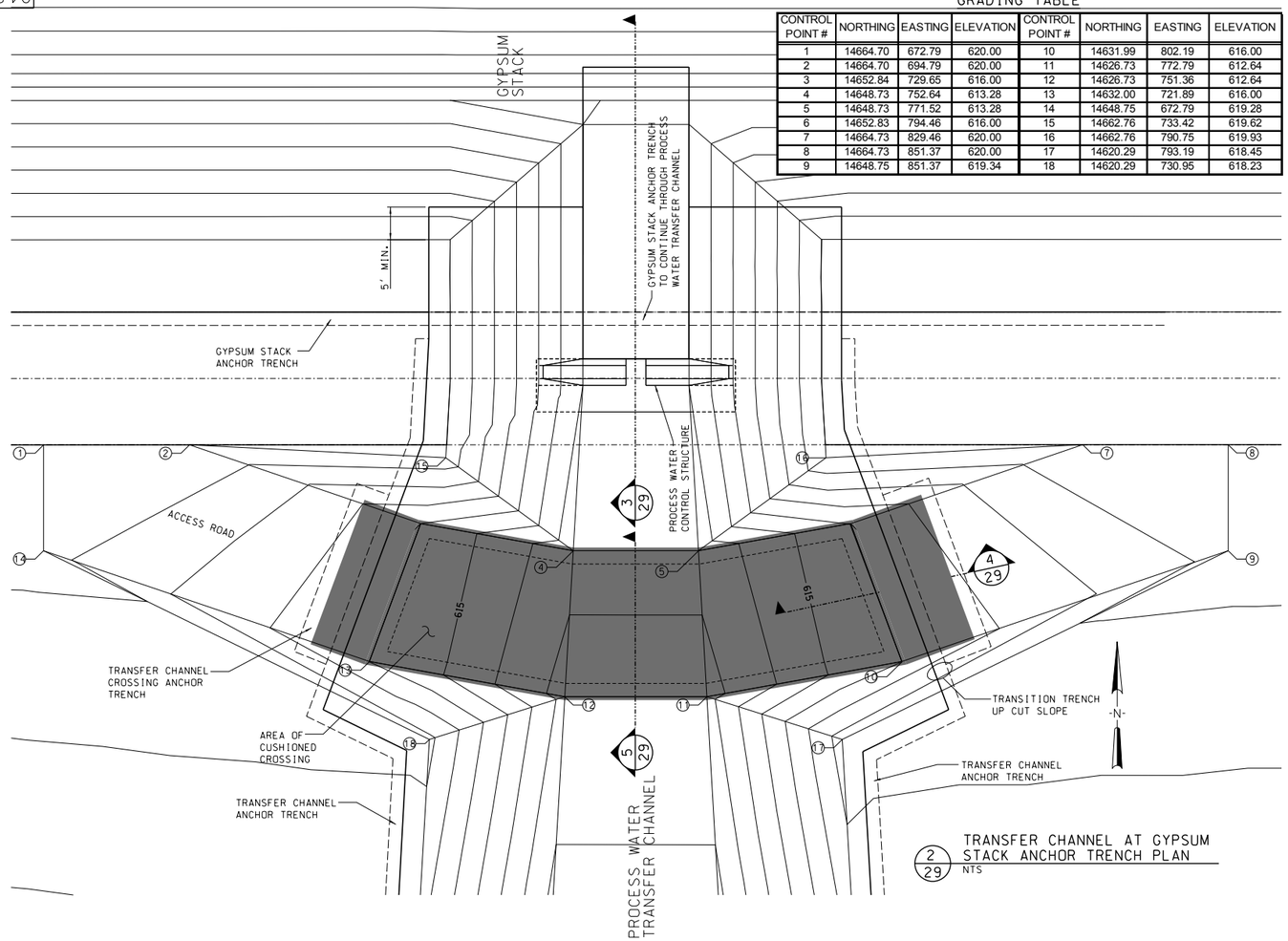
Ameren Energy. Resources Generating

DRAWING NUMBER C180-C102 REV. 5
SHEET NO. 15 OF 33

Brosso00039
09/09/2009
N:\Tasks\C3500\Gypsum Stack\CADD\Sheets\C180-C102-I5.dgn

GRADING TABLE

CONTROL POINT #	NORTHING	EASTING	ELEVATION	CONTROL POINT #	NORTHING	EASTING	ELEVATION
1	14664.70	672.79	620.00	10	14631.99	802.19	616.00
2	14664.70	694.79	620.00	11	14626.73	772.79	612.64
3	14652.84	729.65	616.00	12	14626.73	751.36	612.64
4	14648.73	752.64	613.28	13	14632.00	721.89	616.00
5	14648.73	771.52	613.28	14	14648.75	672.79	619.28
6	14652.83	794.46	616.00	15	14662.76	733.42	619.62
7	14664.73	829.46	620.00	16	14662.76	790.75	619.93
8	14664.73	851.37	620.00	17	14620.29	793.19	618.45
9	14648.75	851.37	619.34	18	14620.29	730.95	618.23

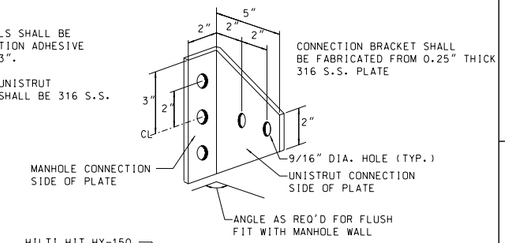


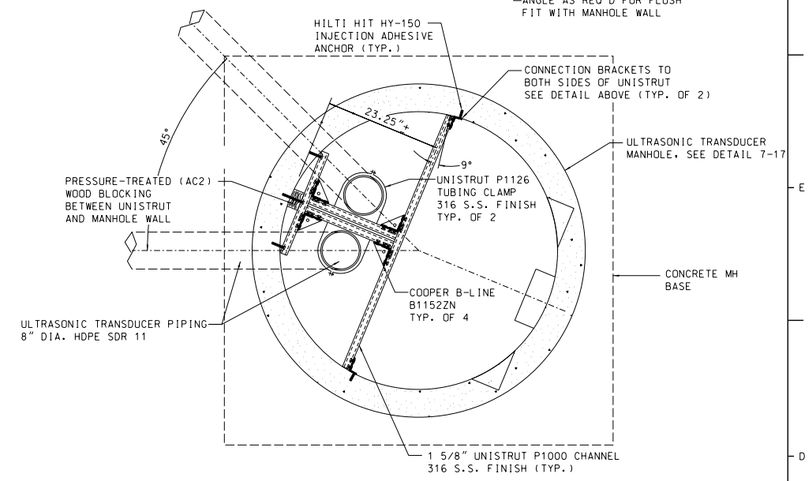
2/29 TRANSFER CHANNEL AT GYPSUM STACK ANCHOR TRENCH PLAN
NTS

NOTE:

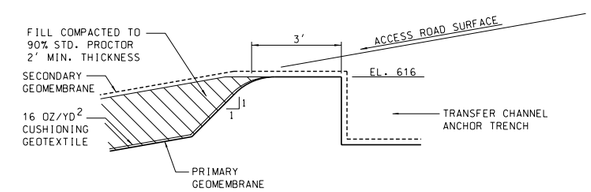
ALL ANCHORS IN MANHOLE WALLS SHALL BE HILTI HIT HY-150 MAX INJECTION ADHESIVE ANCHORS SET TO A DEPTH OF 3".

ALL FASTENER HARDWARE AND UNISTRUT CHANNEL NUTS (PART P1010) SHALL BE 316 S.S. WITH 1/2"x13 BOLT SIZE

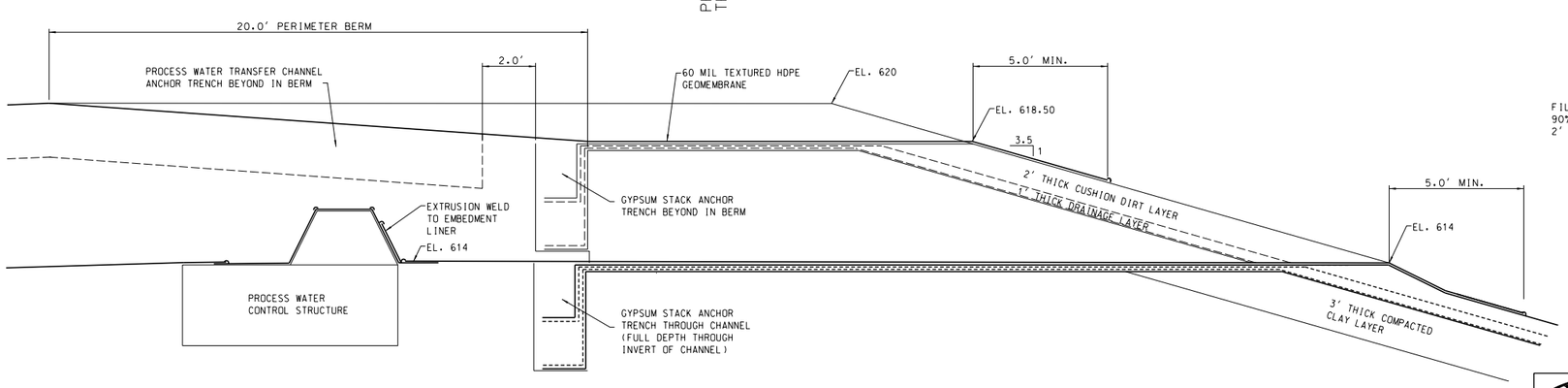




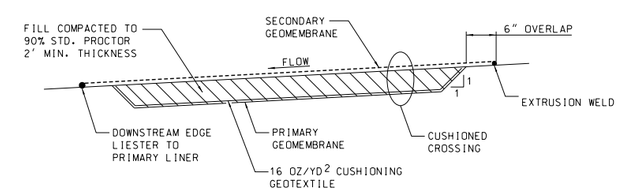
1/29 ULTRASONIC TRANSDUCER PIPE SUPPORT DETAIL
1"=1'



4/29 ACCESS ROAD AT TRANSFER CHANNEL TRENCH
NTS



3/29 TRANSFER CHANNEL AT GYPSUM STACK ANCHOR TRENCH SECTION
NTS



5/29 ACCESS ROAD THRU PROCESS WATER TRANSFER CHANNEL TRENCH
NTS

AEG CAD GENERATED
DO NOT REVISE MANUALLY

DRAWING RECORD

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
0	11-07-08	TCJ	DBH	SMB	ISSUED FOR CONSTRUCTION
1	01-08-09	TCJ	DBH	DBH	ADDED ACCESS ROAD CROSSING AND DETAILS
2	03-05-09	SKB	JMM	-	ISSUED FOR RECORD DRAWING

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
-					-

LAYOUT	TCJ	10-31-08
DRAWN	SKB	04-28-09
REVIEWED	-	- / - / -

30x42

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SCALE -
DRAFTER -
DATE 03-26-09

AWING
FILE NO. -C180-C102-29.dgn

DRAWING TITLE
MISCELLANEOUS DETAILS

GYPSUM MANAGEMENT FACILITY
FULTON COUNTY, ILLINOIS
DUCK CREEK POWER STATION UNIT NO. -

Ameren Energy. Resources Generating

DRAWING NUMBER C180-C102 REV. 2
SHEET NO. 29 OF 33

Brand09039
09PW50039
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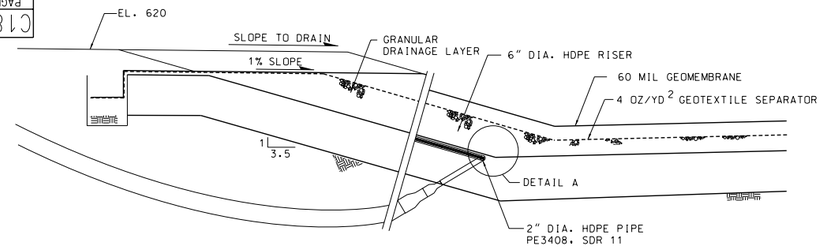
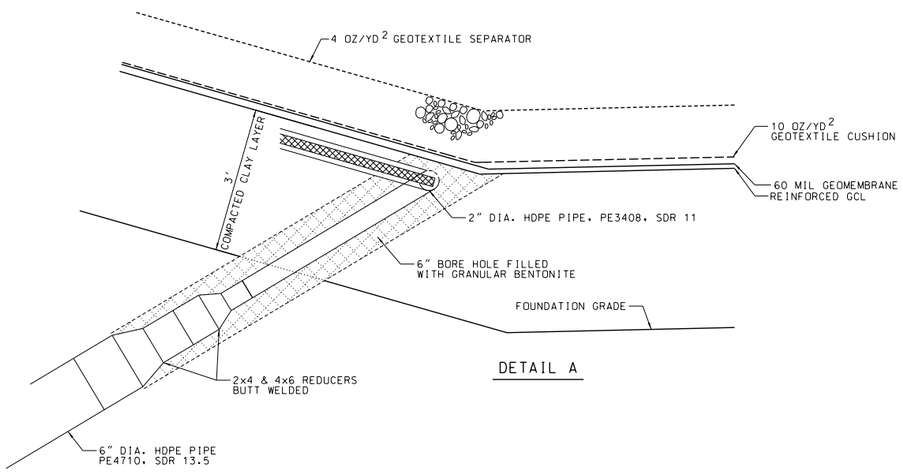
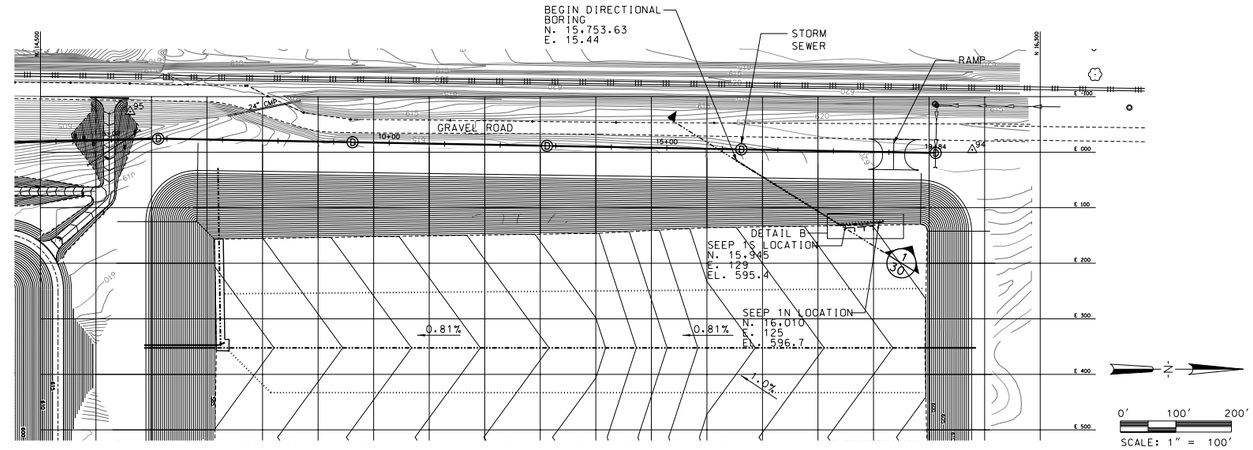
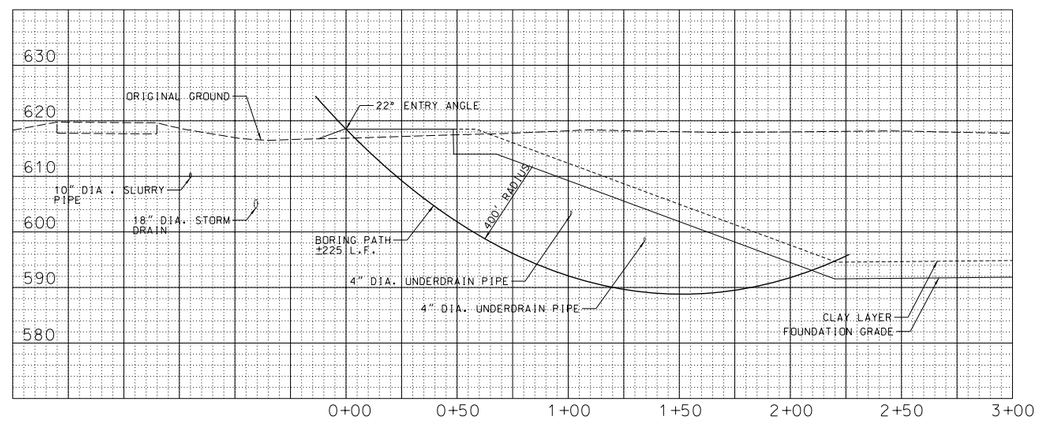


1/30 RISER DETAIL
SCALE: NTS



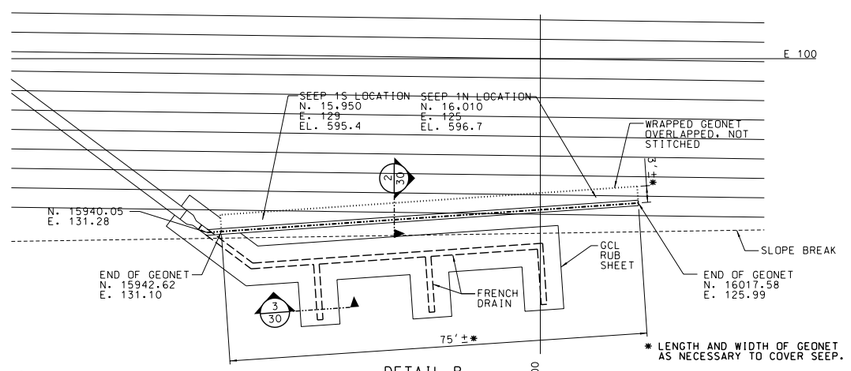
DETAIL A



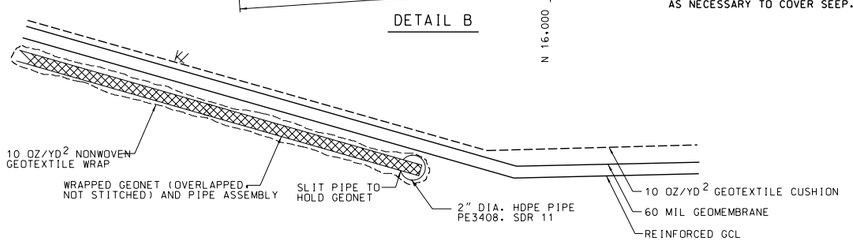


BORING PROFILE

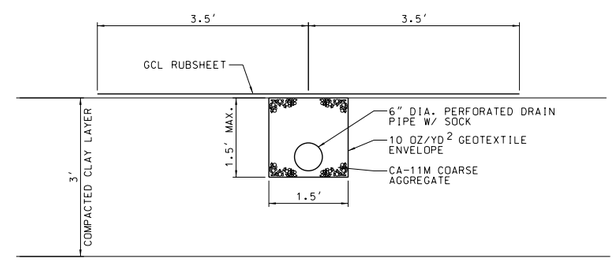
STATION	CLAY LAYER ELEVATION	BORING PATH ELEVATION
0+00	618.50	618.50
0+10	618.50	614.57
0+20	618.50	610.94
0+30	618.50	607.62
0+40	618.50	604.58
0+50	618.50	601.82
0+60	618.26	599.34
0+70	616.79	597.14
0+80	615.31	595.19
0+90	613.84	593.51
1+00	612.36	592.09
1+10	610.89	590.93
1+20	609.41	590.02
1+30	607.94	589.36
1+40	606.46	588.95
1+50	604.98	588.80
1+60	603.51	588.89
1+70	602.03	589.23
1+80	600.56	589.83
1+90	599.08	590.67
2+00	597.61	591.77
2+10	596.13	593.13
2+20	594.66	594.74



DETAIL B



2/30 GEONET DETAIL
SCALE: NTS



3/30 FRENCH DRAIN DETAIL
SCALE: NTS

NOTE:
SEE OTHER PLAN SHEETS FOR STANDARD LEGEND.

RECORD DRAWING

FILE NO. -C180-C102-30_SEEP1.dgn

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Illinois Licensed Professional Service Corporation #184-001084
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DRAWING TITLE
LD/LCRS UNDERDRAIN DEWATERING SYSTEM-SEEP 1
GYPSUM MANAGEMENT FACILITY
FULTON COUNTY, ILLINOIS
DUCK CREEK POWER STATION UNIT NO. -

Ameren Energy. Resources Generating

DRAWING NUMBER	REV.
C180-C102	2

SHEET NO. 30 OF 33

SCALE
DRAFTER
DATE 03-26-09

AEG CAD GENERATED
DO NOT REVISE MANUALLY

DRAWING RECORD

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
0	11-07-08	TCJ	RWH	DBH	ISSUED FOR CONSTRUCTION
1	11-14-08	TCJ			REVISED BORING PATH AND ENTRY POINT - ISSUED FOR CONSTRUCTION
2	03-05-09	SKB	JMM		ISSUED FOR RECORD DRAWING BY HANSON

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
–	–	–	–	–	

LAYOUT	TCJ	11-03-08
DRAWN	SKB	04-28-09
REVIEWED	DBH	11-05-08

30x42

Brons00039
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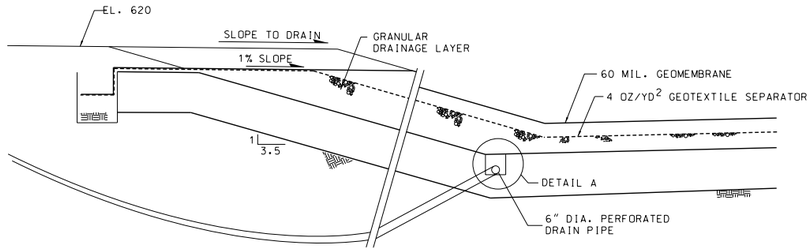
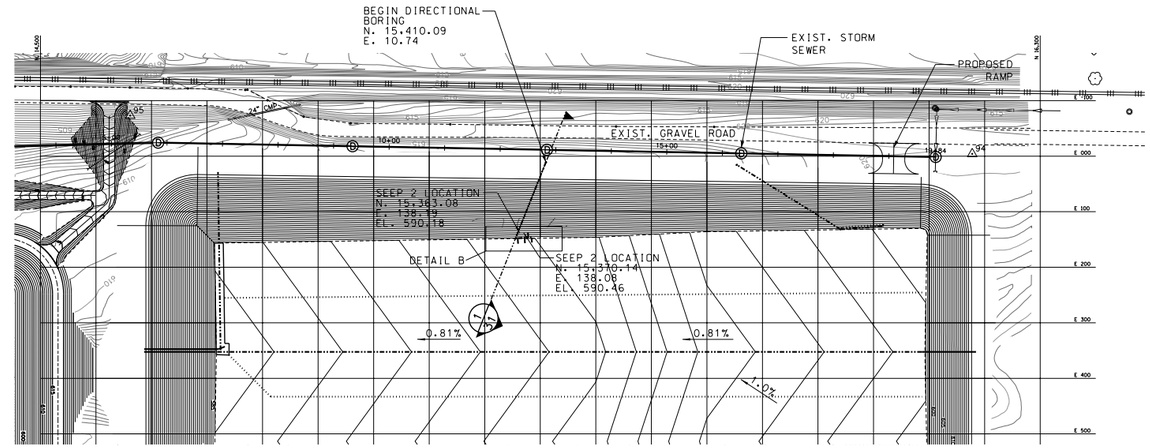
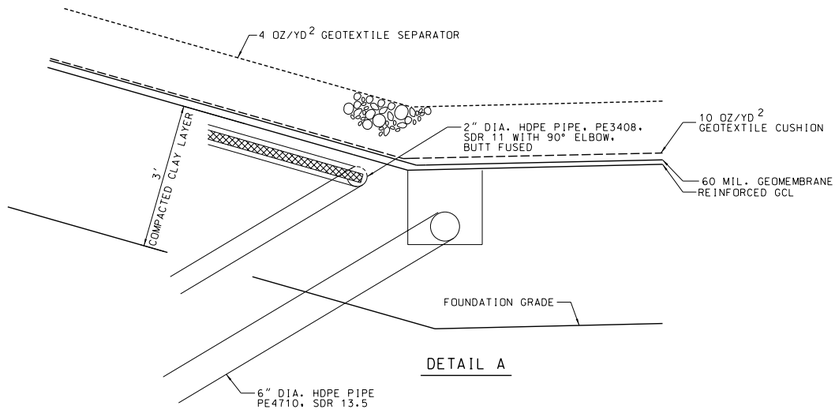
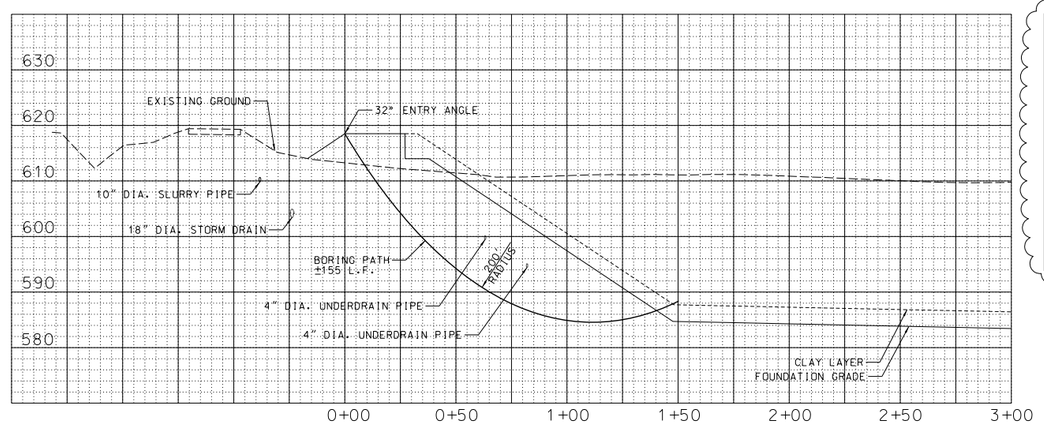


1/31 RISER DETAIL
SCALE: NTS





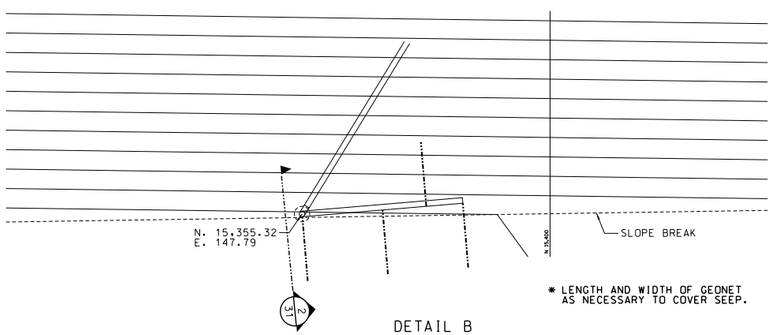
DETAIL A



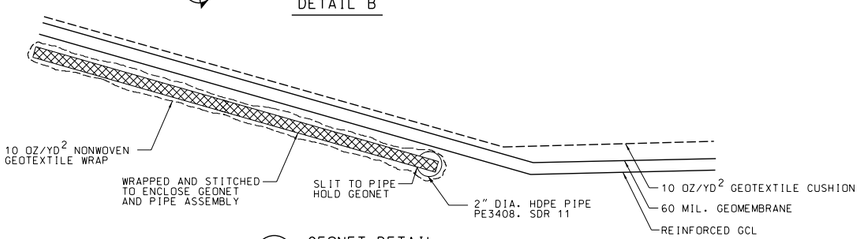
BORING PROFILE

1

STATION	CLAY LAYER ELEVATION	BORING PATH ELEVATION
0+00	618.50	618.50
0+10	618.50	612.21
0+20	618.50	606.70
0+30	618.50	601.90
0+40	616.55	597.77
0+50	613.88	594.24
0+60	611.21	591.30
0+70	608.55	588.91
0+80	605.88	587.05
0+90	603.21	585.72
1+00	600.54	584.89
1+10	597.88	584.57
1+20	595.21	584.75
1+30	592.54	585.43
1+40	589.88	586.61



DETAIL B



2/31 GEONET DETAIL
SCALE: NTS

STANDARD LEGEND

(ALL SYMBOLS MAY NOT BE USED ON EACH PLAN)

650	ORIGINAL CONTOURS	650	NEW CONTOURS
x—x—x—x	FENCELINE		LD/LCRS COLLECTION PIPE
	TRANSMISSION TOWER		GEONET
	OVERHEAD ELECTRIC	MW-53L	MONITORING WELL
	LIMITS OF VEGETATION	B-55	BORING
	GRAVEL ROAD	G69L	FUTURE GROUNDWATER MONITORING WELL
	RAILROAD		4" DIA. PERFORATED DRAINAGE PIPING
	STORM SEWER		6" DIA. OUTFALL PIPING
	CONTROL POINT		

N

0' 100' 200'
SCALE: 1" = 100'

RECORD DRAWING

FILE NO. -C180-C102-31_SEEP2.dgn

AEG CAD GENERATED
DO NOT REVISE MANUALLY

DRAWING RECORD

REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION	REV.	DATE	PREPARED	REVIEWED	APPROVED	DESCRIPTION
0	11-19-08	TCJ	---	---	ISSUED FOR CONSTRUCTION	-	-	-	-	-	-
1	11-24-08	TCJ	RWH	DBH	ISSUED FOR CONSTRUCTION REVISED PENETRATION LOCATION						
2	03-05-09	TCJ	JMM	-	ISSUED FOR RECORD DRAWING BY HANSON						

LAYOUT	TCJ	11-03-08
DRAWN	TCJ	11-19-08
REVIEWED	DBH	-----

HANSON
Hanson Professional Services Inc.
1525 South Sixth Street
Springfield, Illinois 62703-2886
Phone: (217)788-2450 Fax: (217) 788-2503
Illinois Licensed Professional Service Corporation #184-001064
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SCALE -
DRAFTER -
DATE 03-26-09

DRAWING TITLE

LD/LCRS UNDERDRAIN DEWATERING SYSTEM-SEEP 2

GYPSUM MANAGEMENT FACILITY
FULTON COUNTY, ILLINOIS
DUCK CREEK POWER STATION UNIT NO. -

Ameren Energy. Resources Generating

DRAWING NUMBER C180-C102 REV. 2
SHEET NO. 31 OF 33

30x42

Brandon0939
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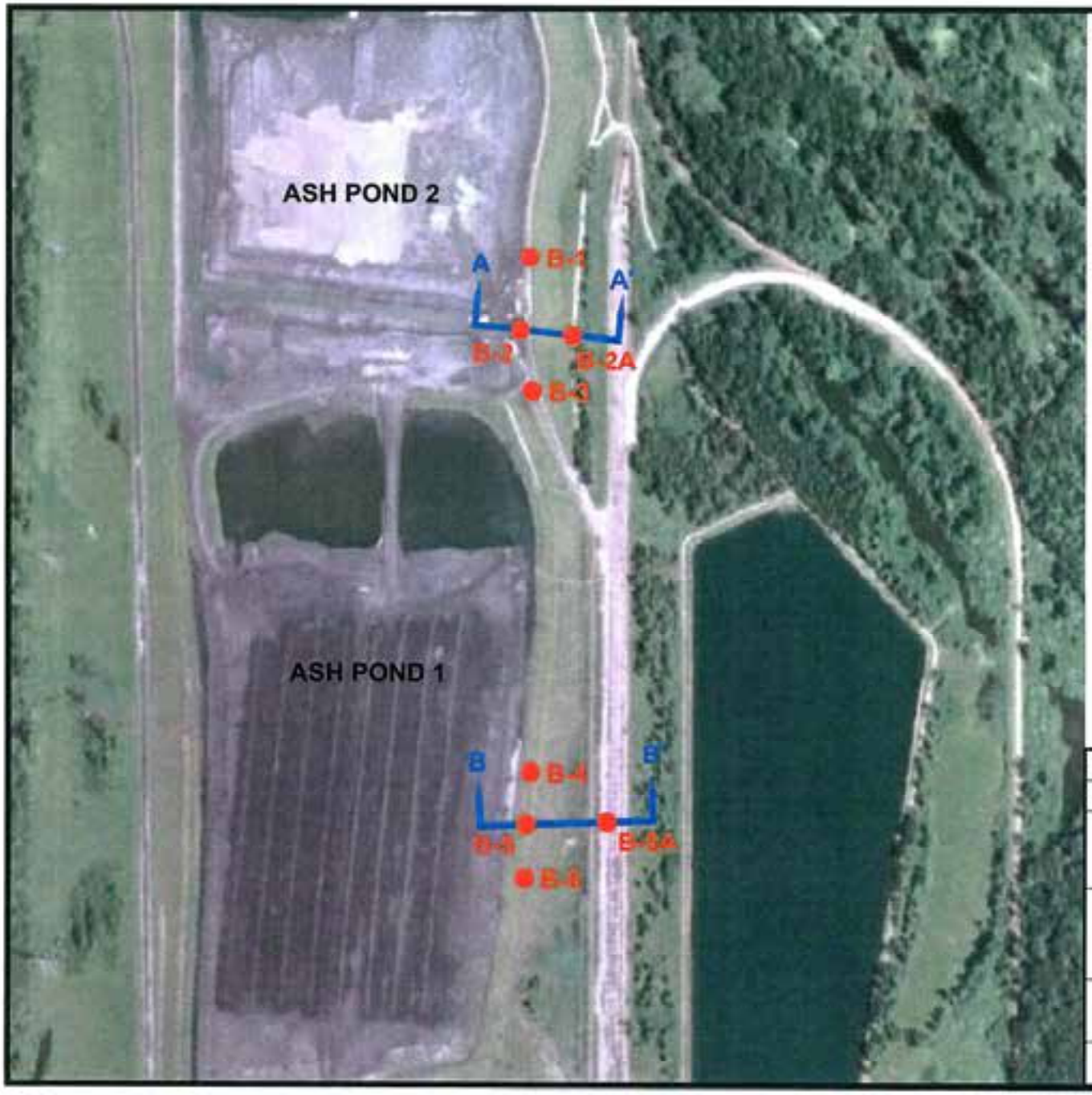
\\A03jobs\03s50\0\system Stock\CADD\Sheets\C180-C102-31_SEEP2.dgn

Appendix C: Duck Creek Power Station Boring and Piezometer Locations



NOTES

1. Plan adapted from an aerial photograph courtesy of Google Earth.

LEGEND

Boring Location

Slope Stablity Cross Section

N

0 500 1000

APPROXIMATE SCALE IN FEET

Drawn By: SLC	Ck'd By: S-C	App'vd By: DAN
Date: 11-03-10	Date: 12/14/10	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Duck Creek Power Station
Canton, Illinois

AERIAL PHOTOGRAPH OF SITE AND BORING LOCATIONS

Project Number
J017150.01

PLATE 2

Figure C.1. Piezometer locations for Ash Pond No. 1 and Ash Pond No. 2.

Appendix D: Project Manual; Specification No's.: C180-C102 (excerpt)

PROJECT MANUAL
GYPSUM STACK AND RECYCLE POND AND CCB LANDFILL CONSTRUCTION
GYPSUM MANAGEMENT FACILITY AND CCB LANDFILL
DUCK CREEK POWER STATION
FULTON COUNTY, ILLINOIS

SPECIFICATION NO'S.: C180-C102

Prepared For:

AMEREN ENERGY RESOURCES GENERATING COMPANY

Prepared By:

HANSON PROFESSIONAL SERVICES INC.
1525 South Sixth Street
Springfield, Illinois 62703

Specifications for Construction

April 11, 2008

BIDDING CLARIFICATIONS FOR AMEREN CONTRACT DOCUMENTS
AMEREN ENERGY RESOURCES GENERATING COMPANY
GYPSUM MANAGEMENT FACILITY AND CCB LANDFILL
PROJECT SPECIFICATIONS NO. C180-C102
ADDENDUM #2

Prepared March 24, 2008
By Hanson Professional Services, Inc.
Preparer: DBH

Hanson Professional Services is please to provide the following clarifications to outstanding questions regarding the contract documents:

1) *Please clarify again Bid Form page BF-A-5 the 146,740 cy is the amount excavated and stockpiled. In addition in that price we include 146,740 cy going back in place?*

   Answer: The Estimated Quantity of 146,740 C.Y. shown on Bid Forms A and B is our estimated TOTAL excavation needed for the Over-excavation of Soil and Sand from NE & SW Corners of Gypsum Stack Area. The excavation shall be backfilled with suitable structural backfill after the unsuitable sand lens material has been removed and stockpiled. Our estimate for unsuitable sand material is the 17,600 C.Y. shown in the same section of the Bid Forms.

2) *What is the status of design on slurry piping plan and details? Currently sheet C102-27 does not provide sufficient information.*

   Answer: An updated sheet will be issued with Addendum #2.

3) *Per sheet C102-05, "All under drain pipes installed under the excavation contract C180-C101 shall remain in place. Subsurface drainage piping shall be sealed with bentonite slurry in accordance with project specifications upon completion of the liner system". Please provide specifications.*

   Answer: Sealing of the subsurface drainage system is specified in Section 02141 - Surface Water Management, paragraph 3.06.

4) *Is dwg. format available with Landfill, Gypsum and Recycle Pond area merged to one drawing. We specifically need existing and proposed contours for both projects consolidated as one design and existing layer. The tins provided are for the Gypsum Pond only, would appreciate fill for Landfill if drawings can not be merged. Will Hanson be able to provide design contours for cushion dirt layer? Currently available drawings provide points only from sheet C102-11.*

   Answer: We will be issuing updated tin & dwg files for the Gypsum Stack Recycle Pond that reflects the work completed under Contract C180-C101 with Addendum #2. Tin & DWG files for the CCB Landfill will be issued later in the week, as it is currently being surveyed and verified.

5) *The granular materials for the drainage layer and seperation berm shall provide a minimum hydraulic conductivity (ASTM D2434) of 1 X 10-3. Is there a specific material anticipated for the completion of this work?*

   Answer: The granular materials required for the drainage layer and separation berm are adequately specified in the Project Specifications. The Contractor shall be responsible for determining availability and sourcing for these materials.

6) *Is a construction joint allowed in the Process Water Control Structure.*

Answer: A Bonded Construction Joint will be allowed for this structure, provided that it is constructed in accordance with article 503.09 of the Illinois Department of Transportation "Standard Specifications for Road and Bridge Construction" Adopted January 1. 2007.

7) *What if anything is required on the low water crossing on sheet 16 of the CCB Landfill?*

Answer: No special materials are required in this area, the invert of the existing spillway channel shall be maintained and crossed by the proposed haul road.

8) *Is the Coarse Aggregate for the Leachate collection pipe also the IDOT CA-7 Per Article 1004.1 of IDOT Specs.*

Answer: The Coarse Aggregate for the Leachate Collection Pipe shall be a gradation as required to provide a minimum hydraulic conductivity (ASTM D2434) of 1×10^{-3} cm/sec. We will issue a correction to the specifications with Addendum #2.

9) *Detail 7/17 for the Ultrasonic Transducer from your web site is different than your handout at the pre-bid meeting is the web site detail the one we are to provide?*

Answer: The latest detail on the web site is the latest one, however a revision to that detail will be issued with Addendum #2.

10) *Bid Form page A-3 Riprap Class B4, the unit of measure is LF, should that be TONS or S.Y.?*

Answer: The correct unit should be S.Y.

11) *In an effort to utilize local aggregate sources, can we use "Special Provision Rock" as specified by IDOT for Contracts 68206 & 68205 for the aggregate base and surface course?*

Answer: All aggregates shall be supplied as specified in Section 02315 Granular Materials.

12) *Can we substitute a butt fusion reducer in lieu of the 50% welded extrusion joints" as shown in detail 5/13?*

Answer: A butt fusion reducer would be acceptable in that location (Detail 5/13 - Plans C180-C102)

13) *Page 27, slurry piping- Is this the sluice piping from section 2640? There is no size listed on the plans. The plan shows dashed and solid lines, what do they represent. Section 2640 calls for valves in the sluice piping, are these the valves shown on sheet 27?*

Answer: A revised sheet C180-102-27 and a new sheet C180-102-28 are included in Addendum #2.

14) *The specs say all underdrain within lined areas of cell is to be grouted. Is the recycle pond lined?*

Answer: The subdrainage outfall piping beneath the recycle pond is to be grouted.

15) *We are trying to figure out what gradation of rock is required for detail 6/14 on the gypsum stack and also for detail 1/12 and 2/12 on the CCB Landfill. Section 2315 Part 2 does not have the gradation language we are used to looking at for the CCB Landfill Course Aggregate.*

Answer: The Coarse Aggregate material called out in these details is the same as is specified in Section 02315 - Part 2.01-B-2 for CCB Landfill Coarse Aggregate. A revised specification will be included in this Addendum.

BIDDING CLARIFICATIONS FOR AMEREN CONTRACT DOCUMENTS
AMEREN ENERGY RESOURCES GENERATING COMPANY
GYPSUM MANAGEMENT FACILITY AND CCB LANDFILL
PROJECT SPECIFICATIONS NO. C180-C102

ADDENDUM #3

Prepared March 27, 2008
By Hanson Professional Services, Inc.
Preparer: DBH

Hanson Professional Services is pleased to provide the following clarifications to outstanding questions regarding the contract documents:

Question: One GCL manufacturer produces a double nonwoven, needlepunch reinforced geosynthetic clay liner that will meet or exceed the project requirements and the GRI-GCL-3 specification, with only two clarifications:

Footnote #2 in Table 1 of the GRI-GCL-3 specification states that for nonwoven reinforced GCLs, one of the Geotextiles must contain a scrim component of mass > 2.9 oz/yd2 for dimensional stability. An exception to the scrim reinforcement requirement has been requested.

Table 1 of the GRI-GCL-3 specification states that nonwoven reinforced GCLs should be manufactured with minimum 5.9 and 5.8 oz/yd2 Geotextiles. Our product is manufactured with minimum 6.0 and 2.7 oz/yd2 nonwoven Geotextiles and it will still meet the peel and tensile strength requirements in the specifications. Accordingly, an exception to the minimum geotextile weights has been requested.

Answer: *We will allow these exceptions, provided that all of the other requirements of the specifications are met by the GCL being submitted for bid.*

Question: Aggregate suppliers cannot perform the testing required to qualify that their materials will meet the project specifications in the time allotted for bidding. What can the aggregate suppliers do to provide a reasonable quote for the aggregate materials within the Gypsum Stack and CCB Landfill footprints.

Answer: Adequate bidding time was allotted for relatively quick permeability and gradation testing, and these test results should be available. However, based on the time allotted for bidding and the turn-around time needed to complete the longer tests necessary to certify project specification compliance, we will allow aggregate suppliers to certify a unit price for these materials based on the contingency that they will meet the following required specifications:

ASTM D3042-03 Standard Test Method for Insoluble Residue in Carbonate Aggregates (15% loss Max.)

Na_2SO_4 Soundness 5 Cycle, Illinois Modified AASHTO T 104 (15% Loss Max.)
ASTM C 1260 Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method) (Less than 0.10% internal expansions at 16 days after casting)

Additional question related to the overexcavation and replacement of materials in the NE and SW corners of the gypsum stack area:
Please clarify "The excavation shall be backfilled with suitable structural backfill". How and where will that backfill be paid for?

Answer: Please note that the bid form section for additional items to be paid on a unit cost or time and material basis provides estimated quantities only. The bid form allows for separate pricing for unsuitable sand soils that will need to be excavated from the NE and SW corners of the gypsum stack areas and transported to stockpiles (estimated at 17,600 cy) and for excavation and recompaction of soil material suitable for reuse (estimated at 146,740 cy). Based on these ESTIMATED volumes, the total ESTIMATED volume to be over-excavated from the NE and SW corners of the gypsum stack excavation is 164,340 cy (17,600 cy of which is estimated to be unsuitable sand that needs to be transported out of the excavation and stockpiled). Note again that we will be removing an unknown amount of sand from the excavation. Shrinkage as a result of the compaction process may also be a factor. Any shortage of suitable backfill shall be obtained from the subsoil stockpiles. Backfilling the excavation with Structural Fill to be obtained from stockpiles will be paid for at Time and Material or by the unit cost included on the bid form for "Backfill w/Structural Fill from Stockpile."

Question: Can the test pad for the clay liner be constructed outside the footprint of the cell?

Answer: The test soil liner must be constructed within the footprint of the cell.

What end treatment is to be applied to the upstream ends of the 6" and 12" perforated laterals shown on Sheet C180-C110-09 and detailed on sheet C180-C110-12 for the CCB Landfill?

Answer: Cleanouts with threaded caps shall be installed at the termination points for the 6" and 12" perforated laterals. Revised drawing #C180-C110-09 is attached indicating this detail.

Question: The new details for vaults on the slurry lines show 8" RFP being bolted into 8" Valves, then a 10" HDPE pipes. The bolt patterns on the 10" pipe and 8" valve are not compatible. Please clarify.

Answer: An FRP spindle needs to be provided to go from the 8" valve to the 10" HDPE pipe. Revised drawing #C180-C102-28 is attached to show this configuration.

FINAL NOTE: THE BIDS ARE DUE MONDAY, 3/31/08. NO MORE QUESTIONS WILL BE ACCEPTED PRIOR TO BIDDING. PLEASE INCLUDE ANY ADDITIONAL ASSUMPTIONS AND CLARIFICATIONS WITH YOUR BIDS.

GYPSUM STACK AND RECYCLE POND AND CCB LANDFILL CONSTRUCTION
GYPSUM MANAGEMENT FACILITY AND CCB LANDFILL
DUCK CREEK POWER STATION
FULTON COUNTY, ILLINOIS

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Appendix 1 – Field Change Order Process

Appendix 2 – Construction Quality Assurance (CQA) Plan

Appendix 3 – Geotechnical Data

~~Appendix 4 – Construction Field Office~~

PART 1. GENERAL

1.0 INTRODUCTION

A. Gypsum Management Facility

The intent of this contract is to provide the services of a General Contractor to construct Gypsum Management Facility, consisting of a lined Gypsum Stack and Recycle Pond for the disposal of gypsum at Ameren Energy Resources Generating Company (AERG) Duck Creek Power Station's Gypsum Management Facility located near Canton, Illinois.

Excavation to approximately 5.4 ft. above foundation grade, partial construction of Recycle Pond perimeter berm, installation of a temporary stormwater outlet ditch, a temporary subsurface drainage system and the Recycle Pond pump station pad with access road were completed under a prior contract as outlined in the plans. Excavated material was stockpiled north and east of the excavation for use in this contract.

B. CCB Landfill

The intent of this contract is to provide the services of a General Contractor to construct a CCB Landfill, consisting a base 3 ft. thick Compacted Clay Liner, Geosynthetic Clay Liner (GCL), High Density Polyethylene (HDPE) Geomembrane, Geotextile Cushion Fabric and Leachate Collection System for the permanent disposal of coal combustion by-products (CCB) at the Ameren Energy Resources Generating Company (AERG) Duck Creek Power Station CCB Landfill located near Canton, Illinois.

Excavation to approximately 6 in. above foundation grade, construction of perimeter berm, installation of a permanent berm ditch outlet structure and a temporary subsurface drainage system were completed under prior contract. Excavated material was visually segregated during excavation and stockpiled east of the excavation for use in this contract.

2.0 DESCRIPTION OF WORK

2.01 Gypsum Management Facility

The scope of work shall consist of furnishing all materials, equipment, tools, labor, and incidentals necessary to perform the work as described below:

A. Gypsum Stack - Foundation Preparation

1. Excavate areas indicated on the plans to remove areas of underground sand seams and backfill with structural soil backfill.
2. Locally excavate to the foundation grade as indicated on the plans and finish grade the portion of the cell to be covered by Compacted Clay Liner.
3. Proof roll to identify unsuitable foundation soil materials.
4. As directed by the Owner's Representative, Excavate and replace unsuitable foundation materials consisting of unknown pockets of peat, sand, muck or other unsuitable materials with suitable structural backfill. Installation of geotextile fabric for ground stabilization, as deemed necessary by the owner's Representative, will be installed on a time and materials basis.

B. Gypsum Stack - Compacted Clay Liner

1. Construct Test Soil Liner, as outlined Section 5.0 of the project Construction Quality Assurance (CQA) Plan, included in Appendix 2, to demonstrate construction procedures and equipment that will produce the specified permeability.
2. Obtain Foundation Grade Verification by Amerens Field Surveyor prior to constructing areas requiring Compacted Clay Liner, as outlined in Section 6.2.1a of the project Construction Quality Assurance Plan.
3. Install Compacted Clay Liner in accordance with the project specifications using the compactive means demonstrated by the Test Soil Liner.

C. Gypsum Stack - Excavation and Backfill of Anchor Trench

1. Excavate anchor trench.
2. Place initial trench backfill after installation of Geosynthetic Clay Liner (GCL) and High Density Polyethylene (HDPE) Geomembrane by geosynthetic liner Contractor.
3. Complete trench backfill after installation of separation geotextile.

D. Gypsum Stack - Geosynthetic Clay Liner (GCL)

1. The Geosynthetics Installer's Representative shall jointly inspect the surface of the Compacted Clay Liner with the Owner's Representative

before commencing daily work. The Geosynthetics Installer's Representative shall continuously observe the condition of the Compacted Clay Liner during GCL placement and submit a Certificate of Acceptance in the daily report that no GCL was placed over visibly defective Compacted Clay Liner.

2. Furnish and install GCL on accepted Compacted Clay Liner. Provide reinforced GCL on the sideslopes and bottom of Gypsum Stack. Protect GCL per the Manufacturer's recommendations until it is covered by HDPE Geomembrane

E. Gypsum Stack High Density Polyethylene (HDPE) Geomembrane (Lower Layer)

1. The Geosynthetics Installer's Representative shall jointly inspect the GCL with the Owner's Representative: continuously observe the condition of the GCL during HDPE Geomembrane placement; and submit a Certificate of Acceptance in the daily report that no HDPE Geomembrane was placed over visibly defective GCL.
2. Furnish and install HDPE geomemebrane on accepted GCL. Provide textured HDPE liner on the side slopes and bottom of the Gypsum Stack. Protect HDPE liner until it is covered by geotextile cushion fabric.
3. The Geosynthetics Installer shall perform non-destructive seam testing at frequencies specified in Section 6.3.2 of the Construction Quality Assurance Plan. Provide samples for destructive seam testing by the Owner's testing consultant, and repair sampled locations.

F. Gypsum Stack - Geotextile Cushion Fabric

1. The Geosynthetics Installer's Representative shall jointly inspect the HDPE Geomembrane with the Owner's Representative: continuously observe the condition of the HDPE Geomembrane during placement of the geotextile cushion fabric; and submit a Certificate of Acceptance in the daily report that no geotextile fabric was placed over visibly defective HDPE Geomembrane.
2. Furnish and install geotextile cushion on accepted Geomembrane.
3. Furnish and install drainage layer material for ballast.

G. Gypsum Stack - HDPE Leachate Collection Piping

1. Furnish and install geotextile fabric for coarse aggregate envelope.
2. Furnish and install initial lift of coarse agregate.
3. Furnish and install leachate collection piping as shown on the plans.
4. Furnish and install coarse aggregate along the pipe to provide lateral stability.
5. The piping installer shall obtain concurrance with the Owner's Representative that the piping installation meets the intended design

requirements before placing remainder of coarse aggregate and geotextile envelope.

H. Gypsum Stack - Drainage Layer

1. Furnish and install granular material for drainage layer in accordance with the project plans and specifications.
2. Obtain verification by the Owner's Field Surveyor that the minimum required Drainage Layer thickness has been achieved.

I. Gypsum Stack - Separation Fabric

1. The Geosynthetics Installer's Representative shall jointly inspect the Drainage Layer with the Owner's Representative; continuously observing the condition of the surface of the Drainage Layer during placement of the Geotextile Separation Fabric; and submit a Certificate of Acceptance in the daily report that no geotextile fabric was placed over visibly defective Drainage Layer surface.
2. Furnish and install geotextile fabric on accepted Drainage Layer and anchor geotextile fabric in anchor trench.

J. Gypsum Stack - Cushion Dirt

1. Place Cushion Dirt to facilitate installation of the second HDPE Geomembrane. The Contractor shall protect the underlaying Separation Fabric per the project specifications.
2. Obtain verification by the Owner's Field Surveyor that the minimum required Cushion Dirt thickness has been achieved.

K. Gypsum Stack High Density Polyethylene (HDPE) Geomembrane (Upper Layer)

1. The Geosynthetics Installer's Representative shall jointly inspect the surface of the Cushion Dirt with the Owner's Representative before commencing daily work. The Geosynthetics Installer's Representative shall continuously observe the condition of the Cushion Dirt during HDPE Geomembrane placement and submit a Certificate of Acceptance in the daily report that no HDPE Geomembrane was placed over visibly defective Cushion Dirt.
2. Furnish and install HDPE Geomembrane on approved Cushion Dirt. Provide textured HDPE Geomembrane on cell side slopes and bottom of cell. Protect HDPE Geomembrane until it is initially covered by gypsum waste material.
3. The Geosynthetics Installer shall perform non-destructive seam testing at frequencies specified in Section 6.3.2 of the Construction Quality Assurance Plan. Provide samples for destructive seam testing by the Owner's testing consultant, and repair sampled locations.

L. Gypsum Stack - HDPE Process Water Recovery System

1. Furnish and install HDPE Process Water Collection System, as shown on the plans.
2. The piping installer shall obtain concurrance with the Owner's Representative that the piping installation meets the intended design requirements before covering the piping with aggregate and filter fabric as shown on the plan.

M. Gypsum Stack - Miscellaneous Earthwork

1. Provide access ramp to perimeter berm of cell.

N. Gypsum Sluice Piping

1. Connect to existing piping and install new Gypsum Sluice Piping, fittings and valves for the Gypsum Stack.

O. Gypsum Stack - Subdrainage System

1. Abandon existing subdrainage system, and remove vent pipes, vertical drains and inlet structures as specified in Section 02140 – Surface Water Management.

P. Gypsum Stack - Erosion Control

2. Maintain previously installed temporary erosion control systems during the life of the contract.
3. Seed and mulch all exposed soil surfaces.

Q. Recycle Pond - Earthwork

1. Strip topsoil from areas of the proposed excavation and proposed compacted berms.
2. Excavate the recycle pond to the lines and grades shown on the plans.
3. Proof roll stripped/excavated areas to expose unsuitable materials.
4. Remove and replace unsuitable foundation material and/or install geotextile fabric for ground stabilization as directed by the Owner's Representative. Work required to correct unsuitable foundation material will be paid by the Owner on a Time and Materials Basis.
5. Construct Recycle Pond Embankments, Process Water Transfer Channel and Emergency Spillway to the line and grades shown on the plans.

R. Recycle Pond – Toe Drain

1. Furnish and install aggregate materials and filter fabric at the outside toe of the recycle pond dam as shown on the plans.

S. Recycle Pond - Excavation and Backfill of Anchor Trench

1. Excavate anchor trench.
2. Backfill trench after installation of High Density Polyethylene (HDPE) Geomembrane by Geosynthetics Installer.

T. Recycle Pond - HDPE Geomembrane

1. The Geosynthetics Installer's Representative shall jointly inspect the surface of the recycle pond foundation soils with the Owner's Representative before commencing daily work. The Geosynthetics Installer's Representative shall continuously observe the condition of the foundation soils during HDPE Geomembrance placement and submit a Certificate of Acceptance in the daily report that no HDPE Geomembrane was placed over visibly defective foundation soil.
2. Furnish and install HDPE Geomembrane on approved foundation soil. Provide textured HDPE Geomembrane on recycle pond side slopes and bottom. Anchor in the excavated anchor trench and backfill in accordance with the project specifications.
3. The Geosynthetics Installer shall perform non-destructive seam testing at frequencies specified in Section 6.3.2 of the Construction Quality Assurance Plan. Provide samples for destructive seam testing by the Owner's testing consultant, and repair sampled locations.

U. Recycle Pond - Water Transfer Structures

1. Furnish, fabricate, and install all materials and aggregate necessary to construct the Process Water Control Structure, Process Water Transfer Channel, Recycle Pond Emergency Spillway/Riprap Stilling Basin, and Side Slope Decant Pipe/Riprap Basin as shown on the plans.

~~V. Construction Field Office~~

~~The Contractor shall furnish and install a Construction Field Office for the Owner's use in accordance with the Specifications of Appendix 4 of these Specifications.~~

2.02 CCB Landfill

A. Foundation Preparation:

1. Remove top 6" of soil from the existing excavation and stockpile in an area designated on the Plans.
2. Finish grade the portion of the cell to be covered by Compacted Clay Liner.
3. Proof roll to expose any unsuitable foundation materials..
4. Remove and replace unsuitable foundation material and/or install geotextile fabric for ground stabilization as directed by the Owner's Representative.

B. Compacted Clay Liner

1. Construct Test Soil Liner, as outlined Section 5.0 of the project Construction Quality Assurance (CQA) Plan, included in Appendix 2, to demonstrate construction procedures and equipment that will produce the specified permeability.
2. Obtain Foundation Grade Verification by Amerens Field Surveyor prior to constructing areas requiring Compacted Clay Liner, as outlined in Section 6.2.1a of the project Construction Quality Assurance Plan.
3. Install Compacted Clay Liner in accordance with the project specifications using the compactive means demonstrated by the Test Soil Liner.

C. Excavation and Backfill of Anchor Trench:

1. Excavate anchor trench.
2. Place initial trench backfill after installation of GCL and HDPE geomembrane by geosynthetic liner contractor.
3. Complete trench backfill after installation of separation geotextile.

D. Geosynthetic Clay Liner (GCL)

1. The Geosynthetics Installer's Representative shall jointly inspect the surface of the Compacted Clay Liner with the Owner's Representative before commencing daily work. The Geosynthetics Installer's Representative shall continuously observe the condition of the Compacted Clay Liner during GCL placement and submit a Certificate of Acceptance in the daily report that no GCL was placed over visibly defective Compacted Clay Liner.
2. Furnish and install GCL on accepted Compacted Clay Liner. Provide re-inforced GCL on the sideslopes and bottom of the cell. Protect GCL per the Manufacturer's recommendations until it is covered by HDPE Geomembrane

E. High Density Polyethylene (HDPE) Geomembrane (Lower Layer)

1. The Geosynthetics Installer's Representative shall jointly inspect the GCL with the Owner's Representative; continuously observe the condition of the GCL during HDPE Geomembrane placement; and submit a Certificate of Acceptance in the daily report that no HDPE Geomembrane was placed over visibly defective GCL.
2. Furnish and install HDPE Geomemebrane on accepted GCL. Provide textured HDPE Geomembrane on cell side slopes and smooth HDPE Geomembrane on bottom of the cell. Protect HDPE liner until it is covered by geotextile cushion fabric.
3. The Geosynthetics Installer shall perform non-destructive seam testing at frequencies specified in Section 6.3.2 of the Construction Quality Assurance Plan. Provide samples for destructive seam testing by the Owner's testing consultant, and repair sampled locations.

F. Geotextile Cushion Fabric:

1. The Geosynthetics Installer's Representative shall jointly inspect the HDPE Geomembrane with the Owner's Representative; continuously observe the condition of the HDPE Geomembrane during placement of the geotextile cushion fabric; and submit a Certificate of Acceptance in the daily report that no geotextile fabric was placed over visibly defective HDPE Geomembrane.
2. Install geotextile cushion on accepted Geomembrane.
3. Install drainage layer material for ballast.

G. HDPE Leachate Collection Piping:

1. Place geotextile fabric for coarse aggregate envelope.
2. Place initial lift of Coarse Aggregate Bedding.
3. Furnish and install HDPE Leachate Collection Piping on Coarse Aggregate bedding.
4. Place coarse aggregate along the pipe to provide lateral stability.
5. The piping installer shall obtain concurrance with the Owner's Representative that the piping installation meets the intended design requirements before covering the piping with remainder of coarse aggregate and geotextile envelope as shown on the plans.

H. Drainage Layer and Separation Berm:

1. Place granular material for separation berm and drainage layer.

I. Separation Fabric:

1. Install geotextile fabric on accepted drainage layer and anchor geotextile fabric in anchor trench.

J. Haul Road

s

1. Funish materials and construct Haul Road to the top of the CCB Landfill.

K. Miscellaneous Earthwork:

1. Provide construction access ramp to bottom of cell.
2. Place general fill to form in-board side of berm ditch.

L. Construct and maintain temporary erosion control systems during the life of the contract. Remove and dispose of temporary erosion control items when no longer required. Seed and mulch all remaining disturbed soil surfaces.

3.0 OWNER AND MANUFACTURER'S DRAWINGS

3.1 Provided By Ameren Energy Resources Generating

A. Hard-Copy Drawings

The following drawings are intended to indicate the scope of the work to be done and details necessary for the installation of items set forth in this specification, and are part of this specification. These drawings in general are to scale, but dimensions shall always be followed and drawings are not to be scaled. In case of errors or discrepancies, the Owner's Representative shall be consulted for the adjustment of all complications arising therefrom. The Owner's Representative's decisions shall be final.

AERG DRAWING NO.	SHEET TITLE
C180-C102-01	Title & Index
C180-C102-02	General Notes
C180-C102-03	Site Plan
C180-C102-04	Existing Site Conditions
C180-C102-04A	Existing Subsurface Drainage Profiles
C180-C102-05	Existing Subsurface & Vertical Drain Details
C180-C102-06	Existing Subsurface Drainage Details
C180-C102-07	Existing Grading Plan
C180-C102-08	Gypsum Stack-Foundation Grade
C180-C102-09	Gypsum Stack-Top of Clay Layer
C180-C102-10	Gypsum Stack- Leak Detection/Leachate Collection

AERG DRAWING NO.	SHEET TITLE
	Recovery System (LD/LCRS) Drainage Layer Grade
C180-C102-11	Process Water Recovery System (PWRS) - Ring Drain System Cushion Dirt Layer Grade
C180-C102-12	PWRS-Ring Drain Details
C180-C102-13	PWRS-Ring Drain Details
C180-C102-14	LD/LCRS Sections & Details
C180-C102-15	Recycle Pond Plan
C180-C102-16	Recycle Pond Details
C180-C102-17	Recycle Pond Details
C180-C102-18	Access Road and Pump Station Site Plan
C180-C102-19	Access Road Vertical Alignments
C180-C102-20	Erosion Control Plan
C180-C102-21	Erosion Control Details
C180-C102-22	Groundwater Monitoring & Boring Plan
C180-C102-23	Geological Cross Sections
C180-C102-24	Geological Cross Sections
C180-C102-25	Geological Cross Sections
C180-C102-26	Geological Cross Sections

AERG DRAWING NO.	SHEET TITLE
C180-C110-01	Title and Index
C180-C110-02	General Notes
C180-C110-03	Site Plan
C180-C110-04	Foundation Grade Plan
C180-C110-05	Foundation Grade Control Data
C180-C110-06	Base Grade Plan
C180-C110-07	Base Grade Control Data
C180-C110-08	Geomembrane Panel Layout
C180-C110-09	Drainage Layer Grade Plan & Leachate Collection Piping
C180-C110-10	Drainage Grade Control Data
C180-C110-11	Typical Sections and Details
C180-C110-12	Leachate Collection Details
C180-C110-13	Typical Cross Sections
C180-C110-14	Separation Berm Details
C180-C110-15	Exist. Sub-Drain Plan & Details
C180-C110-16	~~Haul Road / Construction Water Access Road Plan~~ ***Landfill Haul Road***
~~C180-C110-17~~	~~Construction Water Access Road~~
C180-C110-17	Boring Well and Section Locations

AERG DRAWING NO.	SHEET TITLE
C180-C110-18	Geologic Cross Sections A and B
C180-C110-19	Geologic Cross Sections C, D, and E
C180-C110-20	Geologic Cross Sections F to K

B. Electronic Files

The following electronic files are provided solely for the convenience of the bidder and/or Contractor and are subject to the terms and conditions stipulated in the Disclaimer text included with the electronic files.

1. Drawings listed above in PDF format.
2. TIN files of the existing and proposed ground surfaces.
3. Bid Forms.
4. Disclaimer text.

In the event of a conflict between the hard-copy documents and the electronic files, the hard-copy documents shall govern.

3.2 Provided by the Contractor

The Contractor shall submit to the Owner's Representative, with such promptness as to cause no delay in the performance of the work, four copies of shop drawings, product data sheets, etc., as required by these specifications. No purchasing, fabrication, erection, processing, or shipping of the aforementioned materials may begin until the required documentation has been reviewed by the Owner.

Three copies of data required to be submitted to the Owner's Representative shall be forwarded to each of the following:

Ameren Energy Resources Generating
Dave Boyce
Duck Creek Power Station
17751 North CILCO Road
Canton, Illinois 61520

Hanson Professional Services Inc.
Steven Bishoff
1525 South Sixth Street
Springfield, Illinois 62703-2886

Data sheets and shop drawings shall be reviewed and returned to the Contractor within ten (10) working days after receipt. Approval is for general design features only and will not relieve the Contractor of responsibility for proper quantities, adequacy of details, and

coordination with other trades. Deviation from Contract Documents are not approved unless specifically requested in writing by the Contractor and approved in writing by the Owner.

Should field changes be required, such changes shall be promptly documented by the Contractor and submitted to the Owner in the form of as-built drawings. The field change order process is included in Appendix 1.

4.0 MATERIALS AND EQUIPMENT SUPPLIED BY THE OWNER

The materials and equipment that are to be furnished by the Owner are listed in the schedule below:

ITEM	SHIPPING DATE	LOCATION
~~Drainage Layer Material (Gypsum Stack & CCB Landfill)~~	~~Prior to Start of Construction~~	~~Stockpile~~
~~Coarse Aggregate Encasement for Ring Drain Piping (IDOT CA-7) (Gypsum Stack)~~	~~Prior to Start of Construction~~	~~Stockpile~~
~~Filter Sand for Protection of Ring Drain Piping (IDOT FA-1) (Gypsum Stack)~~	~~Prior to Start of Construction~~	~~Stockpile~~
~~Coarse Aggregate Coarse Encasement For Leachate Collection Piping (CCB Landfill)~~	~~Prior to Start of Construction~~	~~Stockpile~~

Note: Per Addendum #1, none of the above listed aggregates will be supplied by the owner

5.0 MATERIALS AND EQUIPMENT FURNISHED BY THE CONTRACTOR

All materials, equipment, tools, and any incidental items necessary to complete each portion of the work described herein and/or shown on the drawings shall be furnished by the Contractor.

6.0 UTILITIES, FACILITIES, AND MISCELLANEOUS

The following utilities, facilities, etc., shall be provided as indicated.

	Item	Provided By
A.	Telephone Service for Use of Construction Forces	Contractor
B.	Sanitary Facilities	Contractor
C.	Drinking Water	Contractor
D.	Construction Water	Contractor
E.	Electric Service for Contractor's Use	Contractor
F.	Construction Office and Storage Facilities for Contractor's Use	Contractor
G.	Construction of Gravel Haul Roads and Parking Area for Construction Forces	Contractor

Submit with the bid documents a general layout of temporary facilities required for the Contractor's operations, such as haul roads, parking areas, temporary drainage facilities, Contractor's construction field office and storage facilities, electric service, telephone service, staging and laydown areas, etc.

7.0 SCHEDULE

The Contractor shall be required to furnish the Owner's Representative with a complete schedule of the Work to be performed under this contract broken down by major activity.

The schedule shall include the Contractor's estimate of man-days required for each activity, and shall show precedent relationships between activities. The schedule shall be included as part of the bid package presented by the Contractor. The schedule shall comply with the dates and guidelines listed below:

A. The required start date of this contract is upon receipt of Purchase Order. The Purchase Order is expected to be issued within two (2) weeks of the bid due date.

B. The required finish date of this for the Gypsum Management Facility Contract is September 30, 2008. The required finish date for the CCB Landfill Contract is December 31, 2008 for the Scope of Work incuded in Bid Forms A & C.

C. The level of detail in each schedule shall be sufficient to permit the Owner to monitor the Contractor's performance relative to the specified guidelines. The required level of detail will be discussed at the pre-bid meeting.

D. The Contractor shall submit a daily construction report and shall furnish schedule status reports at weekly progress meetings until the work is completed. The schedule status reports shall indicate by activity the scheduled percent of completion as shown on the original schedule, the actual percent completion as of the date of the report, and the number of man-days expended on the project to date.

If at any time during this Contract, when the Contractor's actual progress, in the opinion of the Owner, is such that the completion dates of the work will not be met, the Contractor shall participate in a re-evaluation of the remaining work.

If, as a result of this re-evaluation of the remaining work, it is determined by the Owner that the completion date will not be met, the Owner retains the right to direct the Contractor to accelerate the construction program. It shall be the responsibility of the Contractor to initiate and comply with such corrective action as required or directed.

At the time of the award of this contract, scheduling requirements will be discussed in detail by all interested parties.

8.0 CONSTRUCTION QUALITY CONTROL ASSURANCE

A. Construction Quality Assurance Plan

A Construction Quality Assurance (CQA) Plan has been developed for this project to ensure compliance with the all applicable permit requirements. A copy of this plan is included in Appendix 2. The testing requirements and frequency of this plan will govern in instances which there may be discrepancies between the CQA Plan and these specifications.

B. Testing and Inspections:

1. The Contractor is responsible for construction quality control testing, sampling, and inspections to ensure that the materials and workmanship comply with the plans and specifications. The Contractor shall submit results of construction quality control testing. The Contractor shall visually inspect underlying surfaces on a continuous basis immediately ahead of placement of geosynthetics and geotextile and shall certify in the daily report that no material was placed over visibly defective substrate.
2. The Contractor is responsible for non-destructive testing of all Geomembrane seams and for providing samples for prequalification material testing and destructive seam testing as directed by the Owner's

Representative. The minimum sampling frequencies are specified in Appendix 2.

3. Except as specified above, Construction Quality Assurance (CQA) testing, sampling, and inspections to verify compliance with the plans and specifications are the responsibility of the Owner. The CQA sampling and testing requirements are summarized in Appendix 2. The Contractor shall coordinate and cooperate with the Owner's materials testing consultant to provide samples and accommodate testing activities at no additional cost to the Owner.

C. Construction Surveying

Construction surveying for layout and grading control shall be the responsibility of the Contractor. Finished grades will be surveyed by the Owner's surveyor to verify that the finished grade is within 0.1 ft. of plan grade.

D. CQA Surveys to certify material thickness, leachate piping and ditch grades are the responsibility of the Owner. CQA Surveying requirements are summarized in Appendix 2.

9.0 COORDINATION WITH OTHERS

This Contractor will work in close harmony with other Contractors or AERG personnel who may be employed at this site. In the event of differences of opinion regarding scheduling of work, the decision of the Owner will be final and binding.

The following construction activities are anticipated within the landfill facility boundary during this contract:

A. Loading and Hauling of coal combustion by-product to the site by AERG personnel or Contractor.

B. Loading and Hauling of water for dust contol operations on AERG property.

C. Loading and hauling stockpiled excavated material from the stockpile south of East McKinley Road by Fulton County Highway Department Contractor and by Ameren personnel or contractor.

D. Monitoring, removing, and disposing of leachate by Ameren's CCB disposal facility operator.

10.0 SAFETY AND SITE SECURITY

The Contractor will comply with safety and security requirements stipulated in the General Conditions and Supplemental General Conditions.

A. Although the Ameren Energy Resources Generating property is generally fenced and patrolled by Ameren Energy Resources Generating security, the site should not be considered secure.

   1. A Security Check-In Station will be provided by AERG for the duration of the construction project at the entrance on McKinley Road.

B. Contractor personnel will be required to attend a 2-hour site-specific safety orientation conducted by the Owner.

C. Contractor personnel will be required to submit to a ten (10) panel drug test to be performed and provided by AERG.

D. A copy of the Contractor's Field Construction Safety Program shall be submitted with the Contractor's bid package.

E. The Contractor shall have a designated Safety Supervisor on site whenever construction work is being performed.

11.0 DUST CONTROL

The Contractor shall be responsible for controlling dust and air-borne dirt generated by construction activities. Dust shall be controlled by applying water to exposed surfaces, particularly surfaces on which construction vehicles travel. Water from the Duck Creek Reservoir is unsuitable. A pond north and east of the proposed CCB Landfill is designated at the only water source available for use by the Contractor.

No chemical dust suppressants shall be permitted unless approved in writing by the Owner's Representative. Dust control measures shall be readily available for implementation whenever the Contractor or the Owner's Representative deems that that dust control is needed. The cost of dust control shall be included in the contract lump sum price.

PART 2. PRODUCTS

No products used.

PART 3. EXECUTION

1.0 The Contractor shall be responsible for inspecting the site to note any and all conditions that may affect the work under the contract. The Contractor shall satisfy himself as to the nature, extent and location of the work; the configuration of the ground; the equipment and facilities needed for construction; the general and local conditions of the area; and all other factors and conditions which can, in any way, affect the work under the contract. Any failure by the Contractor to do so will not relieve him from responsibility for successfully performing the work without additional expense to the Owner.

2.0 The Contractor is specifically advised of the presence of overhead power lines that traverse the project work area.

END OF SECTION 01010

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PART 1. GENERAL

1.01 DESCRIPTION

A. This section pertains to the construction and maintenance of existing and proposed temporary erosion control systems to control erosion and sediment damage to adjacent properties and water resources.

1.02 RELATED SECTIONS

The following sections contain items which are related to the work in this section:

02936 - Topsoil, Seeding, and Mulching.

1.03 REFERENCES

The following reference, or cited portions thereof, governs the work:

Illinois Department of Transportation (IDOT): Standard Specifications for Road and Bridge Construction, adopted January 1, 2007.

1.04 SUBMITTALS

A. Submittals shall follow the provisions of Section 01010.

B. Preconstruction Submittals: A storm water best management practices (BMP) plan shall be submitted that includes the following items:

1. Inspection and record-keeping procedures; and
2. Maintenance procedures for erosion controls.

PART 2. PRODUCTS

2.01 EROSION CONTROL SYSTEMS

Materials for erosion control systems shall be in accordance with Article 280.02 of the IDOT Standard Specifications.

PART 3. EXECUTION

3.01 EXAMINATION

The site shall be examined to determine the condition existing temporary erosion controls systems installed under a prior contract and the extent of new work required.

3.02 PRECONSTRUCTION JOBSITE INSPECTION

A. The person who shall be at the jobsite during construction and who shall be responsible for insuring that erosion control work is completed in a timely manner shall be identified at the preconstruction meeting.

B. A jobsite inspection shall be conducted with the Owner's Representative to review and designate the locations and types of erosion protection to be placed. The inspection shall be scheduled at the preconstruction conference and carried out on the job site before beginning any work that will disturb existing drainage or potentially create erodible conditions.

3.03 CONSTRUCTION

A. Temporary erosion control systems shall be constructed in accordance with IDOT Standard 280001 and Article 280.04 of the Standard Specifications and as directed by the Owner's Representative. Erosion control devices shall be in place and approved by the Owner's Representative prior to beginning other work.

B. Incorporate permanent erosion control features into the project at the earliest practicable time to minimize the need for temporary erosion controls.

3.04 MAINTENANCE

A. Temporary erosion control systems shall be maintained in accordance with Article 280.05 of the Standard Specifications, except that measurement and payment provisions shall not apply.

B. Temporary erosion control systems for unprotected disturbed areas shall be cleaned of trapped sediment and repaired immediately prior to project close out.

C. Temporary seeding shall be applied to all disturbed areas except the gypsum stack excavation and the future fill and topsoil stockpiles.

3.05 REMOVAL AND DISPOSAL

All temporary erosion control system shall be left in place by the Contractor for future construction operations at both facilities.

END OF SECTION 01356

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PART 1. GENERAL

1.01 DESCRIPTION

Logs of borings and laboratory soil test data.

PART 2. PRODUCTS

No products used.

PART 3. EXECUTION

3.01 TEST BORINGS

A. Test borings were taken at the locations shown on the drawings. Copies of boring logs, along with soil test data on soil samples recovered from the borings are included in Appendix 3.

B. Data on indicated subsurface conditions are not intended as representations or warrants of continuity of such conditions between soil borings. It is expressly understood that the Owner will not be responsible for interpretations or conclusions drawn therefrom by the Contractor. Data are made available for the convenience of the Contractor.

C. Additional test borings and other exploratory operations may be made by the Contractor at no additional cost to the Owner, provided such operations are approved by the Owner's Representative.

3.02 SITE OBSERVATIONS

B. Gypsum Management Facility (Gypsum Stack & Recycle Pond)

1. The Gypsum Stack has been excavated to foundation grade on the sideslopes, and to within approximately 5.4 of foundation grade at the bottom of the cell. The remaining 5.4 feet of material will be utilized to construct the 3 foot thick clay layer. A drainage channel was cut from the southwest floor of the excavation to allow adequate surface water drainage. During the pre-bid meeting, Contractors will be given opportunity to view the excavation and resulting stockpiles, and to observe the in-situ conditions at the time of the meeting.

2. The earthwork for the recycle pond pump station pad and access road, as well as sections of the recycle pond perimeter berm have been constructed to finish grade. During the pre-bid meeting, Contractors will be given the opportunity to view the in-situ conditions at the time of the meeting.

A. CCB Landfill

1. The CCB Landfill has been excavated to within 6 in. of foundation grade. During the pre-bid meeting, Contractors will be given opportunity to view the excavation and observe the in-situ conditions near foundation grade at the time of the meeting.

END OF SECTION 02010

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PART 1. GENERAL

1.01 DESCRIPTION

This section pertains to stripping of topsoil and vegetation from areas of the site that are to be excavated.

1.02 RELATED SECTIONS

No related sections.

PART 2. PRODUCTS

No products used.

PART 3. EXECUTION

3.01 EXAMINATION

The Contractor shall examine the site to determine the extent of work required, as well as the extent of previously stripped topsoil completed under a previous contract.

3.02 SITE PREPARATION - STRIPPING

A. The Gypsum Stack and portions of the Recycle Pond grading limits have been previously stripped under a separate contract as shown on the plans. Any remaining vegetation and topsoil encountered within the Gypsum Stack and Recycle Pond grading limits required to complete the work in this contract shall be stripped. ~~Topsoil shall be kept clean and free of all foreign material, and stored in separate stockpiles from vegetation and common excavations. Stockpiles shall be located as indicated on the drawings or as directed by the Owner's Representative.~~ ***Topsoil removed by stripping shall not be stockpiled, and shall be deposited completely as described in section 3.02-C of this specification.***

B. The top 6" of the existing excavation area of the CCB Landfill-Cell 1 within the CCB Landfill shall be removed and stockpiled per Specification Section 02200 Earthwork.

C. Stripped Topsoil shall be used to fill depressions east of the Gypsum Management Facility as shown in the Plans.

3.03 DISPOSAL

A. All materials resulting from site preparation operations shall be stockpiled in the designated spoil area. Contractor shall obey all laws and regulations when disposing of the materials.

END OF SECTION 02100

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PART 1. GENERAL

1.01 DESCRIPTION OF WORK

Control of surface water caused by precipitation and abandonment of existing subsurface drainage facilities within the construction limits of the Gypsum Management CCB Landfill shall be considered as part of the work under this specification.

A. The work to be completed by the Contractor includes, but is not necessarily limited to, the following:

1. Maintenance of existing Erosion and Sedimentation Control Measures according to Section 01356; and
2. Dewatering excavations from water caused by precipitation.
3. Abandonment of the existing subdrainage systems.

B. The Contractor shall be responsible for providing all materials, equipment, labor, and services necessary for care of water and erosion control and abandonment of the existing subsurface dewatering systems at the end of the Contract.

1.02 EXISTING FACILITIES

A. Gypsum Management Facility

1. An existing ditch at the south end of the existing excavation provides gravity outlet for the excavation to 5.4 feet above the foundation grade.

2. An existing subdrainage system provides limited control of groundwater migration into the excavation. The subdrainage system outlets by gravity flow to an existing ditch approximately 0.3 mile south of the existing excavation.

B. CCB Landfill Facility

1. An existing ditch at the southeast corner of the existing excavation provides gravity outlet for the excavation to foundation grade.

2. An existing subdrainage system provides limited control of groundwater migration into the excavation. The subdrainage system outlets by gravity flow to an existing channel approximately 0.2 mile east of the existing excavation.

1.03 REQUIREMENTS

B. The General Contractor shall employ standard surface water management practices to prevent the ponding of stormwater runoff and/or erosion of existing and proposed earth surfaces, as required to complete the work.

1.04 RELATED SECTIONS

The following sections contain items which are related to the work in this section:

1. 01356 – Storm Water Pollution Prevention Measures
2. 02010 - Subsurface Investigation
3. 02200 - Earthwork

PART 2. PRODUCTS

2.01 MATERIALS

A. Materials and equipment for surface water management shall be reviewed by the Owner's Representative for compatibility with future construction and operation of the facility.

PART 3. EXECUTION

3.01 SURFACE WATER MANAGEMENT

A. The Contractor shall be responsible for providing all facilities required to divert, collect, control, and remove water caused by precipitation from all construction work areas and excavations.

B. Drainage features shall have sufficient capacity to avoid flooding of work areas.

C. Drainage features shall be so arranged and altered, as required to avoid degradation of the final excavated surface(s).

D. The Contractor shall utilize all necessary erosion and sediment control measures according to Section 01356 to avoid construction-related sedimentation of existing and proposed facilities.

3.02 WATER DISPOSAL

A. Dispose of water removed from the excavations in such a manner as:

1. Will not endanger portions of work under construction or completed.
2. Will cause no inconvenience to Owner or to others working near site.
3. Will comply with the stipulations of Section 01356.

4. Will control runoff. The Contractor shall be responsible for control of runoff in all work areas, including, but not limited to: excavations, access roads, parking areas, stockpile, laydown, and staging areas. The Contractor shall provide, operate, and maintain all ditches, basins, sumps, culverts, site grading, and pumping facilities to divert, collect, and remove all water from the work areas. All water shall be removed from the immediate work areas and shall be disposed of in accordance with Section 01356.

B. Existing site drainage features or proposed subdrainage system may be used for water disposal.

3.03 DAMAGES

A. Immediately repair damages to adjacent facilities caused by the surface water management facilities, as constructed by the Contractor.

3.04 REMOVAL OF STORMWATER MANAGEMENT SYSTEMS INSTALLED BY CONTRACTOR

A. Remove and backfill temporary sumps, ditches, trenches, etc. according to Section 02300, as required by the Owner.

3.05 CORRECTIVE ACTION

Work shall be performed as necessary for reinstatement of foundation soil and damaged structure resulting from such inadequacy or failure by Contractor to control surface water, at no additional cost to Owner.

3.06 ABANDONMENT OF EXISTING SUBDRAINAGE SYSTEMS

Concurrence shall be obtained from Owner before discontinuing operation of subdrainage system.

The General Contractor shall maintain the existing subdrainage systems during construction of the Gypsum Management and CCB Landfill Facilities.

Prior to construction of the Compacted Clay Liner at the Gypsum Management Facility, all vertical drains consisting of a geotextile fabric encased pea gravel envelope shall be removed. The pea gravel shall be stockpiled and the geotextile fabric shall be removed and disposed of in a legal manner. Subdrainage piping damaged during removal of the vertical drains shall be repaired with equal material incidental to the work. An existing drainage structure consisting of 24" diameter reinforced concrete pipes with a ditch grate shall be removed. The concrete pipes shall be disposed of in a legal manner and the ditch grate shall be salvaged per the direction of Owner's Representative

Upon completion of the construction of either facility, that facility's existing subdrainage system within the lined portion of the cell shall be abandoned as follows:

1. At each subdrainage vent pipe riser location, a mixture of high solids bentonite grout shall be pumped into the subdrainage piping to completely seal the system. The high solids bentonite grout shall be CETCO Volclay Grout or an approved equal that is NSF/ANSI Standard 60 certified. The grout shall be mixed according to the manufacturer's specifications for this application to provide a low permeability seal less than $1x10^{-7}$ cm/sec.
2. Cut the vent pipe risers 36 inches below with the ground surface. Fill the remaining vent piping with concrete as shown on the plans.
3. Remove completely the existing concrete inlet at the southeast quadrant of the gypsum stack excavation and dispose of in a legal manner. The grate will be salvaged and stored at the direction of the owner.
4. Remove completely the vent pipe protective bollards and dispose of in a legal manner.

END OF SECTION 02140

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PART 1. GENERAL

1.01 DESCRIPTION

This section pertains to excavation, fill, and backfill required for foundation preparation, construction of Compacted Clay Liners, anchor trench construction, miscellaneous site grading, berm construction.

1.02 RELATED SECTIONS

A. The following sections contain items which are related to the work in this section:

1. 01356 – Storm Water Pollution Prevention Measures
2. 02100 - Site Preparation
3. 02140 – Surface Water Management
4. 02373 – Geotextiles
3. 02936 - Topsoil, Seeding, and Mulching

1.03 REFERENCES

The following references, or cited portions thereof, govern the work:

1. Illinois Department of Transportation (IDOT): Standard Specifications for Road and Bridge Construction, adopted January 1, 2007
2. Department of Sustainable Natural Resources, Soil Survey Standard Test Method, Unified Soil Classification System: Field Method (USCS).

1.04 MEASUREMENT AND PAYMENT

A. The Contractor shall be responsible for estimating the extent of excavation and fill required to complete the work, including, but not limited to, excavation to required elevations; loading, transporting, placing, and compacting the Compacted Clay Liners; excavation and backfill of anchor trench; and miscellaneous site grading, including berm construction. The Contractor shall include the dollar amount associated with all earthwork in his Lump Sum Bid amount.

B. Removal and replacement of unsuitable foundation material (including underground sand channel materials) and subgrade stabilization measures directed by the Owner's Representative will be paid for on a time and material basis. Payment quantities will be based volume of excavation, determined from field surveys by the Owner's Field Surveyor.

1.05 EARTHWORK COMPLETED UNDER PRIOR CONTRACT

A. Gypsum Management Facility

1. The gypsum stack has been excavated to approximately 5.4 ft. above foundation grade across the bottom of the cell.

2. Excavated subsoil material was stockpiled north and east into short term and long term subsoil stockpiles as shown on the plans. Stripped Topsoil was stockpiled separately.

3. The ~~75,000 yard~~ subsoil stockpile east of the Gypsum Stack shall be completely depleted under this contract. Schedule and timing shall be determined by the Contractor.

B. CCB Landfill

1. The cell has been excavated to approximately 6 in. above foundation grade and the perimeter berm has been completed, except for an existing construction access ramp on the east side of the cell near Sta. 205+00.

2. Excavated material was stockpiled in locations east of the excavation. The intended use and location for each stockpile is shown on the plans

1.06 COORDINATION

Existing utilities or other plant facilities shall not be interrupted, except when permitted in writing by the Owner's Representative and then only after acceptable temporary services have been provided. A minimum 48-hour notice shall be provided prior to proceeding with an approved temporary interruption.

1.07 SURFACE WATER MANAGEMENT

Control of surface water caused by precipitation necessary for completion of the work under this contract according to Section 02140 is the responsibility of the Contractor and shall be included in the contract lump sum price.

1.08 SUBMITTALS

A. Materials Handling Plan.

A materials handling plan shall be submitted for construction and protection of the Compacted Clay Liner. The plan shall describe the following:

1. Processing and placement of the Compacted Clay Liner: type, model number, weight, and critical dimensions of equipment to be used for soil processing, compaction, scarification, and smooth rolling;

2. Method of protecting the Compacted Clay Liner from changes in moisture content and freezing after placement.

PART 2. PRODUCTS

2.01 MATERIALS

A. Earth Fill Material

Earth Fill Material shall consist of a mixture of clay, silt, sand, and gravel-sized particles obtained from previously constructed subsoil stockpiles. These materials can be used separately or mixed as required for best results. These materials shall be free of ice, snow, organic matter, rubbish, and debris. Coarse-grained particles shall be well dispersed to prevent the development of segregated pockets or zones with insufficient fine material to fill the interstices.

B. Compacted Clay Liners

1. Gypsum Management Facility

The Compacted Clay Liner for the Gypsum Management Facility shall be soil materials obtained from the approximately 5.4 ft. of material remaining above the foundation grade that was left in-place under the previous excavation contract. The material shall be free of ice, snow, organic matter, rubbish, and debris, and shall have a maximum clod size no greater than the length of the compactor foot for the compaction equipment proposed by the Contractor. When compacted, the material shall have a vertical hydraulic conductivity of less than 1×10^{-4} cm/sec.

2. CCB Landfill

The Compacted Clay Liner for the CCB Landfill shall be soil materials obtained from on-site excavations and materials stockpiled east of the cell. The material shall be free of ice, snow, organic matter, rubbish, and debris, and shall have a maximum clod size no greater than the length of the compactor foot for the compaction equipment proposed by the Contractor. When compacted, the material shall have a vertical hydraulic conductivity of less than 1×10^{-6} cm/sec.

C. Soil Stabilizers and Moisture Conditioning Agents

Additives to accelerate drying or to improve stability and workability of soil shall not be permitted unless approved in writing by the Owner's Representative.

2.02 EQUIPMENT

A. Compaction Equipment

1. Tamping foot rollers

Compaction equipment shall consist of tamping foot rollers which have a minimum weight of 40,000 pounds. At least one tamping foot shall be provided for each 110 square in. of drum surface. The length of each tamping foot, measured from the outside surface of the drum, shall be at least 1 in. longer than the loose lift thickness.

2. Steel-Wheeled Rollers

Equipment used to produce a smooth compacted surface shall be a smooth, non-vibratory steel wheeled roller weighing not less than 1,000 lb. per lineal ft.

B. Scarification Equipment

Discs, rotor tillers, or other equipment used to scarify the surface shall be capable of uniformly disturbing at least the upper 6 in. of surface to provide good bonding between lifts.

C. Mixing and Spreading Equipment

Discs, harrows, and motor graders or other similar equipment shall be available at the site for use in spreading, mixing, and drying Compacted Subsoil Stockpile Material.

PART 3. EXECUTION

3.01 PREPARATION

A. Control of Work

Benchmarks, monuments, and other reference points shall be maintained throughout the work area.

B. Utility Location

Before starting excavation, the location and extent of underground utilities in the work area shall be established.

3.02 EXCAVATION

A. General

Excavation consists of removal and redistribution of material encountered when establishing required grade and subgrade elevations. The Contractor shall be responsible for dewatering, protection, shoring, and disposal of excavated materials as necessary to complete the excavation.

B. Procedures

Excavation may be accomplished by any method and by use of any equipment that is suitable to the work, except that blasting will not be permitted. Based on previous construction experience at the site, it is recommended that excavation to the foundation grade be completed as far in advance of the Compacted Clay Liner placement as possible to allow the foundation surface to dry and form a "crust" capable of sustaining compactive effort.

C. Overexcavation

Overexcavation shall be performed to the lines and grades indicated on the plans. Additional overexcavation required to remove unsuitable materials as requested by the Owner's Representative shall be paid for by the Owner for at the Unit Price for Excavation. Any overexcavation or excess excavation not requested by the Owner's Representative shall be at the expense of the Contractor.

D. Disposal of Excavated Materials

Contractor shall stockpile excess excavated subsoil or topsoil materials in their corresponding stockpile for future use.

3.03 SUBGRADE PREPARATION

A. Areas to receive fill shall be proof rolled under the observation of the Owner's Representative. Soft, loose, weak, or wet materials shall be removed and replaced with compacted fill or stabilized with geotechnical fabric or geogrid as directed by the Owner's Representative and paid on a time and materials basis. Joints, fractures, and moisture seeps shall be repaired, and local sand deposits, if present at foundation grade, shall be removed and backfilled with compacted fill material as directed by the Owner's Representative.

B. The Owner's Representative may recommend additional drying time for soft, wet subgrade that has not been exposed long enough to permit "crust" formation. If approved by the Owner's Representative, the Contractor may install, at his own expense, geotechnical fabric to stabilize the wet subgrade and expedite construction.

C. Following the excavation for the Compacted Clay Liner, the CQA Officer shall direct the Owner's Field Surveyor to verify that actual depths and grades of the foundation are in accordance with the plans and specifications. Elevations shall be surveyed on a 100 ft. grid pattern for the bottom of the cell. The points surveyed for side slopes will be at the top, midpoint, and toe. In addition, all breaks in grade will be surveyed. Foundation excavation grading shall meet a control tolerance requirement of 0 ft to -0.4 ft. The measured depths and grades shall be documented on "as built" drawings furnished to the CQA Officer by the surveyor agency. The CQA Officer shall review the survey data for conformance to requirements and, if found in agreement with requirements, provide certification for the work in accordance with CQA Plan Procedures.

C. The Contractor shall not place fill until the subgrade has been examined jointly with the Owner's Representative and a certificate of approval for the subgrade has been submitted to the Owner's Representative.

3.04 STRUCTURAL FILL

A. Placement

1. Unless otherwise indicated on the plans, all Fill shall be composed of Earth Fill Material.
2. Fill materials used in embankment construction shall normally be placed in lanes parallel to the embankment axis and shall be placed in conformance with the lines, grades, and slopes as indicated on the plans. Placement of fill materials in lanes which are not parallel to the embankment will be allowed only where working room is too restricted for normal placement as determined by the Owner's Representative.
3. Fill shall be spread in approximately flat layers in such a manner as to obtain lifts of relatively uniform thickness without spaces between successively deposited loads. Segregation shall be prevented during placing and spreading. Hauling equipment shall be routed across the fill in such a way as to promote uniform compaction and to prevent the formation of ruts.
4. The maximum compacted thickness of each lift shall not exceed 8 in. where heavy compaction equipment will be used. The maximum compacted thickness shall not exceed 3 in. where power tampers or similar smaller equipment will be used. It may be necessary to reduce the thickness of lifts in order to obtain the required minimum density.
5. Where compacted Fill is to be placed against existing slopes, each lift shall be keyed into existing slope by removing existing slope material in steps as each new lift is placed.
6. The surface of the fill shall be kept reasonably smooth. The fill surface shall be sloped transverse to the axis of the embankments to allow drainage. If the compacted surface is, in the opinion of the Owner's Representative, too smooth or too dry to bond properly with the succeeding lift, it shall be roughened by scarifying, light discing, or other acceptable means, and it shall be sprinkled with water before the

succeeding lift is placed thereon. If the surface becomes rutted or uneven subsequent to compaction, it shall be flattened and leveled before placing the next lift. This extra work shall be at the Contractor's expense.

7. Fill operations shall be suspended during periods of extended wet weather. Upon resuming operations, all fill materials that are excessively wet or soft shall be reprocessed in place or removed and stockpiled for reprocessing. The removal of soft material shall be carried to such depth as is necessary to expose firm materials. Fill shall not be placed on frozen surfaces.
8. When filling operations at any section will be suspended for any period in excess of 12 hours or in wet weather, the surface of the fill shall be rolled smooth to seal it against excessive absorption of moisture and to facilitate runoff. Prior to resuming fill placement and compaction, the fill surface shall be scarified and/or disced and moisture conditioned as required.
9. The Contractor will receive no additional compensation for any removal, reprocessing, stockpiling, recompaction, wasting, or similar operation related to suspensions or conditions due to weather or other causes unless caused by the Owner.
10. Earth fill access ramps shall not be constructed within the limits of the compacted embankments without the approval of the Owner's Representative. When such ramps are approved, they shall be constructed of Compacted Clay Liner material (in-board of the perimeter berm) or compacted Fill (out-board of the perimeter berm).

B. Compaction -

1. Fill materials shall be compacted to a dry density equal to or greater than the following:

   a. The Gypsum Management Facility: 95 percent of the maximum dry density obtained from the Standard Proctor Test, ASTM D698.
   b. The CCB Landfill: 90 percent of the maximum dry density obtained from the Standard Proctor Test, ASTM D698.

   In order to insure uniform coverage and to facilitate construction inspection and control, the compaction of each layer shall proceed in a systematic, orderly, and continuous manner. Rolling shall be parallel to the embankment axis, except where there is insufficient working room for such operations.

2. The moisture content of all earth fill materials shall be as uniform as practicable throughout each lift. Fill shall be compacted at a moisture content that is no more than 2 percent below and no more than 2 percent above optimum moisture content.
3. Moisture conditioning of fill materials shall be performed by discing, harrowing, plowing, blading, or other suitable means prior to excavation. Moisture conditioning where the fill is placed shall be limited to minor adjustments prior to compaction. Addition of moisture shall be by using a

pressure spray bar mounted in front of or to one side of a water tanker so that water will not collect in the tracks of the truck.

4. Any materials that are placed but not compacted prior to drying out or becoming too wet shall be removed and replaced or reprocessed at the Contractor's expense.
5. No admixtures as drying agents or to improve the workability of the soil will be allowed.

3.05 GENERAL FILL

General Fill materials shall be placed to the specifications for Structural Fill, except it shall be compacted to a dry density equal to or greater than 92 percent of the maximum dry density obtained from the Standard Proctor Test, ASTM D698

3.06 COMPACTED CLAY LINERS

A. Sources

The Compacted Clay Liners for both the Gypsum Management Facility and the CCB Landfill shall be constructed from Compacted Clay Liner material as described in paragraph 2.01(B) above.

B. Test Soil Liner

A Test Soil Liner of the actual full scale liner shall be constructed in accordance with the following requirements:

1. Test liner will be constructed from the same soil material sources, to the same design specifications, and with similar equipment and procedures as are proposed for the full scale liner.
2. Test liner will be at least four times the width of the widest piece of equipment to be used.
3. Test liner will be no less than 100 ft long to allow equipment to reach normal operating speed before reaching a central 40-ft test area.
4. Test liner will be constructed with maximum 8-in. compacted lifts for a total liner thickness of 3 ft.
5. Test liner will be tested by the Owner's Testing Firm in accordance with the project Construction Quality Assurance (CQA) Plan, included in Appendix 2, summarized below for each of the following physical properties:

    a. Multiple two-stage Boutwell permeameter tests will be used on the test liner to determine the hydraulic conductivity. The two-stage field hydraulic conductivity test is a falling head infiltration test conducted in a cased borehole, typically 4 in. in diameter. The test is cited in the U.S. EPA Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, September 1993 (EPA/600/R-93/182).

b. Undisturbed samples (Shelby tubes) will be tested in the laboratory for hydraulic conductivity to determine if there is a statistical correlation to the field testing results.

c. Other engineering parameters including, but not limited to, particle size analysis, liquid limits, plasticity, water content, and in-place density that are needed to evaluate the full scale liner will be determined.

6. Additional test fills will be constructed for each new soil type or for each change in equipment or procedures.

C. Full Scale Liner Construction:

1. Full scale liner construction shall not be commenced until the results of the in-place compaction testing and Boutwell permeameter tests on the test liner confirm that the construction procedures and specified compaction requirements produce in-situ hydraulic conductivities as specified in Section 2.01(B) above.

2. The liner shall be constructed according to the placement and compaction requirements for general fill, except the material shall be compacted to a density of no less than 95 percent of maximum dry density as determined by the Standard Proctor Test (ASTM D 698) at the following moisture contents:

   a. Gypsum Stack Compacted Clay Liner shall be compacted at a moisture content between 100 percent and 105 percent of optimum.

   b. CCB Landfill Compacted Clay Liner shall be compacted at a moisture content determined by the "acceptable zone" criteria as outlined in the project CQA Plan.

   The same compaction procedures, such as number of passes, speed, and compaction equipment used on construction of the test liner shall be used. Grade stakes shall not be driven into the clay liner.

3. Moisture/density, hydraulic conductivity, and strength testing of the Compacted Clay Liner shall be conducted by the soil testing agency under the requirements and frequencies specified in the project CQA Plan to verify that ongoing liner placement meets the criteria developed by the Test Soil Liner.

4. The completed liner shall be smooth rolled to limit moisture loss and promote run-off of surface water. Moisture content shall be maintained within the specified range and erosion or other damage that occurs in the soil liner shall be repaired as directed by the Owner's Representative until the geosynthetic liner is placed.

5. Voids created in the Compacted Clay Liner during construction (including, but not limited to, penetrations for test samples, and other penetrations necessary for construction) shall be repaired by removing material that does not meet the requirements for Compacted Clay Liner material, backfill with Compacted Clay Liner material, granular or pelletized bentonite, or a mixture of bentonite and Compacted Clay Liner material in lifts no thicker than 2 in. and tamping each lift with a steel rod. Each lift shall be tamped a minimum of 25 times altering the location of the rod within the void for each blow. Other ruts and depressions in the surface of the lifts shall be scarified, filled, and then compacted to grade.

3.07 CUSHION DIRT (Gypsum Management Facility Only)

Cushion Dirt to be placed beneath the upper High Density Polyethylene (HDPE) Geomembrane is to be placed to the specifications for General Fill in Section 3.04 above, except fill materials for Cushion Dirt shall be compacted to a dry density equal to or greater than 90 percent of the maximum dry density obtained from the Standard Proctor Test, ASTM D698.

3.08 ANCHOR TRENCH CONSTRUCTION

A. Gypsum Management Facility – Gypsum Stack

1. The anchor trench shall be excavated to the depth and width shown on the anchor trench details. The front edge of the trench shall be rounded to eliminate any sharp corners that could cause excessive stress to the geosynthetic liners. Loose soil shall be removed or compacted into the floor of the trench.

2. Subsequent to Geosynthetic Clay Liner (GCL), Bottom HDPE Geomembrane and Geotextile Cushion installation, the liners shall be placed in the trench to fully cover the entire trench floor, but do not extend up the back of the trench wall. After the liner installation, the trench shall be backfilled with 1 ft. of Compacted Clay Liner material. The backfill shall be deposited and compacted according to the requirements for general fill in such a manner as to prevent damage to the GCL and liner materials.

3. Subsequent to installation of separation geotextile on top of drainage layer, it shall be verified that the fabric extends across the top of the initial 1 ft layer of trench backfill, but does not extend up the back of the trench wall. After the separation geotextile has been installed in, the trench shall be backfilled with 2 ft of Compacted Clay Liner material. The backfill shall be deposited and compacted according to the requirements for general fill in such a manner as to prevent damage to the separation geotextile.

4. Subsequent to installation of the upper HDPE Geomembrane, the liner shall be installed into the trench and extend across the top of the initial 1 ft layer of trench backfill, but not extend up the back of the trench wall. After the liner installation in the trench has been inspected jointly with the Owner's Representative, and the Geosynthetics Installer's Representative has submitted a certificate of approval that the HDPE Geomembrane was installed in the anchor trench in accordance with the plans and specifications, the Contractor may backfill the remainder of the trench to the top of the Compacted Clay Liner. Deposit and compact the backfill according to the requirements for general fill in such a manner as to prevent damage to the HDPE Geomembrane.

B. Gypsum Management Facility – Recycle Pond

1. The anchor trench shall be excavated to the depth and width shown on the anchor trench details. The front edge of the trench shall be rounded to eliminate any sharp corners that could cause excessive stress to the geosynthetic liners. Loose soil shall be removed or compacted into the floor of the trench.

2. Subsequent to HDPE Geomembrane installation, it shall be verified that the liner covers the entire trench floor, but does not extend up the back of the trench wall. After the liner installation in the trench has been inspected jointly with the Owner's Representative, and the Geosynthetics Installer's Representative has submitted a certificate of approval that the HDPE Geomembrane was installed in the anchor trench in accordance with the plans and specifications, the Contractor may backfill the remainder of the trench to the top of the Recycle Pond berm. The backfill shall be deposited and compacted according to the requirements for general fill in such a manner as to prevent damage to the liner material.

C. CCB Landfill

1. Excavate a ledge at bottom of anchor trench elevation and place and compact Compacted Clay Liner material on the ledge as shown on the anchor trench details in the plans.

2. Excavate the anchor trench to the depth and width shown on the anchor trench details. Round the front edge of the trench to eliminate any sharp corners that could cause excessive stress to the geosynthetic liners. Remove loose soil or compact it into the floor of the trench.

3. Subsequent to GCL and HDPE geomembrane installation by the geosynthetic liner contractor, verify that the liners cover the entire trench floor, but do not extend up the back of the trench wall. After the liner installation in the trench has been inspected jointly with the Owner's Representative, and the Geosynthetics Installer's Representative has submitted a certificate of approval that the HDPE Geomembrane was

installed in the anchor trench in accordance with the plans and specifications, the Contractor may backfill the remainder of the trench to the top of the Compacted Clay Liner. Deposit and compact the backfill according to the requirements for general fill in such a manner as to prevent damage to the GCL and HDPE geomembrane.

4. Subsequent to installation of separation geotextile on top of drainage layer, verify that the fabric extends across the top of the initial 1 ft layer of trench backfill, but does not extend up the back of the trench wall. After the fabric installation in the trench has been inspected and approved by the Owner's Representative, backfill the remainder of the trench to the top of the Compacted Clay Liner. Deposit and compact the backfill according to the requirements for general fill in such a manner as to prevent damage to the geotextile fabric.

3.09 TESTING

A. Construction Quality Assurance (CQA) compaction and permeability tests will be made by the Owner's Testing Consultant during the progress of the work as indicated in the Construction Quality Assurance Plan, included in Appendix 2. The Contractor shall cooperate with the Testing Consultant and allow such tests to be performed.

B. If tests indicate that an area of fill or Compacted Clay Liner does not meet the specified requirements, additional tests shall be performed to determine the extent of non-compliance. The Contractor shall moisture condition and recompact that area until a passing test result is obtained.

C. Moisture/density testing by nuclear methods will be conducted by the Owner's Testing Firm at a minimum frequency as outlined in the Construction Quality Assurance (CQA) Plan. The range of moisture content will be determined in accordance with the "acceptable zone" method which is also outlined in the Project CQA Manual. A moisture test will be considered failed if the result indicates that the moisture content does not lie within the "acceptable zone." Material that fails will be dried or wetted until satisfactory moisture content is achieved. A density test will be considered failed if the result indicates a dry density outside the "acceptable zone." The material will be compacted until a passing test is achieved.

To ensure accuracy and reproducibility of testing of the soil liner for compaction and moisture content, all density gauges shall be certified by annual calibration.

3.10 FINISH GRADING

All excavated and filled areas shall be fine graded and leveled to provide a smooth finish free of debris, foreign matter, objectionable stones, clods, lumps, pockets, or high spots, properly drained and true to indicated elevations. Finish grading shall be only near completion of work or when requested. Any portions

of the berm damaged by construction shall be restored. The berm ditch shall be finished to design grade, and the ditch side slopes shaped and trimmed to provide a uniform ditch cross section.

3.11 CONSTRUCTION TOLERANCES

A. Elevations will be surveyed at breaks in slopes and on a 100 ft. grid pattern on the base before and after liner construction to verify liner thickness and to verify that proper drainage slopes to leachate collection piping are maintained. To verify material thickness, all horizontal survey coordinates will be the same for the bottom and the top of the material that is placed. Side slope thicknesses will be verified using crest (top), midpoint, and toe documentation points. A test will be considered failed if it does not meet the minimum design requirements. To obtain the specified design thickness, additional soil material will be placed and compacted in failing areas where the as-built thickness is less than the design thickness. Surveying required for verification of final construction tolerances will be performed by the Owner's Land Surveyor.

B. The minimum specified design thickness of all Compacted Clay Liners shall be 3.00 ft.

END OF SECTION 02200

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PART 1. GENERAL

1.01 DESCRIPTION

This section pertains to the placement of riprap for erosion control.

1.02 RELATED SECTIONS

The following section contains items which are related to the work in this section:

02200 - Earthwork

1.03 REFERENCES

Specified references or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.

A. Illinois Department of Transportation (IDOT): Standard Specifications for Road and Bridge Construction, adopted January 1, 2007.

1.04 SUBMITTALS

Product Data: Provide quarry name and material type prior to delivery.

PART 2. PRODUCTS

2.01 MATERIALS

A. Stone Riprap and Bedding materials according to Article 1005.01 of the Illinois Standard Specifications for Road and Bridge Construction.

B. Filter Fabric material, where required by IDOT specifications for Stone Riprap, shall furnished according to Article 1080.03, with an AOS (Apparent Opening Size) as indicated on the plans.

C. Riprap Source shall be listed on the current IDOT Approved Aggregate Source List.

D. Gradation as indicated in the drawings. Quality shall be Class A.

PART 3. EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. Stone Riprap and Bedding shall be installed in accordance with Section 281 of the Illinois Standard Specifications for Road and Bridge Construction for the placement of Stone Riprap. Measurement and payment provisions of Section 281 shall not apply.

B. Filter Fabric for Stone Riprap shall be installed in accordance with Section 282 of the Illinois Standard Specifications for Road and Bridge Construction.

C. The Owner's Representative shall be allowed to visually inspect Riprap for compliance with specifications prior to placement.

END OF SECTION 02275

PART 1. GENERAL

1.01 DESCRIPTION

A. Gypsum Management Facility

This section pertains to the following:

1. Furnishing and placing granular drainage materials for the drainage layer and Leachate Collection System piping.
2. Furnishing and placing coarse aggregate for encasement of the Process Water Recovery System piping.
3. Furnishing and installing Filter Sand for the protection of the Process Water Recovery System piping.
4. Furnishing and installing materials for roadbed construction related to the Gypsum Management Facility access roads.
5. Recycle Pond Drain.
6. Furnishing and installing materials for roadbed construction related to maintaining McKinley Road on AERG property.
7. ***Furnishing and installing materials for roadbed construction related to the Landfill Haul Road.***

B. CCB Landfill

This section pertains to the following:

1. Placing granular material for Drainage Layer.
2. Placing granular material for Separation Berm.
3. Placing Coarse Aggregate for encasement of leachate collection piping.
4. Furnishing and installing materials for roadbed construction related to the landfill access road.

1.02 RELATED SECTIONS

The following sections contain items which are related to the work in this section:

1. 02300 - Earthwork
2. 02373 – Geotextiles
3. 02640 - Leachate Collection Piping

1.03 REFERENCES

The following references, or cited portions thereof, govern the work:

1. Illinois Department of Transportation (IDOT): Standard Specifications for Road and Bridge Construction, adopted January 1, 2007.
2. American Society for Testing and Materials (ASTM):

    a. ASTM D 75 (2003) Practice for Sampling Aggregates.
    b. ASTM D 422 (1963; R 2002) Test Method for Particle-Size Analysis of Soils.
    c. ASTM D 2434 (1968, R 2000) Test Method for Permeability of Granular Soils (Constant Head).
    d. ASTM D 3042 (2003) Test Method for Insoluble Residue in Carbonate Aggregates.
    e. ASTM C 1260 (2005) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).

3. American Geological Institute (AGI). Geoscience Handbook AGI Data Sheets, 4th Edition.

1.04 MEASUREMENT AND PAYMENT

The Contractor shall be responsible for estimating the extent of granular materials required to complete the work including, but not limited to, construction of drainage layer, encasement of leachate collection piping, and road-bed construction. The Contractor shall include the dollar amount associated with furnishing and placing all granular materials in his Lump Sum Bid amount.

1.05 COORDINATION

A. The geosynthetic liner shall be covered with granular materials as soon as practicable after a section of liner has been approved by the Owner's Representative.

1.06 SUBMITTALS

A. Product Data:

1. Aggregate source list: Submit a list of proposed aggregate sources.

2. Shipping Tickets: Submit shipping tickets for the granular materials delivered to the site. Shipping tickets shall be according to paragraph 1004.01f of the IDOT Standard Specifications.

B. Test Reports.

1. Submit results of grain size analysis (ASTM D422) and hydraulic conductivity testing (ASTM D2434) for gradations established by the Contractor that provide the specified hydraulic conductivity. Test results are required for each proposed source and gradation. Submit test results for each source demonstrating compliance with reactivity, soundness, and abrasion requirements specified herein.

C. Samples:

1. Submit one sample per source for each gradation proposed for use on the project. Samples shall be at least one pound and shall be obtained and shipped according to ASTM D75. Submit samples at least 15 days prior to starting construction of the drainage layer and coarse aggregate encasement for leachate piping.

1.07 STORAGE AND HANDLING

A. Storage and handling of granular materials shall be according to paragraph 1004.01e of the IDOT Standard Specifications.

PART 2. PRODUCTS

2.01 MATERIALS

A. General

1. Coarse Granular materials shall be meet the Description of Gravel, as described in Section 1004.01(a)(1) of the IDOT Standard Specifications, and shall be spherical to sub-discoidal, sub-rounded to well rounded particles as defined by AGI Data Sheet, 4th Edition, Sheet 8.4 – Comparison Charts for Estimating Roundness and Sphericity.
2. Granular materials shall experience no more than 15 percent carbonate loss per ASTM D3042.
3. Granular materials shall be free of deleterious material, and shall meet the Na_2SO_4 soundness and Los Angeles Abrasion Specifications for Class B quality aggregate per paragraph 1004.01 of the IDOT Standard Specifications.
4. All material shall pass the 2 in. sieve, and no greater than 5 percent shall be retained on the No. 200 sieve.
5. Granular materials shall be innocuous to alkali-silica reactivity, and shall exhibit internal expansions of less than 0.10 percent at 16 days after casting as determined by ASTM C 1260.

B. Gypsum Management Facility Granular Materials

1. Granular Materials for Drainage Layer

Gradation for granular material for Drainage Layer shall be as required to provide a minimum hydraulic conductivity (ASTM D2434) of 1×10^{-3} cm/sec.

2. Coarse Aggregate around Ring Drain Collection Piping

Coarse Aggregate used to encase the ring drain collection piping shall be IDOT Gradation CA 7 material as outlined in Article 1004.01 of the IDOT Standard Specifications for Road and Bridge Construction.

3. Filter Sand

Filter Sand used for protective cover over the ring drain collection system shall be IDOT Gradation FA 1, Class B or better according to Article 1003 of the IDOT Standard Specifications for Road and Bridge Construction.

4. Aggregate Base Course, Type B

Aggregate Base Course, Type B used for base material for all new access roads and ***the Landfill Haul Road*** shall be IDOT Gradation CA 2, in accordance with Section 1004.04 of the IDOT Standard Specifications for Road and Bridge Construction. The requirements from Section 2.01A of this specification shall not apply.

5. Aggregate Surface Course, Type B

Aggregate Surface Course, Type B used for surface material for all new access roads and the ***Landfill Haul Road*** ~~McKinley Road relocation~~ shall be IDOT Gradation CA 6, in accordance with Section 1004.04 of the IDOT Standard Specifications for Road and Bridge Construction. The material shall originate from an IDOT approved source. The requirements from Section 2.01A of this specification shall not apply.

6. Coarse Aggregate for Leachate Collection/Leachate Detection Piping

Gradation for coarse aggregate encasement around Leachate Collection/Leachate Detection Laterals shall be as required to provide a minimum hydraulic conductivity (ASTM D2434) of 1×10^{-1} cm/sec.

B. CCB Landfill Granular Materials

1. Granular Materials for Drainage Layer and Separation Berm.

Gradation for granular material for drainage layer and separation berm shall be as required to provide a minimum hydraulic conductivity (ASTM D2434) of 1×10^{-3} cm/sec.

2. Coarse Aggregate.

Gradation for coarse aggregate shall be as required to provide a minimum hydraulic conductivity (ASTM D2434) of 1×10^{-1} cm/sec.

2.02 EQUIPMENT

Equipment for spreading and compacting granular materials shall be low ground pressure equipment to prevent damage to the underlying geosynthetic liners.

PART 3. EXECUTION

3.01 PROTECTION OF GEOSYNTHETICS

A. Protection of the geosynthetic liners is critically important. Approved geosynthetic liner shall be covered by granular material as soon as practicable. Granular material shall be placed to a minimum thickness of 1 ft before any heavy equipment or loaded trucks are allowed on the lined area.

B. No vehicular traffic shall travel directly on the geosynthetic liner other than an approved low ground pressure All Terrain Vehicle or equivalent.

C. Any damage to the geosynthetic liner system shall be repaired, as directed by the Owner's Representative, at the expense of the Contractor.

3.02 DRAINAGE LAYER (GYPSUM STACK)

A. Placement on Cell Floor

1. The granular material shall be back-dumped on the geotextile cushion fabric in a sequence of operations beginning at the perimeter of the liner on the cell floor.
2. Placement of material on the fabric shall be accomplished by spreading dumped material off of previously placed material with a bulldozer blade or endloader, in such a manner as to prevent tearing or shoving of the cloth. Dumping of material directly on the fabric will only be permitted to establish an initial working platform. No vehicles or construction

equipment shall be allowed on the fabric prior to placement of the granular blanket to a minimum thickness of 1 ft.

B. Placement on Cell Side Slopes

1. Placement of granular material on cell side slopes shall be accomplished using methods and equipment similar to that specified for placement of material on cell floor.
2. The Contractor may place earth fill material underlain with separation geotextile fabric to buttress the granular material on the slope:

   a. The Construction Quality Assurance (CQA) survey to certify thickness of drainage material shall be completed within the footprint of the gypsum stack before it is covered with separation geotextile fabric.
   b. Separation geotextile fabric shall extend beyond the toe of gypsum buttress a sufficient distance to prevent contamination of the granular drainage layer. See Sections 02373 and 02320 for construction of separation geotextile fabric.

3.03 DRAINAGE LAYER (CCB LANDFILL)

A. Placement on Cell Floor.

1. The granular material shall be back-dumped on the geotextile cushion fabric in a sequence of operations beginning at the perimeter of the liner on the cell floor.
2. Placement of material on the fabric shall be accomplished by spreading dumped material off of previously placed material with a bulldozer blade or endloader, in such a manner as to prevent tearing or shoving of the cloth. Dumping of material directly on the fabric will only be permitted to establish an initial working platform. No vehicles or construction equipment shall be allowed on the fabric prior to placement of the granular blanket to a minimum thickness of 1 ft.

B. Placement on Cell Side Slopes.

1. Placement of granular material on cell side slopes shall be accomplished using methods and equipment similar to that specified for placement of material on cell floor.
2. The Contractor may place CCB underlain with separation geotextile fabric to buttress the granular material on the slope:

   a. The Construction Quality Assurance (CQA) survey to certify thickness if drainage material shall be completed within the footprint of the CCB before CCB placement.

b. Separation geotextile fabric shall extend beyond the toe of CCB buttress a sufficient distance to prevent contamination of the granular drainage layer. See Sections 02373 and 02320 for construction of separation geotextile fabric and CCB, respectively.

C. Placement in Separation Berm.

1. Granular material for the separation berm shall be placed and spread in uniform lifts not to exceed 1 ft. The initial lift shall be placed according to paragraph A. The separation berm shall be constructed across the floor of the cell to at least the level of the top of drainage layer before any CCB is placed within the cell, and the top of berm shall be maintained at or above the level of adjacent CCB as CCB placement progresses.

3.04 COARSE AGGREGATE FOR ENCASEMENT OF RING DRAIN COLLECTION PIPING (GYPSUM MANAGEMENT FACILITY)

A. The geotextile filter fabric for encasement of leachate collection piping shall be placed on the approved cushion geotextile fabric according to Section 02373 – Geotextiles.

B. The coarse aggregate shall be placed and consolidated with a vibratory plate compactor on the encasement fabric to the width shown on the plans to the level of the bottom of the ring drain collection piping.

C. Course aggregate shall be placed and consolidated with a vibratory plate compactor along the pipe during pipe installation. The coarse aggregate shall be placed longitudinally along the pipe in lifts not to exceed 8 in. thick to a height of at least the center of the pipe. The aggregate shall be maintained at equal elevation on each side of the pipe, and the first lift of material shall be mechanically tamped to ensure that the space under the pipe is completely filled. The top of pipe shall not be covered until the CQA survey certifies leachate piping grade has been completed.

D. After the CQA survey has been completed, coarse aggregate material shall continue to be placed in lifts not to exceed 8 in. thick, as specified in the previous paragraph until the minimum cover height shown in the plans is attained.

E. The running of trucks or heavy equipment over leachate piping shall be avoided until there is at least a 12 in. cover of Filter Sand over the completed geotextile envelope.

3.05 COARSE AGGREGATE FOR ENCASEMENT OF LEACHATE COLLECTION PIPING (CCB LANDFILL)

A. Place geotextile fabric for encasement of leachate collection piping on the approved cushion geotextile fabric according to Section 02373 – Geotextiles.

B. Place and consolidate coarse aggregate with a vibratory plate compactor on the encasement fabric to the width shown on the plans to the level of the bottom of the leachate piping.

C. Place and consolidate course aggregate along the pipe during pipe installation. Place coarse aggregate longitudinally along the pipe in lifts not to exceed 8 in. thick to a height of at least the center of the pipe. Maintain the aggregate at equal elevation on each side of the pipe, and mechanically tamp the first lift of material to ensure that the space under the pipe is completely filled. Do not cover the top of pipe until the CQA survey to certify leachate piping grade has been completed.

C. After the CQA survey has been completed, continue placing coarse aggregate material in lifts not to exceed 8 in. thick, as specified in the previous paragraph until the minimum cover height shown in the plans is attained.

D. Avoid running trucks or heavy equipment over leachate piping until there is at least 12 in. cover over the completed geotextile envelope. Provide temporary ramps no steeper than 10H:1V transverse to the piping for temporary equipment crossings until the first lift of CCB is placed.

3.06 ROADWAY CONSTRUCTION

A. Prepare the roadway subgrade as shown on the plans, in accordance with Section 02200 – Earthwork.

B. Furnish Geotechnical Fabric for Ground Stabilization in accordance with Section 02373 – Geotextiles.

C. Furnish Aggregate Base Course, Type B in accordance with Article 351 of the IDOT Standard Specifications for Road and Bridge Construction.

D. Furnish Aggregate Surface Course, Type B in accordance with Article 402 of the IDOT Standard Specifications for Road and Bridge Construction.

3.07 TESTING

A. Independent gradation and permeability tests will be made by the Owner's Testing Lab during the progress of the work at frequencies as required in the project Construction Quality Assurance (CQA) Plan, included in Appendix 2.

The Contractor shall cooperate with the Testing Lab and allow such tests to be performed.

B. If tests indicate that an area of granular material or coarse aggregate does not meet the specified requirements of the project CQA Plan, then the Contractor shall remove the material and replace it with suitable material.

3.05 FINISH GRADING

The granular drainage layer shall be fine graded, but not compacted, to provide a smooth finish before a CQA survey of the completed portion of the drainage layer is requested. The CQA Officer shall direct the survey agency to determine elevations at the top of the final constructed surface of the Drainage Layer using a 100 ft. grid pattern (and the break points in slope) to verify attainment of the plan grades and elevations. To verify thickness, all horizontal survey coordinates shall be the same for the top of the cushion, and final constructed surface. Side slope thicknesses will be verified using crest (top), midpoint, and toe documentation points. In co instance shall the field determined thickness be less than 1.0 ft. The measured depths and grades shall be documented on "as built" drawings furnished to the CQA Officer by the survey agency. Ruts or erosion damage shall be repaired before placement of the separation geotextile fabric.

END OF SECTION 02315

PART 1. GENERAL

1.01 DESCRIPTION

This section pertains to furnishing and installing geotextile fabrics on prepared surfaces.

1.02 RELATED SECTIONS

The following sections contain items which are related to the work in this section:

1. 02300 - Earthwork
2. 02315 - Granular Materials
3. 02800 – HDPE Geomembrane

1.03 REFERENCES

The following references, or cited portions thereof, govern the work:

1. Illinois Department of Transportation (IDOT): Standard Specifications for Road and Bridge Construction, adopted January 1, 2007.
2. American Society for Testing and Materials (ASTM):

    a. ASTM 3776 (1996; R 2002) Standard Test Method for Mass per Unit Area (Weight) of Fabric;
    b. ASTM D 3786 (2001) Test Method for Hydraulic Bursting Strength of Textile Fabrics -- Diaphragm Bursting Strength Tester Method;
    c. ASTM D 4533 (2004) Test Method for Trapezoid Tearing Strength of Geotextiles;
    d. ASTM D 4632 (1991; R 2003) Test Method for Grab Breaking Load and Elongation of Geotextiles;
    e. ASTM D 4751 (2004) Test Method for Determining Apparent Opening Size of Geotextile;
    f. ASTM D 4833 (2000) Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products;
    g. ASTM D 4873 (2002) Guide for Identification, Storage, and Handling of Geosynthetic Rolls;
    h. ASTM D 4884 (1996; R 2003) Test Method for Strength of Sewn or Thermally Bonded Seams of Geotextiles;
    i. ASTM D5261-92(2003) Standard Test Method for Measuring Mass per Unit Area of Geotextiles

j. ASTM D6241-04 Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

1.04 MEASUREMENT AND PAYMENT

A. The Contractor shall be responsible for estimating the extent of geotextile fabric required to complete the work including fabric for laps, anchorage, repairs, and samples for Construction Quality Assurance (CQA) testing. The Contractor shall include the dollar amount associated with all geotextile construction in his Lump Sum Bid amount, except as specified in paragraph B.

B. Geotextile Fabric for Ground Stabilization, when directed by the Owner's Representative for stabilization of foundation soils, will be paid for on a time and materials basis.

C. No additional payment will be made for geotextile fabric for ground stabilization installed at the Contractor's discretion.

1.05 SUBMITTALS

A. Product Data

1. The manufacturer's list of guaranteed properties for each geotextile fabric proposed for use on the project shall be submitted.
2. The manufacturer's installation guidelines shall be submitted.

B. Samples

Samples of geotextile fabrics shall be submitted for CQA prequalification testing. Sample size and sampling frequency are specified in Appendix 2.

C. Inventory

A copy of the roll inventory that identifies, as a minimum, manufacturer or supplier, product or style number, roll number, width, and length of roll as identified on the roll label shall be submitted.

1.06 STORAGE AND HANDLING

Geotextiles shall be stored and handled according to ASTM D4873.

PART 2. PRODUCTS

2.01 MATERIALS

A. Geotextile Fabric for Liner System

Geotextile fabrics for use in the cell liner system shall consist of non-woven filaments of polypropylene, polyester, or polyethylene. Stabilizers and/or inhibitors shall be added to the base polymer if necessary to make the filaments resistant to deterioration caused by ultraviolet light and heat exposure. Reclaimed or recycled fibers or polymer shall not be added to the formulation. Non-woven fabric may be needle-punched, heat-bonded, or a combination thereof. The filaments shall be dimensionally stable (i.e., filaments shall maintain their relative position with respect to each other) and resistant to delamination. The edges of the geotextile shall be finished to prevent the outer fiber from pulling away from the geotextile. The filaments shall be free from any chemical treatment or coating that might significantly reduce porosity and permeability.

Fabric shall have the following physical properties:

Physical Properties[1]	**4 oz. (Separation)**	**6 oz. (PWRS)**	**16 oz. (CA Envelope & Rub Sheet)**
Mass/Unit Area (oz./yd^2) ASTM D5261	4.0	6.0	16.0
Grab Tensile Strength (lb.) ASTM D4632	115	160	380
Grab Elongation (%) ASTM D4632	50	50	50
Puncture Strength (lb.) ASTM D4833	65	85	240
Puncture (CBR) Strength (lb.) ASTM D6241	310	410	1025
Mullen Burst Strength (psi) ASTM D3786	210	280	750
Trapezoidal Tear Strength (lb.) ASTM D4533	50	60	150
Width (ft.)	15	15	15
Apparent Opening Size (AOS) Max. US Std. Sieve No. ASTM D4751	70	70	100
UV Resistance[2] (%) ASTM D4355	70	70	70
Roll Width (ft.)	15	15	15

Notes

(1) All Values listed are Minimum Average Roll Values (MARV) unless otherwise noted, calculated as the typical minus two standard deviations.

(2) UV Resistance is a minimum value and not a MARV. Evaluation to be on 2.0 inch strip tensile specimens after 500 hours exposure.

B. Geotextile Cushion

Fabric for Geotextile Cushion shall consist of non-woven filaments of polypropylene, polyester, or polyethylene. Stabilizers and/or inhibitors shall be added to the base polymer if necessary to make the filaments resistant to deterioration caused by ultraviolet light and heat exposure. Reclaimed or recycled fibers or polymer shall not be added to the formulation. Non-woven fabric may be needle-punched, heat-bonded, or a combination thereof. The filaments shall be dimensionally stable (i.e., filaments shall maintain their relative position with respect to each other) and resistant to delamination. The edges of the geotextile shall be finished to prevent the outer fiber from pulling away from the geotextile. The filaments shall be free from any chemical treatment or coating that might significantly reduce porosity and permeability.

Fabric shall have the following physical properties:

Physical Properties[1]	**10 oz. (Geotextile Cushion)**
Mass per unit area (oz/yd^2) ASTM D5261	10
Grab Tensile Strength (lb.) ASTM D4632	230
Grab Tensile Elongation (%) ASTM D4632	50
Trapezoidal Tear Strength (lb.) ASTM D4533	95
Puncture (CBR) Strength (lb.) ASTM D6241	700
Puncture (CBR) Elongation (in.) ASTM D6241	1.5
UV Resistance[2] (%) ASTM D4355	70
Apparent Opening Size (Max.) (AOS) Sieve No. - ASTM D4751	---
Roll Width (ft.)	15

Notes

(1) All Values listed are Minimum Average Roll Values (MARV) unless otherwise noted, calculated as the typical minus two standard deviations.

(2) UV Resistance is a minimum value and not a MARV. Evaluation to be on 2.0 inch strip tensile specimens after 500 hours exposure.

C. Geotechnical Fabric for Ground Stabilization

Geotechnical fabric for ground stabilization shall conform to Article 1080.02 of the IDOT Standard Specifications for Road and Bridge Construction.

D. Thread for Seams

High strength thread should be used such that seam test should conform to ASTM D4884. The thread shall meet the chemical, ultraviolet, and physical requirements of the geotextile, and the color shall be different from that of the geotextile.

E. Securing Devices

Pins, staples, and other devices that project through the geotextile fabric are not permitted for fabrics installed above the geomembrane. Sandbags, stone, or other appropriate means approved by the Owner's Representative shall be used to prevent movement of the geotextile.

2.02 EQUIPMENT

A. Equipment for spreading and compacting granular materials shall be low ground pressure equipment to prevent damage to the underlying geosynthetic liners.

PART 3. EXECUTION

3.01 SAMPLES FOR CQA TESTING

A. Geotextile fabric samples shall be obtained, identified and packaged from rolls designated by the Owner's Representative according to ASTM D4873.

B. Samples shall be 3 ft. wide by the full roll width.

3.02 BASE PREPARATION

A. Surface on which the geotextile will be placed shall be prepared to a relatively smooth surface condition, and shall be free from obstruction, debris, depressions, erosion features, or any irregularities that would prevent continuous, intimate contact of the geotextile with the entire surface. Rills, gullies, and ruts must be graded out of the surface before geotextile placement. Areas on which geotextile are to be placed shall be graded and/or dressed in accordance with Section 02200 – Earthwork and Section 02315 – Granular Materials. Prior to daily placement, the Installer shall provide the CQA Officer daily "certificates of acceptance" which document the Installer's inspection and acceptance of the underlying surface as being suitable for the geotextile installation.

B. Geotextile cushion fabric will be installed directly on the geosynthetic liner. Jointly inspect the liner with the Owner's Representative before commencing fabric installation each day. Notify the Owner's Representative promptly of any damage or defects observed in the liner as fabric installation progresses. Do not place fabric in the damaged or defective area until the liner has been repaired and

approved by the Owner's Representative. Submit a daily inspection report identifying the area of fabric placement and certifying that there were no visible defects in the area of fabric placement.

C. Do not run heavy vehicle traffic directly on the geosynthetic liner or cushion geotextile. Use vehicles and equipment as specified in paragraph 2.02 to transport and deploy fabric on the liner. Operate the equipment with care, and place protective cover over the geomembrane, if necessary, to avoid damaging the liner. Route traffic and personnel over installed cushion fabric and use the installed fabric as a working platform to the greatest extent possible.

3.03 INSTALLATION

A. General Requirements:

1. Geotextile fabric shall be unrolled and laid out following these requirements to the greatest extent practical:

   a. Orient panels with the longest dimension parallel to the slope.
   b. Minimize the number of seams in corners and odd-shaped areas.
   c. Extend panels on slopes a minimum of 5 ft onto a horizontal surface.

   Geotextile panels shall be unrolled using methods that will not damage the fabric and will protect underlying surface from damage. While unrolling, the geotextile fabric shall be visually inspected for imperfections and faulty or suspect areas marked. Ballast shall be placed on fabric to prevent wind uplift. Expansion and contraction should be allowed for by leaving slack.

   Heavy vehicle traffic shall not be run directly on geotextile fabric. Fabric in areas of heavy traffic shall be protected with protective cover over the fabric.

2. Laps

   Individual panels of geotextile fabric shall be lapped according to manufacturer's instructions and as specified herein. Provide a minimum overlap of 3 in. unless otherwise specified herein or in the plans. Shingle overlaps so that water or other material cannot run down the slope between the two layers of fabric.

3. Field Seams

Continuously sew all laps on slopes steeper than 10H:1V. This requirement does not apply to the heavy geotextile fabric for envelopment of coarse aggregate around leachate piping.

4. Defects and Repairs

Examine the installed geotextile fabric for defects, holes discontinuous seams, puckered or separated laps, etc. Repair defective laps and seams. Patch holes and defects according to manufacturer's recommendations and as directed by the Owner's Representative. Do not cover suspect or patched areas until they have been inspected and approved by the Owner's Representative.

B. Geotextile Fabric for Separation

1. Use low ground pressure equipment to avoid rutting the granular material.
2. Horizontal seams (parallel to top of slope) will be permitted on cell side slopes to facilitate staged construction of the drainage layer on the side slope.
3. Extend separation geotextile fabric into and across the bottom of the anchor trench and complete backfill of the trench according to Section 02200.

C. Geotextile Fabric for Coarse Aggregate Envelope

1. Geotextile for coarse aggregate envelope will be installed directly on the cushion fabric. Remove any foreign materials from the cushion fabric within the footprint of the coarse aggregate leachate piping encasement before installing the geotextile envelope. Place sufficient width to completely envelop the coarse aggregate and provide a longitudinal lap of at least 6 in.
2. After the coarse aggregate encasement has been completed, according to Section 02315, wrap the geotextile around the mounded aggregate, and cover the lap with at least 6 in. of material before permitting vehicle or equipment on the fabric.
3. Any ballast material other than coarse aggregate, according to Section 02315, that is placed within the envelope will require removal during coarse aggregate construction.

D. Geotechnical Fabric for Ground Stabilization

1. Install Geotechnical Fabric for Ground Stabilization in accordance with Section 210 of the IDOT Standard Specifications for Road and Bridge Construction.

2. If approved by the Owner's Representative, the Contractor may, at his own expense, install geotextile or geogrid for ground stabilization outside the limits designated by the Owner's Representative.
3. Submit as-built drawings that clearly delineate limits and type of ground stabilization.

3.04 PROTECTION

A. Protect installed fabric until it is covered by at least 1 ft. of overlying material.

B. Any damage to the geotextile during its installation or during placement of overlying materials shall be replaced by the Contractor at no cost to the Owner. Unless otherwise noted, the work shall be scheduled so that the covering of the geotextile with a layer of the specified material is accomplished within 14 calendar days after placement of the geotextile. Failure to comply shall require replacement of geotextile. The geotextile shall be protected from damage prior to and during the placement of overlying materials. Before placement of overlying materials, the Contractor shall demonstrate that the placement technique will not cause damage to the geotextile.

3.05 TESTING AND INSPECTION

A. Prequalification Testing

Geotextiles are subject to CQA testing by the Owner's Testing Consultant to verify conformance with the manufacturer's list of guaranteed properties according to the project Construction Quality Assurance Plan, included in Appendix 2. The Contractor shall provide samples as specified herein. Any fabric that does not conform to the list of guaranteed properties shall be removed from the site.

B. Installed fabric shall be inspected by the Owner's Representative. No material shall be placed on the fabric, other than ballast, until the installation has been approved by the Owner's Representative. Ballast shall not obscure seams or significant length of unseamed laps. The Owner's Representative may require removal of ballast to inspect suspect areas.

C. If the Owner's Representative suspects that completed work has been damaged by construction methods that do not conform to the specifications, he may require removal of completed work to verify the integrity of the underlying materials. The Contractor shall bear the cost of removal and subsequent repair as directed by the Owner's Representative, if the integrity of the underlying materials was damaged. If no damage was found, the Owner will pay the Contractor for the investigation work on a time and materials basis.

END OF SECTION 02373

PART 1. GENERAL

1.01 DESCRIPTION

A. This section covers furnishing and installation of a reinforced needlepunched Geosynthetic Clay Liner (GCL) at the Gypsum Management Facility and the CCB Landfill.

B. The work includes furnishing all equipment and materials, providing all labor, supervision, administration and management necessary to perform the work as specified herein and as shown on the plans.

1.02 RELATED SECTIONS

None.

1.03 REFERENCES

The following references, or cited portions thereof, govern the work

1. Geosynthetic Institute

   a. GRI-GCL3, Test Methods, Required Properties, and Testing Frequencies of Geosynthetic Clay Liners (GCLs).

2. American Society for Testing and Materials (ASTM):

   a. ASTM D 4632 (1991; R 2003), Standard Test Method for Grab Breaking Load and Elongation of Geotextiles;
   b. ASTM D 4643 (2000), Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method;
   c. ASTM D 5084 (2003), Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter;
   d. ASTM D 5261 (1992; R 2003), Test Method for Measuring Mass Per Unit Area of Geotextiles;
   e. ASTM D 5321 (2002), Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method;

f. ASTM D 5887 (2004), Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter;

g. ASTM D 5888 (1995; R 2002), Practice for Storage and Handling of Geosynthetic Clay Liners;

h. ASTM D 5889 (1997; R 2003), Practice for Quality Control of Geosynthetic Clay Liners;

i. ASTM D 5890 (2002), Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners;

j. ASTM D 5891 (2002), Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners.

1.04 SUBMITTALS

A. With the bid, the Contractor shall furnish the following information:

1. Conceptual description of the proposed plan for placement of the GCL panels over the areas of installation.
2. GCL Manufacturer's Quality Control (MQC) Plan for documenting compliance with Sections 2.01 and 2.02 of these specifications.
3. GCL manufacturer's historical data for reinforced GCL of a) 10,000-hour creep shear testing per Section 2.01 D. and b) seam flow data at 2 psi confining pressure per Section 2.01 E.
4. A copy of GCL manufacturer's International Standards Organization (ISO) Quality Certificate of Registration.
5. Statement of experience from the proposed GCL supplier.
6. Statement of experience from the proposed GCL installer.

B. At the Owner Representative's or Owner's request, the Contractor shall furnish:

1. A representative sample of the GCLs.
2. A project reference list for the GCL(s) consisting of the principal details of at least ten projects totaling at least 10 million sq. ft (100,000 sq. meters) in size.

C. Upon shipment, the Contractor shall furnish:

1. The GCL manufacturer's Quality Assurance/Quality Control (QA/QC) certifications to verify that the materials supplied for the project are in accordance with the requirements of this specification.
2. Inventory of materials received.

D. As installation proceeds, the Geosynthetics Installer's Representative shall submit certificates of subgrade acceptance, signed by the Contractor and Construction Quality Assurance (CQA) Inspector (see Sections 1.06 and 3.03) for each area that is covered by the GCL.

E. Warranty

After construction, the contractor shall submit material and installation warranty certificates.

1.05 QUALIFICATIONS

A. GCL Manufacturer must have produced at least 10 million sq. ft. (1 million sq. meters) of GCL, with at least 8 million sq. ft. (800,000 sq. meters) installed.

B. The GCL Installer must either have installed at least 1 million sq. ft. (100,000 sq. meters) of GCL, or must provide to the Engineer satisfactory evidence, through similar experience in the installation of other types of geosynthetics, that the GCL will be installed in a competent, professional manner.

1.06 CONSTRUCTION QUALITY ASSURANCE (CQA)

A. Construction Quality Assurance of the GCL installation shall be performed as outlined in the project Construction Quality Assurance Plan, included in Appendix 2 of these Specifications.

B. The GCL Installer shall provide his own CQA inspector. The Owner shall provide a third-party inspector for CQA monitoring of the GCL installation. The inspector shall be an individual or company who is independent from the manufacturer and installer and who shall be responsible for monitoring and documenting activities, related to the CQA of the GCL throughout installation.

C. Testing of the GCL as necessary to support the CQA effort shall be performed by a third party laboratory retained by the Owner and independent from the GCL manufacturer and installer.

WARRANTY

The geomembrane material shall be warranted, on a pro-rata basis against manufacturer's defects for a period of five (5) years from the date of liner installation. The installation shall be warranted against defects in workmanship for a period of (1) year from the date of liner completion.

PART 2. PRODUCTS

2.01 MATERIALS

A. The GCL shall be manufactured as a hydraulic barrier consisting of clay bonded between two layers of nonwoven geotextile by needle punching.

B. The GCL shall be manufactured to conform with the test methods, required properties, and testing frequencies of the GRI-GCL3 specification for Reinforced, Geotextile Related GCL.

C. In addition to the minimum properties given in Table 1(a) of GRI-GCL3, the GCL shall conform to the following specifications.

Test Method	Minimum Value
Bentonite Mass/Area (ASTM D 5993)	0.75 lb./ft^2
GCL Grab Tensile Strength (ASTM D 4632)	90 lb.
GCL Peel Strength (ASTM D 4632)	15 lb.

D. The reinforced GCL shall have seam test data from an independent laboratory showing that the seam flow with a grooved cut in one of the nonwoven geotextiles is less than 1×10^{-8} m^3/m^2/s at 2 psi hydraulic pressure.

E. The minimum acceptable dimensions of full-size GCL panels shall be 150 ft. (45.7 m) in length. Short rolls [(those manufactured to a length greater than 70 ft. (21 meters) but less than a full-length roll)] may be supplied at a rate no greater than three (3) per truckload or three (3) rolls every 36,000 sq. ft. (3,500 sq. meters) of GCL, whichever is less.

2.02 PRODUCT QUALITY DOCUMENTATION

The GCL manufacturer shall provide the Contractor or other designated party with manufacturing QA/QC certifications for each shipment of GCL. The certifications shall be signed by a responsible party employed by the GCL manufacturer and shall include:

A. The Manufacturer's Certification that the material was manufactured and tested in accordance with GRI-GCL3 specifications, together with a report of the test results, shall be furnished at the time of shipment.

B. The manufacturers recommended seaming method with seam test data from an independent laboratory showing that the seam flow is less than 1×10^{-8} m^3/m^2/s at 2 psi hydraulic pressure.

C. GCL lot and roll numbers supplied for the project (with corresponding shipping information).

2.03 PRODUCT LABELING

A. Prior to shipment, the GCL manufacturer shall label each roll, identifying:

1. Product identification information (Manufacturer's name and address, brand product code).

2. Lot number and roll number.
3. Roll length, width and weight.

2.04 PACKAGING

A. The GCL shall be wound around a rigid core whose diameter is sufficient to facilitate handling. The core is not necessarily intended to support the roll for lifting but should be sufficiently strong to prevent collapse during transit.

B. All rolls shall be labeled and bagged in packaging that is resistant to photodegradation by ultraviolet (UV) light.

2.05 ACCESSORY BENTONITE

A. The granular bentonite sealing clay used for overlap seaming, penetration sealing and repairs shall be made from the same natural sodium bentonite as used in the GCL and shall be as recommended by the GCL manufacturer. Seaming of GCLs shall be conducted in accordance with the manufacturer's guidelines for each particular GCL.

PART 3. EXECUTION

3.01 SHIPPING AND HANDLING

A. The rolls of GCL shall be packaged and shipped by appropriate means to prevent damage to the material and to facilitate off-loading.

B. The Installation Supervisor shall be present during delivery and unloading of the GCL. A visual inspection of each roll should be made during unloading to identify if any packaging has been damaged. Rolls with damaged packaging should be marked and set aside for further inspection. The packaging should be repaired prior to being placed in storage. The Installation Supervisor shall prepare and submit an inventory that includes lot and roll number for materials received.

C. The Installer is responsible for unloading the GCL. The Installer should contact the Manufacturer prior to shipment to ascertain the appropriateness of the proposed unloading methods and equipment.

3.02 STORAGE

A. Storage of the GCL rolls and accessory bentonite shall be the responsibility of the Installer.

B. Rolls should be stored in a manner that prevents sliding or rolling from the stacks and may be accomplished by the use of chock blocks. Rolls should be stacked at a height no higher than that at which the lifting apparatus can be safely handled (typically no higher than four).

C. All stored GCL materials and the accessory bentonite must be covered with a plastic sheet or tarpaulin until their installation.

D. The integrity and legibility of the labels shall be preserved during storage.

3.03 EARTHWORK

A. The compacted clay liner upon which the GCL is installed shall be prepared and compacted prior to installation. The surface shall be smooth, firm, and unyielding, and free of:

1. Vegetation.
2. Construction debris.
3. Sticks.
4. Sharp rocks.
5. Void spaces.
6. Ice.
7. Abrupt elevation changes.
8. Standing water.
9. Cracks larger than 0.25 in. (6 mm) in width.
10. Any other foreign matter that could contact the GCL.

B. Immediately prior to GCL deployment, the compacted clay liner shall be final-graded by the contractor to fill in all voids or cracks and then smooth-rolled to provide the best practicable surface for the GCL. At completion of this activity, no wheel ruts, footprints or other irregularities shall exist in the subgrade. Furthermore, all protrusions extending more than 0.5 in. (12 mm) from the surface shall either be removed, crushed or pushed into the surface with a smooth-drum compactor.

C. Prior to daily GCL placement, the installer shall provide to the CQA Officer daily "certificates of acceptance" which document the Installer's inspection and acceptance of the underlying surface as being suitable for GCL installation.

D. It shall be the Installer's responsibility thereafter to indicate to the Owner's Representative any change in the condition of the compacted clay liner that could cause the subgrade to be out of compliance with any of the requirements listed in this Section. The Installation Supervisor shall certify in the daily report that no GCL was placed over visibly defective low permeability soil surface.

E. At the top of sloped areas of the job site, an anchor trench for the GCL shall be excavated by the contractor in accordance with the project plans. The trench shall be excavated and approved by the CQA Inspector prior to GCL placement. No loose soil shall be allowed at the bottom of the trench and no sharp corners or protrusions shall exist anywhere within the trench.

3.04 GCL PLACEMENT

A. GCL rolls shall be delivered to the working area of the site in their original packaging. Immediately prior to deployment, the packaging shall be carefully removed without damaging the GCL. The orientation of the GCL (i.e., which side faces up) shall be in accordance with the Owner Representative's recommendations.

B. Equipment which could damage the GCL, shall not be allowed to travel directly on it. If the installation equipment causes rutting of the subgrade, the subgrade must be restored to its originally accepted condition before placement continues.

C. Care must be taken to minimize the extent to which the GCL is dragged across the subgrade in order to avoid damage to the bottom surface of the GCL. A temporary geosynthetic subgrade covering commonly known as a slip sheet or rub sheet may be used to reduce friction damage during placement.

D. The GCL panels shall be placed parallel to the direction of the slope.

E. All GCL panels shall lie flat on the underlying surface, with no wrinkles or folds, especially at the exposed edges of the panels.

F. Only as much GCL shall be deployed as can be covered at the end of the working day with soil, a geomembrane, or a temporary waterproof tarpaulin. The GCL shall not be left uncovered overnight. If the GCL is hydrated when no confining stress is present, the Installer shall remove and replace the hydrated material as directed by the Owner Representative.

3.05 ANCHORAGE

A. As directed by the project drawings and specifications, the end of the GCL roll shall be placed in an anchor trench at the top of the slope. The front edge of the trench shall be rounded so as to eliminate any sharp corners. Loose soil shall be removed from the floor of the trench. The GCL shall cover the entire trench floor, but shall not extend up the rear trench wall.

3.06 SEAMING

A. The GCL seams shall be constructed by overlapping their adjacent edges according to the manufacturer's recommendations. Care should be taken to ensure that the overlap zone is not contaminated with loose soil or other debris.

B. End-of-roll overlapped seams shall be constructed with a minimum overlap of 24 in. (600 mm). Seams at the ends of the panels should be constructed such that they are shingled in the direction of the grade to prevent the potential for runoff

flow to enter the overlap zone. End-of-roll overlapped seams for all reinforced GCL seams require bentonite-enhanced seams as described below.

C. Bentonite-enhanced seams shall be constructed between the overlapping adjacent panels as follows. The underlying edge of the longitudinal overlap is exposed and then a continuous bead of granular sodium bentonite is applied along a zone defined by the edge of the underlying panel and the 6-inch (150 mm) line. The granular bentonite shall be applied at a minimum application rate of one quarter pound per lineal ft. (0.4 kg/m). A similar bead of granular sodium bentonite is applied at the end-of-roll overlap.

3.07 DETAIL WORK

A. There shall be no penetrations through the GCL.

B. Cutting the GCL should be performed using a sharp utility knife. Frequent blade changes are recommended to avoid damage to the geotextile components of the GCL during the cutting process.

3.08 DAMAGE REPAIR

A. If the GCL is damaged (torn, punctured, perforated, etc.) during installation, it may be possible, if approved by the Owner's Representative, to repair it by cutting a patch to fit over the damaged area. The patch shall be obtained from a new GCL roll and shall be cut to size such that a minimum overlap of 12 in. (300 mm) is achieved around all of the damaged area. Granular bentonite or bentonite mastic shall be applied around the damaged area prior to placement of the patch. It may be desirable to use an adhesive to affix the patch in place so that it is not displaced during cover placement. Patching shall be certified by the Installer's CQA Inspector and observed by the Owner's Representative.

PART 4. GRI-GCL3 SPECIFICATIONS

Geosynthetics Research Institute (GRI) GRI-GCL3, "Test Methods, Required Properties, and Testing Frequencies of Geosynthetic Clay Liners (GCLs).", Dated -- May 16, 2005.

END OF SECTION 02376

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Original - May 16, 2005

GRI-GCL3*

Standard Specification for

"Test Methods, Required Properties, and Testing Frequencies of Geosynthetic Clay Liners (GCLs)"

This specification was developed by the Geosynthetic Research Institute (GRI), with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

1.1 This specification covers the manufacturing quality control (MQC) of geosynthetic clay liners (GCLs), describing types of tests, the proper test methods, minimum and sometimes maximum values, and the minimum testing frequencies.

Note 1: Geosynthetic Clay Liners (GCLs) are also called Clay Geosynthetics Barriers (GBR-Cs).

1.2 There are two general categories of GCLs covered in this specification: reinforced and nonreinforced. Within each category there are geotextile, polymer coated geotextiles, and geomembrane/geofilm related types.

1.3 This specification is intended to aid manufacturers, suppliers, purchasers and users of GCLs in establishing an acceptable level of effort for manufacturing quality control.

*This GRI standard is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This specification will be reviewed at least every 2-years, or on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version.

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1.4 This specification does not address manufacturing quality assurance (MQA), product acceptance testing, or conformance testing. These are independent activities taken by organizations other than the GCL manufacturer.

1.5 The values stated in SI (metric) units are to be regarded as the standard. The U.S. (English) units are calculated values using a "soft" conversion accuracy.

1.6 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards

D 638 Test Method for Tensile Properties of Plastics
D 792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
D 882 Test Method for Tensile Properties of Thin Plastic Sheeting
D 1141 Practice for Preparation of Substitute Ocean Water
D 1505 Test Method for Density of Plastics by the Density-Gradient Method
D 4354 Practice for Sampling of Geosynthetics for Testing
D 4439 Terminology for Geosynthetics
D 4632 Test Method for Grab Breaking Load and Elongation of Geotextiles
D 4759 Practice for Determining the Specification Conformance of Geosynthetics
D 5199 Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
D 5261 Test Method for Measuring Mass per Unit Area of Geotextiles
D 5721 Practice for Air-Oven Aging of Polyolefin Geomembranes
D 5887 Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using Flexible Wall Permeameter
D 5888 Practice for Storage and Handling of Geosynthetic Clay Liners
D 5889 Practice for Quality Control of Geosynthetic Clay Liners
D 5890 Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners
D 5891 Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners
D 5993 Test Method for Measuring the Mass Per Unit Area of Geosynthetic Clay Liners
D 5994 Test Method for Measuring the Core Thickness of Textured Geomembrane
D 6102 Guide for Installation of Geosynthetic Clay Liners
D 6141 Guide for Screening the Clay Portion of a GCL for Chemical Compatibility to Liquids

D 6243 Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method

D 6495 Guide for Acceptance Testing Requirements for Geosynthetic Clay Liners

D 6496 Test Method for Determining Average Bonding Peel Strength Between the Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners

D 6693 Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes

D 6766 Test Method for Evaluation of Hydraulic Properties of Geosynthetic Clay Liners Permeated with Potentially Incompatible Liquids

D 6768 Test Method for Tensile Strength of Geosynthetic Clay Liners

2.2 GRI Standards

GM13 Test Properties, Testing Frequency and Recommended Warrant for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes

GM17 Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes

GM18 Test Properties, Testing Frequency and Recommended Warrant for Flexible Polypropylene (fPP and fPP-R) Nonreinforced and Reinforced Geomembranes (Presently suspended as of May 3, 2004)

2.3 Government Document:

U.S. Environmental Protection Agency Technical Guidance Document "Quality Control Assurance and Quality Control for Waste Containment Facilities," EPA/600/R-93/182. September 1993. 305 pgs.

3. Terminology

3.1 Definition

3.1.1 Geosynthetic Definitions:

3.1.1.1 geotextile, n a permeability geosynthetic comprised solely of textiles. (ASTM D 4439)

3.1.1.2 geomembrane, n—an essentially impermeable geosynthetic barrier composed of one or more synthetic sheets. (ASTM D 4439)

3.1.1.3 geofilm, n—a thin polymeric film which is essentially impermeable having a thickness no greater than 0.25 mm (10 mils).

3.1.1.4 geotextile-polymer, n -a geotextile which has been coated with, or impregnated by, a polymer such as polypropylene

3.1.1.5 geosynthetic clay liner, n—a manufactured hydraulic barrier consisting of clay bonded to a layer or layers of geosynthetic materials. (ASTM D 4439)

Note 1: Geotextile Related GCL is one in which two geotextiles are used respectively as cap and carrier to the bentonite. Cap and carrier designations in this standard refer to respective orientations during manufacturing. This may or may not be the as-placed orientation in the field. It can be internally reinforced by needle punching or stitching, or be nonreinforced.
Geotextile Polymer Coated GCL is one in which two geotextiles are used respectively as cap and carrier to the encased bentonite, however, one of the geotextiles has been polymer coated in a manner that the permeability and flux are decreased. Cap and carrier designations refer to the as manufactured product and not necessarily to the as-placed orientation. It can be internally reinforced by needle punching or stitching, or be nonreinforced.
Geomembrane/Geofilm Related GCL is one in which a geomembrane or geofilm is included in the cross section either above or below the cap geotextile. It can be internally reinforced needle punching or be nonreinforced. Also in the nonreinforced category is bentonite adhesively bonded to a geomembrane.

3.1.2 Material Definitions

3.1.2.1 bentonite—a distinct type of fine-grained clay soil typically containing not less than 80% montmorillionite clay, usually characterized by high swelling upon wetting.

3.1.2.2 Formulation, n - The mixture of a unique combination of ingredients identified by type, properties and quantity. For geosynthetic materials, a formulation refers to the exact percentages of resin, additives, carbon black and/or other additives. It does not necessarily refer to individual suppliers of each ingredient. The individual suppliers must meet the manufacturer's internal quality control specification.

3.1.3 Organizational Definitions:

3.1.3.1 installer, n—the party who installs, or facilitates installation of, any materials purchased from manufacturers or suppliers.

3.1.3.2 manufacturer, n—the group, corporation, partnership, or individual that manufactures a product.

3.1.3.3 purchaser, n—the person, company, or organization that purchases any materials or work to be performed.

3.1.3.4 supplier, n—the party who supplies material or services.

3.1.4 Quality Definitions:

3.1.4.1 Manufacturing Quality Control (MQC) - A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications. ref. EPA/600/R-93/182

3.1.4.2 Manufacturing Quality Assurance (MQA) - A planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract specifications. MQA includes manufacturing facility inspections, verifications, audits and evaluation of the raw materials (resins and additives) and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the manufacturer is in compliance with the product certification and contract specifications for the project. ref. EPA/600/R-93/182

3.1.4.3 Construction Quality Control (CQC) - A planned system of inspections that are used to directly monitor and control the quality of a construction project. Construction quality control is normally performed by the geosynthetics manufacturer or installer, or for natural soil materials by the earthwork contractor, and is necessary to achieve quality in the constructed or installed system. Construction quality control (CQC) refers to measures taken by the installer or contractor to determine compliance with the requirements for materials and workmanship as stated in the plans and specifications for the project. ref. EPA/600/R-93/182

3.1.4.4 Construction Quality Assurance (CQA) - A planned system of activities that provide assurance that the facility was constructed as specified in the design. Construction quality assurance includes inspections, verification, audits, and evaluations of materials and workmanship necessary to determine and document the quality of the constructed facility. Construction quality assurance (CQA) refers to measures taken by the CQA organization to assess if the installer or contractor is in compliance with the plans and specifications for a project. ref. EPA.600/R-93/182

4. Significance and Use

4.1 GCLs must be properly manufactured in a manner consistent with a minimum level of quality control as determined by in-house testing of the final product. This specification presents the types of tests, standard methods of the testing, required (usually minimum) test values, and minimum testing frequencies which should be embodied in the manufacturer's quality control documents. The quoted tests, test methods and test values in Table 1 must appear in the MQC plan and the MQC report.

4.2 It should be clearly recognized that manufacturers may perform additional tests or at greater frequency than required in this specification, or both. In this case, the manufacturer's quality control plan will then take precedence over this specification.

4.3 It should also be recognized that purchasers and installers of GCLs may require additional tests or at a great frequency than called for in this specification, or both. The organization(s) producing such project specific specification or quality assurance plan should recognize that such requirements are beyond the current state-of-the-practice. If such a request is made by purchasers or installers, they should clearly communicate the requirements to the manufacturer or supplier during the contract decisions in order that disputes do not arise at a subsequent time.

5. Procedure

5.1 The procedures embodied in this specification are contained in the respective test methods given in Table 1.

5.1.1 The minimum recommended quality control tests for the manufacture of GCLs are given in Table 1. Specific tests are performed on the bentonite, the geosynthetic component materials, and the finished GCL. Table 1(a) is in S.I. (Metric) units and Table 1(b) is in U.S. (English) units.

Note 2: The conversion from S.I. units into U.S. units is soft.

5.1.2 The individual properties in Table 1 are minimum values; except fluid loss, moisture content, and permeability (or flux). They are maximum values. The manner of taking specimens is described in the appropriate test method. When an average value is indicated, it is listed in the table as "min. ave.", or "max. ave.".

5.2 Bentonite (as received)
Two tests are required; swell index and fluid loss. The latter is a maximum value. These tests should be performed on the bentonite prior to fabrication into a GCL.

or on bentonite taken from the manufactured product if the bentonite is modified in any way during manufacturing, e.g., if an adhesive is added.

5.3 Geotextile (as received)
Mass per unit area is required on the as-manufactured cap and carrier fabrics, with different values depending on the fabric being nonwoven or woven.

Note 3: These tests are to be performed on the geotextiles before manufacturing into the final GCL. Removal of the geotextiles from the manufactured product and subsequent testing will give erroneous values and is not an acceptable practice. The exception is polymer coated GCLs where the geotextile must be removed to determine its mass per unit area.

5.4 Geomembrane/Geofilm (as received)
The following tests are required; thickness, density, and tensile strength at break. All are minimum required values. Tensile strength at break is the lowest of machine direction and cross machine direction.

Note 4: These tests are to be performed on the geomembrane or geofilm before manufacturing into the final GCL. Removal of the geomembrane or geofilm from the manufactured product and subsequent testing will give erroneous values and is not an accepted practice.

5.5 GCL (as manufactured)
Six tests are required on the as-manufactured GCL with one having an alternative, i.e., hydraulic conductivity or flux. All are minimum values, with the exception of moisture content and hydraulic conductivity or flux.

5.6 GCL (long-term)
The purpose of these long-term or endurance tests is to provide confidence in the continuing acceptable performance of the bentonite and geosynthetic components of the installed GCL.

5.6.1 The durability of the bentonite is evaluated using a permeant consisting of 0.1 M calcium chloride solution. See ASTM D 6141 which is a guide for this particular aspect of the specification. The GCL is to be hydrated with distilled dionized water prior to conducting the tests with the calcium chloride solution. In this regard, ASTM D6766 Scenario 1 and Method C is the procedure to be used. Furthermore, this test is conducted twice at two different normal pressures, i.e., 35 and 500 kPa. The maximum allowable values are listed in Table 1.

5.6.2 The geotextiles in their as-received condition are evaluated by incubation in a forced air oven per ASTM D5721 set at 60°C for 50 days. The

minimum percent in tensile strength retained at break, as measured by ASTM D6768, is 65%. If individual yarns are used in reinforcing GCLs, they must also meet this same endurance criterion.

5.6.3 The geomembrane in its as-received condition is evaluated for durability via the appropriate GRI Specification. For high density polyethylene (HDPE), the specification is GRI GM13. For linear low density polyethylene (LLDPE), the specification is GRI GM17. For flexible polypropylene (fPP), the specification is GRI GM18.

5.6.4 The geofilm in its as-received condition is evaluated by incubation in a forced air oven per ASTM D5721 set at 60°C for 50 days. The minimum percent tensile strength retained at break for either MD or XMD, as measured by ASTM D882, is reported accordingly and must meet or exceed the specification value.

Note 5: It should be recognized that the above durability criterion for geofilms is not as stringent as the criteria for geomembranes stated in Section 5.6.3.

6. Workmanship and Appearance

6.1 Waterproof ink overlap lines should be printed on both edges of one of the surfaces (geotextile or geomembrane) of the manufactured GCL.

Note 6: The overlap lines are minimally 150 mm (6.0 in.) from the edges of the GCL. Other design-related situations may require greater overlap distances to be printed on the GCLs, e.g., when not backfilled in a timely manner.

6.2 Needle punched and stitch bonded GCLs shall be essentially free of broken needles and fragments of needles that would negatively effect the performance of the final product. There must be continuous needle detection and removal devices, e.g., metal detectors and magnets, used during manufacture of GCL products.

6.3 The manufactured GCL shall have good appearance qualities. It shall be free from such defects that would affect the specified properties and integrity of the product.

6.4 General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and/or documents. ASTM D5888 and D5889 should be followed in this regard.

7. MQC Sampling

7.1 Sampling shall be in accordance with the specific test methods listed in Table 1. If no sampling protocol is stipulated in the particular test method, then test specimens shall be taken evenly spaced across the entire roll width, see ASTM D 4354.

7.2 The number of tests shall be in accordance with the appropriate test methods listed in Table 1.

7.3 The average of the test results should be calculated per the particular standard cited and compared to the minimum value listed in these tables, hence the values listed are the minimum average values and are designated as "min. ave.". When the property is a maximum value, the designation is "max. ave.".

8. MQC Retest and Rejection

8.1 If the results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the manufacturing protocol as set forth in the manufacturer's quality manual.

9. Packaging and Marking

9.1 The GCL shall be rolled, clearly labeled, and onto a substantial core, encased in a waterproof wrapper. Packaging must be adequate for safe transportation to the point of delivery.

9.2 The label should include manufacturer, style, lot and/or roll number, weight, length and width.

10. Conformance and Certification

10.1 Conformance of the manufactured GCL to this specification, or agreed-upon variation thereof, shall be performed by the MQA organization or designated by the purchaser/owner. ASTM D 4759 can be used as a general guide, but individual test methods must be clearly stipulated and communicated to the parties involved.

10.2 Upon request of the purchaser in the contract or order, a manufacturer's certification that the material was manufactured and tested in accordance with this specification, together with a report of the test results, shall be furnished at the time of shipment.

Table 1(a) – Specification for Geosynthetic Clay Liners (GCLs)

Property	ASTM Test Method	Reinforced GCL			Non-Reinforced GCL			Testing Frequency
		GT-Related	GT Polymer Coated	GM-GF Related	GT-Related	GT Polymer Coated	GM-GF Related	
Clay (as received)								
swell index (ml/2g)	D5890	24	24	24	24	24	24	50 tonnes
fluid loss (ml)[1]	D5891	18	18	18	18	18	18	50 tonnes
Geotextiles (as received)								
cap fabric (nonwoven) - mass/unit area (g/m^2)[2]	D5261	200	200	200	70	100	n/a/70	20,000 m^2
cap fabric -(woven) - mass/unit area (g/m^2)	D5261	100	100	100	-	-	-	20,000 m^2
carrier fabric (nonwoven composite) - mass/(g/m^2)[2]	D5261	240	240	240	90	100	n/a/90	20,000 m^2
carrier fabric (woven) - mass/unit area (g/m^2)	D5261	100	100	100	-	-	-	20,000 m^2
coating - mass/unit area (g/m^2)[3]	D5261	n/a	100	n/a	n/a	100	n/a	4,000 m^2
Geomembrane/Geofilm (as received)								
thickness[5] (mm)	D5199/D5994	n/a	n/a	0.40/0.50/0.10	n/a	n/a	0.40/0.75/0.10	20,000 m^2
density (g/cc)	D1505/D792	n/a	n/a	0.92	n/a	n/a	0.92	20,000 m^2
break tensile strength, MD&XMD (kN/m)	D6693	n/a	n/a	n/a	n/a	n/a	6.0	20,000 m^2
break tensile strength, MD (kN/m)	D882	n/a	n/a	2.5	n/a	n/a	2.5	20,000 m^2
GCL (as manufactured)								
mass of GCL (g/m^2)[6]	D5993	4000	4050	4100	4000	4050	4100	4,000 m^2
mass of bentonite (g/m^2)[6]	D5993	3700	3700	3700	3700	3700	3700	4,000 m^2
moisture content[12] (%)	D5993	(4)	(4)	(4)	(4)	(4)	(4)	4,000 m^2
tensile str., MD (kN/m)	D6768	4.0	4.0	4.0	4.0	4.0	4.0	20,000 m^2
peel strength (N/m)	D6496	360	360	360	n/a	n/a	n/a	4,000 m^2
permeability[1] (m/sec), "or"	D5887	5×10^{-11}	5×10^{-12}	5×10^{-12}	5×10^{-11}	5×10^{-12}	5×10^{-12}	25,000 m^2
flux[1] ($m^3/sec\text{-}m^2$),	D5887	1×10^{-8}	1×10^{-9}	1×10^{-9}	1×10^{-8}	1×10^{-9}	1×10^{-9}	25,000 m^2
GCL permeability[1,11,7] (m/sec) (max. at 35 kPa)	D6766	1×10^{-8}	1×10^{-9}	1×10^{-9}	1×10^{-8}	1×10^{-9}	1×10^{-9}	yearly
GCL permeability[1,11,7] (m/sec) (max. at 500 kPa)	D6766 mod.	5×10^{-10}	5×10^{-11}	5×10^{-11}	5×10^{-10}	5×10^{-11}	5×10^{-11}	yearly
Component Durability								
geotextile and reinforcing yarns[8] (% strength retained)	See § 5.6.2	65	65	n/a	65	65	n/a	yearly
geomembrane	See § 5.6.3	n/a	n/a	GM Spec[9]	n/a	n/a	GM Spec[9]	yearly
geofilm/polymer treated[8] (% strength retained)	See § 5.6.4	n/a	85	80	n/a	85	80	yearly

n/a = not applicable with respect to this property

(1) These values are maximum (all others are minimum)

(2) For both cap and carrier fabrics for nonwoven reinforced GCLs, one, or the other, must contain a scrim component of mass ≥ 100 g/m^2 for dimensional stability

(3) Calculated value obtained from difference of coated fabric to as-received fabric

(4) Value is both site-specific and product-specific and is currently being evaluated

(5) First value is for smooth geomembrane; second for textured geomembrane; third for geofilm

(6) Mass of the GCL and bentonite is measured after oven drying per the stated test method

(7) Value represents GCL permeability after permeation with a 0.1 M calcium chloride solution (11.1 g $CaCl_2$ in 1-liter water)

(8) Value represents the minimum percent strength retained from the as-manufactured value after oven aging at 60°C for 50 days

(9) Durability criteria should follow the appropriate specification for the geomembrane type used, i.e., GRI GM-13 for HDPE, GRI GM-17 for LLDPE or GRI GM-18 for fPP

Table 1(b) – Specification for Geosynthetic Clay Liners (GCLs)

Property	ASTM Test Method	Reinforced GCL			Non-Reinforced GCL			Testing Frequency
		GT-Related	GT Polymer Coated	GM-GF Related	GT-Related	GT Polymer Coated	GM-GF Related	
Clay (as received)								
swell index (ml/2g)	D5890	24	24	24	24	24	24	50 tonnes
fluid loss (ml)[1]	D5891	18	18	18	18	18	18	50 tonnes
Geotextiles (as received)								
cap fabric (nonwoven) - mass/unit area (oz/yd^2)[2]	D5261	5.8	5.8	5.8	2.1	2.9	n/a/2.1	25,000 yd^2
cap fabric (woven) - mass/unit area (oz/yd^2)	D5261	3.0	3.0	3.0	-	-	-	25,000 yd^2
carrier fabric (nonwoven composite) - mass/(oz/yd^2)[2]	D5261	5.9	5.9	5.9	2.7	2.9	n/a/2.7	25,000 yd^2
carrier fabric (woven) - mass/unit area (oz/yd^2)	D5261	3.0	3.0	3.0	-	-	-	25,000 yd^2
coating - mass/unit area (oz/yd^2)[3]	D5261	n/a	2.9	n/a	n/a	2.9	n/a	5,000 yd^2
Geomembrane/Geofilm (as received)								
thickness[5] (mils)	D5199/D5994	n/a	n/a	15/20/4	n/a	n/a	15/30/4	25,000 yd^2
density (g/cc)	D1505/D792	n/a	n/a	0.92	n/a	n/a	0.92	25,000 yd^2
break tensile strength, MD&XMD (lb/in.)	D6693	n/a	n/a	n/a	n/a	n/a	34	25,000 yd^2
break tensile strength, MD & XMD (lb/in.)	D882	n/a	n/a	14	n/a	n/a	14	25,000 yd^2
GCL (as manufactured)								
mass of GCL (lb/ft^2)[6]	D5993	0.82	0.83	0.84	0.82	0.83	0.84	5,000 yd^2
mass of bentonite (lb/ft^2)[6]	D5993	0.75	0.75	0.75	0.75	0.75	0.75	5,000 yd^2
moisture content[1] (%)	D5993	(4)	(4)	(4)	(4)	(4)	(4)	5,000 yd^2
tensile str., MD (lb/in.)	D6768	23	23	23	23	23	23	25,000 yd^2
peel strength (lb/in.)	D6496	2.1	2.1	2.1	n/a	n/a	n/a	5,000 yd^2
permeability[7] (cm/sec), "or"	D5887	5×10^{-9}	5×10^{-10}	n/a	5×10^{-9}	5×10^{-10}	n/a	30,000 yd^2
flux[1] (cm^3/sec-cm^2).	D5887	1×10^{-7}	1×10^{-7}	n/a	1×10^{-6}	1×10^{-7}	n/a	30,000 yd^2
GCL permeability[1][7] (cm/sec) (max. at 5 lb/in.^{2})	D6766	1×10^{-8}	1×10^{-7}	1×10^{-7}	1×10^{-8}	1×10^{-7}	1×10^{-7}	yearly
GCL permeability[1][7] (cm/sec) (max. at 70 lb/in.^{2})	D6766 mod.	5×10^{-8}	5×10^{-8}	5×10^{-9}	5×10^{-8}	5×10^{-9}	5×10^{-9}	yearly
Component Durability								
geotextile and reinforcing yarns[8] (% strength retained)	See § 5.6.2	65	65	n/a	65	65	n/a	yearly
geomembrane	See § 5.6.3	n/a	n/a	GM Spec[9]	n/a	n/a	GM Spec[9]	yearly
geofilm/polymer treated[8] (% strength retained)	See § 5.6.4	n/a	85	80	n/a	85	80	yearly

n/a = not applicable with respect to this property

(1) These values are maximum (all others are minimum)
(2) For both cap and carrier fabrics for nonwoven reinforced GCLs: one, or the other, must contain a scrim component of mass > 2.9 oz/yd^2 for dimensional stability
(3) Calculated value obtained from difference of coated fabric to as-received fabric
(4) Value is both site-specific and product-specific and is currently being evaluated
(5) First value is for smooth geomembrane; second for textured geomembrane; third for geofilm
(6) Mass of the GCL and bentonite is measured after oven drying per the stated test method
(7) Value represents GCL permeability after permeation with a 0.1 M calcium chloride solution (11.1 g CaCl2 in 1-liter water)
(8) Value represents the minimum percent strength retained from the as-manufactured value after oven aging at 60°C for 50 days
(9) Durability criteria should follow the appropriate specification for the geomembrane used; i.e., GRI GM-13 for HDPE, GRI GM-17 for LLDPE or GRI GM-18 for fPP

PART 1. GENERAL

1.01 DESCRIPTION

This section pertains to construction of the HDPE (High Density Polyethylene) Piping for the Leachate Collection System, Process Water Recovery System, ~~***the Slurry Piping and Valves,***~~ and Recycle Pond Decant System at the Gypsum Management Facility and the Leachate Collection System for the CCB Landfill.

1.02 RELATED SECTIONS

None.

1.03 REFERENCES

The following references, or cited portions thereof, govern the work

A. American Society of Testing and Materials:

1. ASTM D 2683 (2004); Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
2. ASTM D 3261 (2003); Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
3. ASTM D 3350 (2005); Specification for Polyethylene Plastics Pipe and Fittings Materials.
4. ASTM F 412 (2001a); Terminology Relating to Plastic Piping System.
5. ASTM F 1055 (1998); Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
6. ASTM F 1056 (2004); Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings.
7. ***ASTM F714-06a Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.***
8. ***ASTM F2164-02 Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure***

1.04 SUBMITTALS

A. Qualifications

Submit qualifications of the Welding Supervisor who will be responsible for construction quality control of the pipe joining process.

B. Material Certifications

Submit manufacturer certifications that the pipe provided complies with the requirements herein.

C. Product Data

1. Submit product data and operating instructions for pipe joining equipment.
2. Submit pipe manufacturer's recommended procedures for storing, handling, and installing pipe and fittings.

1.05 QUALIFICATIONS

A. The Contractor or Subcontractor performing the work under this section shall have in his employ a Welding Supervisor who has completed a minimum of 10,000 ft of pipe joining work using the type of equipment proposed for use in this work. The Welding Supervisor shall be on site at all times during pipe line installation, and shall provide direct supervision over other employees.

1.06 WARRANTY

A. The pipe and fittings shall be warranted, on a pro-rata basis, against manufacturer's defects for a period of five (5) years from the date of pipe installation. The installation shall be warranted against defects in workmanship for a period of one (1) year from the date of completion.

PART 2. PRODUCTS

2.01 MATERIALS

A. Leachate and Process Water Collection Piping

1. Pipe material shall be High Density Polyethylene (HDPE) PE 3408, according to ASTM F412, with minimum cell classification values of 345464C, according to ASTM D3350. Iron pipe size (IPS) and standard dimension ratio (SDR) shall be as indicated in the plans.

2. Size and spacing of holes in perforated pipe shall be as indicated in the plans.

~~B. *Slurry* Sluice Piping~~

~~Pipe for HDPE Sluice Lines shall be manufactured from a PE 3408 resin. The resin material shall meet the specifications of ASTM D3350-02 with a minimum cell~~

~~classification of PE345464C. Pipe O.D. sizes 4" to 54" shall be available in steel pipe sizes (IPS). Pipe shall have a manufacturing standard of ASTM D3035 and be manufactured by an ISO 9001 certified manufacturer. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.~~

~~***Pipe shall be manufactured from a pipe resin which meets ASTM D 3350-05 with a minimum cell classification of 445474C. Pipe shall be manufactured to the dimensions of ASTM F-714. The service factor to determine the pressure rating shall be 0.63. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material.***~~

C. Fittings ***(Leachate and Process Water Collection Piping)***

1. Fittings shall be made of the same material and size as the HDPE piping, and shall have a pressure rating no less than 160 psi.

2. Butt Fusion Fittings

   Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99. Butt Fusion Fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans. Fabricated fittings are to be manufactured using a Data Logger. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records.

3. Electrofusion Fittings - Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99. Electrofusion Fittings shall have a manufacturing standard of ASTM F-1055. Fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans.

4. Flanged and Mechanical Joint Adapters - Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D-3350. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D-3261. Fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans. Flanged and Mechanical Joint Adapters are to be used for Sluice Piping only.

~~D. Valves ***and Valve Piping*** for Sluice ***Slurry*** Piping~~

~~Valves used for Sluice Piping shall be ITT Fabri-Valve XS150-ULV-Urethane~~

~~Lined Knife Gate Valves. Valve Material: Yet to Be Determined~~

~~*Valves used for the Slurry Piping System shall be Clarkson KGF Knife Gate Valve with ductile iron housing high tear strength gum rubber sleeves, C276 gate rated at 300 psig, with manual handwheel actuation.*~~

~~*Fittings and piping at valve stations shall be SILVER STREAK model fiberglass reinforced plastic (FRP) as manufactured by Fiber Glass Systems. Flanges shall have ANSI B16.5 Class 150 bolt hole patterns. Flanged connections to valves shall have ANSI B16.5 Class 300 bolt hole patterns. ASTM A307, Grade B, hex head bolts shall be supplied. Washers shall be supplied on all nuts and bolts. Gaskets shall be 1/8" thick, 60-70 durometer full-face type suitable for the service shown on the drawings and as recommended in the manufacturer's standard installation procedures. Pipe shall be installed as specified and indicated on the drawings.*~~

~~*E. Fittings for HDPE Slurry Piping*~~

1. ~~*Butt Fusion Fittings – Fittings Pipe shall be manufactured from a pipe resin which meets ASTM D 3350-05 with a minimum cell classification of 445474C. Pipe shall be manufactured to the dimensions of ASTM F-714. The service factor to determine the pressure rating shall be 0.63. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material*~~

2. ~~*Molded Butt Fusion Fittings shall have a manufacturing standard of ASTM D-3261. Molded & fabricated fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans. Fabricated fittings must have the same pressure rating as the pipe; a DR less than the pipe shall be used. Fabricated fittings are to be manufactured using a Data Logger to record temperature, fusion pressure, and a graphic representation of the fusion cycle shall be part of the Quality Control records.*~~

3. ~~*Electrofusion Fittings – Fittings shall be made from resin or pipe meeting ASTM D 3350-05 with a minimum cell classification of 445474C.; Electrofusion Fittings shall meet the manufacturing standard of ASTM F-1055. Fittings shall have the same pressure rating as the pipe or higher unless otherwise specified on the plans.*~~

4. ~~*Flanged and Mechanical Joint Adapters – Flanged and Mechanical Joint Adapters shall be made from materials containing resin that meets ASTM D 3350-05 with a minimum cell classification of 445474C.*~~

2.02 EQUIPMENT

A. Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 PSI. The butt fusion joining will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. All field welds shall be made with fusion equipment equipped with a Data Logger. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the Quality Control records.

B. Sidewall fusions for connections to outlet piping shall be performed in accordance with HDPE pipe and fitting manufacturer's specifications. The heating irons used for sidewall fusion shall have an inside diameter equal to the outside diameter of the HDPE pipe being fused. The size of the heating iron shall be ¼ inch larger than the size of the outlet branch being fused.

C. Mechanical joining will be used where the butt fusion method can not be used. Mechanical joining will be accomplished by either using a HDPE flange adapter with a Ductile Iron back-up ring or HDPE Mechanical Joint adapter with a Ductile Iron back-up ring.

D. Socket fusion, hot gas fusion, threading, solvents, and epoxies will not be used to join HDPE pipe.

PART 3. EXECUTION

3.01 MATERIAL DELIVERY, STORAGE, AND HANDLING

A. HDPE pipe and fittings shall be packaged and shipped by appropriate means to prevent damage to the material and to facilitate off-loading. The Owner will provide an on-site storage site. Storage site requirements (size and preferred location) shall be submitted with the bid documents.

B. Storage and handling shall be according to manufacturer's recommendations.

3.02 BASE PREPARATION

HDPE Piping for leachate and process water collection shall be installed on a layer of coarse aggregate placed by the Contractor in accordance with the plans. The grade of the coarse aggregate base shall be verified before installing the piping.

3.03 TRENCH INSTALLATION

Excavation, Foundation, Bedding and Haunching for the underground installation of HDPE Sluice Piping shall be in accordance with Section 20-2.20 of the "Standard Specifications for Water and Sewer Main Construction in Illinois". The trench shall be backfilled with excavated material to the top of trench surface. Excavations in areas of Structural Fill shall be backfill with and compacted to the specifications of Section 02200-Earthwork for Structural Fill. All other areas shall be backfilled to 92% of the dry density, as determined by the Standard Proctor Test ASTM D698.

3.03 INSTALLATION

All pipe and fittings shall be installed according to the manufacturer's recommendations. Removal of weld beads is not required. Contractor shall place coarse aggregate along the pipe to provide lateral stability. Welds shall not be obscured until they have been approved by the Owner's Representative, the top of pipe shall not be covered until the Construction Quality Assurance (CQA) survey has been completed to verify conformance with specified tolerances.

3.04 INSPECTIONS

A. The Owner's Representative shall shall visually inspect pipe materials to verify that each pipe material is properly stamped (by the manufacturer) for ASTM acceptance before installation. Defective or damaged materials shall be removed from the site.

B. Each weld and connection shall be visually inspected by the Owner's Representative. Defective welds shall be repaired as directed by the Owner's Representative and according to manufacturer's recommendations. Welds and connections shall not be covered until they have been approved by the Owner's Representative.

3.05 TOLERANCES

A. HDPE piping shall be located within 0.5 ft. of plan location, and elevation shall be within 0.1 ft. of plan elevation with no adverse slopes.

~~***3.06 TESTING***~~

~~***A. All Slurry Piping shall be Hydrostatic Tested in accordance with ASTM F 2164, using a Design Pressure of 270 PSIG.***~~

END OF SECTION 02936

PART 1. GENERAL

1.01 DESCRIPTION

A. This section includes installing pipe culverts and end sections for pipe culverts.

B. Storm Drainage installation shall include incidental related work such as topsoil removal, trench excavation, backfill, compaction, tie-in of existing system, etc..

1.02 RELATED SECTIONS

A. The following sections contain items which are related to the work in this section:

1. 02200 - Earthwork

1.03 REFERENCES

A. The following reference, or cited portions thereof, governs the work:

1. Illinois Department of Transportation (IDOT): Standard Specifications for Road and Bridge Construction, adopted January 1, 2007. Payment provisions shall not apply.

PART 2. PRODUCTS

2.01 PIPE CULVERTS

A. ***HDPE*** Pipe Culverts shall be installed in accordance with Article 542 of the Standard Specifications. All piping shall be Corrugated PE (Polyethylene) with a Smooth Interior, in accordance with AASHTO M 294, Type S.

2.02 METAL END SECTIONS

A. Metal End Sections shall be either aluminum or steel in accordance with Article 542.07(c) of the Standard Specifications.

2.03 REINFORCED CONCRETE CULVERT PIPE

A. Reinforced Concrete Culvert Pipe shall be furnished in accordance with Article 1042.06(a) of the Standard Specifications.

2.03 PRECAST REINFORCED CONCRETE FLARED END SECTIONS

A. Precast Reinforced Concrete Flared End Sections shall be furnished in accordance with Article 1042.07(a) of the Standard Specifications.

PART 3. EXECUTION

3.01 STORM DRAINAGE PIPING INSTALLATION

A. Construct pipe culverts in accordance with the Article 542 of the Standard Specifications. Bedding and Haunching shall be IDOT CA-6 Gradation. Trench excavations are to be backfilled with on-site clayey materials instead of sand. Compact backfill to 95 percent of the maximum dry density as determined by the Standard Proctor test – ASTM D-698.

3.02 ~~METAL~~ END SECTION INSTALLATION

A. End Treatments shall be installed according to Article 542.07 of the Standard Specifications.

END OF SECTION 02700

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PART 1. GENERAL

1.01 DESCRIPTION

A. This section includes manufacturing, furnishing, and installing High Density Polyethylene (HDPE) Geomembranes for the Gypsum Management Facility and the CCB Landfill.

B. The work includes furnishing all equipment and materials and providing all labor, supervision, administration and management necessary to perform the work as shown on the plans.

1.02 RELATED SECTIONS

A. The following sections contain items which are related to the work in this section:

1. 02373 – Geotextiles
2. 02376 – Geosynthetic Clay Liner

1.03 REFERENCES

A. The following references, or cited portions thereof, govern the work:

1. American Society for Testing and Materials (ASTM):

   a. D 638, Standard Test Method for Tensile Properties of Plastics.
   b. D 751, Standard Test Methods for Coated Fabrics.
   c. D 792, Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
   d. D 1004, Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
   e. D 1204, Standard Test Method for Linear Dimensional Changes of Non Rigid Thermoplastic Sheeting or Film at Elevated Temperature.
   f. D 1238, Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
   g. D 1505, Standard Test Method for Density of Plastics by Density-Gradient Technique.
   h. D 1603, Standard Test Method for Carbon Black in Olefin Plastics.
   i. D 3895, Test Method for Oxidative Induction Time of Polyolefins by Thermal Analysis.

j. D 4218, Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.

k. D 4437, Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes.

l. D 4833, Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products.

m. D 5199, Standard Test Method for Measuring Nominal Thickness of Smooth Geomembranes.

n. D 5397, Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefins using Notched Constant Tensile Load Test.

o. D 5596, Standard Practice for Microscopical Examination of Pigment Dispersion in Plastic Compounds.

p. D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.

q. D 5721, Practice for Air-Oven Aging of Polyolefin Geomembranes.

r. D 5820, Test Method for Air Testing.

s. D 5885, Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry.

t. D 5994, Standard Test Method for Measuring Nominal Thickness of Textured Geomembranes

u. D 6365, Standard Practice for the Nondestructive Testing of Geomembrane Seams using The Spark Test

2. Geosynthetic Research Institute (GRI):

a. GRI GM 6, Pressurized Air Channel Test for Dual Seamed Geomembranes

b. GRI GM 9, Cold Weather Seaming of Geomembranes

c. GRI GM 10, Specification for Stress Crack Resistance of HDPE Geomembrane Sheet

d. GRI GM 13, Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes

e. GRI GM 14, Test Frequencies for Destructive SeamTesting

1.04 SUBMITTALS

A. Submit the following to the Engineer or Owner, for review and approval, within a reasonable time so as to expedite shipment or installation of the Geomembrane:

1. Documentation of manufacturer's qualifications as specified in subsection 1.05A of this Section.

2. Manufacturer's Quality Control program manual or descriptive documentation.

3. A material properties sheet, including at a minimum all properties specified in GRI GM 13, including test methods used.

4. Sample of the material.

5. Documentation of Installer's qualifications, as specified below and in subsection 1.05B of this Section.
   a. Submit a list of at least ten completed facilities. For each name and type of facility; its location; the date of installation; phone number of contact at the facility; type and thickness of geomembrane and; surface area of the installed geomembrane.
   b. Submit resumes or qualifications of the Installation Supervisor, Master Seamer and Technicians to be assigned to this project.
   c. Quality Control Program.

6. Example Material Warranty and Liner Installation Warranty complying with subsections 1.07 and 1.08 of this Section.

7. Resin Supplier's name, resin production plant identification, resin brand name and number, production date of the resin, resin Manufacturer's quality control certificates, and certification that the properties of the resin meet the requirements of these specifications.

B. Shop Drawings

1. Submit copies of shop drawings for engineer's approval within a reasonable time so as not to delay the start of geomembrane installation. Shop drawings shall show the proposed panel layout identifying seams and details. Seams should generally follow direction of the slope. Butt seams or roll-end seams should not occur on a slope unless approved by the Owner's Representative. Butt seams on a slope, if allowed, should be staggered.

2. Placement of geomembrane will not be allowed to proceed until Owner's Representative has received and approved the shop drawings.

C. Additional Submittals (In-Progress and at Completion)

1. Manufacturer's warranty (refer to subsection 1.08).
2. Geomembrane installation warranty (refer to subsection 1.09).
3. Daily written acceptance of subgrade surface (refer to subsection 3.01.C).
4. Low-temperature seaming procedures if applicable (refer to subsection 3.03.A)
5. Prequalification test seam samples (refer to subsection 3.05.A.6).
6. Field seam non-destructive test results (refer to subsection 3.05.B.1).
7. Field seam destructive test results (refer to subsection 3.05.C.6).
8. Daily field installation reports (refer to subsection 3.05.G).

9. Installation record drawing, as discussed in subsection 3.05.G).

1.05 QUALITY CONTOL

A. Manufacturer's Qualifications:

The manufacturer of geomembrane of the type specified or similar product shall have at least five years experience in the manufacture of such geomembrane. In addition, the geomembrane manufacturer shall have manufactured at least 10,000,000 sq. ft. of the specified type of geomembrane or similar product during the last five years.

B. Installer's Qualifications:

1 The Geomembrane Installer shall be the Manufacturer, approved Manufacturer's Installer or a contractor approved by the Owner's Representative to install the geomembrane.

2 The Geomembrane Installer shall have at least three years experience in the installation of the specified geomembrane or similar. The Geomembrane Installer shall have installed at least 10 projects involving a total of 5,000,000 sq. ft. of the specified type of geomembrane or similar during the last three years.

3 Installation shall be performed under the direction of a field Installation Supervisor who shall be responsible throughout the geomembrane installation, for geomembrane panel layout, seaming, patching, testing, repairs, and all other activities of the Geomembrane Installer. The Field Installation Supervisor shall have installed or supervised the installation and seaming of a minimum of 10 projects involving a total of 5,000,000 sq. ft. of geomembrane of the type specified or similar product.

4 Seaming shall be performed under the direction of a Master Seamer (who may also be the Field Installation Supervisor or Crew Foreman) who has seamed a minimum of 3,000,000 sq. ft. of geomembrane of the type specified or similar product, using the same type of seaming apparatus to be used in the current project. The Field Installation Supervisor and/or Master Seamer shall be present whenever seaming, patching, other welding operations, and testing is performed.

5 All seaming, patching, other welding operations, and testing shall be performed by qualified technicians employed by the Geomembrane Installer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Each roll of geomembrane delivered to the site shall be labeled by the manufacturer. The label shall be firmly affixed and shall clearly state the manufacturer's name, product identification, material thickness, roll number, roll dimensions and roll weight.

B. Geomembrane shall be protected from mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions.

C. Rolls shall be stored away from high traffic areas. Continuously and uniformly support rolls on a smooth, level prepared surface.

D. Rolls shall not be stacked more than three high.

1.07 PROJECT CONDITIONS

Geomembrane shall not be installed in the presence of standing water, while precipitation is occurring, during excessive winds, or when material temperatures are outside the limits specified in Section 3.03.

1.08 MATERIAL WARRANTY

As required by specification, or as required in GRI GM 13 (attachment A)

1.09 GEOMEMBRANE INSTALLATION WARRANTY

The Geomembrane Installer shall guarantee the geomembrane installation against defects in the installation and workmanship for 1 year commencing with the date of final acceptance.

1.10 GEOMEMBRANE PRE-CONSTRUCTION MEETING

A. Geomembrane Pre-Construction Meeting shall be held at the site prior to installation of the geomembrane. At a minimum, the meeting shall be attended by the Geomembrane Installer, Owner, Owner's representative (Engineer and/or CQA Firm), and the General Contractor.

B. Topics for this meeting shall include:

1. Responsibilities of each party.
2. Lines of authority and communication. Resolution of any project document ambiguity.
3. Methods for documenting, reporting and distributing documents and reports.
4. Procedures for packaging and storing archive samples.
5. Review of time schedule for all installation and testing.
6. Review of panel layout and numbering systems for panels and seams including details for marking on geomembrane.
7. Procedures and responsibilities for preparation and submission of as-built panel and seam drawings.
8. Temperature and weather limitations. Installation procedures for adverse weather conditions. Defining acceptable subgrade, geomembrane, or ambient moisture and temperature conditions for working during liner installation.
9. Subgrade conditions, dewatering responsibilities and subgrade maintenance plan.
10. Deployment techniques including allowable subgrade for the geomembrane.
11. Plan for controlling expansion/contraction and wrinkling of the

geomembrane.

12. Covering of the geomembrane and cover soil placement.
13. Measurement and payment schedules.
14. Health and safety.

C. The meeting shall be documented by the Owner's Representative and minutes shall be transmitted to all parties.

PART 2. PRODUCTS

2.01 SOURCE QUALITY CONTROL

Manufacturing Quality Control

A. The test methods and frequencies used by the manufacturer for quality control/quality assurance of the above geomembrane prior to delivery, shall be in accordance with GRI GM13, or modified as required for project specific conditions.

B. The manufacturer's geomembrane quality control certifications, including results of quality control testing of the products, as specified in subsection 2.01.C of this Section, must be supplied to the Owner's Representative. The certification shall be signed by a responsible party employed by the manufacturer, such as the QA/QC Manager, Production Manager, or Technical Services Manager. Certifications shall include lot and roll numbers and corresponding shipping information.

C. The Manufacturer will provide Certification that the geomembrane and welding rod supplied for the project have the same base resin and material properties.

2.02 GEOMEMBRANE

A. The geomembrane shall consist of new, first quality products designed and manufactured specifically for the purpose of this work which shall have been satisfactorily demonstrated by prior testing to be suitable and durable for such purposes. The geomembrane rolls shall be seamless, high density polyethylene (HDPE- Density >0.94g/cm) containing no plasticizers, fillers or extenders and shall be free of holes, blisters or contaminants, and leak free verified by 100% in line spark or equivalent testing. The geomembrane shall be supplied as a continuous sheet with no factory seams in rolls. Smooth Geomembrane shall meet the property requirements shown in Table 1(a) of the GRI GM13 Specifications included at the end of this Section. Textured Geomembrane shall meet the property requirements shown in Table 2(a) of the GRI GM13 Specifications included at the end of this Section.

B. Material shall be reviewed for conformance to the project specifications by the Owner's Representative.

PART 3. EXECUTION

3.01 SUBGRADE PREPARATION

A. Geomembrane installed over geosynthetic clay liner (GCL) (Gypsum Stack and CCB Landfill).

The area of GCL to be covered with geomembrane shall be jointly inspected by the Geosynthetics Installer's CQA Representative daily with the Owner's Representative before commencing geomembrane installation for the day, and the condition of the GCL shall be continuously observed as geomembrane installation progresses. Rocks, stones, sticks, sharp objects and debris of any kind shall be removed from the surface of the GCL. The Owner's Representative shall be notified of any discontinuities, premature hydration, or otherwise defective GCL. Geomembrane shall not be placed over suspect areas until they have been repaired to the satisfaction of the Owner's Representative. The Geosynthetics Installer's CQA Representative shall submit a certificate of acceptance to the Owner's Representative daily, stating that the GCL surface was acceptable at the time of geomembrane installation.

B. Geomembrane installed over cushion dirt.(Gypsum Stack only) ***or Earth Fill Material (Recycle Pond only)***

The area of cushion dirt to be covered with geomembrane shall be prepared in accordance with the Section 02200 – Earthwork. The surface shall be smooth and free of ruts and holes, rocks, stones, sticks, sharp objects and debris of any kind.

C. The Geomembrane installer shall provide daily, a certificate of acceptance for the surface to be covered by the geomembrane in that day's operations. The surface shall be maintained in a manner, during geomembrane installation, to ensure subgrade suitability.

D. All subgrade damaged by construction equipment and deemed unsuitable by the Owner's Representative for geomembrane deployment shall be repaired prior to placement of the geomembrane. All repairs shall be reviewed by the Owner's Representative and approved by the Geomembrane Installer. This damage, repair, and the responsibilities of the contractor and Geomembrane Installer shall be defined in the preconstruction meeting.

3.02 GEOMEMBRANE PLACEMENT

A. No geomembrane shall be deployed until the applicable certifications and quality control certificates listed in subsection 1.04 of this Section are submitted to and approved by the Owner's Representative. Should geomembrane material be deployed prior to approval by the Owner's Representative it will be at the sole risk of the Geomembrane Installer and/or Contractor. If the material does not meet project specifications it shall be removed from the work area at no cost to the

owner.

B. The geomembrane shall be installed to the limits shown on the project drawings and essentially as shown on approved panel layout drawings.

C. No geomembrane material shall be unrolled and deployed if the material temperatures are lower than 0 degrees C (32 degrees F). Temperature limitations should be defined in the preconstruction meeting. Typically, only the quantity of geomembrane that will be anchored and seamed together in one day should be deployed.

D. No vehicular traffic shall travel on the geomembrane other than an approved low ground pressure All Terrain Vehicle or equivalent.

E. Sand bags or equivalent ballast shall be used as necessary to temporarily hold the geomembrane material in position under the foreseeable and reasonably - expected wind conditions. Sand bag material shall be sufficiently close- knit to prevent soil fines from working through the bags and discharging on the geomembrane.

F. Geomembrane placement shall not be done if moisture prevents proper subgrade preparation, panel placement, or panel seaming. Moisture limitations will be defined in the preconstruction meeting.

G. Damaged panels or portions of the damaged panels which have been rejected shall be marked and their removal from the work area recorded.

H. The geomembrane shall not be allowed to "bridge over" voids or low areas in the subgrade. In these areas, the subgrade shall be prepared to allow the geomembrane to rest in intimate contact with the subgrade.

I. Wrinkles caused by panel placement or thermal expansion should be minimized in accordance with section 1.10 B11.

J. Considerations on Site Geometry: In general, seams shall be oriented parallel to the line of the maximum slope. In corners and odd shaped geometric locations, the total length of field seams shall be minimized. Seams shall not be located at low points in the subgrade.

K. Overlapping: The panels shall be overlapped prior to seaming to whatever extent is necessary to effect a good weld and allow for proper testing. In no case shall this overlap be less than 75mm (3 in.).

3.03 SEAMING PROCEDURES

A. No geomembrane material shall be seamed when liner temperatures are less than 0 degrees C (32 degrees F).

B. No geomembrane material shall be seamed when the sheet temperature is above 75 degrees C (170 degrees F) as measured by an infrared thermometer or surface thermocouple.

C. Seaming shall primarily be performed using automatic fusion welding equipment and techniques. Extrusion welding shall be used where fusion welding is not possible such as at pipe penetrations, patches, repairs and short (less than a roll width) runs of seams.

D. Fishmouths or excessive wrinkles at the seam overlaps, shall be minimized and when necessary cut along the ridge of the wrinkles back into the panel so as to

effect a flat overlap. The cut shall be terminated with a keyhole cut (nominal 10 mm (1/2 in) diameter hole) so as to minimize crack/tear propagation. The overlay shall subsequently be seamed. The key hole cut shall be patched with an oval or round patch of the same base geomembrane material extending a minimum of 150 mm (6 in.) beyond the cut in all directions.

3.04 PIPE AND STRUCTURE PENETRATION SEALING SYSTEM

A. Provide penetration sealing system as shown in the Project Drawings.

B. Penetrations shall be constructed from the base geomembrane material, flat stock, prefabricated boots and accessories as shown on the Project Drawings. The pre-fabricated or field fabricated assembly shall be field welded to the geomembrane as shown on the Project Drawings so as to prevent leakage. This assembly shall be tested as outlined in section 3.05.B. Alternatively, where field non destructive testing can not be performed, attachments will be field spark tested by standard holiday leak detectors in accordance with ASTM 6365. Spark testing should be done in areas where both air pressure testing and vacuum testing are not possible.

1. Equipment for Spark testing shall be comprised of but not limited to: A hand held holiday spark tester and conductive wand that generates a high voltage.
2. The testing activities shall be performed by the Geomembrane Installer by placing an electrically conductive tape or wire beneath the seam prior to welding. A trial seam containing a non welded segment shall be subject to a calibration test to ensure that such a defect (non welded segment) will be identified under the planned machine settings and procedures. Upon completion of the weld, enable the spark tester and hold approximately 25mm (1 in) above the weld moving slowly over the entire length of the weld in accordance with ASTM 6365. If there is no spark the weld is considered to be leak free.
3. A spark indicates a hole in the seam. The faulty area shall be located, repaired and retested by the Geomembrane Installer.
4. Care should be taken if flammable gases are present in the area to be tested.

3.05 FIELD QUALITY CONTROL

The Owner's Representative shall be notified prior to all pre qualification and production welding and testing, or as agreed upon in the pre construction meeting.

A. Prequalification Test Seams

1. Test seams shall be prepared and tested by the Geomembrane Installer to verify that seaming parameters (speed, temperature and pressure of welding equipment) are adequate.
2. Test seams shall be made by each welding technician and tested in accordance with ASTM D 4437 at the beginning of each seaming period. Test seaming shall be performed under the same conditions and with the same equipment and operator combination as production seaming. The

test seam shall be approximately 3.3 meters (10 feet) long for fusion welding and 1 meter (3 feet) long for extrusion welding with the seam centered lengthwise. At a minimum, tests seams should be made by each technician 1 time every 4–6 hours; additional tests may be required with changes in environmental conditions.

3. Two 25 mm (1 in) wide specimens shall be die-cut by the Geomembrane Installer from each end of the test seam. These specimens shall be tested by the Geomembrane Installer using a field tensiometer testing both tracks for peel strength and also for shear strength. Each specimen shall fail in the parent material and not in the weld, "Film Tear Bond"(F.T.D. failure). Seam separation equal to or greater than 10% of the track width shall be considered a failing test.
4. The minimum acceptable seam strength values to be obtained for all specimens tested are listed in Subsection 3.05.C.4 of this Section. All four specimens shall pass for the test seam to be a passing seam.
5. If a test seam fails, an additional test seam shall be immediately conducted. If the additional test seam fails, the seaming apparatus shall be rejected and not used for production seaming until the deficiencies are corrected and a successful test seam can be produced.
6. A sample from each test seam shall be labeled. The label shall indicate the date, geomembrane temperature, number of the seaming unit, technician performing the test seam and pass or fail description. The sample shall then be given to the Owner's Representative for archiving.

B. Field Seam Non-destructive Testing

1. All field seams shall be non-destructively tested by the Geomembrane Installer over the full seam length before the seams are covered. Each seam shall be numbered or otherwise designated. The location, date, test unit, name of tester and outcome of all non-destructive testing shall be recorded and submitted to the Owner's Representative.
2. Testing should be done as the seaming work progresses, not at the completion of all field seaming. All defects found during testing shall be numbered and marked immediately after detection. All defects found should be repaired, retested and remarked to indicate acceptable completion of the repair.
3. Non-destructive testing shall be performed using vacuum box, air pressure or spark testing equipment.
4. Non-destructive tests shall be performed by experienced technicians familiar with the specified test methods. The Geomembrane Installer shall demonstrate to the Owner's Representative all test methods to verify the test procedures are valid.
5. Extrusion seams shall be vacuum box tested by the Geomembrane Installer in accordance with ASTM D 4437 and ASTM D 5641 with the following equipment and procedures:
   a. Equipment for testing extrusion seams shall be comprised of but not limited to: a vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft rubber gasket

attached to the base, port hole or valve assembly and a vacuum gauge; a vacuum pump assembly equipped with a pressure controller and pipe connections; a rubber pressure/vacuum hose with fittings and connections; a plastic bucket; wide paint brush or mop; and a soapy solution.

b. The vacuum pump shall be charged and the tank pressure adjusted to approximately 35 kPa (5 psig).

c. The Geomembrane Installer shall create a leak tight seal between the gasket and geomembrane interface by wetting a strip of geomembrane approximately 0.3m (12 in) by 1.2m (48 in) (length and width of box) with a soapy solution, placing the box over the wetted area, and then compressing the box against the geomembrane. The Geomembrane Installer shall then close the bleed valve, open the vacuum valve, maintain initial pressure of approximately 35 kPa (5 psig) for approximately 5 seconds. The geomembrane should be continuously examined through the viewing window for the presence of soap bubbles, indicating a leak. If no bubbles appear after 5 seconds, the area shall be considered leak free. The box shall be depressurized and moved over the next adjoining area with an appropriate overlap and the process repeated.

d. All areas where soap bubbles appear shall be marked, repaired and then retested.

e. At locations where seams cannot be non destructively tested, such as pipe penetrations, alternate nondestructive spark testing (as outlined in section 3.04.B) or equivalent should be substituted.

f. All seams that are vacuum tested shall be marked with the date tested, the name of the technician performing the test and the results of the test.

6. Double Fusion seams with an enclosed channel shall be air pressure tested by the Geomembrane Installer in accordance with ASTM D 5820 and ASTM D 4437 and the following equipment and procedures:

a. Equipment for testing double fusion seams shall be comprised of but not limited to: an air pump equipped with a pressure gauge capable of generating and sustaining a pressure of 210 kPa (30 psig), mounted on a cushion to protect the geomembrane; and a manometer equipped with a sharp hollow needle or other approved pressure feed device.

b. The Testing activities shall be performed by the Geomembrane Installer. Both ends of the seam to be tested shall be sealed and a needle or other approved pressure feed device inserted into the tunnel created by the double wedge fusion weld. The air pump shall be adjusted to a pressure of 210 kPa (30 psig), and the valve closed,. Allow 2 minutes for the injected air to come to equilibrium in the channel, and sustain pressure for 5 minutes. If pressure loss does not exceed 28 kPa (4 psig) after this five minute period the seam shall be considered leak tight. Release pressure from the opposite end verifying pressure drop on needle to ensure testing of

the entire seam. The needle or other approved pressure feed device shall be removed and the feed hole sealed.

c. If loss of pressure exceeds 28 kPa (4 psig) during the testing period or pressure does not stabilize, the faulty area shall be located, repaired and retested by the Geomembrane Installer.

d. Results of the pressure testing shall be recorded on the liner at the seam tested and on a pressure testing record.

C. Destructive Field Seam Testing

1. One destructive test sample per 150 linear m (500 linear ft) seam length or another predetermined length in accordance with GRI GM 14 shall be taken by the Geomembrane Installer from a location specified by the Owner's Representative. The Geomembrane Installer shall not be informed in advance of the sample location. In order to obtain test results prior to completion of geomembrane installation, samples shall be cut by the Geomembrane Installer as directed by the Owner's Representative as seaming progresses.

2. All field samples shall be marked with their sample number and seam number. The sample number, date, time, location, and seam number shall be recorded. The Geomembrane Installer shall repair all holes in the geomembrane resulting from obtaining the seam samples. All patches shall be vacuum box tested or spark tested. If a patch cannot be permanently installed over the test location the same day of sample collection, a temporary patch shall be tack welded or hot air welded over the opening until a permanent patch can be affixed.

3. The destructive sample size shall be 300 mm (12 in) wide by 1 m (36 in) long with the seam centered lengthwise. The sample shall be cut into three equal sections and distributed as follows: one section given to the Owner's Representative as an archive sample; one section given to the Owner's Representative for laboratory testing as specified in paragraph 5 below; and one section retained by the Geomembrane Installer for field testing as specified in paragraph 4 below.

4. For field testing, the Geomembrane Installer shall cut 10 identical 25 mm (1 in) wide replicate specimens from his sample. The Geomembrane Installer shall test five specimens for seam shear strength and five for peel strength. Peel tests will be performed on both inside and outside weld tracks. To be acceptable, 4 of 5 test specimens must pass the stated criteria in section 2.02 with less than 10% separation. If 4 of 5 specimens pass, the sample qualifies for testing by the testing laboratory if required.

5. If independent seam testing is required by the specifications it shall be conducted in accordance with ASTM 5820 or ASTM D4437 or GRI GM 6.

6. Reports of the results of examinations and testing shall be prepared and submitted to the Owner's Representative.

7. For field seams, if a laboratory test fails, that shall be considered as an indicator of the possible inadequacy of the entire seamed length corresponding to the test sample. Additional destructive test portions shall

then be taken by the Geomembrane Installer at locations indicated by the Engineer, typically 3 m (10 ft) on either side of the failed sample and laboratory seam tests shall be performed. Passing tests shall be an indicator of adequate seams. Failing tests shall be an indicator of non-adequate seams and all seams represented by the destructive test location shall be repaired with a cap-strip extrusion welded to all sides of the capped area. All cap-strip seams shall be non-destructively vacuum box tested until adequacy of the seams is achieved. Cap strip seams exceeding 50 M in length (150 FT) shall be destructively tested.

D. Identification of Defects

1. Panels and seams shall be inspected by the Installer and Owner's Representative during and after panel deployment to identify all defects, including holes, blisters, undispersed raw materials and signs of contamination by foreign matter.

E. Evaluation of Defects: Each suspect location on the liner (both in geomembrane seam and non-seam areas) shall be non-destructively tested using one of the methods described in Section 3.05.B. Each location which fails non-destructive testing shall be marked, numbered, measured and posted on the daily "installation" drawings and subsequently repaired.

1. If a destructive sample fails the field or laboratory test, the Geomembrane Installer shall repair the seam between the two nearest passed locations on both sides of the failed destructive sample location.
2. Defective seams, tears or holes shall be repaired by reseaming or applying a extrusion welded cap strip.
3. Reseaming may consist of either:
   a. Removing the defective weld area and rewelding the parent material using the original welding equipment; or
   b. Reseaming by extrusion welding along the overlap at the outside seam edge left by the fusion welding process.
4. Blisters, larger holes, and contamination by foreign matter shall be repaired by patches and/or extrusion weld beads as required. Each patch shall extend a minimum of 150 mm (6 in) beyond all edges of the defects.
5. All repairs shall be measured, located and recorded.

F. Verification of Repairs on Seams: Each repair shall be non-destructively tested using either vacuum box or spark testing methods. Tests which pass the non-destructive test shall be taken as an indication of a successful repair. Failed tests shall be reseamed and retested until a passing test results. The number, date, location, technician and test outcome of each patch shall be recorded.

G. Daily Field Installation Reports: At the beginning of each day's work, the Installer shall provide the Engineer with daily reports for all work accomplished on the previous work day. Reports shall include the following:

1. Total amount and location of geomembrane placed;

2. Total length and location of seams completed, name of technicians doing seaming and welding unit numbers;
3. Drawings of the previous day's installed geomembrane showing panel numbers, seam numbers and locations of non-destructive and destructive testing;
4. Results of pre-qualification test seams;
5. Results of non-destructive testing; and
6. Results of vacuum testing of repairs.

H. Destructive test results shall be reported prior to covering of liner or within 48 hours.

3.06 LINER ACCEPTANCE

A. Geomembrane liner will be accepted by the Owner's Representative when:

1. The entire installation is finished or an agreed upon subsection of the installation is finished;
2. All Installer's QC documentation is completed and submitted to the owner
3. Verification of the adequacy of all field seams and repairs and associated geomembrane testing is complete.

3.07 ANCHOR TRENCH

A. Construct as specified on the project drawings.

3.08 DISPOSAL OF SCRAP MATERIALS

A. On completion of installation, the Geomembrane Installer shall dispose of all trash and scrap material in a location designated by the Owner's Representative, remove equipment used in connection with the work herein, and shall leave the premises in a neat acceptable manner. Scrap sections larger than 5 feet on each edge shall be segregated from smaller scraps and retained by the Owner. No scrap material shall be allowed to remain on the geomembrane surface.

PART 4. GRI GM13 SPECIFICATIONS

Geosynthetics Research Institute (GRI) Test Method GM13 – "Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes", Revision 8, Dated July 10, 2006.

ATTACHMENT A:

Minimum Average Weld Properties for Smooth and Textured HDPE Geomembranes (English units)								
Property	**Test Method**	**30 mil**	**40 mil**	**50 mil**	**60 mil**	**80 mil**	**100 mil**	**120 mil**
Peel strength (fusion & extrusion) lb/in.	ASTM 4437	39	52	65	78	104	130	156
Shear strength (fusion & extrusion) lb/in.	ASTM 4437	60	80	100	120	160	200	239

END OF SECTION 02800

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Revision 8: July 10, 2006
Revision schedule on pg. 11

GRI Test Method GM13*

Standard Specification for

"Test Methods, Test Properties and Testing Frequency for
High Density Polyethylene (HDPE) Smooth and Textured Geomembranes"

This specification was developed by the Geosynthetic Research Institute (GRI), with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

1.1 This specification covers high density polyethylene (HDPE) geomembranes with a formulated sheet density of 0.940 g/ml, or higher, in the thickness range of 0.75 mm (30 mils) to 3.0 mm (120 mils). Both smooth and textured geomembrane surfaces are included.

1.2 This specification sets forth a set of minimum, physical, mechanical and chemical properties that must be met, or exceeded by the geomembrane being manufactured. In a few cases a range is specified.

1.3 In the context of quality systems and management, this specification represents manufacturing quality control (MQC).

Note 1: Manufacturing quality control represents those actions taken by a manufacturer to ensure that the product represents the stated objective and properties set forth in this specification.

1.4 This standard specification is intended to ensure good quality and performance of HDPE geomembranes in general applications, but is possibly not adequate for the complete specification in a specific situation. Additional tests, or more restrictive

*This GRI standard is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This specification will be reviewed at least every 2-years, or on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version.

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values for test indicated, may be necessary under conditions of a particular application.

Note 2: For information on installation techniques, users of this standard are referred to the geosynthetics literature, which is abundant on the subject.

2. Referenced Documents

2.1 ASTM Standards

D 792 Specific Gravity (Relative Density) and Density of Plastics by Displacement
D 1004 Test Method for Initial Tear Resistance of Plastics Film and Sheeting
D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
D 1603 Test Method for Carbon Black in Olefin Plastics
D 3895 Test Method for Oxidative Induction Time of Polyolefins by Thermal Analysis
D 4218 Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
D 4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
D 5199 Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
D 5397 Procedure to Perform a Single Point Notched Constant Tensile Load – (SP-NCTL) Test: Appendix
D 5596 Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
D 5721 Practice for Air-Oven Aging of Polyolefin Geomembranes
D 5885 Test method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry
D 5994 Test Method for Measuring the Core Thickness of Textured Geomembranes
D 6693 Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes

2.2 GRI Standards

GM10 Specification for the Stress Crack Resistance of Geomembrane Sheet
GM 11 Accelerated Weathering of Geomembranes using a Fluorescent UVA-Condensation Exposure Device
GM 12 Measurement of the Asperity Height of Textured Geomembranes Using a Depth Gage

2.3 U. S. Environmental Protection Agency Technical Guidance Document "Quality Control Assurance and Quality Control for Waste Containment Facilities." EPA/600/R-93/182. September 1993, 305 pgs.

3. Definitions

Manufacturing Quality Control (MQC) - A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications.
ref. EPA/600/R-93/182

Manufacturing Quality Assurance (MQA) - A planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract specifications. MQA includes manufacturing facility inspections, verifications, audits and evaluation of the raw materials (resins and additives) and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the manufacturer is in compliance with the product certification and contract specifications for the project.
ref. EPA/600/R-93/182

Formulation, n - The mixture of a unique combination of ingredients identified by type, properties and quantity. For HDPE polyethylene geomembranes, a formulation is defined as the exact percentages and types of resin(s), additives and carbon black.

4. Material Classification and Formulation

4.1 This specification covers high density polyethylene geomembranes with a formulated sheet density of 0.940 g/ml, or higher. Density can be measured by ASTM D1505 or ASTM D792. If the latter, Method B is recommended.

4.2 The polyethylene resin from which the geomembrane is made will generally be in the density range of 0.932 g/ml or higher, and have a melt index value per ASTM D1238 of less than 1.0 g/10 min.

4.3 The resin shall be virgin material with no more than 10% rework. If rework is used, it must be a similar HDPE as the parent material.

4.4 No post consumer resin (PCR) of any type shall be added to the formulation.

5. Physical, Mechanical and Chemical Property Requirements

5.1 The geomembrane shall conform to the test property requirements prescribed in Tables 1 and 2. Table 1 is for smooth HDPE geomembranes and Table 2 is for single and double sided textured HDPE geomembranes. Each of the tables are given in English and SI (metric) units. The conversion from English to SI (metric) is soft.

Note 3: The tensile strength properties in this specification were originally based on ASTM D 638 which uses a laboratory testing temperature of 23°C ± 2°C. Since ASTM Committee D35 on Geosynthetics adopted ASTM D 6693 (in place of D 638), this GRI Specification followed accordingly. The difference is that D 6693 uses a testing temperature of 21°C ± 2°C. The numeric values of strength and elongation were not changed in this specification. If a dispute arises in this regard, the original temperature of 23°C ± 2°C should be utilized for testing purposes.

Note 4: There are several tests often included in other HDPE specifications which are omitted from this standard because they are outdated, irrelevant or generate information that is not necessary to evaluate on a routine MQC basis. The following tests have been purposely omitted:

- Volatile Loss
- Dimensional Stability
- Coeff. of Linear Expansion
- Resistance to Soil Burial
- Low Temperature Impact
- ESCR Test (D 1693)
- Wide Width Tensile
- Water Vapor Transmission
- Water Absorption
- Ozone Resistance
- Modulus of Elasticity
- Hydrostatic Resistance
- Tensile Impact
- Field Seam Strength
- Multi-Axial Burst
- Various Toxicity Tests

Note 5: There are several tests which are included in this standard (that are not customarily required in other HDPE specifications) because they are relevant and important in the context of current manufacturing processes. The following tests have been purposely added:

- Oxidative Induction Time
- Oven Aging
- Ultraviolet Resistance
- Asperity Height of Textured Sheet (see Note 6)

Note 6: The minimum average value of asperity height does not represent an expected value of interface shear strength. Shear strength

associated with geomembranes is both site-specific and product-specific and should be determined by direct shear testing using ASTM D5321/ASTM D6243 as prescribed. This testing should be included in the particular site's CQA conformance testing protocol for the geosynthetic materials involved, or formally waived by the Design Engineer, with concurrence from the Owner prior to the deployment of the geosynthetic materials.

Note 7: There are other tests in this standard, focused on a particular property, which are updated to current standards. The following are in this category:

- Thickness of Textured Sheet
- Puncture Resistance
- Stress Crack Resistance
- Carbon Black Dispersion (In the viewing and subsequent quantitative interpretation of ASTM D 5596 only near spherical agglomerates shall be included in the assessment).

Note 8: There are several GRI tests currently included in this standard. Since these topics are not covered in ASTM standards, this is necessary. They are the following:

- UV Fluorescent Light Exposure
- Asperity Height Measurement

5.2 The values listed in the tables of this specification are to be interpreted according to the designated test method. In this respect they are neither minimum average roll values (MARV) nor maximum average roll values (MaxARV).

5.3 The properties of the HDPE geomembrane shall be tested at the minimum frequencies shown in Tables 1 and 2. If the specific manufacturer's quality control guide is more stringent and is certified accordingly, it must be followed in like manner.

Note 9: This specification is focused on manufacturing quality control (MQC). Conformance testing and manufacturing quality assurance (MQA) testing are at the discretion of the purchaser and/or quality assurance engineer, respectively.

6. Workmanship and Appearance

6.1 Smooth geomembrane shall have good appearance qualities. It shall be free from such defects that would affect the specified properties of the geomembrane.

6.2 Textured geomembrane shall generally have uniform texturing appearance. It shall be free from agglomerated texturing material and such defects that would affect the specified properties of the geomembrane.

6.3 General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and/or documents.

7. MQC Sampling

7.1 Sampling shall be in accordance with the specific test methods listed in Tables 1 and 2. If no sampling protocol is stipulated in the particular test method, then test specimens shall be taken evenly spaced across the entire roll width.

7.2 The number of tests shall be in accordance with the appropriate test methods listed in Tables 1 and 2.

7.3 The average of the test results should be calculated per the particular standard cited and compared to the minimum value listed in these tables, hence the values listed are the minimum average values and are designated as "min. ave."

8. MQC Retest and Rejection

8.1 If the results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the manufacturing protocol as set forth in the manufacturer's quality manual.

9. Packaging and Marketing

9.1 The geomembrane shall be rolled onto a substantial core or core segments and held firm by dedicated straps/slings, or other suitable means. The rolls must be adequate for safe transportation to the point of delivery, unless otherwise specified in the contract or order.

10. Certification

10.1 Upon request of the purchaser in the contract or order, a manufacturer's certification that the material was manufactured and tested in accordance with this specification, together with a report of the test results, shall be furnished at the time of shipment.

ENGLISH UNITS

Table 1(a) – High Density Polyethylene (HDPE) Geomembrane -Smooth

Properties	Test Method	Test Value							Testing Frequency (minimum)
		30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness (min. ave.)	D5199	nom.	Nom.	Nom.	Nom.	Nom.	Nom.	Nom.	Per roll
• lowest individual of 10 values		-10%	-10%	-10%	-10%	-10%	-10%	-10%	
Density mg/l (min.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	200,000 lb
Tensile Properties *(1)* (min. ave.)	D 6693 Type IV								20,000 lb
• yield strength		63 lb/in.	84 lb/in.	105 lb/in.	126 lb/in.	168 lb/in.	210 lb/in.	252 lb/in.	
• break strength		114 lb/in.	152 lb/in.	190 lb/in.	228 lb/in.	304 lb/in.	380 lb/in	456 lb/in.	
• yield elongation		12%	12%	12%	12%	12%	12%	12%	
• break elongation		700%	700%	700%	700%	700%	700%	700%	
Tear Resistance (min. ave.)	D 1004	21 lb	28 lb	35 lb	42 lb	56 lb	70 lb	84 lb	45,000 lb
Puncture Resistance (min. ave.)	D 4833	54 lb	72 lb	90 lb	108 lb	144 lb	180 lb	216 lb	45,000 lb
Stress Crack Resistance *(2)*	D5397 (App.)	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	per GRI-GM10
Carbon Black Content (range)	D 1603 *(3)*	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	20,000 lb
Carbon Black Dispersion	D 5596	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(5)*									200,000 lb
(a) Standard OIT	D 3895	100 min.	100 min.	100 min.	100 min.	100 min.	100 min.	100 min.	
— or —									
(b) High Pressure OIT	D 5885	400 min.	400 min.	400 min.	400 min.	400 min.	400 min.	400 min.	
Oven Aging at 85°C *(5), (6)*	D 5721								
(a) Standard OIT (min. ave.) - % retained after 90 days	D 3895	55%	55%	55%	55%	55%	55%	55%	per each formulation
or									
(b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5885	80%	80%	80%	80%	80%	80%	80%	
UV Resistance *(7)*	GM 11								
(a) Standard OIT (min. ave.)	D 3895	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	per each formulation
— or —									
(b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(9)*	D 5885	50%	50%	50%	50%	50%	50%	50%	

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 1.3 inches
Break elongation is calculated using a gage length of 2.0 in.

(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(3) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.

(4) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3

(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(7) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

SI (METRIC) UNITS

Table 1(b) – High Density Polyethylene (HPDE) Geomembrane - Smooth

Properties	Test Method	Test Value							Testing Frequency (minimum)
		0.75 mm	1.00 mm	1.25 mm	1.50 mm	2.00 mm	2.50 mm	3.00 mm	
Thickness - mils (min. ave.) • lowest individual of 10 values	D5199	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	per roll
Density (min.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	90,000 kg
Tensile Properties *(1)* (min. ave.) • yield strength • break strength • yield elongation • break elongation	D 6693 Type IV	11 kN/m 20kN/m 12% 700%	15 kN/m 27 kN/m 12% 700%	18 kN/m 33 kN/m 12% 700%	22 kN/m 40 kN/m 12% 700%	29 kN/m 53 kN/m 12% 700%	37 kN/m 67 kN/m 12% 700%	44 kN/m 80 kN/m 12% 700%	9,000 kg
Tear Resistance (min. ave.)	D 1004	93 N	125 N	156 N	187 N	249 N	311 N	374 N	20,000 kg
Puncture Resistance (min. ave.)	D 4833	240 N	320 N	400 N	480 N	640 N	800 N	960 N	20,000 kg
Stress Crack Resistance *(2)*	D 5397 (App.)	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	per GRI GM-10
Carbon Black Content - %	D 1603 *(3)*	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	9,000 kg
Carbon Black Dispersion	D 5596	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(5)* (a) Standard OIT — or — (b) High Pressure OIT	D 3895 D 5885	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	90,000 kg
Oven Aging at 85°C *(5), (6)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	per each formulation
UV Resistance *(7)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(9)*	D 3895 D 5885	N. R. *(8)* 50%	N.R. *(8)* 50%	N.R. *(8)* 50%	N.R. *(8)* 50%	N.R. *(8)* 50%	N.R. *(8)* 50%	N.R. *(8)* 50%	per each formulation

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction
Yield elongation is calculated using a gage length of 33 mm
Break elongation is calculated using a gage length of 50 mm

(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(3) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.

(4) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3

(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(7) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

Table 2(a) – High Density Polyethylene (HDPE) Geomembrane - Textured

Properties	Test Method	Test Value							Testing Frequency (minimum)
		30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness mils (min. ave.)	D 5994	nom. (-5%)	nom. (-5%)	nom. (-5%)	nom. (-5%)	nom. (-5%)	nom. (-5%)	nom. (-5%)	per roll
• lowest individual for 8 out of 10 values		-10%	-10%	-10%	-10%	-10%	-10%	-10%	
• lowest individual for any of the 10 values		-15%	-15%	-15%	-15%	-15%	-15%	-15%	
Asperity Height mils (min. ave.) *(1)*	GM 12	10 mil	10 mil	10 mil	10 mil	10 mil	10 mil	10 mil	every 2nd roll *(2)*
Density (min. ave.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	200,000 lb
Tensile Properties (min. ave.) *(3)*	D 6693 Type IV								20,000 lb
• yield strength		63 lb/in	84 lb/in	105 lb/in	126 lb/in	168 lb/in	210 lb/in	252 lb/in	
• break strength		45 lb/in	60 lb/in	75 lb/in	90 lb/in	120 lb/in	150 lb/in	180 lb/in	
• yield elongation		12%	12%	12%	12%	12%	12%	12%	
• break elongation		100%	100%	100%	100%	100%	100%	100%	
Tear Resistance (min. ave.)	D 1004	21 lb	28 lb	35 lb	42 lb	56 lb	70 lb	84 lb	45,000 lb
Puncture Resistance (min. ave.)	D 4833	45 lb	60 lb	75 lb	90 lb	120 lb	150 lb	180 lb	45,000 lb
Stress Crack Resistance *(4)*	D 5397 (App.)	300 hr	300 hr	300 hr	300 hr	300 hr	300 hr	300 hr	per GRI GM10
Carbon Black Content (range)	D 1603 *(5)*	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	20,000 lb
Carbon Black Dispersion	D 5596	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(7)*									200,000 lb
(a) Standard OIT	D 3895	100 min.	100 min.	100 min.	100 min.	100 min.	100 min.	100 min.	
or									
(b) High Pressure OIT	D 5885	400 min.	400 min.	400 min.	400 min.	400 min.	400 min.	400 min.	
Oven Aging at 85°C *(7)* *(8)*	D 5721								
(a) Standard OIT (min. ave.) - % retained after 90 days	D 3895	55%	55%	55%	55%	55%	55%	55%	per each formulation
- - or —									
(b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5885	80%	80%	80%	80%	80%	80%	80%	
UV Resistance *(9)*	GM11								
(a) Standard OIT (min. ave.)	D 3895	N.R. *(10)*	N.R. *(10)*	N.R. *(10)*	N.R. *(10)*	N.R. *(10)*	N.R. *(10)*	N.R. *(10)*	per each formulation
— or —									
(b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(11)*	D 5885	50%	50%	50%	50%	50%	50%	50%	

(1) Of 10 readings, 8 out of 10 must be ≥ 7 mils, and lowest individual reading must be ≥ 5 mils, also see Note 6

(2) Alternate the measurement side for double sided textured sheet

(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction
Yield elongation is calculated using a gage length of 1.3 inches
Break elongation is calculated using a gage length of 2.0 inches

(4) P-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials.
The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(5) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.

(6) Carbon black dispersion (only near spherical agglomerates) for 10 different views
9 in Categories 1 or 2 and 1 in Category 3

(7) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(8) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(9) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(10) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(11) UV resistance is based on percent retained value regardless of the original HP-OIT value.

Table 2(b) – High Density Polyethylene (HDPE) Geomembrane - Textured

Properties	Test Method	Test Value							Testing Frequency (minimum)
		0.75 mm	1.00 mm	1.25 mm	1.50 mm	2.00 mm	2.50 mm	3.00 mm	
Thickness mils (min. ave.) • lowest individual for 8 out of 10 values • lowest individual for any of the 10 values	D 5994	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	per roll
Asperity Height mils (min. ave.) *(1)*	GM 12	0.25 mm	0.25 mm	0.25 mm	0.25 mm	0.25 mm	0.25 mm	0.25 mm	every 2nd roll *(2)*
Density (min. ave.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	90,000 kg
Tensile Properties (min. ave.) *(3)* • yield strength • break strength • yield elongation • break elongation	D 6693 Type IV	11 kN/m 8 kN/m 12% 100%	15 kN/m 10 kN/m 12% 100%	18 kN/m 13 kN/m 12% 100%	22 kN/m 16 kN/m 12% 100%	29 kN/m 21 kN/m 12% 100%	37 kN/m 26 kN/m 12% 100%	44 kN/m 32 kN/m 12% 100%	9,000 kg
Tear Resistance (min. ave.)	D 1004	93 N	125 N	156 N	187 N	249 N	311 N	374 N	20,000 kg
Puncture Resistance (min. ave.)	D 4833	200N	267 N	333 N	400 N	534 N	667 N	800 N	20,000 kg
Stress Crack Resistance *(4)*	D 5397 (App.)	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	per GRI GM13
Carbon Black Content (range)	D 1603 *(5)*	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	9,000 kg
Carbon Black Dispersion	D 5596	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(7)* (a) Standard OIT — or — (b) High Pressure OIT	D 3895 D 5885	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	90,000 kg
Oven Aging at 85°C *(7), (8)* (a) Standard OIT (min. ave.) - % retained after 90 days or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	per each formulation
UV Resistance *(9)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(11)*	GM11 D 3895 D 5885	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	per each formulation

(1) Of 10 readings, 8 out of 10 must be ≥ 0.18 mm, and lowest individual reading must be ≥ 0.13 mm, also see Note 6.

(2) Alternate the measurement side for double sided textured sheet

(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 33 mm
Break elongation is calculated using a gage length of 50 mm

(4) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials.
The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(5) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.

(6) Carbon black dispersion (only near spherical agglomerates) for 10 different views
9 in Categories 1 or 2 and 1 in Category 3

(7) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(8) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(9) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(10) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(11) UV resistance is based on percent retained value regardless of the original HP-OIT value.

Adoption and Revision Schedule

for

HDPE Specification per GRI-GM13

"Test Methods, Test Properties, Testing Frequency for
High Density Polyethylene (HDPE) Smooth and Textured Geomembranes"

Adopted:	June 17, 1997
Revision 1:	November 20, 1998; changed CB dispersion from allowing 2 views to be in Category 3 to requiring all 10 views to be in Category 1 or 2. Also reduced UV percent retained from 60% to 50%.
Revision 2:	April 29, 1999: added to Note 5 after the listing of Carbon Black Dispersion the following: "(In the viewing and subsequent quantitative interpretation of ASTM D5596 only near spherical agglomerates shall be included in the assessment)" and to Note (4) in the property tables.
Revision 3:	June 28, 2000: added a new Section 5.2 that the numeric table values are neither MARV or MaxARV. They are to be interpreted per the the designated test method.
Revision 4:	December 13, 2000: added one Category 3 is allowed for carbon black dispersion. Also, unified terminology to "strength" and "elongation".
Revision 5:	May 15, 2003: Increased minimum acceptable stress crack resistance time from 200 hrs to 300 hrs.
Revision 6:	June 23, 2003: Adopted ASTM D 6693, in place of ASTM D 638, for tensile strength testing. Also, added Note 2.
Revision 7:	February 20, 2006: Added Note 6 on Asperity Height clarification with respect to shear strength.
Revision 8:	Removed recommended warranty from specification.

PART 1. GENERAL

1.01 DESCRIPTION

This section pertains to seeding and placing mulch or erosion control blanket over seeded areas.

1.02 RELATED SECTIONS

A. Specified elsewhere:

1. 02200 - Earthwork

1.03 REFERENCES

The following reference or cited portions thereof, current at date of bidding documents unless otherwise specified, governs the work.

A. Illinois Department of Transportation (IDOT): Standard Specifications for Road and Bridge Construction, adopted January 1, 2007.

1.04 SPECIFICATIONS

A. Work shall conform to the applicable requirements of Sections 250 and 251 of Standard Specifications for Road and Bridge Construction and to the requirements hereinafter specified.

B. Exceptions: All references in the IDOT specifications to methods of measurement and payment shall not apply.

1.05 WARRANTY

A. Warranty for one (1) year plus one growing season from date of substantial completion shall be provided.

PART 2. PRODUCTS

2.01 MATERIALS

A. Seed: Seed shall conform to Article 1081.04 of the IDOT Standard Specifications where IDOT seed mixtures are specified. In areas where Ameren Energy

Generating hay seeding mix is specified, it shall be composed as follows:

Seed Type	Pounds/Acre
Vernal Alfalfa	12
Wrangler Alfalfa	8
Medium Red Clover	6
Timothy	4

B. Mulch Material and Erosion Control Blanket: Mulch material shall conform to Article 1081.06 and the excelsior blanket/knitted straw mat shall conform to Article 1081.10 of the IDOT Standard Specifications.

C. Fertilizer and agricultural ground limestone will not be permitted.

PART 3. EXECUTION

3.01 CONSTRUCTION

A. Seed bed preparation and seeding methods shall conform to Section 250 of the IDOT Specifications. Seeding of areas disturbed by construction activities after September 30, 2008 may be deferred until Spring 2009 at no additional cost to the Owner.

B. Seed shall be applied to the perimeter berm ditch, to disturbed portions of the perimeter berm, and to all disturbed earth surfaces outside of the existing perimeter berm. IDOT seeding mixture 7 shall be used on stockpiles. IDOT seeding mixture 1A shall be used on the gypsum stack perimeter earthen berm, the recycle pond dam embankment and on slopes that are 4H:1V or steeper. The Ameren hay seed mix shall be used on slopes flatter than 4H:1V.

C. Application rates for IDOT seed mixtures shall be as specified in Section 250 of the IDOT Specifications. The application rate for the Ameren Energy Resources Generating's seed mix shall be as specified in the Ameren Energy Resources Generating's hay seeding mix.

D. Seeded areas shall be mulched in accordance with Article 251.03. The Contractor may use either Method 2 or Method 3.

3.02 MAINTENANCE OF COMPLETED WORK

A. All areas seeded by the Contractor shall be maintained by the Contractor during the period between completion of such work and final completion and acceptance of the Contractor's work by the Owner. This maintenance shall be such that the completed work, at time of acceptance, complies in all respects with the requirements herein

specified.

B. The areas seeded will be required to germinate. If the seed does not germinate, the Contractor will be required to regrade and reseed at no additional cost to the Owner.

END OF SECTION 02936

PART 1. GENERAL

1.01 WORK INCLUDES

A. The complete installation of the formwork for cast-in-place concrete, with shoring, bracing and anchorage, openings for other work, form accessories, form stripping.

1.02 RELATED SECTIONS

A. Section 03200 - Concrete Reinforcement.

B. Section 03300 - Cast-In-Place Concrete.

C. Section 03400 – Concrete Embedment Liner.

1.03 REFERENCES

A. ACI 347 - Recommended Practice For Concrete Formwork.

B. ACI 301 - Specifications For Structural Concrete For Buildings.

1.04 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347 and 301.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for design, fabrication, erection and removal of formwork.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.08 COORDINATION

A. Coordinate this Section with other Sections of work which require attachment of components of formwork.

B. If formwork is placed which results in insufficient concrete cover over reinforcement. request instructions from Owner's Representative before proceeding.

PART 2. PRODUCTS

2.01 WOOD FORM MATERIALS

A. Softwood Plywood: 3/4 in. PS 1-83 "B-B" (concrete form) plywood, Class I, exterior grade or better, mill-oiled and edge sealed with each piece bearing legible inspection trademark.

B. Architectural Plywood: 3/4 in. PS 1-83 "B-B" plyform. Class I, with High Density smooth overlay, 1 surface, edge sealed with each piece bearing legible inspection trademark.

2.02 MANUFACTURERS - PREFABRICATED FORMS

A. Weyerhauser Concrete Form.

B. Georgia Pacific, G-P Exterior Soft Wood Plywood Product.

C. Plywood and Door Corporation's Finn-Form.

2.03 PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

2.04 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, galvanized metal, adjustable length, 1 in. back break dimension, free of defects that could leave holes larger than 1 in. in concrete surface; Dayton-Sure Grip snap-in-form ties, as manufactured by Dayton Superior

Corp., Symons Ties as manufactured by Symons Corporation, Snap-Tys as manufactured by Richmond Corporation. Ties shall be removed after forms are removed, and holes filled with mortar that matches the adjacent surfaces.

B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture; by Magic Kote manufactured by Symons Manufacturing Co., Form Coat manufactured by Concrete Services Co., Formcel manufactured by Lambert Corp.

C. Corners: Chamfered, wood strip type; 3/4 x 3/4 in. size on all exterior corners, 3 x 3 in. size where shown on the drawings; maximum possible lengths.

D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

E. Concrete Embedment Liner, where required, shall be installed in accordance with Section 03400 – Concrete Embedment Liner.

PART 3. EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

A. Earth forms are not permitted, except for footings.

3.03 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301. Metal forms shall be installed in strict accordance with manufacturer's directions and specifications.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members which are not indicated on drawings.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are affected by agent.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in or passing through concrete work.

B. Locate and set in place items which will be cast directly into concrete.

C. Coordinate work of other Sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors, and other inserts.

D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING

A. Clean and remove foreign matter within forms as erection proceeds.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts or water to clean out forms. Use compressed air or other means to remove foreign matter.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

3.08 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

B. Do not reuse wood formwork more than three times for concrete surfaces to be exposed to view. Do no patch formwork.

3.09 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finished concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION 03100

PART 1. GENERAL

1.01 WORK INCLUDES

A. The complete installation of the reinforcing steel bars and accessories for cast-in-place concrete.

1.02 RELATED SECTIONS

A. Section 03100 - Concrete Formwork.

B. Section 03300 - Cast-in-Place Concrete.

1.03 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 318 - Building Code Requirements For Reinforced Concrete.

C. ACI SP-66 - American Concrete Institute - Detailing Manual.

D. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

E. CRSI - Concrete Reinforcing Steel Institute Manual of Practice.

1.04 SUBMITTALS

A. Submit under provisions of Section 01010.

B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel, and bending and cutting schedules. Contract drawings shall not be reproduced as the basis for shop drawings.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI Manual of Standard Practice.

B. Submit certified copies of mill test report of reinforcement materials analysis.

1.06 COORDINATION

A. Coordinate with placement of formwork, formed openings and other work.

PART 2. PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars.

2.02 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage, annealed steel wire, epoxy coated when used with epoxy-coated reinforcement.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required.

2.03 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI Manual of Standard Practice and ACI SP-66.

B. Splice reinforcement on at locations indicated on drawings. Indicate location of splices on shop drawings.

PART 3. EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position. Clean reinforcement of foreign particles or coatings.

B. Accommodate placement of formed openings.

C. Conform to ACI 318 code for concrete cover over reinforcement.

3.02 FIELD QUALITY CONTROL

A. Contractor shall notify the Owner's Representative at least 24 hrs. in advance of concrete placement. Placement of reinforcing shall occur in such sequence that the Owner's Representative has sufficient time to inspect the correctness of the reinforcing within the placement area. The Owner's Representative retains the right to require necessary revisions be made before concrete is placed.

END OF SECTION 03200

PART 1. GENERAL

1.01 WORK INCLUDES

A. The complete installation of cast-in-place concrete structures, including joint sealants.

1.02 RELATED SECTIONS

A. Section 03100 - Concrete Formwork: Formwork and accessories.

B Section 03200 - Concrete Reinforcement.

C. Section 03400 – Concrete Embedment Liner

1.03 REFERENCES

A. ACI 301 – Structural Concrete for Buildings.

B. ACI 302 - Guide for Concrete Floor and Slab Construction.

C. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

D. ACI 305R - Hot Weather Concreting.

E. ACI 306R - Cold Weather Concreting.

F. ACI 308 - Standard Practice for Curing Concrete.

G. ACI 318 - Building Code Requirements for Reinforced Concrete.

H. ASTM C31 - Concrete Test Specimens.

I. ASTM C33 - Concrete Aggregates.

J. ASTM C94 - Ready-Mixed Concrete.

K. ASTM C150 - Portland Cement.

L. ASTM C260 - Air Entraining Admixtures for Concrete.

M. ASTM C494 - Chemical Admixtures for Concrete.

1.04 SUBMITTALS

A. Product Data: Provide data on joint devices, attachment accessories, admixtures.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Acquire cement and aggregate from same source for all work.

C. Conform to ACI 305R when concreting during hot weather.

D. Conform to ACI 306R when concreting during cold weather.

1.06 COORDINATION

A. Coordinate this Section with other Sections which require embedment of components in cast-in-place concrete.

1.07 PRODUCT DATA

A. Submit proposed mix design to Owner's Representative for review prior to commencement of work. Identify source and provide material certificates for cement, fine and coarse aggregates. Provide recent laboratory gradation for fine and coarse aggregates and mix design information in accordance with ACI 301.

B. Submit Construction joint plan.

PART 2. PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal Portland Type, Gray Color.

B. Fine and Coarse Aggregates: ASTM C33.

C. Water: Potable.

2.02 ADMIXTURES

A. Air Entrainment: ASTM C260.

B. Chemical: ASTM C494. Maximum 0.05% Chloride Ion Contents.

C. The use of calcium chloride in any concrete is not permitted.

2.03 ACCESSORIES

A. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

B. Curing Compound: Dress and Seal No. 18 by L&M Construction Chemicals, MB-429 by Master Builders, or Sikagard Cure/Hard by the Sika Corporation.

C. Epoxy Grouted Adhesive Anchors: Hilti, Red Head, Simpson, or Rawl.

2.04 CONCRETE MIX

A. Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94.

B. Select proportions for normal weight concrete in accordance with ACI 301.

C. Provide normal weight concrete of the following characteristics:

1. Compressive strength at 28 days: 4,000 psi.

2. Slump: 4 in. - A tolerance of up to 1 in. above the maximum shall be allowed for one batch in any five consecutive batches tested.

3. Water/cement ratios: 0.4 (max).

D. Use accelerating admixtures in cold weather only when approved by Owner's Representative. Use of admixtures will not relax cold weather placement requirements.

E. Use set-retarding admixtures during hot weather only when approved by Owner's Representative.

F. Water-reducing admixtures may be used in all concrete except footings and in strict compliance with the manufacturer's directions.

G. Add air-entraining agent to concrete mix for air content of 6% (± 1%).

PART 3. EXECUTION

3.01 EXAMINATION

A. Verify requirements for concrete cover over reinforcement.

B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.02 PLACING CONCRETE

A. Place concrete in accordance with ACI 301.

B. Notify Owner's Representative minimum of 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, and embedded parts are not disturbed during concrete placement.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Place concrete continuously between predetermined expansion, control, and construction joints.

F. When air temperature is between 80°F and 90°F, reduce the mixing and delivery time specified in ASTM C94 from 1-1/2 hours to 75 minutes. When the air temperature is above 90°F, reduce the mixing and delivery time to 60 minutes.

G. Cold weather concreting. Comply with ACI 306 except as follows:

1. In freezing weather, provide suitable means for maintaining concrete temperature at a minimum of 70°F for three days, or 50°F for five days after placing.

2. Cooling of concrete to outside temperature: Not faster than 1° per hour for first day and 2° per hour thereafter until outside temperature is reached.

3. Maximum temperature of concrete produced with heated aggregated, heated water, or both, at any time during its production or transportation: 90°F.

4. Do not mix chemicals or other foreign materials in concrete to prevent freezing or to accelerate hardening of concrete, unless approved in writing by Owner's Representative.

H. Hot weather concreting. Comply with ACI 305R.

1. ACI recommendations shall be observed when any combination of high air

temperature, low relative humidity and wind velocity tend to impair the quality of fresh or hardened concrete.

2. Retarding and water reducing admixtures shall be approved in writing for each concrete mix design prior to placement.

3.03 CONCRETE FINISHING

A. Provide exterior concrete formed surfaces to be left exposed with smooth rubbed finish in accord with ACI 301. All other formed surfaces shall have fins, projections and offsets removed.

B. Provide Class A tolerances to exterior concrete slabs according to ACI 301.

1. Broom finish all exterior slabs. Broom out all tool marks.

C. Pitch slabs to drain.

3.04 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for a period necessary for hydration of cement and hardening of concrete in accordance with ACI 308.

C. Cure and protect finished concrete slabs in accordance with ACI 308.

3.05 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed in accordance with ACI 301 and under provisions of Section 01010, paragraph 8.0.

B. Testing firm will take cylinders, perform slump and air entrainment tests in accordance with ACI 301.

C. Provide free access to Work and cooperate with appointed firm.

D. Submit proposed concrete mix design to Owner's Representative firm for review 14 days prior to commencement of Work.

E. Testing frequency shall be as specified in Section 01010, paragraph 8, except that one additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.

3.06 PATCHING

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by Owner's Representative and performed by the Contractor at no additional cost to the project.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Owner's Representative for each individual area.

END OF SECTION 03300

PART 1. GENERAL

1.01 WORK INCLUDES

A. Specifications and guidelines for manufacturing and installing high-density polyethylene embedment liners.

1.02 RELATED SECTIONS

A. Section 03100 - Concrete Formwork.

B. Section 03300 - Cast-in-Place Concrete.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
2. D 1603 Test Method for Carbon Black in Olefin Plastics
3. D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
4. D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
5. D 6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
6. D 1204 Standard Test Method for Linear Dimensional Changes of Nongrid Thermoplastic Sheeting or Film at Elevated Temperature
7. D 696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer
8. D 746 Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
9. D 570 Standard Test Method for Water Absorption of Plastics
10. E 96 Standard Test Method for Water Vapor Transmission of Material

1.04 SUBMITTALS

A. All work for and in connection with the installation of the lining, field seaming and welding joints shall be completed in strict conformity with all applicable instructions and recommendations of the liner manufacturer.

B. Included with the shipment of liner, submit certified test reports that the liner and material are manufactured in accordance with standards specified herein.

1.05 QUALIFICATIONS

A. The HDPE liner specified in this section shall be furnished by a manufacturer who is fully experienced, reputable and qualified in the manufacturing of the materials. The manufacturer must at least 10 years of manufacturing experience.

B. Locking devices must be extruded to the sheet as a one step process.

C. Liner shall be GSE StudLiner as manufactured by GSE Lining Technology, Inc.

D. Liner shall be 8 feet in width.

E. Liner shall demonstrate a minimum pull-out strength of 14,000 psf.

1.06 COORDINATION

A. Coordinate with placement of formwork, formed openings and other work.

PART 2. PRODUCTS

2.01 ROLL DIMENSIONS

A. Embedment sheets shall be produced in rolls that are 8.0 ft (2.4 m) in width and a thickness range of 80 mils (2.0 mm) to 200 mils (5.0 mm) in thickness. Roll lengths vary according to thickness.

B. Locking studs of the same material as that of the liner shall be integrally extruded with the sheet. Stud spacing shall be on approximate 1.25 in (30 mm) centers, such that there are approximately 110 studs per square foot (1200 per square meter).

2.02 MATERIAL PROPERTIES

A. The material used in the embedment liner and in all welding strips shall be made from 97-98% virgin high density polyethylene and 1.5-3% carbon black or pigmentation for the purpose of an otherwise specified color.

B. Plasticizer shall not be added to the resin formulation.

C. Embedment sheet and welding strips shall be free of holes, pinholes, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.

D. The HDPE cap strips shall be made from HDPE, have good impact resistance and have an elongation sufficient to bridge up to 1/4 inch settling cracks.

E. Cap strips shall be approximately 4 inches wide or greater and shall be equivalent to that of the liner.

F. Material shall maintain a repairable state through it's lifecycle by methods approved and recommended by the manufacturer.

G. Embedment sheets shall have the following physical properties when tested in accordance with Table 1.

H. Raw resin shall have the following properties when tested in accordance with Table 2.

Table 1: Material Properties

Property	Test Method	Nominal Value				Testing Frequency
Thickness, mm (mil)	ASTM D 5199	2.00 (80)	3.00 (120)	4.00 (160)	5.00 (200)	1/every 5th roll
Density, g/cm³	ASTM D 1505	0.94	0.94	0.94	0.94	1/100,000 ft²
Tensile Properties Strength@Yield, lb/in² (MPa) Elongation @ Break, %	ASTM D 6693 Type IV, Dumbell G.L. = 2.0in.	2,200 (14.5) 500	2,200 (14.5) 500	2,200 (14.5) 500	2,200 (14.5) 500	1/100,000 ft²
Stud Pull-Out Strength[1], lb/ft² (kN/m²)		>14,000 (669.89)	>14,000 (669.89)	>14,000 (669.89)	>14,000 (669.89)	1/ product
Carbon Black Content/ Pigment Content, % Black Liner Gray Liner	ASTM D 1603, mod. ASTM D 5630, mod.	2-3 1.5 – 2.5	2-3 1.5 – 2.5	2-3 1.5 – 2.5	2-3 1.5 – 2.5	1/100,000 ft²
Carbon Black Dispersion[2]	ASTM D 5596	Note 2	Note 2	Note 2	Note 2	1/100,000 ft²
Notched Constant Tensile Load, hours	ASTM D 5397	400	400	400	400	1/ formulation
Coefficient of Linear Thermal Expansion, per °C	ASTM D 696	1.20E-04	1.20E-04	1.20E-04	1.20E-04	1/ product
Low Temperature Brittleness, °C	ASTM D 746	-77	-77	-77	-77	1/ product
Dimensional Stability, % (each direction)	ASTM D 1204	± 1.0	± 1.0	± 1.0	± 1.0	1/ product
Water Absorption, %	ASTM D 570	0.1	0.1	0.1	0.1	1/ product
Water Vapor Transmission, (g/m²/day)	ASTM E 96	<0.01	<0.01	<0.01	<0.01	1/ product

[1]Note: Concrete must have a compressive strength of at least 5,000 lb/in² (34,500 kPa).

[2]Note: Dispersion only applies to near spherical agglomerates. 8 of 10 views shall be Category 1 or 2. No more than 1 view for category 3.

Table 2: Raw Material Properties

Property	Test Method	Value	Testing Frequency
Density, g/cm3	ASTM D 1505	0.932	1/ resin lot
Melt Flow, g/10 min	ASTM D 1238 (190/2.16)	≤ 1.0	1/ resin lot
OIT, minutes	ASTM D 3895 (1atm/200°C)	100	1/ formulation

2.03 MATERIAL SUPPLY

A. Embedment sheets shall be supplied in roll form, sheets, pre-fabricated tubes or panels.

B. Cap strips shall be supplied in 4 inch widths or greater.

PART 3. EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position. Clean reinforcement of foreign particles or coatings.

B. Accommodate placement of formed openings.

C. Conform to ACI 318 code for concrete cover over reinforcement.

3.02 FIELD QUALITY CONTROL

A. Contractor shall notify the Owner's Representative at least 24 hrs. in advance of concrete placement. Placement of the Concrete Embedment Liner shall occur in such sequence that the Owner's Representative has sufficient time to inspect the correctness of the placement within the concrete formwork area. The Owner's Representative retains the right to require necessary revisions be made before concrete is placed.

END OF SECTION 03200

APPENDIX 2

CONSTRUCTION QUALITY ASSURANCE PLAN

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APPENDICES

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1.0 INTRODUCTION

This Plan describes the Construction Quality Assurance (CQA) program for the proposed Gypsum Management and CCB Landfill Facilites at the Ameren Duck Creek Power Plant in Fulton County, Illinois. The plan has been developed in accordance with the requirements of 35 IAC Part 811, Subpart E entitled *Construction Quality Assurance* Programs.

The Plan requires a scheduled program of CQA monitoring, inspection, sampling and testing to verify compliance with project plans and specifications. The Plan also addresses the testing requirements for test soil liners that will be constructed to verify materials and construction methods for the full-scale liners. The goal of this program is to achieve a reasonable degree of certainty that the construction of the facilites meets the specified designs.

Appendix A lists the testing methods, acceptance requirements and testing frequencies that shall guide the implementation of this plan. Also listed is the party responsible for conducting the testing for each of the constucted components of the landfill. The plan requires oversight by the CQA Officer for all testing carried out by the geosynthetic installers.

The CQA Plan also requires preparation by the CQA Officer of a final report at the end of construction that provides all inspection and testing documentation and certifies that the facilites have been constructed in accordance with the engineering design.

This Plan is intended to supplement, the project plans and specifications. Where a conflict exists, the approved CQA Plan will govern.

2.0 RESPONSIBILITY AND AUTHORITY OF PROJECT PERSONNEL

The project participants involved in the construction and quality assurance oversight of the construction are shown in Figure 2.1 *Project Organization Chart*. The Owner is the Ameren Energy Resources Generating Company (AERG or Ameren) who will retain a General Contractor to construct the facilities and a CQA Officer to provide the quality assurance oversight services. The following list the responsibilities and authority of each of the participants shown in Figure 2.1.

2.1 Owner

Ameren Energy Resources Generating Company (Ameren) is responsible for obtaining all necessary permits for construction and operation of the facilities. Ameren retains under contract all parties for the construction including the General Contractor, the Design Engineer (Hanson Professional Services Inc.), the CQA Officer, and the CQA testing and monitoring firms.

The Ameren Construction Manager will be in charge of coordinating overall construction activities and will act as Ameren's primary interface with the General Contractor. The Construction Manager coordinates all matters involving contract issues with the Ameren Project Manager including approving field changes to the project plans and specifications.

2.2 Design Engineer

The Design Engineer (Hanson Professional Services Inc.) is responsible for development of plans and specifications that fulfill the needs of the Owner and meet the requirements of the regulatory agencies. The Design Engineer is also responsible for responding to Contractor requests for information (RFIs) during the construction process as may be required to clarify the plans and specifications or to address identified conflicts in the documents. The Design Engineer is further responsible for developing any modifications to the plans and specifications as may be required to address changed field conditions, field cost savings, design improvements or other necessary or desired modifications as approved by the Owner.

2.3 CQA Personnel

2.3.1 Key Personnel (Owner's Representative)

Ameren will retain a CQA Officer for the project who will report directly to Ameren's Construction Manager (see Figure 2.1 *Organization Chart*). The CQA Officer shall be a professional engineer registered in the State of Illinois, who is a person other than the operator or an employee of the operator, and who will supervise and be responsible for all inspection, testing, and other activities required to be implemented as part of the CQA program. The CQA Officer will also be responsible for, and will provide direct supervision to, the testing and monitoring firms shown in Figure 2.1 who will perform the monitoring, testing, sampling, and inspections required by the CQA program as described more specifically in Section 6.0. The CQA Officer will be present at the outset of major undertakings and at critical times during the construction. The time that the CQA Officer must be at the project site will be dependent upon the type of construction being conducted. The CQA Officer will exercise his/her own professional judgment to be present at the project site as required to assume full responsibility for the inspection and testing performed by those persons under his/her direct supervision. The CQA Officer shall have sufficient on-site full-time staff to adequately carry out the quality assurance activities specified herein.

If the CQA Officer is unable to be present to perform duties as outlined, then the CQA Officer will provide, in writing, reasons for his/her absence including designation of the person who will exercise professional judgment in carrying out the duties of a CQA Officer as the designated CQA Officer-in-absentia. A signed statement shall be provided and recorded that the CQA Officer assumes full responsibility for all inspections performed and reports prepared by the designated CQA Officer-in-absentia during any absence of the CQA Officer.

It is required that the CQA Officer (or his designated representative), with on-site support personnel as required, provide oversight of the monitoring, inspection, testing and/or sampling of the following construction activities for the facilities:

- Test Liner,
- Excavation, grading, and preparation of the subgrade and foundation,
- Placement of the compacted soil liner,
- Placement of geosynthetic components,

- Installation of the leachate drainage and collection systems.
- Construction of surface water ditches, channels, berms, and drainage structures, and
- Placement of concrete structures.

The CQA Officer (or his designated representative) must certify that the sampling, inspection and test results for the major elements of the construction are in compliance with established design requirements before subsequent sequential items of the construction can be initiated. The major elements of Work requiring compliance certification include:

- Subgrade prior to placement of soil test liner (CCB landfill facility only),
- Soil test liner prior to placement of the low permeability soil liner,
- Subgrade prior to placement of the low permeability soil liner (CCB landfill facility only),
- Low permeability soil liner prior to placement of the geosynthetic clay liner (GCL),
- GLC liner prior to placement of the geomembrane,
- Geomembrane prior to placement of the geotextile cushion,
- Geotextile cushion prior to placement of the drainage layer,
- Piping installation prior to completed placement of the drainage layer,
- Drainage layer prior to placement of geotextile fabric,
- Cushion Dirt prior to placement of the geomembrane (gypsum facility only), and
- Geosynthetic installations in anchor trenches prior to backfilling.

Certification will require a through review of all inspection, sampling and testing completed for the work item to ensure that all design requirements have been met, a visual inspection of the work item, and the completion and signing of form CQAP 2.1 *CQA Certification* by the CQA Officer. The Contractor or Installer for the immediately following item of work shall not be allowed to initiate work until completion of the signed form by the CQA Officer.

The completed and signed forms CQAP-2.1 shall be filed as a project records in accordance with the provisions of Section 11.0

2.3.2 Document Controller

The staff of the CQA Officer shall include a Document Controller who will be responsible for: (1) control of the CQA Plan to ensure that only current documents are being employed by the CQA staff and (2) filing of all CQA records related to the monitoring, sampling, inspecting and testing specified in the CQA Plan.

Requirements for control of the CQA Plan and for filing of project records are presented in Section 11.0.

2.4 Testing and Monitoring Firms

The testing and monitoring firms, under the direction of the CQA Officer (see Figure 2.1), shall be responsible for conducting the quality assuranace sampling, inspection and testing required by Section 6.0 of the CQA Plan <u>except that</u> only monitoring and limited (independent) sampling and testing shall be required for the geosynthetics (i.e., geomembranes, geothensytic clay liners and

geotextiles). The suppliers and installers shall be responsible for all the sampling and testing required by Section 6.0 for the geosynthetics (see Section 2.6).

2.4.1 *Soil/Concrete Testing (Lab and Field)*

One or more soil/concrete testing firms that has been qualified by the Illinois Department of Transporation (IDOT) will be retained to perform the field and laboratory sampling and testing required by the CQA Plan. Materials sampled and tested will include fine-grained soils, coarse grained soils, aggregates, rip rap and concrete.

Each firm shall be required to provide "certificates of calibration" (or other proof of calibration) to the CQA Officer for each of the measuring and/or test equipment used in the laboratory or field; except that such certificates are not required for commercial grade equipment such as rulers, tape measures or other devices that provide adequate accuracy for their intended purpose.

All field and laboratory forms proposed for collection of data shall be subject to review by Ameren prior to use. Forms deemed to be incomplete or otherwise shall be modified to meet the intent of the CQA Plan.

2.4.2 *Surveyor*

One or more surveyors will be retained to verify attainment of specified elevations, slopes and grades within the tolerances required by the CQA Plan. The firm(s) selected shall have the capacity to complete all work by or under the supervision of an Illinois Professional Land Surveyor.

Each surveyor will be required to provide "certificates of calibration" (or other proof of calibration) to the CQA Officer for each surveying device used; except that such certificates are not required for commercial grade equipment such as rulers, tape measures or other devices that provide adequate accuracy for their intended purpose.

All field forms proposed for collection of data shall be subject to review by Ameren prior to use. Forms deemed to be incomplete or otherwise unacceptable shall be modified to meet the intent of the CQA Plan.

2.4.3 *Geosynthetics Monitor and Geosynthetics Testing Laboratory*

A geosynthetics monitoring firm will be retained to conduct oversight of the quality assurance inspections, testing and sampling carried out in the field by the suppliers and installers for the geosynthetics (see Section 2.5) to ensure that the requirements of the CQA Plan are met including directing additional inspection, sampling and testing as may be deemed necessary by the monitoring firm. The monitoring firm will also collect its own representative samples of the geosynthetics for independent testing by a geosynthetics testing laboratory. The monitoring firm shall have previous experience in installation oversight of at least 10,000,000 sq. ft. of similar geosynthetic materials.

The laboratory will be independent of both the manufacturer and the installer of the geosynthetics and will be required to have its own QA plan for the project work. The QA Plan shall be subject to review by Ameren prior to start of services.

All field and laboratory forms proposed for collection of data shall be subject to review by Ameren prior to use. Forms deemed to be incomplete or otherwise unacceptable shall be modified to meet the intent of the CQA Plan.

2.5 Contractors, Suppliers and Installers

The contractor, subcontractors, suppliers and installers are responsible for completing their portions of the work within specified schedules and in accordance with the requirements of the plans and specifications. They additionally shall accommodate the monitoring, sampling, inspections and testing that are the responsibility of the CQA Officer under the QCA Plan.

The geosynthetic Suppliers and Installers shall provide the quality assurance inspection, sampling and testing as required by Section 6.0 of the CQA Plan. Additionally, the geosynthetic suppliers shall be required to submit "certificates of acceptance" for certain items of work that precede their construction activities. The "certificates" are more specifically discussed in Section 4.0.

3.0 PROJECT MEETINGS

Periodic meetings will be held during the life of the project to enhance coordination among the various parties involved. Meetings will include preconstruction meetings, routine progress meetings and, as needed, problem or work deficiency meetings.

3.1 Preconstruction Meetings

Preconstruction meetings shall be held at the site for the major earthwork. items and geosynthetic installations. At a minimum. the Ameren Construction Manager, the CQA Officer, representatives of the testing firms, and the earthwork contractor or geosynthetic installer should attend. In addition to the topics for discussion as listed in the project specifications. the following CQA items will be covered:

- Discuss the established protocol for inspections, tests and sampling including use of form CQAP 8.1 *Daily Inspection Report* (see Section 8.0).
- Discuss items of work requiring CQA Officer certification or Installer acceptance before subsequent work items can be initiated (see Section 4.0), and
- Discuss the established protocol for handling construction deficiencies, corrective measures, and retesting (see Section 7.0).

The meeting shall be conducted by the Ameren Construction Manager or CQA Officer and will be documented by CQA personnel with distribution to all attendees. Meeting minutes will be filed as project records in accordance with Section 11.0.

3.2 Progress Meetings

At the discretion of the Ameren Construction Manager or the CQA Officer, brief progress meetings will be scheduled to discuss on-going and up-coming construction activities. The meeting will be attended by the Ameren Construction manager, the CQA Officer, and the appropriate site foreman (i.e. when earthwork is being performed, the earthwork foreman will be present; when geosynthetics are being installed, the installer foreman will be present, etc.). In addition to the CQA Officer topics of discussion regarding progress, the following CQA items should be reviewed:

- Discuss the established protocol for inspections, tests and sampling including use of form CQAP 8.1 *Daily Inspection Report* (see Section 8.0),
- Discuss items of work requiring CQA Officer certification or Installer acceptance before new work items can be initiated (see Section 4.0), and
- Discuss the established protocol for handling construction deficiencies, corrective measures, and retesting (see Section 7.0).

These meetings will be documented by the CQA Officer with distribution to all attendees including the Ameren Project Manager. Meeting minutes will be filed as project records in accordance with Section 11.0.

3.3 Problem or Work Deficiency Meetings

Special meetings will be approved by the CQA Officer when a problem or work deficiency is present (or is likely to occur) that is (or could be) of a serious nature. At a minimum, the meeting should be attended by theAmeren Construction Manager, earthwork or installer foremen as appropriate, and the CQA Officer. The Ameren Project Manager should attend those meetings that include discussions of severe and/or recurring problems or deficiencies. The purpose of these meetings is to define and resolve the problem or work deficiency in the following manner:

- Define the problem or deficiency and its probable causes,
- Discuss alternative actions to address the problem or deficiency ,
- Implement the selected action to resolve the problem or deficiency, and
- Verify that the implemented action has been effective.

The meeting will be documented by the CQA Officer with distribution to all attendees including the Ameren Project Manager. Meeting minutes will be filed as project records in accordance with Section 11.0.

4.0 IN-PROGRESS ACCEPTANCE OF WORK

4.1 Introduction

It is very important during placement of the geosynthetics not to entrap fugitive clay, stones, sand, etc. that could damage the geosynthetic, cause clogging of drains or filters, or hamper seaming of the geosynthetic. The geosynthetic installers shall accept responsibility for inspecting

the substrate (on a daily basis) to ensure such entrapments are not present within the substrate area to be covered each day. When found acceptable, the installer shall complete and sign form CQAP-4.1 *Installer Certificate of Acceptance* that documents (on a daily basis) acceptance of the substrate for geosynthetic placement. The Installer shall provide the original signed document to the CQA Officer for his signature of receipt.

Completed and signed forms CQAP-4.1 shall be filed as project records in accordance with the provisions of Section 11.0.

4.2 Elements of Work Requiring Prior Acceptance

The following table cites the elements of work that shall require daily "certificates of acceptance" for the substrate including the installer responsible for providing the certification. Any other areas of geosynthetic installation not included in the table shall still be subject to the requirements of this section.

Table 4.1 Installer Certifications for Acceptance of Work

Substrate to Be Accepted by Installer	Installer
1. Surface of Low Permeability Soil Liner	Geosynthetic Clay Liner (GLC) Installer
2. Surface of Geosynthethic Clay Liner (GCL)	Geomembrane Installer
3. Surface of Geomembrane	Geotextile Cushion Installer
4. Surface of Drainage Layer	Geotextile Filter Installer
5. Surface of Cushion Dirt	Geomembrane Installer

5.0 TEST SOIL LINER

5.1 Introduction

A compacted low permeability soil test liner shall be constructed within the footprint of the proposed soil liner prior to any work being initiated on the full scale construction. The purpose of the test liner is to verify that the materials and methods of construction proposed for the full scale liner will provide the quality of construction required by the CQA Plan. Additional soil test liners shall be constructed for each time the material properties from a new borrow source are found to be significantly different or there is a significant change in the methods of construction and/or equipment.

The test liner will be constructed on a competent foundation from the same prequalified soil material sources, to the same design specifications, and with similar equipment and procedures as are proposed by the contractor for the full scale liner. The foundation (subgrade) for the soil test liner shall be subject to the requirements of Section 6.2.1 and sampling/testing for material prequalification and placement shall be that provided in Section 6.2.2 except that:

1. The survey grid for foundation grade verification and for liner thickness verification shall be as established by the CQA Officer.

2. The frequencies for placement testing shall be as established by the CQA Officer.

3. The testing for hydraulic conductivity shall be as provided in Section 5.2.

5.2 Sampling and Testing Program

The soil test liner shall be sampled and tested under the direction of the CQA officer as described below for each of the physical properties listed.

1. At least five (5) two-stage field tests (ASTM designation D 6391-06) shall be used on the test liner to determine the hydraulic conductivity. Both the vertical hydraulic conductivity (k1) and the horizontal hydraulic conductivity (k2) shall be calculated.

2. Undisturbed samples (Shelby tubes) will be tested in the laboratory for vertical hydraulic conductivity to determine if there is a statistical correlation to the field testing results. At least two (2) samples should be tested.

3. The determination of other engineering parameters including, but not limited to, particle size analysis, liquid limits, plastic limits, water contents, and unconfined compressive strengths that are needed to evaluate the full scale liner shall be as directed by the CQA Officer.

5.3 Requirements for CQA Certification of Test Soil Liner for Landfill Construction

1. At least four of the five field hydraulic conductivity tests shall result in a measured vertical hydraulic conductivity of 5.0×10^{-7} cm/sec or less. No test shall have a hydraulic conductivity greater than 1.0×10^{-6} cm/sec.

2. The laboratory hydraulic conductivity tests shall indicate a measured vertical hydraulic conductivity of 1.0×10^{-6} or less.

5.4 Requirements for CQA Certification of Test Soil Liner for Gypsum Stack

1. At least four of the five field hydraulic conductivity tests shall result in a measured vertical hydraulic conductivity of 5.0×10^{-5} cm/sec or less. No test shall have a hydraulic conductivity greater than 1.0×10^{-4} cm/sec.

3. The laboratory hydraulic conductivity tests shall indicate a measured vertical hydraulic conductivity of 1.0×10^{-4} or less.

5.5 Report of Results and Certification

The CQA Officer shall prepare reports describing the test programs carried out and the results obtained. The reports shall be filed as project records in accordance with Section 11.0.

The CQA Officer shall review the sampling and test results for the test soil liners and, if found in agreement with requirements, provide certification for the work using form CQAP 2.1.

6.0 SAMPLING AND TESTING REQUIREMENTS

6.1 Introduction

Prequalification and placement sampling/testing requirements for the various materials and construction activities are as summarized in Table A.1. Frequencies for material placement testing listed in Table A.1 are based on the volume of material used in construction and are to be considered minimums. The CQA Officer shall select the specific locations for testing on a random basis exercising professional judgment to ensure that testing and sampling fairly represent the construction.
The testing firms under the direction of the CQA Officer shall be responsible for the sampling and testing listed in Table A.1 for: (1) the Soils Prequalification and Placement Testing, (2) the Drainage Media Prequalification and Placement Testing, and (3) the Other Material Placement Testing. The geosynthetic installers shall be responsible for the sampling and testing listed in Table A.1 for the Geosynthetics Prequalification and Placement Testing with daily overview (and some independent laboratory testing) by the geosynthetic firms and the CQA Officer.

The results of the sampling and testing shall be documented on a daily basis by each agency or installer providing the quality assurance activities and the originals of the sampling and testing results provided to the CQA Officer. The CQA officer shall complete form CQAP 8.1 *Daily Inspection Report* (see Section 8.0) for each of the testing firms or installer proving results and attach the results to the form. The completed form CQAP 8.1 and attached results shall be incorporated into the *Daily Summary Report* (see Section 8.0).

6.2 Soils

6.2.1 Foundation (Subgrade) – Low Permeability Soil Liner

6.2.1a. Foundation Grade Verification

Following excavation for the low permeability soil liner, the CQA Officer shall direct the surveyor to verify that actual depths and grades of the foundation (subgrade) are in accordance with the plans and specifications. Elevations shall be surveyed on a 100 ft grid pattern for the bottom of the cell. The points surveyed for side slopes will be at the top, midpoint, and toe. In addition, all breaks in grade will be surveyed. Foundation excavation grading shall meet a control tolerance requirement of 0 ft to -0.4 ft. The measured depths and grades shall be documented on "as built" drawings furnished to the CQA Officer by the surveyor.

The CQA Officer shall review the survey data for conformance to requirements and, if found in agreement with requirements, provide certification for the work using form CQAP 2.1.

6.2.1b. Foundation Fill

Foundation (subgrade) materials not meeting the requirements of the plans and specifications are required to be excavated and replaced with suitable foundation fill to develop a stable foundation for the landfill. The CQA Officer shall make a foundation inspection with the soil testing firm and direct any sampling and testing necessary to identify areas requiring removal and replacement. The CQA Officer shall inform the earthwork contractor of unsuitable areas requiring removal and replacement.

Foundation fill used by the contractor for replacement shall be sampled and tested by the soil testing firm to check compliance with the prequalification and placement requirements listed in Table A-1. The CQA Officer shall direct the surveying firm to determine the locations and extent of all removal and replacement activity and to document all such information on "as built" drawings to be furnished to the CQA Officer.

The CQA Officer shall review the sampling and test results for the foundation fill and, if found in agreement with the prequalification and placement requirements, provide certification for the work using form CQAP 2.1. The certification for foundation fill may be provided on the same form providing the certification for foundation grade.

6.2.2 Low Permeability Soil Liner

6.2.2a. Prequalification Testing

Table 1.1 requires that prequalification testing for each soil type being used for liner construction at the landfill include the development of an "acceptable zone" of moisture-density for the compacted soil that will result in a liner with a minimum hydraulic conductivity of 1.0×10^{-6} cm/sec. The resulting "acceptable zone" then serves as the major control for material placement during construction.

The CQA officer shall direct the soil testing agency to determine the "acceptable zone" for each soil type to be used for landfill liner construction and provide the results in a written report to be available for comparisons with the material placement testing results. The determination of the "acceptable zone" shall be in accordance with Appendix B or other published methodology used in the profession. The report will be filed as a project record in accordance with Section 11.0.

There is no prequalification testing required for the soil materials to be used for the gypsum stack liner construction except that the materials selected shall have sufficient fines to achieve the in-place hydraulic conductivity specified in Section 5.4.

6.2.2b. Material Thickness Testing

The CQA Officer shall direct the survey agency to determine elevations at the foundation of the soil liner and at the final constructed surface using a 100 ft grid pattern (and the break points in slope) to verify attainment of the plan grades and elevations. To verify liner thickness, all horizontal survey coordinates shall be the same for the foundation and final constructed surface. Side slope thicknesses will be verified using crest (top), midpoint, and toe documentation points.

The measured depths and grades shall be documented on "as built" drawings furnished to the CQA Officer by the surveyor agency.

6.2.2c. Moisture/Density Testing

Moisture/density testing of the compacted soil liner shall be conducted by the soil testing agency under the requirements and at the frequencies specified in TableA.1. During construction of the soil liner the CQA Officer shall confirm the following:

- Use of the same construction equipment as used in the test soil liner.
- Use of same procedures, such as number of passes and speed,
- Uniformity of coverage by compaction equipment,
- Consistent achievement of density, water content and permeability of each successive lift.
- Use of methods to bond successive lifts together,
- Achievement of liner strengths on sidewalls,
- Contemporaneous placement of protective covering to prevent drying and desiccation, where necessary,
- Prevention of placement of frozen material or the placement of material on frozen ground,
- Prevention of damage to completed liner sections, and
- That construction proceeds only during favorable climatic conditions.

6.2.2d. Hydraulic Conductivity Testing

Samples of the in-place liner shall be obtained and tested for hydraulic conductivity under the requirements and at the minimum frequency as specified in Table A.1. Multiple samples may be collected at a given test location for the purpose of retesting in the event of unacceptable hydraulic conductivity results from the initial sample.

Boreholes, excavations or other disturbances to the soil liner resulting from the obtainment of samples shall be backfilled as directed by the CQA Officer.

6.2.2e. Certification of Work

The CQA Officer shall review the sampling and test results for the low permeability soil liner and, if found in agreement with the prequalification and placement requirements, provide certification for the work using form CQAP 2.1.

6.2.3 Berms

6.2.3a. Landfill Containment Berms

The CQA Officer shall direct verification of excavated foundation (subgrade) depths and grades as specified in Section 6.2.1a except that the foundation grid shall be as directed by the CQA Officer. Foundation fills shall be as specified in Section 6.2.1b.

Prequalification testing for material sources shall meet the requirements in Table A.1.

The CQA Officer shall direct the soil agency to conduct the following inspection activities during berm construction:

- Observation of fill material characteristics.
- Observation of loose lift thickness.
- Observation of clod size reduction and material homogenization, and
- Placement testing as specified in Table A.1.

Documentation of construction on "as-built" plans shall be as specified in Section 6.5.2.

The CQA Officer shall review the sampling and test results for the landfill containment berms and, if found in agreement with the prequalification and placement requirements, provide certification for the work using form CQAP 2.1.

6.2.3b Temporary Cell Separation Berms

The CQA Officer shall direct verification of excavated foundation (subgrade) depths and grades as specified in Section 6.2.1a except that the foundation grid shall be as directed by the CQA Officer. Foundation fills shall be as specified in Section 6.2.1b.

Prequalification testing for material sources shall meet the requirements in Table A.1.

The CQA Officer shall direct the soil agency to conduct the following inspection activities during berm construction:

- Observation of fill material characteristics,
- Observation of loose lift thickness.
- Observation of clod size reduction and material homogenization,
- Placement testing as specified in Table A.1, and
- Measurements of berm slopes.

6.3 Geosynthetics

6.3.1 Geosynthetic Clay Liner (GCL)

6.3.1a. Prequalification Testing

The geosynthetic clay liner (GCL) installer shall provide to the CQA Officer the test results from a qualified laboratory for the type and frequency of prequalification testing listed in Table A.1. The submittal shall include certification from the laboratory that the test results verify the manufacturer's guaranteed properties.

The CQA Officer shall direct the geosynthetics QA monitor firm to select a representative number of additional samples of the GCL for submittal to the monitor's geosynthetic laboratory for independent verification of the manufacturer's guaranteed properties.

The results of laboratory testing shall meet the GCL manufacturer's specifications as shown in the following table.

GCL Laboratory Testing Methods/Minimum Values Required	
Test Method	**Minimum Value**
Bentonite Mass/Area (ASTM D5993)	0.75 lb./ft^2
GCL Grab Tensile Strength (ASTM D4632)	90 lb.
GCL Peel Strength (ASTM D4632)	15 lb.

The installer shall direct the test laboratory to submit the results of all laboratory test results and certification to the Document Controller for filing as project records in accordance with Section 11.0.

6.3.1b. Installer Certification of Placement Surface

Prior to daily clay liner placement, the installer shall provide to the CQA Officer daily "certificates of acceptance" (form CQAP-4.1) which document the installer's inspection and acceptance of the underlying surface as being suitable for the GCL installation (see Section 4.0).

All daily "certificates of acceptance" (form CQAP-4.1) shall be filed as project records in accordance with Section 11.0.

6.3.1c Deployment

The CQA Officer shall direct the geosynthetic QA monitor firm to oversee activities of the installer during placement and field testing of the GCL.

Incoming rolls of GCL shall be inventoried and inspected by the installer. Manufacturer's certifications will be inspected for conformance with the requirements of this plan. Holes or other visible defects shall be recorded in the CQA Officer's daily report and clearly marked on the GCL roll for identification of necessary repairs or rejection of the roll.

GCL shall be placed such that all seams run parallel to the slope. GCL should be dry when installed. Wet or hydrated GCL shall not be used. GCL panels shall be laid with a minimum 6 in. overlap on longitudinal seams and a minimum 12 in. overlap on panel end seams. Seam overlaps shall be placed such that the direction of flow is from the top panel to the underlying panel to form a shingle effect. Direct contact with GCL shall be minimized.

6.3.1d. Seaming

The GCL shall be sealed in accordance with the recommendations of the GCL manufacturer. Dry bentonite having the same chemical and material properties as the GCL shall be evenly dispersed from the panel edge to the lap line continuously along the seam or overlap areas. All dirt, gravel, or other debris shall be removed from the seam or overlap areas.

Prior to covering the GCL, the installer shall verify all exposed seams or overlaps and examine the GCL for any defects. At the judgment of the installer, a panel or section that becomes seriously damaged or hydrated shall be replaced. All repairs shall be made by placement of a

patch of the same material over the damaged area at least 1 ft beyond the repair area. The GCL will be immediately covered and protected from precipitation by the overlaying geomembrane.

6.3.1e. Shear Strength Conformance Testing

Shear strength conformance tests shall be performed on the GCL to verify the interface shear strengths of the GCL with the appropriate material (HDPE geomembrane or compacted clay). The results of the shear strength conformance tests will be used to confirm that the actual interface shear strengths are equal to or greater than the interface shear strengths used in the stability analyses. Shear strength conformance tests on subsequent phases and/or cell development need not be performed if the same manufacturer and materials are used in the construction of the subsequent phase and/or cell. Conformance testing shall be in accordance with ASTM D 5321 or other suitable method.

6.3.2 Geomembrane

6.3.2a. Prequalification Testing

The geomembrane installer shall provide to the CQA Officer the test results from a qualified laboratory for the type and frequency of prequalification testing listed in Table A.1. The submittal shall include certification from the laboratory that the test results verify the manufacturer's guaranteed properties.

The CQA Officer shall direct the geosynthetics QA monitor firm to select a representative number of additional samples of the geomembrane for submittal to the monitor's geosynthetic laboratory for independent verification of the manufacturer's guaranteed properties.

The installer shall direct the test laboratory to submit the results of all laboratory results and certification to the Document Controller for filing as project records in accordance with Section 11.0.

6.3.2b. Installer Certification of Placement Surface

Prior to daily geomembrane placement, the installer shall provide to the CQA Officer daily "certificates of acceptance" (form CQAP-4.1) which document the installer's inspection and acceptance of the underlying surface as being suitable for the geomembrane installation (see Section 4.0).

All daily "certificates of acceptance" (form CQAP-4.1) shall be filed as project records in accordance with Section 11.0.

6.3.2c. Placement Testing for Seam Overlap

The contractor and installer shall arrange geomembrane sections such that the use of field seams is minimized and that horizontal seams are not used on side slopes. Seam overlaps shall be field measured by the installer to verify the requirement in Table A.1 is met for all seams within the geomembrane footprint. The CQA Officer shall direct the geosynthetics QA monitor firm to

make independent measurements of a representative number of seam overlaps for additional verification of the requirement in Table A.1.

At completion of geomembrane placement, the installer shall provide the CQA Officer with "as-built" drawings of the geomembrane installation showing all seam locations and seam measurement locations.

6.3.2d. Placement Non-Destructive Testing

The installer shall conduct non-destructive testing of seams at the frequency specified in Table A.1. All seams shall be nondestructively tested over their full-length using a vacuum test unit, air pressure test or other method approved by the CQA Officer. Continuity testing will be completed as the seaming progresses.

The CQA Officer shall direct the geosynthetics QA monitor firm to monitor all non-destructive testing carried out by the installer.

The installer shall submit all non-destructive field testing results to the CQA Officer for filing as project records in accordance with Section 11.0.

Vacuum testing and air pressure testing procedures shall be as given in the following sections.

Vacuum Testing (Extruded Welds)

The following procedures are applicable to those processes which produce an extruded weld.

Equipment

The following equipment shall be used when conducting vacuum tests:

- A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, a port hole or valve assembly, and a vacuum gauge,
- A steel vacuum tank and pump assembly equipped with a pressure controller and pipe connections,
- A rubber pressure/vacuum hose with fittings and connections,
- A bucket, and
- A soapy solution.

Procedures

The following procedures will be followed:

1. Energize the vacuum pump and reduce the tank pressure to approximately minus 5 psi (10 in. of Hg) gauge.
2. Wet a strip of geomembrane approximately 12 in. wide by 48 in. long (an area larger than the coverage size of the vacuum box) with the soapy solution.
3. Place the box over the wetted area.
4. Close the bleed valve and open the vacuum valve.
5. Verify that a leak tight seal is created.

6. For a period of not less than 10 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.
7. If no bubble appears after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area, repeat the process.
8. All areas where soap bubbles appear will be marked and repaired and then retested until passing test results are obtained.

Air Pressure Testing (For Double Fusion Seam Only)

The following procedures are applicable to those processes which produce a double seam with an enclosed space.

Equipment

The equipment will be comprised of the following:

- An air pump (manual or motor driven) equipped with pressure gauge capable of generating and sustaining a pressure between 25 psi to 30 psi and mounted on a cushion to protect the geomembrane,
- A rubber hose with fittings and connections, and
- A sharp hollow needle, or other approved pressure feed device.

Procedures

The following procedures will be observed:

1. Both ends of the seam to be tested will be sealed.
2. A needle or other approved pressure feed device will be inserted into the tunnel created by the fusion weld.
3. A protective cushion will be inserted between the air pump and the geomembrane.
4. The air pump will be energized to a pressure between 25 psi and 30 psi. The valve will be closed, and the pressure will be sustained for approximately 5 minutes.
5. If loss of pressure exceeds 3 psi or does not stabilize, the faulty area will be located, then repaired and retested until passing test results are obtained.
6. At the conclusion of a passing air pressure test, the opposite end of the seam will be slit and subsequent drop in pressure will be monitored. This will ensure that the entire seam was completely tested.
7. Remove needle or other approved pressure feed device and seal.

6.3.2e. Placement Destructive Testing

General

Destructive seam tests shall be performed at randomly selected geomembrane locations. The purpose of these tests is to evaluate seam strength. Seam strength testing shall be done as the seaming work progresses, not at the completion of all field seaming.

The CQA Officer shall direct the geosynthetics QA monitor firm to monitor all destructive testing carried out by the installer.

The installer shall submit the results of all destructive testing to the CQA Officer for filing as project records in accordance with Section 11.0.

Location and Frequency

The installer shall select locations where seam samples will be cut out for testing. Those locations shall be established as follows:

1. Selection will be at a minimum frequency of one test location per 500 ft of seam length. This minimum frequency is to be determined as an average taken throughout the entire area of placement.

2. Test locations will be determined during seaming at the installer's discretion. Selection of such locations may be prompted by suspicion of excess crystallinity, contamination, offset welds, or any other potential cause of imperfect welding.

The CQA Officer shall direct the geosynthetics QA monitor firm to select and cut out a representative number of additional samples for independent laboratory testing.

Sampling Procedure

Samples will be cut as the seaming progresses in order to have laboratory test results before the geomembrane is covered by another material. The installer shall:

- Assign a number to each sample, and mark it accordingly,
- Record sample location on layout ("as-built") drawing, and
- Record reason for taking the sample at this location (e.g., statistical routine, suspicious feature of the geomembrane).

All holes in the geomembrane resulting from destructive seam sampling shall be immediately repaired. The continuity of the new seams in the repaired area shall be vacuum tested.

Field Testing

The installer shall test in the field, by tensiometer, two 1 in. wide sample strips from the samples identified for destructive testing; one for peel and one for shear. This testing shall include the independent samples obtained by the geosynthetics QA monitor firm. Field testing will prequalify samples for laboratory testing. The requirements and frequency for field testing shall be as provided in the table at the end of this section.

The installer shall conduct all field tests and mark all samples and portions with their number. The installer shall also log the date, time, ambient temperature, number of seaming unit, name of seamer, welding apparatus temperatures and pressures, and pass or fail description, and attach a copy to each sample portion.

Geosynthetic Quality Assurance Laboratory Testing

Prequalifying field tests shall identify samples for laboratory testing. The installer's quality assurance laboratory shall be as selected by the installer with concurrence of the CQA Officer.

Testing shall include shear strength and peel adhesion. At least five specimens shall be tested by the installer's laboratory for each method. Specimens shall be selected alternately by test from the samples (i.e., peel, shear). All laboratory testing shall be accordance with ASTM D 4437.

The CQA Officer shall direct the geosynthetic QA monitor firm to have additional samples tested for peel and strength by the monitor's independent geosynthetics laboratory as deemed necessary.

Procedures for Destructive Test Failure

The following procedures will apply whenever a sample fails a destructive test, whether the test was conducted in the laboratory or by field tensiometer. The installer has two options:

1. The installer may reconstruct the seam between any two passed test locations.

2. The installer may trace the welding path to an intermediate location at least 10 ft from the point of the failed test in each direction, and take a small sample for an additional field test at each location. If these additional samples pass the tests, then full laboratory samples are taken. If these laboratory samples pass the tests, then the seam is reconstructed between these locations. If either sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.

All acceptable seams must be bounded by two locations from which samples passing laboratory destructive tests have been taken. In cases exceeding 150 ft of reconstructed seam, a sample taken from the zone in which the seam has been reconstructed must pass destructive testing.

The installer will document all actions taken in conjunction with destructive test failures.

Geomembrane Destructive Seam Tests and Frequency

Property	Test Method	60-mil HDPE	40-mil HDPE	40-mil LLDPE	Frequency
Seam Shear Strength	ASTM D 4437	120 ppi	80 ppi	44 ppi	See Note 1
Seam Peel Strength (hot wedge fusion)	ASTM D 4437	78 ppi	52 ppi	40 ppi	See Note 1
Seam Peel Strength (fillet extrusion)	ASTM D 4437	72 ppi	45 ppi	40 ppi	See Note 1

Notes:

1. Destructive testing of seams shall occur at a minimum frequency of once per 500 ft of seam length.
2. Values apply for both smooth and textured geomembranes.

6.3.3 Geotextile

6.3.3a. Prequalification Testing

The geotextile installer shall provide to the CQA Officer the test results from a qualified laboratory for the type and frequency of prequalification testing listed in Table A.1. The submittal

shall include certification from the laboratory that the test results verify the manufacturer's guaranteed properties.

The CQA Officer shall direct the geosynthetics QA monitor firm to select a representative number of additional samples of the geomembrane for submittal to the monitor's geosynthetic laboratory for independent verification of the manufacturer's guaranteed properties.

The installer shall submit the results of all laboratory results and certification to the CQA Officer for filing as project records in accordance with Section 11.0.

6.3.3b. Installer Certification of Placement Surface

Prior to daily geotextile placement, the installer shall provide to the CQA Officer daily "certificates of acceptance" (form CQAP-4.1) which document the installer's inspection and acceptance of the underlying surface as being suitable for the geotextile installation (see Section 4.0).

All daily "certificates of acceptance" (form CQAP-4.1) shall be filed as project records in accordance with Section 11.0.

6.3.3c. Deployment

Incoming rolls of geotextile shall be inventoried and inspected by the installer. Manufacturer's certifications will be inspected for conformance with the requirements of this plan. Holes, tears, or other visible defects will be recorded in the CQA Officer's daily report and clearly marked on the synthetic for identification of necessary repairs.

The installer shall check that the geosynthetic installation conforms to the construction requirements and manufacturer's recommendations. The CQA Officer shall direct the geosynthetics QA monitor firm to oversee the inspections by the installer.

On slopes steeper than 10H:1V, all geotextiles shall be continuously sewn. Geotextiles shall be overlapped a minimum of 3 in. prior to seaming. This requirement does not apply to the leachate system filter fabric. All sewing shall be done using thread with physical, chemical, and ultraviolet high resistance properties equal to or exceeding those of the geotextile. The CQA Officer shall direct the geosynthetics QA monitor firm to make independent measurements of a representative number of seam overlaps for additional verification of the requirement in Table A.1.

The 10-oz. cushion geotextile (immediately above the geomembrane liner and beneath the drainage layer) shall be placed with vertical seams running up the slopes and into the anchor trench. Horizontal seams (perpendicular to the slope) shall be allowed on side slopes for the 4-oz. filter geotextile overlaying the drainage layer to facilitate staged construction of the drainage layer going up the slope. All overlaps shall be "shingled" so that water or other material can not run down the slope between the geotextile seams.

6.4 Drainage Media

6.4.1 Granular Drainage Layer

6.4.1a. Prequalification Testing

Each source of material for the drainage layer shall be tested for hydraulic conductivity and grain size analyses in accordance with Table A.1 to determine suitability of the source.

6.4.1b. Material Thickness Testing During Placement

The CQA Officer shall direct the survey firm to determine elevations at the top of the geotextile cushion and at the final constructed surface of the granular drainage layer using a 100 ft grid pattern (and the break points in slope) to verify attainment of the plan grades and elevations. To verify liner thickness, all horizontal survey coordinates shall be the same for the top of the cushion and final constructed surface. Side slope thicknesses will be verified using crest (top), midpoint, and toe documentation points.

The CQA officer may approve the use of thickness plates as an alternative method to surveying.

In no instance shall the field determined thickness be less than 1.0 ft. The measured depths and grades shall be documented on "as built" drawings furnished to the CQA Officer by the surveyor.

6.4.1c. Gradation and Hydraulic Conductivity Testing During Placement

The CQA officer shall direct the soil test firm to take an initial sample of the granular drainage layer within the first 100 cu. yds. of material placement and test for hydraulic conductivity and grain size to confirm suitability of the source. Continuing sampling and testing shall be completed at the frequencies specified in Table A.1.

Compaction of the drainage layer shall not be allowed during placement to avoid breakdown of materials

Gradation tests may be considered passing provided the hydraulic conductivity requirements are met and the specified percentage of fines is not exceeded.

6.4.d. Certification of Work

The CQA Officer shall review the sampling and test results for the granular drainage layer and, if found in agreement with the prequalification and placement requirements, provide certification for the work using form CQAP 2.1.

6.4.2 Coarse Aggregate

6.4.2a. Prequalification Testing

Each source of material for the coarse aggregate shall be tested for hydraulic conductivity and grain size analyses in accordance with Table A.1 to determine suitability of the source.

6.4.2b. Material Placement

The CQA Officer shall direct that inspection of piping as provided in Section 6.5.1 be completed prior to placement of coarse aggregate around the piping. Compaction of the coarse aggregate shall not be allowed during placement to avoid breakdown of materials.

The CQA officer shall direct the soil test firm to take an initial sample of the coarse aggregate within the first 100 cu. yds. of material placement and test for hydraulic conductivity and grain size to confirm suitability of the source. Continuing sampling and testing shall be completed at the frequencies specified in Table A.1.

Gradation tests may be considered passing provided the hydraulic conductivity requirements are met and the specified percentage of fines is not exceeded.

6.4.2c. Certification of Work

The CQA Officer shall review the sampling and test results for the coarse aggregate and, if found in agreement with the prequalification and placement requirements, provide certification for the work using form CQAP 2.1.

6.5 Other Material Placement Testing

6.5.1 Placement testing of Leachate Piping System

The CQA Officer shall direct the surveyor to check the invert elevations and plan coordinates for the constructed piping system at the locations and frequencies specified in Table A.1.

The CQA Officer or other CQA staff shall inspect pile size, materials and connections including all components of the leachate collection and management systems to verify compliance with plan and specification requirements.

The measured grades and coordinates shall be documented on "as built" drawings furnished to the CQA Officer by the surveyor.

The CQA Officer shall review the survey results for the leachate piping system and management systems and, if found in agreement with the placement requirements, provide certification for the work using form CQAP 2.1.

6.5.2 Placement Testing of Surface Water Management System

The CQA Officer shall direct the survey agency to determine the elevations and grades of the constructed berms and channels in accordance with the requirements and frequency specified in Table A.1.

The measured elevations and grades shall be documented on "as built" drawings furnished to the CQA Officer by the surveyor.

6.5.3 Placement Testing of Concrete

The CQA Officer shall direct the soil test firm to carry out placement testing for concrete in accordance with the requirements and frequency specified in Table A.1.

The contractor shall submit proposed concrete mix designs to the CQA Officer for review prior to ordering of concrete.

The CQA Officer shall review the concrete testing results and, if found in agreement with the placement requirements, provide certification for the work using form CQAP 2.1.

7.0 CORRECTIVE MEASURES

The CQA Officer shall reject and require replacement of all materials for which sampling, testing or inspection results show that prequalification requirements are not met. The CQA Officer shall also reject workmanship (and require corrective rework) for which sampling, testing or inspection results show that material placement requirements are not met. The lateral and/or vertical extent of corrective measures for rework shall be based on the frequency of testing and judgment of the CQA Officer.

The CQA Officer may neglect the occasional occurrence of failed moisture/density tests or laboratory hydraulic conductivity tests carried out for the low permeability soil liner provided the failed tests can be shown to be outliers and are not concentrated in one area or lift. The CQA officer shall provide written justification in the Daily Summary Report for assignment of failed tests as outliers.

8.0 DOCUMENTATION OF SAMPLING AND TESTING

8.1 Daily Summary Reports

A daily summary report shall be prepared by the CQA Officer, or under the direct supervision of the CQA Officer, during each day of activity. Form CQAP 8.1 *Daily Summary Report* shall serve as the base document to which the daily inspection reports (see Section 8.2) are to be attached.

Each report shall be signed and dated by the CQA Officer and CQA Officer-in-absentia. The original report (and attachments) shall be submitted to the Document Controller and filed as a project record in accordance with Section 11.0.

8.2 Daily Inspection Reports

A daily inspection report shall be prepared by the CQA Officer, or under the direct supervision of the CQA Officer. for each day that materials, or placement of materials, are being inspected, sampled or tested. Form CQAP 8.2 *Daily Inspection Report* shall serve as the base document to which the test data, photographic records, test results, etc. are to be attached.

Each report shall be signed and dated by the CQA Officer or CQA Officer-in-absentia. The original report (and attachments) shall be submitted to the CQA Officer who shall incorporate the report into the daily summary report.

8.3 Photographs

Photographs may be incorporated into the daily inspection report or daily summary report to provide a visual record of work progress, inspection/testing activity, construction work, or other items considered important to the report. The photographs, at a minimum, shall be furnished with the following information:

- The location, date and time of the photograph,
- A description of the item photographed including direction of view (N,S,E or W),
- Personnel, testing agencies, installers or contractors present, and
- Name of photographer.

9.0 FINAL CERTIFICATION REPORT

Upon completion of the construction contract (but before the landfill or gypsum stack is placed into service), the CQA Officer shall submit an acceptance report to the Illinois Environmental Protection Agency. The acceptance report shall contain the following:

- A certification by the CQA officer that the construction has been prepared and constructed in accordance with the engineering design.
- As-built drawings as specified herein, and
- All daily summary reports.

10.0 CONSTRUCTION MANAGEMENT ACTIVITIES

10.1 Requests for Information (RFIs)

The general contractor or installer may, after exercising due diligence to locate required information, request from the CQA Officer clarification or interpretation of the contract documents. The general contractor or installer shall make specific reference to the contract drawing(s) or specification(s) in question and include estimates of any cost or schedule impacts that could possibly be associated with the requested clarification or interpretation.

The general contractor or installer shall initiate the RFI in a timely manner using form CQAP-10.1 *Request for Information*. The CQA Officer shall, with reasonable promptness, respond to the RFI on the same form CQAP-10.1 and return a copy of the completed form to the party making the request as final disposition of the matter.

Additional copies of the completed form shall be distributed as directed by the CQA Officer. All RFI's shall be filed as project records in accordance with Section 11.0.

10.2 Review of Contractor Submittals

The Contractor shall submit shop drawings, product data and samples to the CQA Officer in accordance with the requirements of the project specifications and with such promptness as to cause no delay of the work. The Contractor shall not authorize purchase, fabrication, erection, processing or shipping of any items associated with the submittal until review of the shop drawings, product data or samples has been completed by the CQA Officer and no resubmittals are required by the CQA Officer.

All submittals from subcontractors shall be reviewed first by the Contractor to satisfy the contractor's responsibilities for lengths, dimensions, quantities, means and methods, and other such items.

The CQA Officer and/or Design Engineer shall review the submittals for conformance with design concepts and conformance with the information shown in the contract documents. Upon completion of review, the CQA Officer shall return the submittal to the Contractor with one of the following notations for each item in the submittal:

- No exceptions taken.
- Furnish as corrected,
- Revise and resubmit,
- Submit specified item, or
- Rejected.

The Contractor shall resubmit corrected shop drawings, product data or samples for those items noted as requiring revision or submission or noted as rejected.

The CQA Officer shall maintain copies of all submittals and a log documenting submittal descriptions, dates of receipt, dates of return, review personnel, and actions taken on the submittals. Copies of submittals and the log shall be filed as project records in accordance with Section 11.0.

10.3 Field Change Order Process

The Contractor shall be responsible for preparing requests for field change order (FCO) in accordance with AREG procedures and submitting the FCO requests on the appropriate AREG FCO form to the CQA Officer.

The CQA Officer shall be responsible for reviewing the FCO with the Design Engineer, determining agreement or non-agreement with the requested change, and submitting the documented decision to the Contractor on the appropriate AREG CFO form with copies to the Ameren Project Manager. Agreement to the FCO shall require signature approval of the Ameren Project Manager.

The CQA Officer shall maintain an on-going log of authorized FCOs and running balance of project costs. Copies of the FCOs and log of authorized FCOs shall be retained as project records in accordance with Section 11.0.

11.0 DOCUMENT CONTROL AND PROJECT RECORDS

11.1 CQA Plan

The CQA officer shall control the preparation, issue and revisions of the CQA Plan so that correct documents are being employed by the project participants. The CQA Plan, including all changes thereto, shall be reviewed for adequacy and approved for release by the CQA Officer and Ameren Project Manager.

The Document Controller shall issue controlled copies of the CQA Plan and maintain all records associated with its preparation, issue and revisions.

11.2 Project Records

The maintenance of project records during construction of the landfill shall be the responsibility of the Document Controller and shall be protected against damage, deterioration, and loss. Records shall be maintained in a manner as to be readily identifiable and retrievable.

Control of CQA documents and samples during the construction process shall be as shown in Figure 11.1. All original CQA documents from both the field and laboratories shall be ultimately furnished to the Document Controller for filing and maintenance. Samples may be discarded after testing and documentation of results is complete.

Project records shall be made available to the Ameren Project Manager as requested during construction and, when requested, shall be turned over to AERG at completion of the construction contract.

Records shall include, but not be limited to, the following:

- CQA Plan (all revision levels),
- CQA Plan documentation (reviews, issuance and revisions),
- Meeting minutes,
- Daily inspection reports (form CQAP 8.1),
- Daily summary reports (form CQAP 8.2),
- Certificates of acceptance by geosynthetic installers,
- CQA certifications (form CQAP 2.1),
- Certificates of calibration for inspection, measuring and test equipment,
- Report for test soil liner,
- Report for compacted soil liner "acceptable zone",
- "As-built" drawings,
- Laboratory test results for soils, drainage media, and concrete,
- Laboratory test results for geosynthetics,
- Laboratory certifications of manufacturer's guaranteed properties for geosynthetics,
- Contractor Requests for Field Change Order (AERG FCO form),

- Log of Authorized Field Change Orders,
- Shop drawing submittals,
- Log of shop drawing submittals,
- Requests for information from contractor/installers,
- Responses to requests for information, and
- Final certification report.

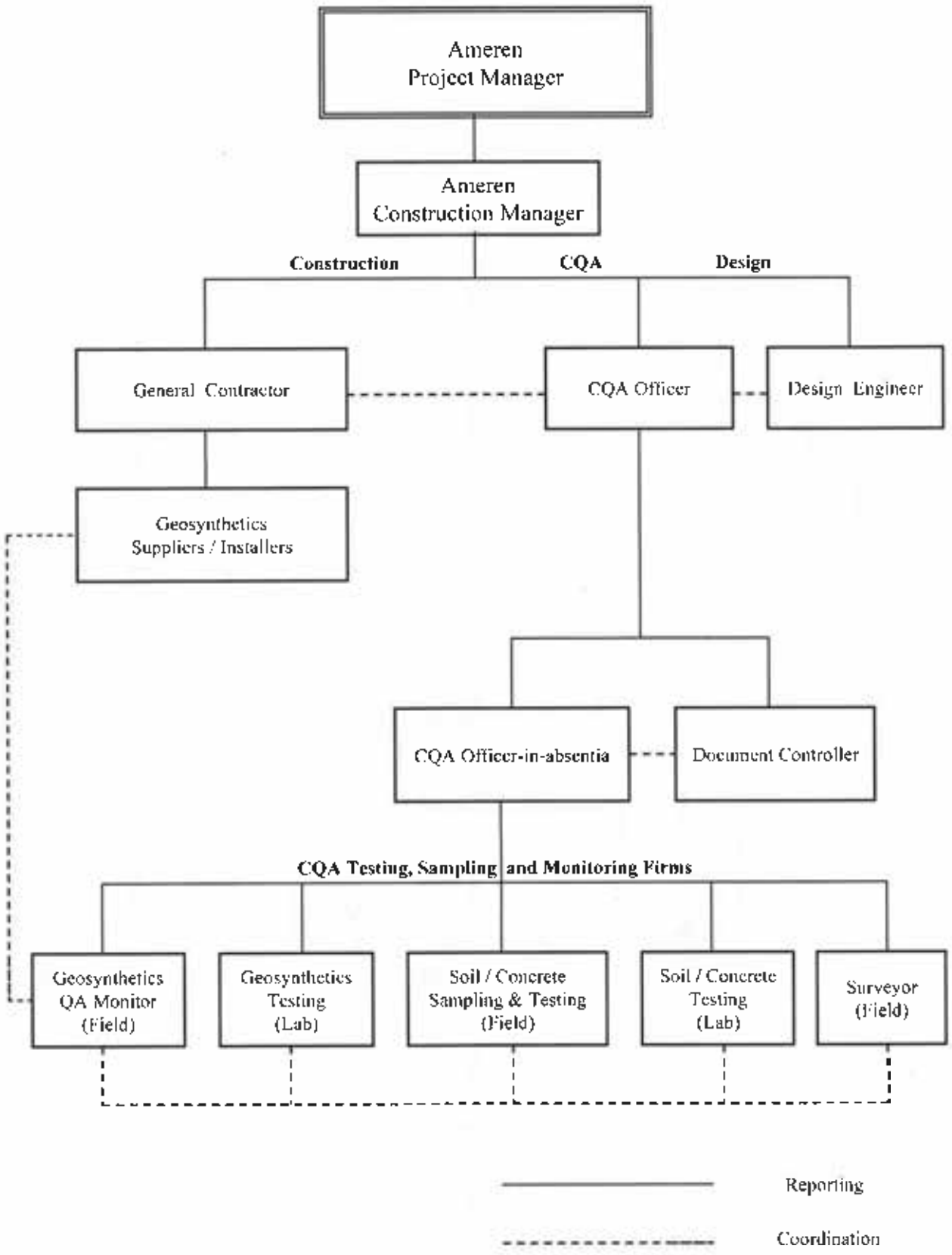

Figure 2.1 Project Organization Chart

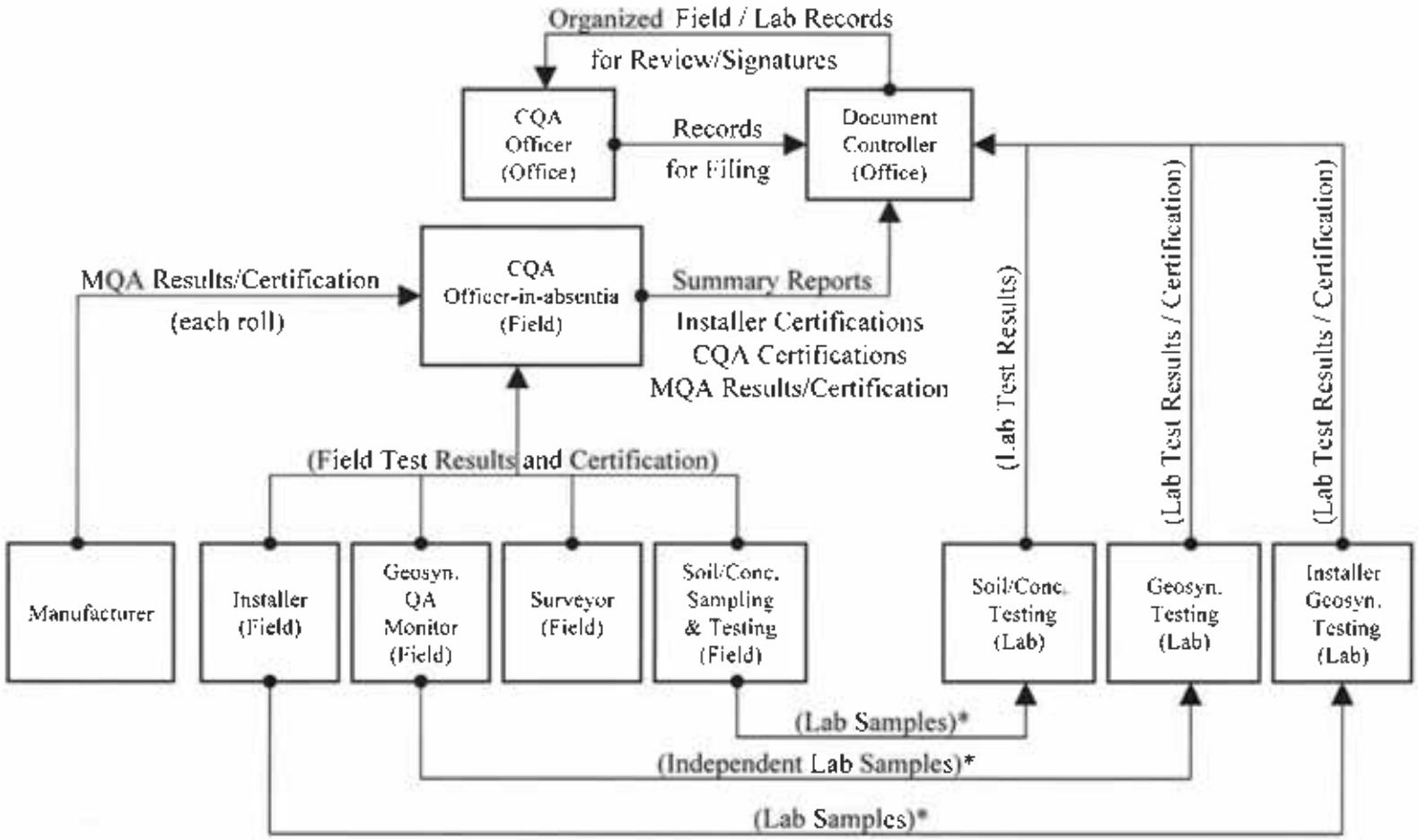

Figure 11.1 Control of CQA Documents and Samples

* Transmittal letters shall direct the original lab test results/certifications to be sent to Document Controller with copies to submitting installer or testing/monitoring agency.

Appendix A

Material Testing and Frequency

TABLE A.1: MATERIAL TESTING & FREQUENCY

Property/Test Method	Requirement/Specification	Frequency	Responsibility
SOILS - PREQUALIFICATION TESTING			
FOUNDATION FILL & BERMS			CQA Officer
Standard Proctor Curve - ASTM D698		Per soil type (See Note 2)	
Atterberg Limits - ASTM D4318	PI > 5, LL > 20%	Per soil type	
Grain Size Analysis - ASTM D422	200 Sieve > 50%	Per soil type	
Hydraulic Conductivity - ASTM D5084	See Note 1	Per soil type	
		Per soil type	
SOIL LINER			CQA Officer
Standard Proctor Curve - ASTM D698	"Acceptable Zone" see Appendix B	Per soil type	
Atterberg Limits - ASTM D4318	USCS Classification	Per soil type	
Grain Size Analysis - ASTM D422	USCS Classification	Per soil type	
Hydraulic Conductivity - ASTM D5084	1.0×10^{-7} cm/sec	Per soil type	
Develop "Acceptable Zone"	"Acceptable Zone" see Appendix B	Per soil type	
3' PROTECTIVE FINAL SOIL COVER			Not Applicable to this Contract
Standard Proctor Curve - ASTM D698*	"Acceptable Zone" see Appendix B	Per soil type*	
Atterberg Limits - ASTM D4318*	USCS Classification	Per soil type*	
Grain Size Analysis - ASTM D422*	USCS Classification	Per soil type*	
Hydraulic Conductivity - ASTM D5084	See Note 1	Per soil type*	
Develop "Acceptable Zone"*	"Acceptable Zone" see Appendix B	Per soil type*	
Suitable for Vegetation	Visual Acceptance	Per soil type	

* On the first two feet of the protective layer only. (The third foot is topsoil.)

Note 1: There is no specific requirement for hydraulic conductivity for the foundation, berms and final cover soils as they are not part of the liner system. However, insitu materials on the site generally exhibit hydraulic conductivities in the range of 1×10^{-4} cm/sec to 1×10^{-5} cm/sec. The construction contractor will attempt to utilize the most impermeable materials available (as identified visually) when constructing foundation fill and berms. For purposes of a complete construction record, hydraulic conductivity of placed foundation fill and side berms will be field tested at a rate of 1 test per each 10,000 cubic yards of material placed, although no specific threshold values are required.

Note 2: "Soil Type" refers to differences in soil color and/or textural consistency that would be indicative of differences in soil characteristics.

Note for Geosynthetics: See Section 6.0 of the CQA Plan for additional GCL and geomembrane testing requirements.

TABLE A.1: MATERIAL TESTING & FREQUENCY

Property/Test Method	Requirement/Specification	Frequency	Responsibility
SOILS - MATERIAL PLACEMENT TESTING			
FOUNDATION			CQA Officer
Survey	0 to -0.5 feet Design Grade	100-foot grid	
FOUNDATION FILL & BERMS			CQA Officer
Density/Moisture - ASTM D2922 & D3017	90% Standard Proctor Density and -1% to Optimum Moisture Content	1 per 10,000 cubic yards (minimum 1 per compacted lift)	
Strength	0.5 tsf (hand-held penetrometer)	1 per 10,000 cubic yards (minimum 1 per compacted lift)	
Hydraulic Conductivity - ASTM D5084	See Note 1	1 per 10,000 cubic yards	
Sieve and Hydrometer Analysis of Soils - ASTM D422	200 Sieve > 50%	Per Soil Type	
Liquid Limit, Plastic Limit and Plasticity Index (Atterberg Limits) - ASTM D4318	PI > 5, LL > 20	Per Soil Type	
SOIL LINER			CQA Officer
Thickness	5 feet minimum thickness (base), 1 foot minimum thickness (cover), and maintain design grade	100-foot grid	
Density/Moisture - ASTM D2922 & D3017	95% Standard Proctor Density and Optimum to +5% Moisture Content in accordance with "Acceptable Zone" (see Note 3)	1 per acre per lift or 1 per 1,000 cubic yards	
Strength	0.5 tsf (hand-held penetrometer)	1 per acre per lift or 1 per 1,000 cubic yards	
Hydraulic Conductivity - ASTM D5084	See Note 4	1 per 10,000 cubic yards	
PROTECTIVE FINAL SOIL COVER			Not Applicable to this Contract
Thickness	3 feet minimum total thickness including 1 foot of topsoil - maintain design grade	100-foot grid	
Density/Moisture* - ASTM D2922 & D3017	90% Standard Proctor Density and -3% to Optimum Moisture Content	1 per 10,000 cubic yards (minimum 1 per compacted lift)	
Strength*	0.5 tsf (hand-held penetrometer)	1 per 10,000 cubic yards (minimum 1 per compacted lift)	

* On the first two feet of the protective layer only. (The third foot is topsoil.)

Note 1: There is no specific requirement for hydraulic conductivity for the foundation, berms and final cover soils as they are not part of the liner system. However, insitu materials on the site generally exhibit hydraulic conductivities in the range of 1×10^{-4} cm/sec to 1×10^{-5} cm/sec. The construction contractor will attempt to utilize the most impermeable materials available (as identified visually) when constructing foundation fill and berms. For purposes of a complete construction record, hydraulic conductivity of placed foundation fill and side berms will be field tested at a rate of 1 test per each 10,000 cubic yards of material placed, although no specific threshhold values are required.

Note 3: Acceptable Zone" restriction applies only to the soil liner for the landfill. The gypsum stack soil liner shall only be required to meet the compaction and moisture content specification.

Note 4: The hydraulic conductivity for the landfill soil liner is 1.0×10^{-6} cm/sec(maximum) and for the gypsum stack soil liner is 1.0×10^{-5} cm/sec (maximum).

TABLE A.1: MATERIAL TESTING & FREQUENCY

Property/Test Method	Requirement/Specification	Frequency	Responsibility
GEOSYNTHETICS - PREQUALIFICATION TESTING			
GEOMEMBRANES (60 mil smooth, 60 mil textured, 40 mil textured)			Installer
Raw Material	Manufacturer's List of Guaranteed Properties	All rolls	
Geomembrane Properties	Manufacturer's List of Guaranteed Properties	All rolls	
Puncture Resistance - ASTM D4833	Manufacturer's List of Guaranteed Properties	1 per 100,000 square feet or per raw material batch, whichever is greater. Sample 3 feet wide by the full roll width	
Tear Resistance - ASTM D1004	Manufacturer's List of Guaranteed Properties	1 per 100,000 square feet or per raw material batch, whichever is greater. Sample 3 feet wide by the full roll width	
Thickness - ASTM D5199/D5994	Manufacturer's List of Guaranteed Properties	1 per 100,000 square feet or per raw material batch, whichever is greater. Sample 3 feet wide by the full roll width	
Tensile Strength and Elongation - ASTM D638 (Modified) or D6693	Manufacturer's List of Guaranteed Properties	1 per 100,000 square feet or per raw material batch, whichever is greater. Sample 3 feet wide by the full roll width	
GEOTEXTILES (Non-Woven, 4 ounce, 10 ounce, 16 ounce)			Installer
Geotextile Properties	Manufacturer's List of Guaranteed Properties	All rolls	
Mass per Unit Area - ASTM D5261	Manufacturer's List of Guaranteed Properties	1 per lot or one per 100,000 square feet, whichever is greater. Sample 3 feet wide by the full roll width	
Grab Tensile Strength - ASTM D4632	Manufacturer's List of Guaranteed Properties	1 per lot or one per 100,000 square feet, whichever is greater. Sample 3 feet wide by the full roll width	
Trapezoidal Tear Strength - ASTM D4533	Manufacturer's List of Guaranteed Properties	1 per lot or one per 100,000 square feet, whichever is greater. Sample 3 feet wide by the full roll width	
Apparent Opening Size - ASTM D4751	Manufacturer's List of Guaranteed Properties	1 per lot or one per 100,000 square feet, whichever is greater. Sample 3 feet wide by the full roll width	
Puncture Resistance - ASTM D4833	Manufacturer's List of Guaranteed Properties	1 per lot or one per 100,000 square feet, whichever is greater. Sample 3 feet wide by the full roll width	
Permittivity - ASTM D4491	Manufacturer's List of Guaranteed Properties	1 per lot or one per 100,000 square feet, whichever is greater. Sample 3 feet wide by the full roll width	

TABLE A.1: MATERIAL TESTING & FREQUENCY

Property/Test Method	Requirement/Specification	Frequency	Responsibility
GEOSYNTHETICS - PREQUALIFICATION TESTING			
GEOSYNTHETIC CLAY LINER (GCL)			Installer
GCL Properties	Manufacturer's List of Guaranteed Properties	All rolls	
Bentonite Mass/Area - ASTM D5993	Manufacturer's List of Guaranteed Properties	1 per 100,000 square feet or per raw material batch, whichever is greater. Sample 3 feet wide by the full roll width	
Grab Tensile Strength - ASTM D4632	Manufacturer's List of Guaranteed Properties	1 per 100,000 square feet or per raw material batch, whichever is greater. Sample 3 feet wide by the full roll width	
Peel Strength - ASTM D4632	Manufacturer's List of Guaranteed Properties	1 per 100,000 square feet or per raw material batch, whichever is greater. Sample 3 feet wide by the full roll width	
GEOSYNTHETICS - MATERIAL PLACEMENT TESTING			
GEOMEMBRANES (60 mil smooth, 60 mil textured, 40 mil textured)			Installer
Seam Overlap	3" to 4"	All Seams	
Non-Destructive Testing	As per Section 6.3d of CQA Plan	All Seams	
Destructive Testing	As per Section 6.3e of CQA Plan	Minimum One Every 500 Feet	
GEOTEXTILES (Non-Woven, 4 ounce, 10 ounce, 26 ounce)			Installer
Seam Overlap	3" to 4"	All Seams	
Installation	Physical Installation per Section 6.3c of CQA Plan	None	
GEOSYNTHETIC CLAY LINER (GCL)			Installer
Seam Overlap	As per Section 6.3d of CQA Plan	All Seams	
Installation	Physical Installation per Section 6.3c of CQA Plan	None	

TABLE A.1: MATERIAL TESTING & FREQUENCY

Property/Test Method	Requirement/Specification	Frequency	Responsibility
DRAINAGE MEDIA - PREQUALIFICATION TESTING			
GRANULAR DRAINAGE LAYER			
Hydraulic Conductivity - ASTM D2434	1.0×10^{-3} cm/sec (Minimum)	One Test per Source	CQA Officer
Grain Size Analysis - ASTM D422	Field Established Based on Hydraulic Conductivity (Fines Passing #200<5%)	One Test per Source	
COARSE AGGREGATE			
Hydraulic Conductivity - ASTM D2434	1.0×10^{-1} cm/sec (Minimum)	One Test per Source	CQA Officer
Grain Size Analysis - ASTM D422	Field Established Based on Hydraulic Conductivity (Fines Passing #200<5%)	One Test per Source	
DRAINAGE MEDIA - MATERIAL PLACEMENT TESTING			
GRANULAR DRAINAGE LAYER			
Thickness	One Foot Minimum Thickness	100 Foot Grid	CQA Officer
Gradation - ASTM D422	Field Established Based on Hydraulic Conductivity (Fines Passing #200 < 5%)	1 per 3,000 cubic yards	
Hydraulic Conductivity - ASTM D2434	1.0×10^{-3} cm/sec (Minimum)	1 per 10,000 cubic yards	
COARSE AGGREGATE			
Gradation - ASTM D422	Field Established Based on Hydraulic Conductivity (Fines Passing #200 < 5%)	1 per 3,000 cubic yards	CQA Officer
Hydraulic Conductivity - ASTM D2434	1.0×10^{-1} cm/sec (Minimum)	1 per 10,000 cubic yards	

TABLE A.1: MATERIAL TESTING & FREQUENCY

Property/Test Method	Requirement/Specification	Frequency	Responsibility
OTHER MATERIAL PLACEMENT TESTING REQUIREMENTS			
LEACHATE PIPING SYSTEM ELEVATIONS & LOCATIONS			CQA Officer
Survey	Elevation +/- 0.1 feet with no adverse slopes. Plan location +/- 0.5 feet.	Every 100 feet and connections	
Welds and Connections	Visual Inspection	Each connection	
SURFACE WATER MANAGEMENT SYSTEM			CQA Officer
Survey	Field established for positive drainage (+/- 0.4 feet)	Inlet and Outlet and every 100 lineal feet along ditch channel	
CONCRETE			CQA Officer
Slump - ASTM C143	2" to 4" at time of placement	1 per 25 cubic yards or minimum 1 per day	
Air Entrainment - ASTM C231	5% to 7% at time of placement	1 per 100 cubic yards or minimum 1 per day	
Compressive Strength - ASTM C31 and C39	3,500 psi at 28 days	2 cylinders per 50 cubic yards or minimum 2 cylinders per day	
Delivery Time - ASTM C94	Total Mixing and Delivery Time Less than 1.5 Hours	Each Delivery	

Appendix B

Acceptable Zone Procedure

PROCEDURE FOR DETERMINATION OF SOIL LINER ACCEPTABLE ZONE OF COMPACTION AND MOISTURE CONTENT

INTRODUCTION

One of the most significant factors affecting the performance of compacted soil liners is the adequate control of water content and dry unit weight during construction. A carefully written compaction specification will result in a compacted soil liner achieving the required hydraulic conductivity while also satisfying other factors affecting performance such as strength, compressibility, and resistance to desiccation. Because a soil liner is meant to be a hydraulic barrier, hydraulic conductivity requirements are the primary factor affecting the criteria of a compaction specification. The specification should be then tightened as necessary to meet other performance standards.

For this project, the specification will require that the soil be compacted to at least 95 percent maximum dry density as obtained from the Standard Proctor test per ASTM D 698, with a moisture range of optimum to 5 percentage points wet of optimum. Testing of the proposed liner soils will be performed to determine its acceptable density and moisture content zone for a maximum hydraulic conductivity of 1.0×10^{-6} cm/sec for the final cover and base liner. Research work performed by Benson and Daniel (1990) shows that the acceptable zone can be expected to parallel a "line of optimums." This procedure should be run when a new source of soil is selected for liner construction or when the Proctor density changes by 10 pcf or more.

PROCEDURE

The following steps will be performed during prequalification of a soil source for liner construction. The source investigation will identify consistency of the soil and have completed soil index tests including grain size distribution and Atterberg Limit determinations. Once the initial index testing is complete, a proper value for Proctor density can be selected, and then the following steps can be followed.

- Compact three samples at a controlled moisture of ±1 percent of optimum moisture at approximately 97 percent to 93 percent of standard Proctor maximum dry density. These samples should be tested for hydraulic conductivity using ASTM D 5084. If all samples pass, it can be assumed as confirmation that the specified 95 percent of maximum dry density is an appropriate lower density range.

- If all three initial hydraulic conductivity test results are $\leq 1.0 \times 10^{-6}$ cm/sec for the base liner and the final cover, then three more samples shall be prepared to confirm the moisture content range. Using approximately 93 percent to 95 percent dry density, prepare one sample at -1 points (dry of optimum), one at +3 points and one at +8 points of optimum moisture content. Test these new samples for hydraulic conductivity using ASTM D 5084. If all samples pass, it can be assumed as confirmation that the optimum to +5 percentage points is an appropriate moisture content range.

- If the first two steps do not confirm the permeability window, the CQA Officer will determine if the soil will be used for construction. If it will be used, then further testing can be performed to define a smaller acceptable zone.

- In some cases, the borrow sources may be so variable that composting of the soil will be required for testing. In these cases, three or four Proctor tests should be performed to determine the range of maximum dry density. If the range of maximum dry densities is less than 10 pcf, a composite can be tested as outlined above. If the range of maximum dry densities is greater, the highest and lowest soil values should be tested to determine an acceptable range.

Selection of density value shall be based on inspector's identification of soil percentages. Prequalification testing will assure the conformance of permeability.

USE OF THE ACCEPTABLE RANGE

During construction, the acceptable window will be verified by the specified interval of construction sample testing. Each sample will be tested for density, moisture, grain size, and Atterberg Limits when submitted for hydraulic conductivity testing. The results can then be compared to prequalification testing to verify soil consistency and passing hydraulic conductivity. These tests can also be plotted on the Proctor curve as documentation of acceptable zone or as a demonstration that the zone can be enlarged.

Appendix E: Operation and Maintenance Manual, Duck Creek Energy Center, Gypsum Management Facility

Operation and Maintenance Manual
Illinois Power Resources Generating, LLC
Duck Creek Energy Center
Gypsum Management Facility
Fulton County, Illinois

Prepared For:

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OPERATION AND MAINTENANCE MANUAL
DUCK CREEK ENERGY CENTER
GYPSUM MANAGEMENT FACILITY
FULTON COUNTY, ILLINOIS

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SECTION 1.0
GENERAL

This operation and maintenance (O&M) manual outlines objectives, proposed policies, responsibilities, and procedures for Illinois Power Resources Generating, LLC (IPRG) and Contractor personnel who are responsible for the management of the Duck Creek Energy Center Gypsum Management Facility (GMF). The GMF incorporates two reservoirs, the Gypsum Stack and the Recycle Pond, for processing and storing gypsum.

1.1 REASONS FOR DEVELOPMENT OF THE O&M MANUAL

In addition to providing guidance to the IPRG and Contractor personnel who are responsible for the operations and maintenance of Duck Creek GMF, this manual has been prepared in accordance with state regulations. The State of Illinois Rivers, Lakes and Streams Act, (615 ILCS 5) Paragraph 23a includes the statement "The Department is authorized to carry out inspections of any dam within the State, and to establish standards and issue permits for the safe construction of new dams and the reconstruction, repair, operation and maintenance of all existing dams." (emphasis added).

Part 3702 of the 17 Illinois Administrative Code, Chapter I entitled the "Construction and Maintenance of Dams" details the requirements to obtain a permit for the construction, operation, and maintenance of a dam. Section 3702.40 b) includes the following statement:

> "5) As a condition of each permit, the dam owner shall submit a maintenance plan detailing the procedures and schedules to be followed to maintain the dam and its appurtenances in a reasonable state of repair."

Thus it is a requirement of all dam owners who have dams which fall under the jurisdiction of the Illinois Department of Natural Resources to operate and maintain them safely.

As a dam owner, IPRG is responsible for the safety of the public and for maintaining the structures at the facility for both safety and economy. The overall public interest is served by providing a document to serve as a basis for the safe and economical operation and maintenance of the dam during both emergency and day-to-day conditions.

1.2 GENERAL RESPONSIBILITIES CONCERNING DAMS

IPRG is responsible for the operation and maintenance of the Gypsum Stack Dam and the Recycle Pond Dam. These responsibilities include general maintenance (mowing, removing debris from decants, placing riprap where needed, etc.), operation, inspection and emergency action decisions. IPRG plans to enter into an agreement with an independent contractor to perform certain aspects of the operation and maintenance of the GMF.

SECTION 2.0
DEFINITIONS

Abutment - That part of the valley side or concrete walls against which the dam is constructed. Right and left abutments are those on respective sides of an observer when viewed looking downstream.

Appurtenant Works - The structures or machinery auxiliary to dams which are built to operate and maintain dams; such as outlet works, spillways, gates, valves, channels, etc.

Boil - A stream of water discharging from the ground surface downstream of the dam carrying with it a volume of soil which is distributed around the hole formed by the discharging water.

Berm - A horizontal step or bench in the sloping profile of an embankment dam.

Breach - A break, gap, or opening (failure) in a dam which releases impoundment water.

Dam - A barrier built for impounding or diverting the flow of water.

Dike (Levee) - An embankment, usually applied to embankments or structures built to protect land from flooding.

Drain, Layer or Blanket - A layer of pervious material in a dam to facilitate the drainage of the embankment including such items as a toe drain, a weephole, and a chimney drain.

Drawdown - The resultant lowering of the water surface level due to the release of water from the impoundment.

Duck Creek Plant Datum - the Duck Creek Station horizontal and vertical coordinate system ("Plant System") on which the design and construction survey information, and elevations used in this document is based. Reference the control points shown on the construction drawings (Drawing C180-C102-04, Rev 3, or later) for horizontal and vertical control information.

Embankment - Fill material, usually rock or earth, placed with sloping sides.

Earthen Dam - Any dam constructed of excavated natural materials.

Failure - An incident resulting in the uncontrolled release of water from the dam.

Freeboard - The vertical distance between a stated water level and the top of the dam.

Gate or Valve - In general, a device in which a leaf or member is moved across the waterway to control or stop the flow.

Groin - The junction of the upstream or downstream face of the dam with the valley wall.

Maintenance - The upkeep, involving labor and materials, necessary for efficient operation of dams and their appurtenant works.

Operation - The administration, management, and performance needed to operate the dam and appurtenant works.

Operation and Maintenance Inspection - Inspections conducted by the dam Operator. These inspections are frequent visual "Walk-around" inspections of the dam surface and appurtenant works.

Outlet - An opening through which water can freely discharge for a particular purpose from an impoundment.

Phreatic Surface - The upper surface of saturation in an embankment.

Piping - The progressive development of internal erosion by seepage, appearing downstream as a hole or seam, discharging water that contains soil particles.

Riprap - A layer of large stones, broken rock or precast blocks placed in a random fashion usually on the upstream slope of an embankment dam, on a reservoir shore, or on the sides of a channel as a protection against wave and ice action.

Silt/Sediment - Soil particles and debris in an impoundment.

Slump/Slide Area - A portion of earth embankment which moves downslope, sometimes suddenly, often with cracks developing.

Spillway System - A structure or structures over or through which flows are discharged. If the flow is controlled by gates, it is considered a controlled spillway. If the elevation of the spillway crest is the only control of the flows, it is considered an uncontrolled spillway.

Emergency Spillway - A spillway designed to operate very infrequently, only during exceptionally large floods, usually constructed of materials expected to erode slowly.

Principal Spillway - The main spillway which controls both normal and flood flows and is usually constructed of non-erodable materials.

Auxiliary Spillway - A spillway which works in conjunction with the principal spillway to control flood flows and is usually constructed of non-erodable materials.

Stilling Basin - A basin constructed to dissipate the energy of fast flowing water, such as from a spillway, and to protect the streambed from erosion.

Toe of Embankment - The junction of the face of the dam with the ground surface in the floodplain upstream or downstream of the dam.

SECTION 3.0
INFORMATION ABOUT THE DAMS

3.1 LOCATION

The Gypsum Stack and Recycle Pond Dams are located in the NW 1/4 of Section 18, Township 6 North, Range 5 East of the Forth Principal Meridian in Fulton County, Illinois. More specifically, the dams are located east of Bethel Cemetery Road approximately 2 miles southeast of Canton, Illinois. A map showing the location of the dams is included in Appendix A.

3.2 DESCRIPTION OF DAM AND APPURTENANCES

The gypsum stack dam has a maximum earthen embankment height of 32 ft and a maximum impounding capacity of 773 acre-ft, measured at the top of the earthen dam elevation of 620 ft per Duck Creek Plant Datum (EL 620). However, due to the "stacking" of gypsum above the top of the earthen dam, the total volume within the completed gypsum stack will be approximately 2256 acre-ft. The recycle pond dam has a maximum embankment height of 41 ft and a maximum impounding capacity of 150 acre-ft (measured at the top of dam elevation of 615 ft).

The gypsum stack dam has a single high density polyethylene (HDPE) lined spillway (transfer channel) which discharges to the recycle pond. The transfer channel is a trapezoidal channel with 3H:1V side slopes. The transfer channel transitions from a 16-ft bottom width at an invert elevation of 614.0 ft at the upstream end, to a 35-ft bottom width at an invert elevation of 609.0 ft at the downstream end. A 2-ft tall HDPE covered concrete weir, located near the upstream end of the transfer channel, is fitted with stop logs capable of raising the discharge control elevation to 616.0 ft. To protect the HDPE liner from abrasion during flows, the transfer channel and a portion of the recycle pond dam incorporate an additional sacrificial layer of HDPE at the location where the transfer channel discharges to the recycle pond.

The emergency spillway for the recycle pond consists of four 42-inch diameter HDPE pipes which discharge into a riprap lined plunge pool. The upstream inverts of the pipes are at EL 610.0 and the downstream inverts are at EL 607.0. The emergency spillway has been provided in the event of an accidental overfilling of the recycle pond or catastrophic rainfall only. It is not expected to be activated during the life of the facility.

Pertinent data about the dams, appurtenant works, and reservoirs are presented in Appendix B.

3.3 SIZE CLASSIFICATION

The gypsum stack earthen dam has a maximum embankment height of 32 ft and a maximum impounding capacity of 773 acre-ft (measured at the top of dam elevation of 620 ft). Based on IDNR criteria, the gypsum stack earthen dam is classified as a small-size dam. However, since the gypsum stack is planned to ultimately meet or exceed 100 ft in height, the gypsum stack will eventually be classified as a large-size dam.

The recycle pond dam has a maximum embankment height of 41 ft and a maximum impounding capacity of 150 acre-ft (measured at the top of dam elevation 615 ft). Since the recycle pond dam embankment exceeds 40 ft in height, it is classified as an intermediate-size dam.

3.4 HAZARD CLASSIFICATION

The breach wave resulting from a failure of either dam is expected to be contained within the Duck Creek Reservoir located immediately downstream. Considering the low probability for causing loss of life or economic loss to adjacent landowners, both dams are classified as CLASS III, LOW HAZARD POTENTIAL dams.

SECTION 4.0
OPERATIONS ACTIVITIES

The operations plan describes the proposed operation of the Duck Creek Gypsum Management Facility (GMF) which includes the gypsum stack and the recycle pond.

4.1 SITE OPERATIONS

The GMF will receive flue gas desulfurization sludge (gypsum) from the Duck Creek Energy Center (the Plant). Gypsum will be transported to the GMF in slurry form (approximately 20 percent solids) and allowed to settle. Clarified process water will then be siphoned or decanted to the recycle pond and returned to the Plant for reuse via pipeline.

The GMF will potentially receive gypsum slurry 24 hours per day, seven days per week. Routine operation and maintenance activities are expected to be conducted during day shift hours. The filling times and staging chronology included in this document are calculated from gypsum production rates estimated at 23,500 tons per month, which is based on the plant burning high sulfur coal (6.8 lbs of SO_2 per million BTU) at a 90% capacity factor. The sluice and process water return rates referenced in this document are per the Hitachi Power Systems America, Ltd. MATERIAL BALANCE Case Study: 4,131 mmBtu/hr Drawing No. 0013-361-110-0381 Rev. B dated 3-19-07. Variations in these parameters would result in variations in the estimated chronology and flow rates.

The Plant is a restricted access location. A series of fences and gates exist to prevent unauthorized access to the property. The proposed GMF is located within the restricted plant confines, and is, therefore, not accessible to the general public.

4.2 PERSONNEL

The proposed GMF will be owned and operated by IPRG. Corporate offices are located in Houston, Texas. IPRG plans to enter into an agreement with an independent Contractor to perform certain aspects of the operation and maintenance of the GMF. The contractual operator (Operator) of the gypsum stack will be responsible for daily operation and maintenance of the gypsum stack, recycle pond and peripheral areas.

4.3 OPERATION OF VAULTS AND VALVES

IPRG personnel will be responsible for the operation of the valves which control the flow of slurry and water between the Plant, recycle pond and gypsum stack to the first valve vault located at the recycle pond entrance road. Beyond that point, the Operator will be responsible for distribution of gypsum slurry to various areas of the gypsum stack (this includes the valve vaults on the mid-western side of the gypsum stack and the north side of the gypsum stack). Two redundant pipes will carry the gypsum slurry from the plant. Although only one pipe will be in use at any time, conditions at the plant may result in a discharge pipe switch at any time. BOTH PIPES MUST BE AVAILABLE TO DISCHARGE GYPSUM AT ALL TIMES WHEN

THE PLANT IS OPERATING. Valves to both pipes must be open, and the ends of both pipes must be positioned so that there would be no restrictions to gypsum discharge at any time.

4.4 GYPSUM MANAGEMENT FACILITY STARTUP

The major components of the GMF consist of:

- The gypsum stack;
- The recycle pond;
- The HDPE-lined earthen transfer channel that connects the two structures, and through which clarified process water will be decanted from the gypsum stack into the recycle pond; and
- The recycle pond decant system and pump-house, through which process water will be returned to the Plant for reuse.

Upon completion of the recycle pond construction, the recycle pond will be partially filled with water pumped from the Plant or from Duck Creek Reservoir. The recycle pond pumps will be commissioned and then shut off pending the introduction of slurry into the gypsum stack. Procedures for these operations are discussed in the following sections.

4.4.1 Siphon Installation and Operation

The bottom of the gypsum stack is approximately 29 ft below the transfer channel invert elevation of 614 ft. During the period when the gypsum sluicing and stacking operations are conducted below the transfer channel elevation, clarified water must be siphoned from the gypsum stack to the recycle pond. Based on a slurry discharge rate of 653 gal/minute (gpm), and an average reclaim water return rate of 626 gpm, a minimum of two redundant (2) 10-inch diameter HDPE siphons should be primed and operable at all times. Installation of the siphon pipes and valves is included in the original GMF construction.

Each of the siphon pipes will pass through the transfer channel and the outlet end of the siphon pipes shall be laid on the bottom of the recycle pond at elevation 590 ft. Ballast will be required at the outlet of the pipe to prevent the pipes from potentially floating to the surface and breaking the siphon. Ballast or other means of restraint may also be required in the transfer channel to hold the pipes in place. For a 300 ft long, 10-inch diameter HDPE siphon, the water level in the gypsum stack will need to be approximately 4.5 ft higher than the water level in the recycle pond in order to pass the equilibrium process water return rates discussed above.

4.4.2 Initial Filling of Recycle Pond With Water

The recycle pond will initially be partially filled with water pumped from Duck Creek Reservoir or the plant. The recycle pond will be filled to a water surface elevation of 598 ft in order to accommodate proper pump functioning during commissioning and startup of the slurry discharge to the gypsum stack. Duck Creek plant personnel will monitor and regulate the water level in the recycle pond.

4.4.3 Commissioning the Pumps and Siphons

Once the recycle pond and gypsum stack have operational levels of water, the siphons, the recirculation pump system (recycle pond to gypsum stack), and the recycle pump system (recycle pond to plant) will be primed and tested. IPRG will be responsible for operation and maintenance of the recycle / recirculation pumps.

4.5 GYPSUM MANAGEMENT FACILITY OPERATION

The gypsum slurry (approximately 20 percent solids) will be pumped from the Plant to the gypsum stack via piping. Piping will be HDPE with a pressure rating for the design hydraulic and static head. The HDPE pipe will discharge the slurry into the gypsum stack, and the gypsum will settle by gravity.

The water level in the recycle pond should be maintained at a minimum elevation of 598 ft in order to insure uninterrupted pumping of water back to the plant. However, at times, there will be intermittent outages at the plant. During an outage, bottom drains in the gypsum stack will continue to discharge water to the recycle pond and the recycle pumps will continue to recirculate water from the recycle pond to the gypsum stack. The recirculation of water is required during outages in order to utilize the water storage capacity of the gypsum to help maintain sufficient storage capacity in the recycle pond to accommodate all precipitation runoff from the entire gypsum stack/recycle pond area during an expected maximum 12-week maintenance outage at the Plant.

At a placement rate of 23,500 tons per month, it will take approximately 3 years to fill the gypsum stack with gypsum to the invert of the HDPE-lined transfer channel at EL 614. Until that time, clarified return water will be siphoned into the recycle pond using one of two redundant 10-inch diameter siphon pipelines. Water that flows from the gypsum stack to the recycle pond will be pumped back to the Plant for reuse, or recirculated to the top of the gypsum stack during periods when the plant is shutdown.

In order to stack the gypsum material with the required factors of safety for slope stability, a system of strategically placed perimeter ditches and dikes must be constructed. Interior dikes will also need to be constructed to accommodate the installation of ring drains and the development of cells located within the gypsum stack. Key components of the gypsum stacking process are described in the following sections to highlight the effort required to successfully stack gypsum with the required factors of safety against slope failure.

4.5.1 Initial Filling With Gypsum Slurry

There are two redundant gypsum slurry pipelines which will be capable of discharging midway along the north side or west side of the of the gypsum stack at a maximum rate of 1.5 cfs (675 gal/min). The initial construction of the GMF includes a ring drain system on the HDPE liner on the bottom of the gypsum stack. When gypsum slurry is initially discharged into the gypsum stack, **extreme care must be taken to prevent any erosion of the sand layer over the ring drain**. **Any displacement of sand may impair the function of the ring drain.** If necessary, the sand layer may be protected with a layer of larger aggregate or temporarily

covered with an approved geotextile wherever necessary to prevent erosion of the sand layer. It may be preferable to use a flange-connected pipe extension to extend the slurry discharge line to the interior side of the ring drain so that the bottom troughs will collect the water and prevent erosion of the sand layer. The pipe extension can be removed when the ring drains are covered and protected by settled gypsum. If any ring drain sand is displaced, the Operator shall immediately notify Ameren so that an appropriate response and repair method can be determined. Please see Figure A for details and a general depiction of the ring drain assembly.

Settled gypsum will gradually create a plane of material (gypsum beach) sloping gently towards the south end of the gypsum stack. Please see Figure B for a depiction of the gypsum beach. Clarified water will collect in the south end of the gypsum stack and will be siphoned into the recycle pond when it reaches EL 602.5, the level necessary to provide the head to siphon the process water at the system equilibrium rates. The GMF Operator will be responsible for operation and maintenance of the siphons. At the design flow rates, it will take approximately 95 days of operation in order for the water in the gypsum stack to reach this level.

4.5.2 Gypsum Dike and Cell Construction

The bottom slope of the gypsum stack liner, and the siphoning of water from the gypsum stack to the recycle pond, will partially drain the gypsum to allow for "early stacking" of material below the crest of the earthen dam. This is advantageous for several reasons. One reason is that the construction of compacted dikes at a lower elevation may improve foundation conditions for the remainder of the stack. Employing stacking procedures at a lower elevation also affords the opportunity for the Operator to become familiar with the material and develop confidence in a construction routine which will maximize stability when stacking the material above the top of the earthen embankment. Early stacking also allows Ameren the opportunity to complete preliminary testing on proposed piezometer locations for development of a piezometer installation and monitoring plan, as discussed in Section 4.5.8, which will be refined prior to stacking above the top of the earthen embankment.

The procedures for controlling the deposition of gypsum will begin once the gypsum beach at the north end of the gypsum stack reaches an elevation of approximately 605 ft, NGVD, which is 10 ft above the HDPE liner (7.5 ft above the top of the ring drain assemblies). Based on an assumed deposited gypsum slope of 0.3%, and a water level of 602.5 ft, the gypsum beach which will be visible above water is predicted to span half the length of the gypsum stack (reference Figure B). At full production (16.7 acre-ft deposited per month), the time required for the gypsum beach to reach this configuration is estimated at five to six months. .

The first procedural steps in controlling the deposition of (stacking) gypsum are the construction of a perimeter ditch, a perimeter dike, a rim ditch, and a rim dike. The perimeter ditch is the ditch which will be formed between the earthen embankment and the gypsum. The perimeter dike is the gypsum dike on the interior side of the perimeter ditch. The rim ditch is a ditch which will be formed on the interior side of the perimeter dike. The rim dike is a gypsum dike which will be formed on the interior side of the rim ditch. These basic components of the gypsum stack are illustrated in Figure C. Specific details pertaining to the ditches are provided in Sections 4.5.3 and 4.5.4.

During the initial stages of stacking, the perimeter ditch, perimeter dike, rim ditch and rim dike will be constructed simultaneously. They will be constructed by building two elevated dikes on the gypsum beach beginning at the middle of the north side and proceeding both clockwise and counterclockwise around the perimeter of the gypsum beach (see Figure D). Access to the beach will be provided by carefully pushing an approved fill material onto the beach from the crest of the earthen embankment to create an access pad. The thickness of the fill layer will need to be at least 24-inches over the geomembrane liner to avoid damage to the liner, and will need to be at least 36-inches over the gypsum beach. Once the fill material has been placed far enough out onto the beach to allow excavation of the gypsum without damaging the liner, the access pad can be completed using gypsum excavated from the beach (see Figure E).

Gypsum excavated from the beach is expected to be soft and saturated and must be windrowed and allowed to dewater before it can be spread and compacted to form the roadway. The gypsum is expected to dewater sufficiently in 24 hours to allow spreading and compacting. Adequate compaction is expected to be achieved by tracking with a D-6 dozer or similar equipment.

After construction of the dikes and ditches has begun, the slurry discharge lines should be relocated to discharge to the rim ditch. This will allow the rim ditch to be refilled each day to provide gypsum for raising the roadway as the excavator retreats from the most recently placed windrow. The rim ditch will also serve as the primary means of diverting slurry around the stack to the location where deposition is desired.

When the initial perimeter dike is completed, the top of the perimeter dike should be at least 30 ft wide, at least 10 ft above the beach and the side slopes graded to be 3.0H:1.0V (see Detail A on Figure B). The top of the initial rim dike should be at least 3.5 ft above the beach. Additional interior dikes may also be constructed as needed to create cells which facilitate the settling process. The exterior side slope of the rim dike shall be 3.0H:1.0V. The interior side slope of the rim dike and the side slopes on any interior dikes may be allowed to form at the angle of repose for the gypsum material. **A minimum freeboard of 3.5 ft must be maintained between the slurry level in the rim ditch and the crest of the perimeter dike. Subsequently, the perimeter dike must always be maintained at an elevation at least 3.5 ft higher than the rim dike or any other interior dike.**

The rim and perimeter dikes should be raised in lift increments of approximately 1 foot and may be moved laterally each lift as needed to maintain the required design slopes of 3.0H:1.0V on the perimeter dike. The slopes can be graded with a smooth-edged excavator bucket, e.g., a finish or cleanup bucket. **Under no circumstances should the slopes of the gypsum stack be graded using a toothed excavator bucket**.

Clarified water will be transferred from the rim ditch to the perimeter ditch where it will be carried to the transfer channel for discharge to the recycle pond. The GMF construction included installation of a stop log system for the transfer channel. The stop logs may be used for **temporary** reductions in flow to the Recycle Pond and increases in water levels in the gypsum stack for water balance purposes during operation. During the initial stacking process, when a siphon must be used to transfer water to the recycle pond, the transfer of water from the rim ditch

to the perimeter ditch may be achieved with an open cut through the perimeter dike. However, once the perimeter dike rises above elevation 614 ft (the invert of the transfer channel), decants, stilling wells and splash pads (see Sections 4.5.5 and 4.5.7) are required for the purpose of transferring clarified water from the rim ditch to the perimeter ditch.

4.5.3 Perimeter Ditch

Throughout the stacking operations, a perimeter ditch must be constructed and maintained around the toe of the gypsum stack. The perimeter ditch will be located between the perimeter dike (outer gypsum slope) and the HDPE lined earthen embankment. This ditch will collect water from the ring drains, decants and rainfall runoff, and convey it to the transfer channel where it will be discharged to the recycle pond. The perimeter ditch shall be constructed by covering the HDPE liner with a 2 ft thick protective layer of gypsum and shaping the channel to the required dimensions. The perimeter ditch is required to have a maximum invert elevation of 614 ft (6 ft below the top of the earthen perimeter dam) and a bottom width of at least 5 ft. A larger ditch bottom width may be utilized to reduce the frequency of any dredging necessary to maintain the minimum required dimensions.

4.5.4 Rim Ditch

The rim ditch will be the primary means of diverting slurry from the slurry discharge pipes to the desired deposition area. The rim ditch will also transport clarified water to the decant structures so the water can be discharged to the perimeter ditch. Consequently, the width of the rim ditch will vary according to the needs at any particular location on the gypsum stack. There may also be cases were blocking the rim ditch is desirable to divert water into a particular cell. There are only two primary constraints on the construction of the rim ditch: (1) the outer slope shall not be steeper than 3.0H:1.0V (this is the inner slope of the perimeter dike); and (2) the normal operating water level shall be at least 3.5 ft below the top of the perimeter dike.

4.5.5 Installation and Operation of Decants and Stilling Wells

The progressive stacking of gypsum will require the installation of at least four (4) decant structures (2 redundant sets of 2) in the rim ditch to convey water to the lower perimeter ditch without eroding the gypsum stack slopes. A minimum of two (2) decant structures are required in order to maintain the water level in the rim ditch and provide adequate discharge capacity for design precipitation events. An additional redundant set of two (2) decant structures will also be required to be installed. The decant structures will consist of 16-inch diameter solid wall HDPE IPS DR 11 pipe sections with 12-inch diameter screw-capped tees installed at 6 ft intervals along the length of the pipe. (When installed on a 3H:1V slope, the tees at 6 ft intervals will translate to 2 ft elevation intervals.) The decant structures will each discharge to a stilling well located in the perimeter ditch at the toe of the outer gypsum stack slope.

During construction of the first gypsum dike above elevation 614 ft (the invert elevation of the perimeter ditch and transfer channel), a 16-inch diameter solid wall HDPE IPS DR11 pipe will be installed as shown in Figure F**Error! Reference source not found.**. The horizontal portion of the pipe will be approximately 80 ft long with an invert at EL 614. The inlet end of the horizontal pipe will be attached to the first decant pipe section with an 18.4 degree angle

fitting. Prior to backfilling over the horizontal portion of the pipe, a 20 ft wide geogrid must be installed over the entire horizontal portion of the pipe, to prevent the pipe from potentially floating out of the saturated gypsum layer during the initial stages of the stacking operation.

The outlet end of the decant pipe will be welded to, and discharge into, a 48-inch diameter HDPE stand pipe with a 1-inch thick HDPE plate welded to the bottom. The stand pipe will have a top elevation of 618 ft and a bottom elevation of 611 ft. The stand pipe will be filled with concrete ballast to EL 614 (see Detail A on Figure F). Additionally, a 4-inch diameter low flow drain will be installed in the stand pipe at elevation 614 ft in order to allow for the cleanout of any gypsum which might accumulate in the stand pipe. In order to allow for proper function of the stilling well, the low flow drain pipe should not be installed in line with the 16-inch decant pipe, but rather offset to one side.

Each time the perimeter gypsum dike is raised, a new decant pipe section will be butt welded to the decant structure. The decant pipe section will be supported by the interior 3H:1V slope of the rim ditch. The water level in the rim ditch will be progressively raised through the stacking operation by capping the appropriate tees in the decant pipe sections. As previously stated, the normal water level shall be at least 3.5 ft below the crest of the perimeter gypsum dike.

4.5.6 Installation of Upper Ring Drains

Upon completion of the first gypsum dike above elevation 614 ft, and prior to construction of the next progressively stacked dike, two interior ring drains must be installed concurrent with development and operation of the interior gypsum cells. Additional ring drains will be required as the height of the gypsum stack increases. Final details and specifications for the upper ring drains will be provided by the design engineer at the time of installation. The upper ring drains are required to control the phreatic surface which will develop within the stack. A preliminary design for the upper ring drains is as follows, as shown on Figure C: A 3 ft tall gypsum dike will be constructed along the centerline of the proposed ring drain using the same techniques as for gypsum dike construction. After construction of the dike, a 4 ft deep channel with a 4 ft bottom width will be excavated along the center of the dike. Side slopes on the cut should be no steeper than 1:1. The bottom and sides of the cut should be filled with IDOT FA1 gradation sand to form a layer which is 1 ft thick. After the sand is placed, the channel will then be lined with non-woven geotextile to be specified by the design engineer. The geotextile will be covered with coarse granular material (to be specified) 2 ft wide by 2 ft deep, with a perforated HDPE pipe imbedded in the center. The fabric will then be wrapped over the top of the coarse granular material and covered with an additional 1 ft thick layer of FA1 gradation sand. The gypsum must not be in direct contact with the non-woven geotextile. The upper ring drains will discharge to the perimeter ditch via solid-wall HDPE pipe.

4.5.7 Splash Pads at Ring Drain & Decant Discharge Locations

At each location where a ring drain and/or a decant structure discharges to the perimeter ditch, the ditch shall be lined with a material capable of resisting the erosive velocities. Materials such as concrete, cable stayed concrete blocks or a geogrid backfilled with washed

aggregate may be acceptable. Operator-proposed methods shall be submitted to Ameren for approval prior to placement. The splash pads shall be installed concurrently with or immediately after construction of the perimeter ditch, ring drain outlets and decant stilling wells.

4.5.8 Piezometer Installation and Monitoring

The side slopes of the gypsum stack will be constructed with 3.0H:1.0V side slopes. (After consolidation of the settled gypsum over time, the final slopes are expected to approach 3.75H:1.0V.) The stability of the gypsum stack slopes is critically dependent on the location of the phreatic surface which will develop within the gypsum stack. Proper installation and functioning of the ring drains will ensure that the phreatic surface is located an adequate distance from the surface of the slope as necessary to maintain a stable slope. In order to monitor the phreatic surface within the gypsum stack, piezometers will be installed on each side of the gypsum stack. A preliminary piezometer detail is included on Figure C. The location and depth of each piezometer will be determined by the design engineer prior to installation, and an installation and monitoring plan will be developed based on information obtained during the initial gypsum stacking operations below the level of the earthen berm. "Critical elevations" corresponding to the anticipated readings at various stages during the progressive raising of the gypsum stack will be established for each piezometer. The water level in each piezometer will be read and recorded in accordance with a specified schedule. If at any time a reading is recorded higher than the "critical elevation" for that stage of operation, Ameren and the design engineer must be contacted immediately for evaluation of the reading. It is imperative that the piezometers are installed and monitored in accordance with the plan and the design engineer's specifications. Depending on the piezometer readings, it may also be necessary to install additional seepage collection drains to maintain the phreatic surface at or below the critical level within the gypsum stack.

Figure A – Bottom Ring Drain Assembly

Figure B - Initial Gypsum Dike Construction

Figure C - Components of Gypsum Stack

Figure D - Progression of Ditch and Dike Construction

Figure E - Access Pad Extension onto Gypsum Beach

Figure F - Decant Pipe and Stilling Well Details

SECTION 5.0 DAM INSPECTIONS

The inspection program includes two types of dam inspections which are required to be performed in accordance with IDNR/OWR's Rules for Construction and Maintenance of Dams. The first type of inspection is regularly conducted by the dam Operator and is referred to as an Operation and Maintenance Inspection. The second type of inspection, referred to as the Engineering Inspection, is conducted by a qualified engineer approved by Ameren.

Inspections shall be conducted throughout the operating life of the structures. The "operating life of the structure" will be considered to cease upon receipt of written affirmation from IDNR/OWR indicating that the structure is no longer considered a dam. Copies of all inspection reports shall be maintained at the Plant for the operating life of the structures.

5.1 OPERATION AND MAINTENANCE INSPECTION

"Walk-around" inspections of the dams and appurtenant works are to be made by the dam Operator. During these inspections, a checklist of items to be maintained and items to be observed should be recorded. The checklist provided in Appendix B shall be utilized for these inspections. **If any of the following items are found to be unusual or are cause for concern, the Ameren Shift Supervisor should be immediately notified.**

Frequency: Weekly. Also, during and after unusual events such as heavy rainfall or after an earthquake.

Inspection Items: During each inspection the following items should be noted in particular.

1. Water Level - Maximum levels as a result of heavy rainfall should be recorded.

2. Earth Embankment - Walk the crest, side slopes and downstream toe of the dam concentrating on surface erosion, seepage, cracks, settlement, slumps, slides, and animal burrows. These are described as follows:

   - Surface Erosion - Removal of vegetative cover by water action or pedestrian or vehicle usage forming deep ruts or gullies.

   - Seepage - The passage of water through and/or underneath the earth embankment abutment and natural groundline or at the contact between the embankment and outlet works. It can be indicated by cattails or other wet environmental vegetation, erosion, channelization, or slumping on the embankment face.

   - Cracks - Deep cracks usually indicate the movement of the dam and/or the foundation and can be in either the longitudinal (along the length of the dam) or transverse (across the dam) directions. Cracking can be an indicator of the

beginning of slumps. Shallow cracks may develop during the summer when the surface soils of the embankment become severely dried and are usually of no concern in regard to the safety of the dam.

- Settlement - Settlement is indicated by depressions or low spots and can be signs of consolidation of the dam or foundation or the loss of material beneath the settlement area.

- Slumps/Slides - A slow or sudden movement of the earth embankment slope on either face toward the toe of the dam.

- If seepage indicates the presence of soil particles, or if deep cracks, settlement, slumps, or slides are noticed, a qualified engineer should be contacted immediately for consultation.

- Animal Burrows - Animal burrows result in a loss of earth embankment material and can provide seepage paths for water through the embankment.

3. Gypsum Embankment - Walk the crest, side slopes and downstream toe of the dam concentrating on surface erosion, seepage, cracks, settlement, slumps, slides and animal burrows. The descriptions for these are the same as for earth embankment.

4. Vegetation - Grass should be a thick vigorous growth to stabilize the earth embankment soils and prevent erosion from occurring. Note the height of the grass; if greater than 1 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 ft of the embankment toes or other structures. The gypsum embankment will not be seeded and is not expected to have any vegetation.

5. Gypsum Stack piezometers should be inspected for any damage or loss of function. Damaged piezometers must be promptly repaired or replaced since their function is critical to ensuring stability of the gypsum stack.

6. The water level in each Gypsum Stack piezometer must be measured and recorded. If the water level in any piezometer is above the "critical elevation" as discussed in Section 4.5.8, Ameren should be notified and the **design engineer should be immediately consulted for guidance on an appropriate course of action**.

7. Gypsum Stack LD/LCRS Drains - The change in location or amount of flows discharging from the Leak Detection/Leachate Collection Recovery System (LD/LCRS) should be recorded. If a significant change has occurred, a qualified engineer should be contacted for consultation.

8. Gypsum Stack Ring Drains - The change in location or amount of flows discharging from the Ring Drains should be recorded. If a significant change has occurred, a qualified engineer should be contacted for consultation.

9. Gypsum Stack Fixed Decant – Check the alignment and supports for the pipe. Record the amount of flows discharging from the pipe and any erosion or scour around the discharge point.

10. Gypsum Stack Perimeter Ditch – The perimeter ditch should have a consistent prismatic shape for the entire length. Inspect the perimeter ditch for evidence of erosion, sediment deposition and irregularity in channel geometry, especially in the vicinity of siphon, decant or ring drain outfall structures. If irregularities are noted, repairs should be scheduled and completed.

11. Stop Logs - Check to make sure that the stop logs in the transfer ditch are undamaged, and, if installed, are operating well and allowing for the free flow of water over them.

12. Transfer Channel - Check for any debris or other obstructions which may block or restrict the free flow of water. Check for any pools or undulation of the floor of the channel.

13. Recycle Pond Decant - Check for any debris or other obstructions around the Recycle Pond decant which may block or restrict the free flow of water. The emergency dewatering valve should be lubricated. If there is no return water in the pipe, the emergency dewatering valve should be exercised. Record the physical and operating conditions of the system.

14. Recycle Pond Drop Inlet Spillways - Check for any debris or other obstructions around the inlet crest and at the bottom of the drop inlet which may block or restrict the free flow of water. Check for the development of any rusty areas on the concrete, and seepage, cracking, breaking, or spalling of the concrete. Check for settlement or cracking of the crest. Check for any debris in the pipes which may restrict the flow of water. Check for any tears or leaks in the HDPE liner covering the concrete.

15. Recycle Pond Rip Rap Basin - Check for any debris or other obstructions in the riprap basin which may block or restrict the free flow of water. Check to make sure that the rip rap is remaining in a uniform position. Freeze/thaw action or flow over the rip rap may tend to lift or fracture, thus requiring replacement or leveling to maintain the necessary level of protection. NO trees or woody vegetation should be growing through the rip rap.

16. Fences - Check for damage, accumulated debris, operation of gates and locks, and adequacy of locations (this may change with time as people access the area or development occurs in the area).

17. Perimeter - Check the perimeter of the dams for a distance of at least 100 ft beyond the toe for signs of seepage or boils.

18. HDPE Liner – Wherever exposed, the HDPE Liner should be inspected for tears, gouges, protrusions under the liner and abrasion.

Records: Log books of activities occurring at the dam is to be kept current by the dam Operator. The log books shall be made available for review by the inspecting engineer during the Engineering Inspection. The log books should contain at the least the following documentation:

1. Completed operation and maintenance inspection checklists
2. Readings from all piezometers on the Gypsum Stack
3. Additional visual observations
4. A list of maintenance performed
5. A list of any unusual occurrences at the dam
6. A copy of the engineering inspection reports

5.2 ENGINEERING INSPECTION

The engineering inspection is to be conducted by a qualified engineer approved by IPRG. The inspection will provide a thorough evaluation of the dam and appurtenant structures. The forms provided in Appendix C shall be utilized for these inspections.

Frequency: The Gypsum Stack Dam and Recycle Pond Dam are classified as CLASS III, LOW HAZARD POTENTIAL dams. Class III dams are to be inspected at least once every five years.

Inspection Items: The engineer will thoroughly inspect all of the items noted under Operation and Maintenance Inspection.

Records: The Dam Inspection Report form, Appendix C, will be completed by the inspecting engineer and will be signed and sealed by an Illinois Registered Professional Engineer. This report will document any deficiencies; recommend remedial actions; and establish time requirements for addressing the deficiencies. The original report will be retained in Ameren's file and a copy of the report will be submitted to the Illinois Department of Natural Resources, Office of Water Resources.

SECTION 6.0
MAINTENANCE ACTIVITIES

Timely repairs are a must after problem areas have been identified. The dam Operator is to perform the work required to correct items noted in the operation and maintenance and engineering inspections. Such items include mowing, seeding, tree and brush removal, replacing rip rap, repairing fences and locks, clearing debris, etc. The maintenance activities specified in the following sections are minimum requirements. NOTE: NO alterations or repairs to structural elements should be made without the assistance of a qualified engineer and the concurrence of the Illinois Department of Natural Resources, Office of Water Resources.

6.1 ROUTINE MAINTENANCE

Debris: Remove all trash, logs and other debris which may obstruct flow into the principal spillway pipes and drop inlets, or block passage from their discharge channels.

Rip Rap: Replace rip rap as needed to provide adequate protection against erosion.

Vegetation Control:

1. Maintain a good grass cover on the embankment by seeding, fertilizing and mulching areas which are refilled, barren, or thinly vegetated. Seeding mixtures used for maintenance reseeding shall result in a cover compatible with adjacent cover. The seeding mixture specified at the time of the dam's construction was IDOT Standard Specifications Class 1A (Salt Tolerant Lawn Mixture) as follows:

   IDOT Class 1A Salt Tolerant Lawn Mixture
   Bluegrass .....60 lb/acre
   Perennial Ryegrass.....20 lb/acre
   Dawsons Red Fescue.....20 lb/acre
   Scaldis Hard Fescue .....20 lb/acre
   Fults Salt Grass .....60 lb/acre

2. Grassed areas such as the embankment and the areas beyond the embankment toes for a distance of at least 20 ft should be mowed at least twice annually or at any time the height of the grass exceeds 1 foot.

3. All erosion areas will be filled and compacted, reseeded, fertilized and mulched to establish a thick erosion resistant cover.

4. Remove all trees and brush growing on the dam embankment to prevent development of a root system which could provide seepage paths. Herbicides utilized for tree and brush control are discussed in Appendix D.

5. Keep the riprap basin clear of weeds, brush, and trees.

6. Remove all trees and brush growing on the dam embankment to prevent development of a root system which could provide seepage paths. Herbicides utilized for tree and brush control are discussed in Appendix D.

7. Clear all brush and trees to a distance of approximately 20 ft beyond both toes of the dam.

Animal Damage: Fill rodent holes and other animal burrows with compacted clayey dirt and reseed. If rodents become a nuisance, an effective rodent control program as approved by the Illinois Department of Natural Resources District Wildlife Biologist should be implemented.

Signs: All warning sings shall be maintained (repaired, painted, or replaced) as needed.

6.2 EROSION AND DUST CONTROL

As stacking operations commence, the dewatered gypsum is expected to form a thin layer of "crust" which will resist erosion and prevent the migration of fugitive dust from the gypsum stack. (This expectation is based on a case study of flue-gas desulfurization by-product (gypsum) stacking by the Electric Power Research Institute entitled Evaluation of Chiyoda Thoroughbred 121 FGD Process and Gypsum Stacking, Volume 3 Addendum, dated March 1981.) Should a protective layer of crust fail to form or fail to provide adequate erosion and dust control, appropriate measures for addressing these concerns will be implemented.

APPENDIX A
LOCATION MAP

APPENDIX B
PERTINENT DATA ABOUT THE DAMS

Gypsum Stack Dam

DAM		
Top of Dam Elevation	620	ft
Invert of Reservoir Elevation	585	ft
Reservoir Area at Invert	0.7	acres
Reservoir Area at Top of Dam	31.6	acres
Total Reservoir Volume	773.2	acre-ft
Total Watershed Area	31.6	acres

TRANSFER CHANNEL		
Bottom Width	16.00	ft
Top Width	16.00	ft
Depth	6.00	ft
Upstream Invert	614.00	ft
Downstream Invert	609.00	ft
Weir Elevation	616.00	ft
Weir Length	16.00	ft

PERIMETER DITCH		
Bottom Width	5.00	ft
Top Width	44.00	ft
Depth	6.00	ft
Outer Side Slope	3.5:1	H:V
Inner Side Slope	3:1	H:V
Upstream Invert	615.16	ft
Downstream Invert	614.00	ft
Ditch slope	0.00050	ft/ft
Bank Full Cross-sectional Area	147.00	sf
Length of Each Ditch (Centerline)	2322.00	ft
Bank Full Volume of Each Ditch	7.84	acre-ft
Total Ditch length (Centerline)	4644.00	ft
Total Ditch Bank Full Volume	15.67	acre-ft

0.5 PMF STORM EVENT		
Critical Storm Duration	24	hours
Peak Inflow	374.7	cfs
Peak Outflow	190	cfs
Total Inflow	54.88	acre-ft
Total Outflow	54.91	acre-ft
Peak Storage	9.46	acre-ft
Peak WSEL (HEC-HMS)	618.5	ft
Peak WSEL (HEC-RAS)	618.31	ft
Freeboard over Max WSEL	1.5	ft
Wave Runup/Wind Setup	1.48	ft

100-YR STORM EVENT		
Critical Storm Duration	0.5	hours
Peak Inflow	274.7	cfs
Peak Outflow	91.4	cfs
Total Inflow	21.08	acre-ft
Total Outflow	21.12	acre-ft
Peak Storage	6.31	acre-ft
Computed WSEL (HEC-HMS)	617.54	ft
Computed WSEL (HEC-RAS)	617.66	ft
Freeboard over Max WSEL	2.34	ft
Wave Runup/Wind Setup	1.48	ft

Recycle Pond Dam

DAM		
Top of Dam Elevation	615	ft
Invert of Reservoir Elevation	592	ft
Reservoir Area at Invert	4.87	acres
Reservoir Area at Top of Dam	8.21	acres
Total Reservoir Volume	150.4	acre-ft
Total Watershed Area	39.81	acres

SPILLWAY		
Pipe Length	60	ft
Pipe Diameter (Inside)	42	inch
Number of Pipes	4	
Pipe Slope	0.03333	Ft/ft
Upstream Invert	610	ft
Downstream Invert	607	ft
Entrance Loss Coefficient	0.9	

0.5 PMF Storm Event - Starting WSEL @ 610		
Critical Storm Duration	24	hours
Peak Inflow	252.4	cfs
Peak Outflow	123.6	cfs
Total Inflow	65.96	acre-ft
Total Outflow	62.88	acre-ft
Peak Storage	135.79	acre-ft
Peak WSEL (HEC-HMS)	612.99	ft
Peak WSEL (HEC-RAS)	613.00	ft
Freeboard over Peak WSEL	2.01	ft
Wave Runup/Wind Setup	1.77	ft
Peak Spillway Outlet Velocity	12.73	fps

100-yr Storm Event - Starting WSEL @ 610		
Critical Storm Duration	2	hours
Peak Inflow	107.1	cfs
Peak Outflow	29.5	cfs
Total Inflow	27.22	acre-ft
Total Outflow	24.15	acre-ft
Peak Storage	125.25	acre-ft
Peak WSEL (HEC-HMS)	611.37	ft
Computed WSEL (HEC-RAS)	611.37	ft
Freeboard over Peak WSEL	3.63	ft
Wave Runup/Wind Setup	1.77	ft
Peak Spillway Outlet Velocity	9.92	fps

0.5 PMF Storm Event - Starting WSEL @ 599.5		
Critical Storm Duration	24	hours
Peak Inflow	252.1	cfs
Peak Outflow	0	cfs
Total Inflow	65.96	acre-ft
Total Outflow	0	acre-ft
Peak Storage	114.47	acre-ft
Peak WSEL (HEC-HMS)	609.70	ft
Freeboard over Peak WSEL	5.3	ft
Wave Runup/Wind Setup	1.77	ft

100-yr Storm Event - Starting WSEL @ 604		
Critical Storm Duration	24	hours
Peak Inflow	32.3	cfs
Peak Outflow	0	cfs
Total Inflow	36.46	acre-ft
Total Outflow	0	acre-ft
Peak Storage	114.07	acre-ft
Peak WSEL (HEC-HMS)	609.64	ft
Freeboard over Peak WSEL	5.36	ft
Wave Runup/Wind Setup	1.77	ft

APPENDIX C
OPERATION AND MAINTENANCE INSPECTION CHECKLIST

OPERATION AND MAINTENANCE INSPECTION CHECKLIST

Dam Name (circle one): Gypsum Stack Dam Recycle Pond Dam

Date: _____ Time: _____

Name of Inspector: _____

Reservoir Elevation: _____ ft

ITEM	NO	YES	IF YES
Record Piezometer Readings for Gypsum Stack. Are any readings above the critical level? (see section 4.8.2 of O&M)			Contact Engineering Manager and notify Hanson Professional Services
Note the condition of the Piezometers on the Gypsum Stack. Any damage?			Contact Engineering Manager
Deep Surface Cracks			Contact Engineering Manager
Slump or Slide on the upstream or downstream face			Contact Engineering Manager
Erosion from runoff, wave action or traffic			Repair and stabilize
Wet areas on the gypsum or earthen embankment indicating seepage			Contact Engineering Manager
Flows of cloudy water from seepage areas on the gypsum or earthen embankment			Contact Engineering Manager
Uneven settlement			Contact Engineering Manager
Trees, brush or burrow holes on the embankment or in the riprap basin			Remove trees and brush, fill holes
Transfer channel or Spillway pipes blocked			Clear immediately
Damage to stop logs			Repair or replace
Tear in Liner			Repair and schedule engineer inspection
Settlement or displacement of Gypsum Stack siphon decant pipes or outlets			Schedule engineer inspection
Settlement or displacement of Gypsum Stack fixed decant pipes or outlets			Schedule engineer inspection
Discharge from Gypsum Stack LD/LCRS Drains?			Record discharge rate for each outlet (time to fill bucket)
Discharge from Gypsum Stack Ring Drains?			Record discharge rate for each outlet (time to fill bucket)
Gypsum Stack Perimeter Ditch erosion			Schedule repair
Problems with Recycle Pond decant			Contact Engineering Manager
Height of grass (inches		inches	If more than 1 foot, schedule mowing

APPENDIX D
ENGINEERING INSPECTION FORM

Dam Inspection Report

Name of Dam IPRG Duck Creek Gypsum Stack & Recycle Pond Dams Dam ID No. IL50573 & IL50574

Permit Number DS2007125 Class of Dam III

Location NW 1/4 Section 18 Township 6N Range 5E 4th P.M.

Owner _____ _____
Name Telephone Number (Day)

_____ _____
Street Telephone Number (Night)

_____ County Fulton
City Zip Code

Type of Dam Homogeneous earthen embankment (gypsum stack is homogeneous gypsum embankment)

Type of Spillway _____

Date(s) Inspected _____

Weather When Inspected _____

Temperature When Inspected _____

Pool Elevation When Inspected _____

Tailwater Elevation When Inspected _____

Inspection Personnel:

_____
Name Title

_____
Name Title

_____
Name Title

_____
Name Title

Professional Engineer's Seal

The Department of Natural Resources is requesting information that is necessary to accomplish the statutory purpose as outlined under the River, Lakes and Streams Act, 615 ILCS 5 (1994 State Bar Edition). Submittal of this information is REQUIRED. Failure to provide the required information could result in the initiation of non-compliance procedures as outlined in Section 702.160 of the "Rules for Construction and Maintenance of Dams". This form has been approved by the State Forms Management Center.

CONDITION CODES

EC	**-**	**Emergency Condition. A serious dam safety condition exists that needs immediate action. Emergency measures implemented as instructed by Chief Dam Safety Engineer; such as, pool draw down, work stoppage, plant stoppage.**
NE	**-**	**No evidence of a problem**
GC	**-**	**Good condition**
MM	**-**	**Item needing minor maintenance and/or repairs within the year, the safety or integrity of the item is not yet imperiled**
IM	**-**	**Item needing immediate maintenance to restore or ensure its safety or integrity. Remediation should be completed within 1 month.**
EC	**-**	**Emergency condition which if not immediately repaired or other appropriate measures taken could lead to failure of the dam**
OB	**-**	**Condition requires regular observation to ensure that the condition does not become worse**
NA	**-**	**Not applicable to this dam**
NI	**-**	**Not inspected - list the reason for non-inspection under deficiencies**
EC	**-**	**Emergency Condition. A serious dam safety condition exists that needs immediate action. Emergency measures implemented as instructed by Chief Dam Safety Engineer; such as, pool draw down, work stoppage, plant stoppage.**

GYPSUM STACK - EARTH EMBANKMENT

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Surface Cracks			
Vertical and Horizontal Alignment of Crest			
Unusual movement or Cracking at or Beyond Toe			
Sloughing or Erosion of Outer Embankment Slopes			
Upstream Face Slope Protection (HDPE Liner)			
Seepage			
Animal Damage			

GYPSUM STACK - EARTH EMBANKMENT

(Continued)

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Vegetative Cover			

GYPSUM STACK - GYPSUM EMBANKMENT

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Surface Cracks			
Vertical and Horizontal Alignment of Crest			
Unusual movement or Cracking at or Beyond Toe			
Sloughing or Erosion of **Outside** Embankment Slopes			
Sloughing or Erosion of **Inside** Embankment Slopes			
Seepage			
Animal Damage			

GYPSUM STACK - GYPSUM EMBANKMENT

(Continued)

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Condition of Piezometers on Gypsum Stack			
Piezometer Readings on Gypsum Stack Above Critical Level?			

GYPSUM STACK – PERIMETER DITCH

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Ditch Geometry (15 ft bottom width, 3:1 slopes, 8-9 ft depth)			
Concrete Apron at ring drain outlets			
Ring Drain Discharge Pipes			
Stilling Wells for Fixed Decants			

TRANSFER CHANNEL - (between gypsum stack and recycle pond)

[ ] Drop Inlet Structure [X] Overflow Spillway Structure [ ] Gated

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Debris			
Side Slope Stability			
HPDE Liner			
HDPE Liner Welds			
Stop Logs			
Differential Settlement			

RECYCLE POND - EMBANKMENT

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Surface Cracks			
Vertical and Horizontal Alignment of Crest			
Unusual movement or Cracking at or Beyond Toe			
Sloughing or Erosion of Outer Embankment Slopes			
Upstream Face Slope Protection (HDPE Liner)			
Seepage			
Animal Damage			

RECYCLE POND - EMBANKMENT

(Continued)

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Vegetative Cover			

RECYCLE POND - PRINCIPAL SPILLWAY (Left, Looking Downstream)

[X] Drop Inlet Structure [ ] Overflow Spillway Structure [ ] Gated

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Alignment of Structure Walls			
Construction Joints			
Differential Settlement			
Erosion, Spalling, Cavitation			
Joint Separation			
Seepage Around or into Conduit			
Surface Cracks			

RECYCLE POND - PRINCIPAL SPILLWAY (Left, Looking Downstream)

(Continued)

[X] Drop Inlet Structure [ ] Overflow Spillway Structure [ ] Gated

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Structural Cracks			

RECYCLE POND - PRINCIPAL SPILLWAY (Center)

[X] Drop Inlet Structure [ ] Overflow Spillway Structure [ ] Gated

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Alignment of Structure Walls			
Construction Joints			
Differential Settlement			
Erosion, Spalling, Cavitation			
Joint Separation			
Seepage Around or into Conduit			
Surface Cracks			

RECYCLE POND - PRINCIPAL SPILLWAY (Center)

(Continued)

[X] Drop Inlet Structure [ ] Overflow Spillway Structure [ ] Gated

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Structural Cracks			

RECYCLE POND - PRINCIPAL SPILLWAY (Right, Looking Downstream)

[X] Drop Inlet Structure [ ] Overflow Spillway Structure [ ] Gated

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Alignment of Structure Walls			
Construction Joints			
Differential Settlement			
Erosion, Spalling, Cavitation			
Joint Separation			
Seepage Around or into Conduit			
Surface Cracks			

RECYCLE POND - PRINCIPAL SPILLWAY (Right, Looking Downstream)

(Continued)

[X] Drop Inlet Structure [ ] Overflow Spillway Structure [ ] Gated

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Structural Cracks			

RECYCLE POND - ENERGY DISSIPATOR

[X] Principal Spillway [ ] Outlet Works Type: Riprap Basin

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Riprap			
Outlet Channel			
Debris			

RECYCLE POND - DECANT STRUCTURE

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Alignment			
Connection to Bollard			
Debris in Inlets			
Condition of Pipe			
Condition of Liner Beneath Pipe			
Connection to Ballast			
Connection of Pipe Boot to Liner			

RECYCLE POND - DECANT STRUCTURE

(continued)

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE
Seepage Around or into Conduit			

RECYCLE POND – WATER LEVEL GAGE STRUCTURE

ITEM	CONDITION	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES & SCHEDULE

APPENDIX E
HERBICIDES

HERBICIDES

Site personnel should check with the Illinois Department of Natural Resources, Regional Fisheries Biologist and the Regional Wildlife Biologist before using any herbicide. Read the product label prior to use and follow the use directions and precautions accordingly.

On March 1, 1979 the U.S. Environmental Protection Agency (U.S.E.P.A.) halted the use of the herbicide 2, 4, 5-T in parks and recreation areas. The use of silvex (2, 4, 5-TP) around water has also been banned.

The Agronomy Department at the University of Illinois and the Aquatic Biology Section of the Department of Natural Resources, Office of Scientific Research and Analysis indicate that the herbicides containing the 2, 4-D or 2, 4-DP are legal for use in parks and recreation areas and effective for controlling brush and woody growth. Some examples of approved herbicides are:

1. Tordon RTU by DOW Chemical. (Can be obtained with blue dye.)
2. WEEDONE 170 by Union Carbide
3. WEEDONE, 2, 4-DP by Union Carbide
4. A 1% to 2% solution of ROUNDUP
5. Garlon by DOW Chemical
6. Banvel by Sandoz

Your distributor may carry brand name herbicides other than those listed above. Be certain that the product does not contain the ingredients 2, 4, 5-T or 2, 4, 5-TP. An example of an unacceptable product is ESTERON 2, 4, 5 by DOW Chemical.

ATTACHMENT C

Duck Creek Power Plant – GMF Pond System's Chemical Constituents

In accordance with 35 I.A.C. 845.230(d)(2)(C), IPRG is submitting available/existing analyses of "the chemical constituents of all waste streams, chemical additives and sorbent materials entering or contained in" the CCR impoundments, GMF Pond System.

A list of the chemical constituents contained in the CCR surface impoundment and gypsum can be found in Appendix A. As determined through antidegradation studies, this list contains chemical constituents found in the surface free liquid. 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 (IL0055620) can be found in Appendix B. For the chemical additives used, IPRG is also including in Appendix C the safety data sheet's Section 3 Composition/Information on Ingredients.

Appendix A: Chemical Constituents Contained in the GMF Pond System

Pollutant	GMF Pond System			
	Surface Free Liquids Average Concentration	Units	Spray Dryer Absorber/Gypsum Concentration**	Units
Aluminum			236	mg/kg
Ammonia	430	mg/L		mg/kg
Antimony			< 0.79	mg/kg
Arsenic			< 0.79	mg/kg
Barium			7.9	mg/kg
Beryllium			< 0.32	mg/kg
Boron	71	mg/L	72.3	mg/kg
Cadmium			< 0.13	mg/kg
Calcium			243,000	mg/kg
Chloride	3,500	mg/L		mg/kg
Chromium			4.8	mg/kg
Chromium *			4.8	mg/kg
Cobalt			< 0.79	mg/kg
Copper			< 1.6	mg/kg
Fluoride			16	mg/kg
Iron			570	mg/kg
Lead			0.47	mg/kg
Lithium			< 0.79	mg/kg
Magnesium			2,170	mg/kg
Manganese			73.8	mg/kg
Mercury	0.0018	mg/L	0.073	mg/kg
Molybdenum			< 0.79	mg/kg
Nickel			1.2	mg/kg
pH			7.2	SU
Potassium			121	mg/kg
Selenium			8.8	mg/kg
Silver			< 0.79	mg/kg
Sodium			305	mg/kg
Sulfate	4,300	mg/L		mg/kg
Thallium			< 0.16	mg/kg
TDS	12,000	mg/L		mg/kg
TSS	30	mg/L		mg/kg
Vanadium			< 1.6	mg/kg
Zinc			< 7.9	mg/kg

*Chromium screened as both Total Chromium and Hexavalent Chromium to be conservative.

Appendix B: List of Chemical Additives, Waste Streams and Sorbent Materials

Chemical Additives
Nalco – 71D5 Plus (Anti-Foam)
Activated Carbon (100%)

Waste Streams and Sorbent Materials*
Gypsum Slurry

*No sorbent materials

Appendix C: SDS Section 3 Composition/Information on Ingredients

SAFETY DATA SHEET

NALCO® 71D5 PLUS

Section: 3. COMPOSITION/INFORMATION ON INGREDIENTS

Pure substance/mixture : Mixture

Chemical Name	CAS-No.	Concentration: (%)
Straight Run Middle Distillate	64741-44-2	30 - 60
Hydrotreated Light Distillate	64742-47-8	10 - 30
Polypropylene Glycol	25322-69-4	5 - 10
1-Octanol	111-87-5	1 - 5
Fatty Alkyl Polyglycol	Proprietary	1 - 5
Aliphatic alcohol	Proprietary	1 - 5
Paraffin Wax	8002-74-2	1 - 5

DYNEGY

Safety Data Sheet

Section 1
Identification of the Substance and of the Supplier

1.1 Product Identifier

Product Name/Identification:	FGD Gypsum
Synonyms:	Gypsum, calcium sulfate dihydrate, calcium sulphate dihydrate, gesso, alabaster, plaster of Paris.
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, agricultural amendment.
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):

- STOT-SE Category 3 (Respiratory Irritation)
- STOT-RE Category 1 (Lungs)
- Carcinogen Category 1A

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):	*May cause respiratory irritation.* *Causes damage to lungs after repeated/prolonged exposure via inhalation.* *May cause cancer of the lungs.*
Precautionary Statement(s):	*Obtain special instructions before use.* *Do not handle until all safety precautions have been read and understood.* *Do not breathe dust.* *Wash hands thoroughly after handling.* *Do not eat, drink or smoke when using this product.* *Wear protective gloves/protective clothing/eye protection/face protection.* *Do not eat drink or smoke when using this product.* *Use outdoors or in a well-ventilated area.* *If inhaled: Remove to fresh air and keep comfortable for breathing.* *Get medical advice/attention if you feel unwell.* *Store in a secure area.* *Dispose of product in accordance with local/national regulations.*

The following elements may be present in trace amounts as oxides: aluminum, calcium, iron, magnesium, nickel, phosphorus, potassium, silicon, sulfur, titanium, and vanadium. The exact composition of the gypsum will be dependent on the fuel source and flue additives composed of many constituents.

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*
Calcium sulfate, dihydrate	*10104-14-1*	*90 - 99%*	*STOT – Single Exposure Category 3 (Respiratory Irritation)*
Crystalline Silica	*14808-60-7*	*≥0.1 - 3%*	*STOT – Repeated Exposure Category 1 (Lung)* *Carcinogen, Category 1A*
Silica, crystalline respirable (RCS)	*14808-60-7*	*See Footnote 1*	*STOT – Repeated Exposure Category 1 (Lungs)* *Carcinogen Category 1A*
Fly Ash	*68131-74-8*	*<2%*	*STOT – Single Exposure Category 3 (Respiratory Irritation)*

Footnote 1: *The percentage of respirable crystalline silica has not been determined. Therefore, a GHS classification of Carcinogen, Category 1A has been assigned.*

Section 4
First Aid Measures

4.1 Description of First Aid Measures

Inhalation:	If product is inhaled and irritation of the nose or coughing occurs, remove person to fresh air. Get medical advice/attention if respiratory symptoms persist.
Skin Contact:	If skin exposure occurs, wash with soap and water.
Eye Contact:	If product gets into the eye, rinse copiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical attention/advice if irritation occurs or persists.
Ingestion:	No specific first aid measures are required.

4.2 Most Important Health Effects, Both Acute and Delayed

Acute Effects: Short-term airborne exposure to FGD gypsum dust may cause respiratory irritation. Direct exposure can dry and irritate the skin and cause dermatitis or eye irritation through mechanical abrasion.

Chronic Effects: Chronic (long-term) exposure to FGD gypsum may cause lung damage from repeated exposure. Prolonged inhalation of dusts containing respirable crystalline silica above certain concentrations may cause lung disease (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:	Above 1450°C (~2600°F), gypsum decomposes to calcium oxide and sulfur dioxide.

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)**
Particulates Not Otherwise Regulated	Total	15	15	10	10
	Respirable	5	5	3	5
Respirable Crystalline Silica	Total Respirable	0.05-	0.05	0.025	0.05
Calcium Sulfate, anhydrous (CAS# 7778-18-9)	Total Dust	*	10	10	*
	Respirable	*	5	-	*
Note: In the absence of a CA-PEL, the value for Particulates Not Otherwise Regulated (PNOR) is applied.					

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.): White or gray cake-like material	**Upper/lower flammability or explosive limits:** Not applicable
Odor: Odorless	**Vapor Pressure (Pa):** Not applicable
Odor threshold: Not applicable	**Vapor Density:** Not applicable
pH (25 °C) (in water): 6 - 8	**Specific gravity or relative density:** 2.0 – 2.9
Melting point/freezing point (°C): 128	**Water Solubility:** 0.1 – 0.3%
Initial boiling point and boiling range (°C): >163	**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):** 1450
Flammability (solid, gas): Nonflammable/non-combustible	**Viscosity:** Not applicable

Section 10
Stability and Reactivity

10.1 Reactivity:	Avoid contact with strong acids or oxidizers and diazomethane.
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; 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:	Acids, ammonium salts, diazomethane, phosphorus and aluminum metal.
10. 6 Hazardous decomposition products:	None known.

Section 11
Toxicological Information

11.1 Information on Toxicological Effects

Endpoint	Data
Acute oral toxicity	Oral LD50 > 2000 mg/kg
Acute dermal toxicity	No data.
Acute inhalation toxicity	Inhalation LC50: > 3.26 mg/L
Skin corrosion/irritation	Not irritating or corrosive to skin based on 4-hour, semi-occlusive exposure to rabbits.
Eye damage/irritation	No positive responses in rabbits based upon 24-, 48-, and 72-hour mean scores for corneal opacity, iritis, conjunctival redness/edema.
Respiratory/skin sensitization	Not a respiratory or dermal sensitizer.
Germ cell mutagenicity	Several in vitro and in vivo mutagenicity assays determined that calcium sulfate, dihydrate was non-mutagenic, with and without metabolic activation.
Carcinogenicity	No data on calcium sulfate, dihydrate. Carcinogenic studies were not conducted based on the non-neoplastic effects noted in the oral and inhalation repeated dose studies as well as the negative mutagenicity assays. Respirable crystalline silica has been identified as a carcinogen by NTP, IARC, ACGIH and OSHA.
Reproductive toxicity	No significant developmental or reproductive toxicity were identified in rabbits after exposure to either calcium sulfate, dehydrate or calcium sulfate, dihydrate.
STOT-SE	Acute toxicity testing did not result in direct organ toxicity after a single exposure to calcium sulfate, dihydrate. However, as the form tested was not indicated, FGD gypsum dust may result in mechanical respiratory irritation.
STOT-RE	A repeat dose oral toxicity study (35-45 days) with calcium sulfate, dihydrate conducted using rats reported a NOAEL for males of 100 mg/kg/day on the basis of decreased total protein, albumin, blood urea nitrogen, and creatinine levels observed at the 300 and 1,000 mg/kg/day dose groups. No effects were observed in females. Repeated inhalation exposures to high levels of respirable crystalline silica may result in lung damage (silicosis) and lung cancer.
Aspiration Hazard	Not applicable based on product form.

Section 12
Ecological Information

12.1 Toxicity

Calcium sulfate (CAS# 7778-18-9) [1]	
Toxicity to Fish	Fathead Minnow (*Pimephales promelas*): Acute, 7-day LC50 > 1,970 mg/L Acute, 96-hour NOEC = 1,470 mg/L
	Rainbow trout (*Oncorhynchus mykiss*): Chronic, 30-day NOEC (survival, growth, reproduction) = 732 mg/L
	Bluegill (*Lepomis macrochirus*): Acute, 96-hour LC50 = 2,890 mg/L
Toxicity to Aquatic Invertebrates	Water Flea (*Ceriodaphnia dubia*): Acute, 96-hour NOEC = 1447.4 mg/L
	Water Flea (*Daphnia magna*): Acute, 48-hour LC50 = 1,970 mg/L Chronic, 21-day NOEC (and 42-day post-hatch): 1,600 mg/L
Toxicity to Aquatic Algae and Plants	Algae (*Navicula seminulum; Nitzschia linearis*): Chronic, 96-hour LC50 and EC50 (growth) = 3,200 mg/L

[1]The aquatic toxicity of sulfate has been shown to be dependent on water hardness, generally decreasing as hardness increases.

12.2 Persistence and Degradability

Not relevant for inorganic materials.

12.3 Bioaccumulative Potential

This material does not contain any compounds that 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
  - FGD gypsum as well as listed impurities are on the TSCA Inventory.
- California Proposition 65

  The following substances are known to the State of California to be carcinogens and/or reproductive toxicants:
  - Respirable crystalline silica
- State Right-to-Know (RTK)

Component	CAS	MA[1,2]	NJ[3,4]	PA[5]	RI[6]
Gypsum; calcium sulfate; calcium sulfate dihydrate	7778-18-9 or 10101-41-4	Yes	Yes	Yes	No
Calcium carbonate	1317-65-3	Yes	Yes	Yes	No
Silica-crystalline (SiO2), quartz	14808-60-7	Yes	Yes	Yes	No

[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 27, 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
- FGD: Flue Gas Desulfurization
- GHS: Globally Harmonized System of Classification and Labelling
- IARC: International Agency for Research on Cancer
- LC50: Concentration estimated to result in the mortality of 50% of an animal population
- LD50: Dose estimated to result 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:	1*	**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 D

Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 Ill. Admin. Code Part 845 - Fault Area Location Demonstration for GMF Pond at Duck Creek Power Plant

Illinois Power resources Generating, LLC operates the coal-fired Duck Creek Power Plant located in Fulton County, Illinois. The Duck Creek GMF Pond is an existing surface impoundment storing coal combustion residuals (CCR). The requirements for the Duck Creek GMF Pond are found in 35 Ill. Admin. Code (I.A.C.) 845 (Part 845).

This memorandum addresses the requirements of Section 845.320 Fault Areas, which states:

Section 845.320 Fault Areas

a) *Existing and new CCR surface impoundments, and all lateral expansions of CCR surface impoundments must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR surface impoundment.*

b) *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).*

Pursuant to Section 845.210(d)(2), for existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and Section 845.340 (Unstable Areas), provided that the previously completed assessments meet the applicable requirements of those Sections.

The previous fault area demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.62. The requirements described in 40 C.F.R. § 257.62 are nearly identical to the requirements contained in I.A.C. Section 845.320. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed fault area demonstration is included in Attachment D.

HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

16 October 2018
File No. 129788

SUBJECT: Location Restriction Demonstration - Fault Areas
Duck Creek Power Station
GMF Pond
Canton, Illinois

Illinois Power Resources Generating, LLC operates the coal-fired Duck Creek Power Station (Plant) located near Canton, Illinois. The GMF Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.62 *(Fault Areas)* of the U.S. Environmental Protection Agency's (EPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities.* 80 Fed. Reg. 21,302 (Apr. 17, 2015) (promulgating 40 CFR §257.62); 83 Fed. Reg. 36,435 (July 30, 2018) (amending 40 CFR §257.62).

§257.62(a): New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit.

A review of available data from the U.S. Geologic Survey, the Illinois State Geological Survey, and other available information was completed for this demonstration. The nearest known mapped fault is the Sicily Fault, which is located approximately 66 miles southeast and the timeframe of the most recent activity on this fault is not known. Based on the available published geologic data and information reviewed, there are no active faults or fault damage zones that have had displacement in Holocene time reported or indicated within 200 feet of the Unit.

Duck Creek

§257.62(b): The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration meets the requirements of paragraph (a) of this section.

I, Steven F. Putrich, 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 demonstration that the CCR Unit is not located within 60 meters (200 feet) of the outermost damage zone of a fault that has had a displacement in Holocene time as included in the CCR Rule Location Restrictions Evaluation memorandum dated 12 October 2018 meets the requirements of 40 CFR §257.62(a).

Signed: _____
Consulting Engineer

Print Name:	Steven F. Putrich
Illinois License No.:	62048779
Title:	Vice President
Company:	Haley & Aldrich, Inc.

Professional Engineer's Seal:

Duck Creek

Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 Ill. Admin. Code Part 845 - Placement Above the Uppermost Aquifer Location Demonstration for GMF Pond at Duck Creek Power Plant

Illinois Power resources Generating, LLC operates the coal-fired Duck Creek Power Plant located in Fulton County, Illinois. The Duck Creek GMF Pond is an existing surface impoundment storing coal combustion residuals (CCR). The requirements for the Duck Creek GMF Pond are found in 35 Ill. Admin. Code (I.A.C.) 845 (Part 845).

This memorandum addresses the requirements of Section 845.300 Placement Above the Uppermost Aquifer, which states:

Section 845.300 Placement Above the Uppermost Aquifer

a) *Existing and new CCR surface impoundments, and all lateral expansions of CCR surface impoundments must, be constructed with a base that is located at least 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR surface impoundment and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table).*

b) *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).*

Pursuant to Section 845.210(d)(2), for existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and Section 845.340 (Unstable Areas), provided that the previously completed assessments meet the applicable requirements of those Sections.

The previous upper aquifer demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.60. The requirements described in 40 C.F.R. § 257.60 are nearly identical to the requirements contained in I.A.C. Section 845.300. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed upper aquifer demonstration is included in Attachment D.

HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

16 October 2018
File No. 129788

SUBJECT: Location Restriction Demonstration – Placement Above Uppermost Aquifer
Duck Creek Power Station
GMF Pond
Canton, Illinois

Illinois Power Resources Generating, LLC operates the coal-fired Duck Creek Power Station (Plant) located near Canton, Illinois. The GMF Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.60 *(Placement above the uppermost aquifer)* of the U.S. Environmental Protection Agency's (EPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities*. 80 Fed. Reg. 21,302 (Apr. 17, 2015) (promulgating 40 CFR §257.60); 83 Fed. Reg. 36,435 (July 30, 2018) (amending 40 CFR §257.60).

§257.60(a): New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table). The owner or operator must demonstrate by the dates specified in paragraph (c) of this section that the CCR unit meets the minimum requirements for placement above the uppermost aquifer.

Haley & Aldrich reviewed available information provided by Vistra including historic record drawings and design drawings and based on review and evaluation of the information provided, the results do not demonstrate compliance with the requirements of 40 CFR §257.60(a).

Duck Creek

§257.60(b): The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration meets the requirements of paragraph (a) of this section.

I, Steven F. Putrich, 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 that the above-referenced CCR Unit does not meet the requirements of 40 CFR §257.60(a).

Signed: _____
Consulting Engineer

Print Name:	Steven F. Putrich
Illinois License No.:	62048779
Title:	Vice President
Company:	Haley & Aldrich, Inc.

Professional Engineer's Seal:

Duck Creek

Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 Ill. Admin. Code Part 845 – Seismic Impact Zone Location Demonstration for GMF Pond at Duck Creek Power Plant

Illinois Power resources Generating, LLC operates the coal-fired Duck Creek Power Plant located in Fulton County, Illinois. The Duck Creek GMF Pond is an existing surface impoundment storing coal combustion residuals (CCR). The requirements for the Duck Creek GMF Pond are found in 35 Ill. Admin. Code (I.A.C.) 845 (Part 845).

This memorandum addresses the requirements of Section 845.330 Seismic Impact Zone, which states.

Section 845.330 Seismic Impact Zones

a) *Existing and new CCR surface impoundments, and all lateral expansions of CCR surface impoundments must not be located in seismic impact zones unless the owner or operator demonstrates that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.*

b) *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).*

Pursuant to Section 845.210(d)(2), for existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and Section 845.340 (Unstable Areas), provided that the previously completed assessments meet the applicable requirements of those Sections.

The previous seismic impact zone demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.63. The requirements described in 40 C.F.R. § 257.63 are nearly identical to the requirements contained in I.A.C. Section 845.330. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed seismic impact zone demonstration is included in Attachment D.

HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

16 October 2018
File No. 129788

SUBJECT: Location Restriction Demonstration – Seismic Impact Zone
Duck Creek Power Station
GMF Pond
Canton, Illinois

Illinois Power Resources Generating, LLC operates the coal-fired Duck Creek Power Station (Plant) located near Canton, Illinois. The GMF Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.63 *(Seismic Impact Zones)* of the U.S. Environmental Protection Agency's (EPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities*. 80 Fed. Reg. 21,302 (Apr. 17, 2015) (promulgating 40 CFR §257.63); 83 Fed. Reg. 36,435 (July 30, 2018) (amending 40 CFR §257.63).

§257.63(a): New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of a CCR units must not be located in seismic impact zones unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

A Seismic Impact Zone is defined in the CCR Rule (40 CFR §257.63) as "an area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 50 years". The 2014 US Geological Survey Hazard Map raw data for the Duck Creek Power Station GMF Pond indicates that the maximum expected horizontal acceleration for 2 percent probability of exceedance in 50 years is 0.06g. Accordingly, the Unit is not located in a seismic impact zone and a demonstration that the structural components have been designed to resist the maximum horizontal acceleration in lithified earth material for the site is not required.

Duck Creek

<u>§257.63(b):</u> The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration meets the requirements of paragraph (a) of this section.

I, Steven F. Putrich, 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, that the CCR Unit is not located in a seismic impact zone as included in the CCR Rule Location Restrictions Evaluation memorandum dated 12 October 2018 and, therefore, satisfies all requirements of 40 CFR §257.63(a).

Signed: _____
Consulting Engineer

Print Name:	Steven F. Putrich
Illinois License No.:	62048779
Title:	Vice President
Company:	Haley & Aldrich, Inc.

Professional Engineer's Seal:

STEVEN F. PUTRICH
062-048-779
REGISTERED
PROFESSIONAL
ENGINEER
STATE OF ILLINOIS

Duck Creek

Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 Ill. Admin. Code Part 845 – Unstable Areas and Floodplains Location Standard Demonstration for the GMF Pond at Duck Creek Power Plant

Illinois Power Resources Generating, LLC is the owner of the coal-fired Duck Creek Power Plant (Plant) located in Fulton County, Illinois. The GMF Pond is an existing surface impoundment storing coal combustion residuals (CCR). The requirements for the GMF Pond are found in 35 Ill. Admin. Code (I.A.C.) 845 (Part 845).

This certification addresses the requirements of Part 845, Section 845.340 Unstable Areas and Floodplains, which states:

> *Section 845.340 (a): An existing or new CCR surface impoundment, or any lateral expansion of a CCR surface impoundment must not be located in an unstable area unless the owner or operator demonstrates that recognized and generally accepted engineering practices have been incorporated into the design of the CCR surface impoundment to ensure that the integrity of the structural components of the CCR surface impoundment will not be disrupted.*
>
> *Section 845.340 (b): The owner or operator must consider all the following factors, at a minimum, when determining whether an area is unstable: 1) On-site or local soil conditions, including but not limited to liquefaction, that may result in significant differential settling; 2) On-site or local geologic or geomorphologic features; and 3) On-site or local human-made features or events (both surface and subsurface).*

Pursuant to Section 845.210(d)(2), for existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and Section 845.340 (Unstable Areas), provided that the previously completed assessments meet the applicable requirements of those Sections.

The previous unstable area demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.64. The requirements described in 40 C.F.R. § 257.64 are nearly identical to the requirements contained in I.A.C. Section 845.340 (a). Pursuant to Section 845.210(d)(2), a certification is not required for the unstable area demonstration. The previously completed unstable area demonstration meeting the requirements of Section 845.340 (a) is included in Attachment D.

> *<u>Section 845.340 (c):</u> An existing or new CCR surface impoundment, or any lateral expansion of a CCR surface impoundment, must not be located in a floodplain unless the owner or operator demonstrates that 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, so as to pose a hazard to human life, wildlife, or land or water resources.*

The boundaries of the impoundment were determined by a survey conducted by a professional surveyor licensed in the State of Illinois. The surveyed boundaries were compared to the existing floodplain boundary from the effective FEMA Flood Insurance Rate Map (FIRM) Number 17057C0250E, dated February 4, 2011. The location of the Duck Creek GMF Pond is outside of the FEMA 100-year floodplain, therefore, it was determined that the Duck Creek GMF Pond is not located within the floodplain.

> *<u>Section 845.330 (d):</u> The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsections (a) and (c).*

Pursuant to Section 845.210(d)(2), for existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.340 (Unstable Areas) and demonstrated in Attachment D. Therefore, a new certification is not included for Section 845.340 (a). Certification for Section 845.340 (c) is included below.

35 Illinois Administration Code Part 845:
Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments
Section 845.340 (c): Certification

I, *Sarah Espinosa*, being a Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that this floodplain demonstration meets the requirements of 35 Ill. Adm. Code 845.340(c).

Sarah Espinosa, P.E.

Printed Name

LICENSED PROFESSIONAL ENGINEER
SARAH H
ESPINOSA
062.068732
OF ILLINOIS

Sarah H Espinosa

Exp Date: Nov 30, 2021

2021.10.21 16:17:17-05'00'

October 21, 2021

Date

HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

16 October 2018
File No. 129788

SUBJECT: Location Restriction Demonstration – Unstable Areas
Duck Creek Power Station
GMF Pond
Canton, Illinois

Illinois Power Resources Generating, LLC operates the coal-fired Duck Creek Power Station (Plant) located near Canton, Illinois. The GMF Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.64 *(Unstable Areas)* of the U.S. Environmental Protection Agency's (EPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities.* 80 Fed. Reg. 21,302 (Apr. 17, 2015) (promulgating 40 CFR §257.64); 83 Fed. Reg. 36,435 (July 30, 2018) (amending 40 CFR §257.64).

Duck Creek

§257.64(a): An existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit must not be located in an unstable area unless the owner or operator demonstrates by the dates specified in paragraph (d) of this section that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted.

§257.64(b): The owner or operator must consider all of the following factors, at a minimum, when determining whether an area is unstable:

(1) On-site or local soil conditions that may result in significant differential settling;
(2) On-site or local geologic or geomorphologic features; and
(3) On-site or local human-made features or events (both surface and subsurface).

Determination of compliance with §257.64(b)(1) - Conditions associated with the potential for significant differential settlement due to liquefaction were not identified in the area where the Plant is located. A separate report completed by AECOM entitled "CCR Certification Report: Initial Structural Stability Assessment, Initial Safety Factor Assessment, and Initial Inflow Design Flood Control System Plan for the GMF Pond at Duck Creek Power Station" dated October 2016 concluded that the soils beneath the Unit are not susceptible to liquefaction.

Determination of compliance with §257.64(b)(2) - Based on available United States Geological Survey (USGS) and Illinois State Geological Survey (ISGS) information, karst topography or physiographic features such as sinkholes, vertical shafts, sinking streams, caves, large springs, or blind valleys do not exist at the Plant. To evaluate the susceptibility of landslides, we reviewed readily available USGS and ISGS data. The USGS data indicates that the Plant is in an area of low landslide incidence and ISGS data indicates that there has not been a documented landslide occurrence at the Unit. The ISGS documented

landslide occurrences near the site are along U.S. Highway 24 and appear to be associated with roadside landslides. Accordingly, it is our opinion that the Unit is not located in an area that has high susceptibility to landslides.

Determination of compliance with §257.64(b)(3) - Finally, there are no documented surface or subsurface anthropogenic activities that would be indicative of creating unstable foundation conditions.

§257.64(c): The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration meets the requirements of paragraph (a) of this section.

I, Steven F. Putrich, 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 demonstration indicating the CCR Unit is not located in an unstable area as included in the CCR Rule Location Restrictions Evaluation memorandum dated 12 October 2018 meets the requirements of 40 CFR §257.64(a).

Signed: _____
Consulting Engineer

Print Name: Steven F. Putrich
Illinois License No.: 62048779
Title: Vice President
Company: Haley & Aldrich, Inc.

Professional Engineer's Seal:

Duck Creek

Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 Ill. Admin. Code Part 845 - Wetland Location Demonstration for GMF Pond at Duck Creek Power Plant

Illinois Power resources Generating, LLC operates the coal-fired Duck Creek Power Plant located in Fulton County, Illinois. The Duck Creek GMF Pond is an existing surface impoundment storing coal combustion residuals (CCR). The requirements for the Duck Creek GMF Pond are found in 35 Ill. Admin. Code (I.A.C.) 845 (Part 845).

This memorandum addresses the requirements of Section 845.310 Wetlands, which states:

Section 845.310 Wetlands

a) *Existing and new CCR surface impoundments, and all lateral expansions of CCR surface impoundments must not be located in wetlands unless the owner or operator demonstrates* [that the requirements listed in 845.310(a)(1) through (5) are met.]

b) *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).*

Pursuant to Section 845.210(d)(2), for existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and Section 845.340 (Unstable Areas), provided that the previously completed assessments meet the applicable requirements of those Sections.

The previous wetlands demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.61. The requirements described in 40 C.F.R. § 257.61 are nearly identical to the requirements contained in I.A.C. Section 845.310. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed wetlands demonstration is included in Attachment D.

HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

16 October 2018
File No. 129788

SUBJECT: Location Restriction Demonstration - Wetland Areas
Duck Creek Power Station
GMF Pond
Canton, Illinois

Illinois Power Resources Generating, LLC operates the coal-fired Duck Creek Power Station (Plant) located near Canton, Illinois. The GMF Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.61 *(Wetlands)* of the U.S. Environmental Protection Agency's (EPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities*. 80 Fed. Reg. 21,302 (Apr. 17, 2015) (promulgating 40 CFR §257.61); 83 Fed. Reg. 36,435 (July 30, 2018) (amending 40 CFR §257.61.

§257.61(a): New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands, as defined in §232.2 of this chapter, unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that the CCR unit meets the requirements of paragraphs (a)(1) through (5) of this section.

Based on a review of the U.S. Fish and Wildlife Service's National Wetland Inventory mapping, 0.5-meter resolution aerial imagery (2016) and the results of on-site field assessments, the Unit is not located in wetlands as defined by 40 CFR §232.2.

Duck Creek

<u>§257.61(b):</u> The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration meets the requirements of paragraph (a) of this section.

I, Steven F. Putrich, 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 CCR Unit is not located in wetlands as included in the CCR Rule Location Restrictions Evaluation memorandum dated 12 October 2018 and, therefore, meets the requirements of 40 CFR §257.61(a).

Signed: _____
Consulting Engineer

Print Name:	Steven F. Putrich
Illinois License No.:	62048779
Title:	Vice President
Company:	Haley & Aldrich, Inc.

Professional Engineer's Seal:

Duck Creek

ATTACHMENT E

DUCK CREEK
GMF POND
ID #: W0578010001-04
ILLINOIS POWER RESOURCES
GENERATING, LLC
DUCK CREEK
GMF RECYCLE POND
ID #: W0578010001-05
ILLINOIS POWER RESOURCES
GENERATING, LLC

ATTACHMENT F

Illinois Power Resources Generating, LLC

DUCK CREEK POWER PLANT

FULTON COUNTY, ILLINOIS

Emergency Action Plan (EAP)

40 C.F.R. § 257.73(a)(3), Ill. Adm. Code 845.520
Coal Combustion Residual (CCR) Impoundment
& Related Facilities

- Ash Pond No. 1 (NID # IL50715) (IEPA # W0578010001-01)
- Ash Pond No. 2 (NID # IL50014) (IEPA # W0578010001-02)
- Bottom Ash Pond (NID # IL50716) (IEPA # W0578010001-03)
- Gypsum Management Facility (GMF) Pond (NID # IL50573) (IEPA # W0578010001-04)

Revision Date: September 16, 2021

Qualified Professional Engineer Certification; Emergency Action Plan for the Duck Creek Power Plant Ash Pond 1, Ash Pond 2, Bottom Ash Pond, and GMF Pond

In accordance with 40 C.F.R. § 257.73(a)(3)(iv) and 35 Ill. Adm. Code 845.520(e), the owner or operator of a CCR unit that is required to prepare a written Emergency Action Plan under 40 C.F.R. § 257.73(a)(3) and 35 Ill. Adm. Code 845.520(a) must obtain a certification from a qualified professional engineer stating that the written Emergency Action Plan meets the requirements of 40 C.F.R. § 257.73(a)(3) and 35 Ill. Adm. Code 845.520.

I, Phil Morris, being a Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that:

1. the information contained in this Emergency Action Plan was prepared in accordance with the accepted practice of engineering; and

2. this Emergency Action Plan meets the requirements of 40 C.F.R. § 257.73(a)(3) and 35 Ill. Adm. Code 845.520.

Phil Morris
Senior Director, Corporate Environmental

9/27/21

Date

PHIL L. MORRIS
062-058763
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS
9/27/21

DUCK CREEK POWER PLANT
EMERGENCY ACTION PLAN
CCR IMPOUNDMENTS & RELATED FACILITIES

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DUCK CREEK POWER PLANT
EMERGENCY ACTION PLAN
CCR IMPOUNDMENTS & RELATED FACILITIES

1 STATEMENT OF PURPOSE

The Duck Creek Power Plant (Power Plant) is a retired facility located near Canton in Fulton County, Illinois. The location is shown in Figure 1-1. The Power Plant is a coal-fired electricity producing power plant owned and operated by Illinois Power Resources Generating, LLC, a subsidiary of Dynegy Midwest Generation, LLC (DMG). This Emergency Action Plan (EAP) was prepared in accordance with 40 CFR § 257.73(a)(3) and Title 35, Section 845.520 of IEPA Administrative Code and covers the following Coal Combustion Residual (CCR) surface impoundments located at the site:

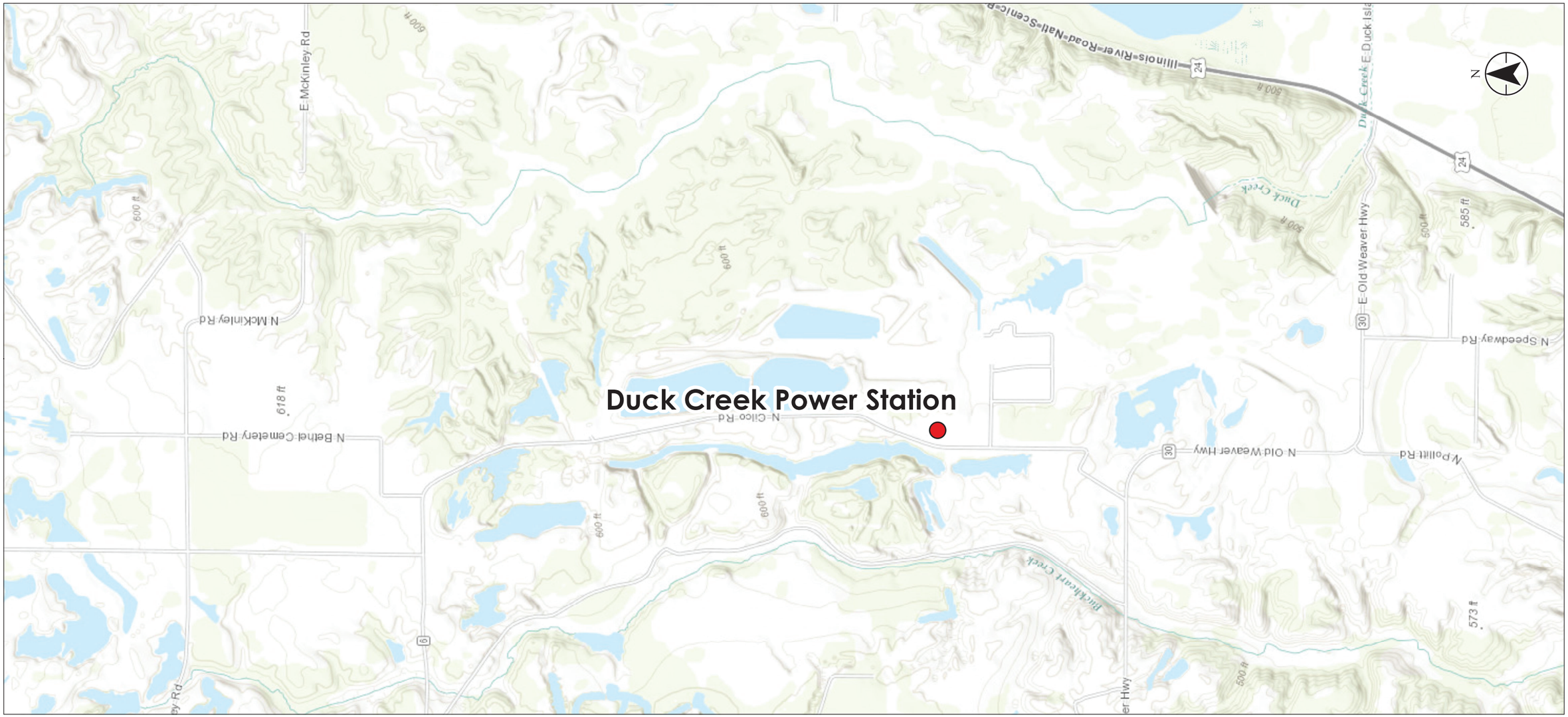
- Ash Pond No. 1 (Capped/Closed) (NID # IL50715) (IEPA # W0578010001-01)
- Ash Pond No. 2 (Capped/Closed) (NID # IL50014) (IEPA # W0578010001-02)
- Bottom Ash Pond (NID # IL50716) (IEPA # W0578010001-03)
- Gypsum Management Facility (GMF) Pond (NID # IL50573) (IEPA # W0578010001-04)

The locations of these impoundments are shown in Figure 1-2. Section 6 of this EAP includes a description of each impoundment.

The purpose of this Emergency Action Plan (EAP) is to:

1. Safeguard the lives, as well as to reduce property damage, of citizens living within potential downstream flood inundation areas of CCR impoundments and related facilities at the Duck Creek Power Plant.
2. Define the events or circumstances involving the CCR impoundments and related facilities at the Duck Creek Power Plant that represent atypical operating conditions that pose a safety hazard or emergency and how to identify those conditions.
3. Define responsible persons, their responsibilities, and notification procedures in the event of a safety emergency.
4. Provide contact information of emergency responders.
5. Identify emergency actions in the event of a potential or imminent failure of the impoundments.
6. Identify the downstream area that would be affected by failure of the impoundments.
7. Provide for effective facility surveillance, prompt notification to local Emergency Management Agencies, citizen warning and notification responses, and preparation should an emergency occur.

Information provided by Illinois Power Resources Generating, LLC was utilized and relied upon in preparation of this report.



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Stantec DYNEGY

Project Location
Latitude: 40.466181
Longitude: -89.984236
Fulton County, Illinois

175605019
Prepared by CAJ on 2017-03-23
Technical Review by PV on 2017-03-23
Independent Review by NS on 2017-03-23

Client/Project
Duck Creek Power Station
Emergency Action Plan

Figure No.
1-1

Title
Location Map

Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
2. Aerial Source: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO,
3. USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User

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Legend

CCR Surface Impoundment Boundary

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Stantec DYNEGY

Project Location
Latitude: 40.466181
Longitude: -89.984236
Fulton County, Illinois

175605019
Prepared by CAJ on 2017-03-16
Technical Review by PV on 2017-03-16
Independent Review by NS on 2017-03-16

Client/Project
Duck Creek Power Station
Emergency Action Plan

Figure No.
1-2

Title
CCR Impoundments

Notes

1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
2. Aerial Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community2015 NAIP Imagery

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2 COMMUNICATION

To facilitate understanding among everyone involved in implementing this EAP, four response levels are used to identify the condition of an impoundment. These are:

Response Levels:

- **Level 0:** Normal conditions and routine operations, including surveillance and initial investigation of unusual conditions and effects of storm events.
- **Level 1:** Potentially hazardous condition exists, requiring investigation and possible corrective action.
- **Level 2:** Potential failure situation is developing; possible mode of failure is being assessed; corrective measures are underway.
- **Level 3:** Failure is occurring or is imminent, public protective actions are required.

The 4-Step Incident Response Process is outlined in Figure 2-1. This should be used in conjunction with the Notification Flowchart (Figure 2-2) and EAP Decision Tree (Figure 2-3). Section 4 provides guidance tables for determining Response Levels and a table providing emergency actions to be taken given various situations. Table 2-1 lists contact information for the emergency responders.

Figure 2-1. Summary/Sequence of Tasks 4-Step Incident Response Process

Step 1: Detection, Evaluation, and Response Level Determination

Sequence of Tasks:

- Notify EAP Coordinator, Power Plant Management (Director and Engineering), and DMG Dam Safety Manager of unusual condition detected and confer on next steps needed.
- Conduct technical evaluation of conditions as needed.
- Determine Response Level based on evaluation. **(Table 4-1)**
- Reset Response Level as revised evaluations warrant.

Step 2: Notification

Sequence of Tasks:

- Notify authorities, designated personnel, and external response partners of change in Response Level, using the Notification Flowchart. **(Figure 2-2)**
- *Re-notify authorities, designated personnel, and external response partners as Response Level is changed.*

Step 3: Emergency Actions

Sequence of Tasks:

- Perform emergency actions with goal of saving the impoundment and minimizing impacts to life, property, and environment. **(Table 4-3)**
- Take continuous actions to include situation assessment, information sharing, remediation, and public safety advisories or warnings, as warranted.
- *Revise action plan as changes in conditions warrant.*

Step 4: Follow-up

Sequence of Tasks:

- Document conditions and decisions in the Emergency Incident Log.
- Notify authorities, designated personnel, and external response partners that condition is stabilized; limit incident termination declarations to conditions at the site.
- Conduct and document after-action review of incident and response.

Figure 2-2. Notification Flowchart

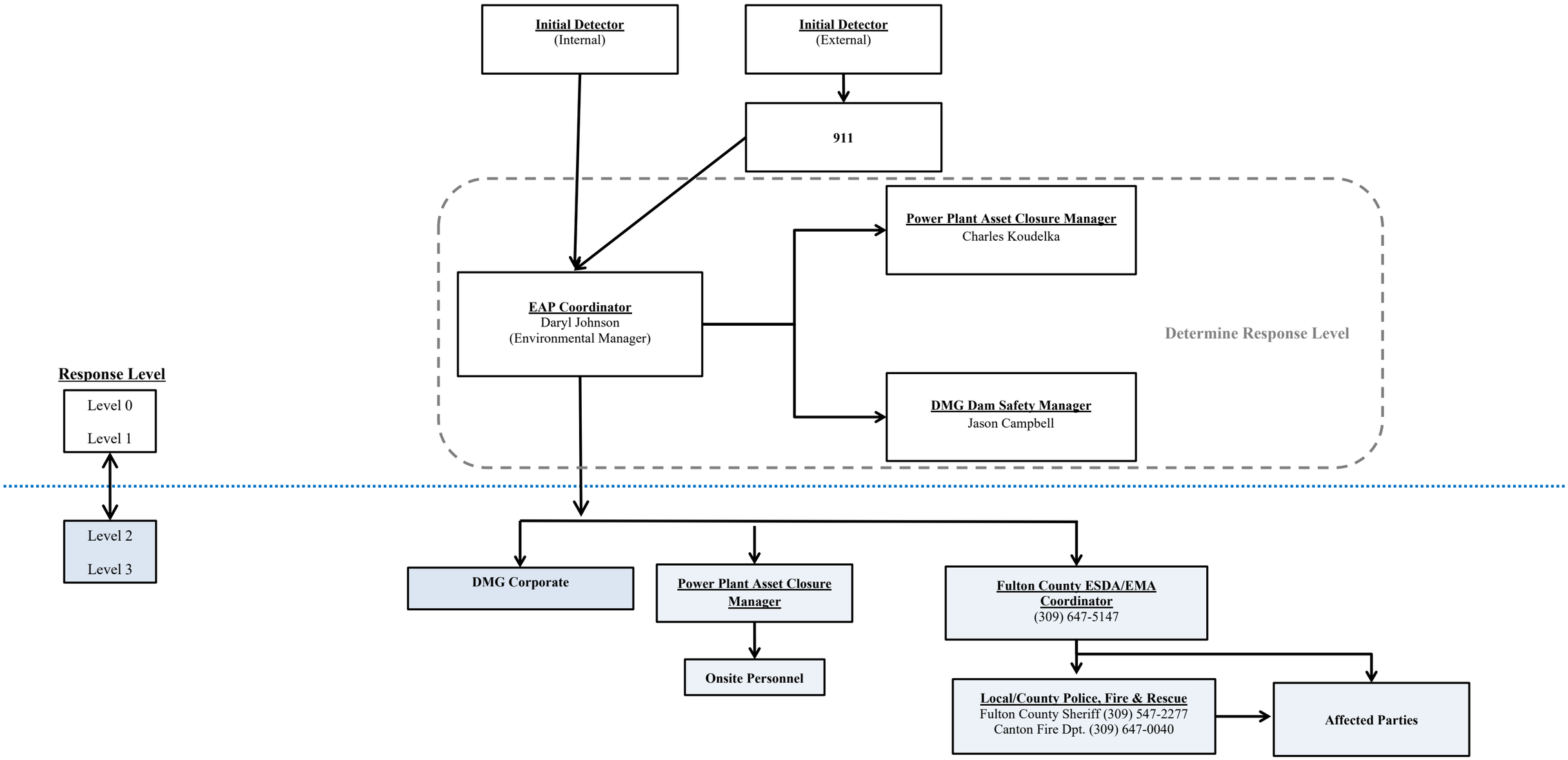

Figure 2-3. EAP Response Process Decision Tree

Note: At any given below, if failure is imminent or actively occurring **CALL 911 IMMEDIATELY** to notify emergency responders and then continue with process afterwards.

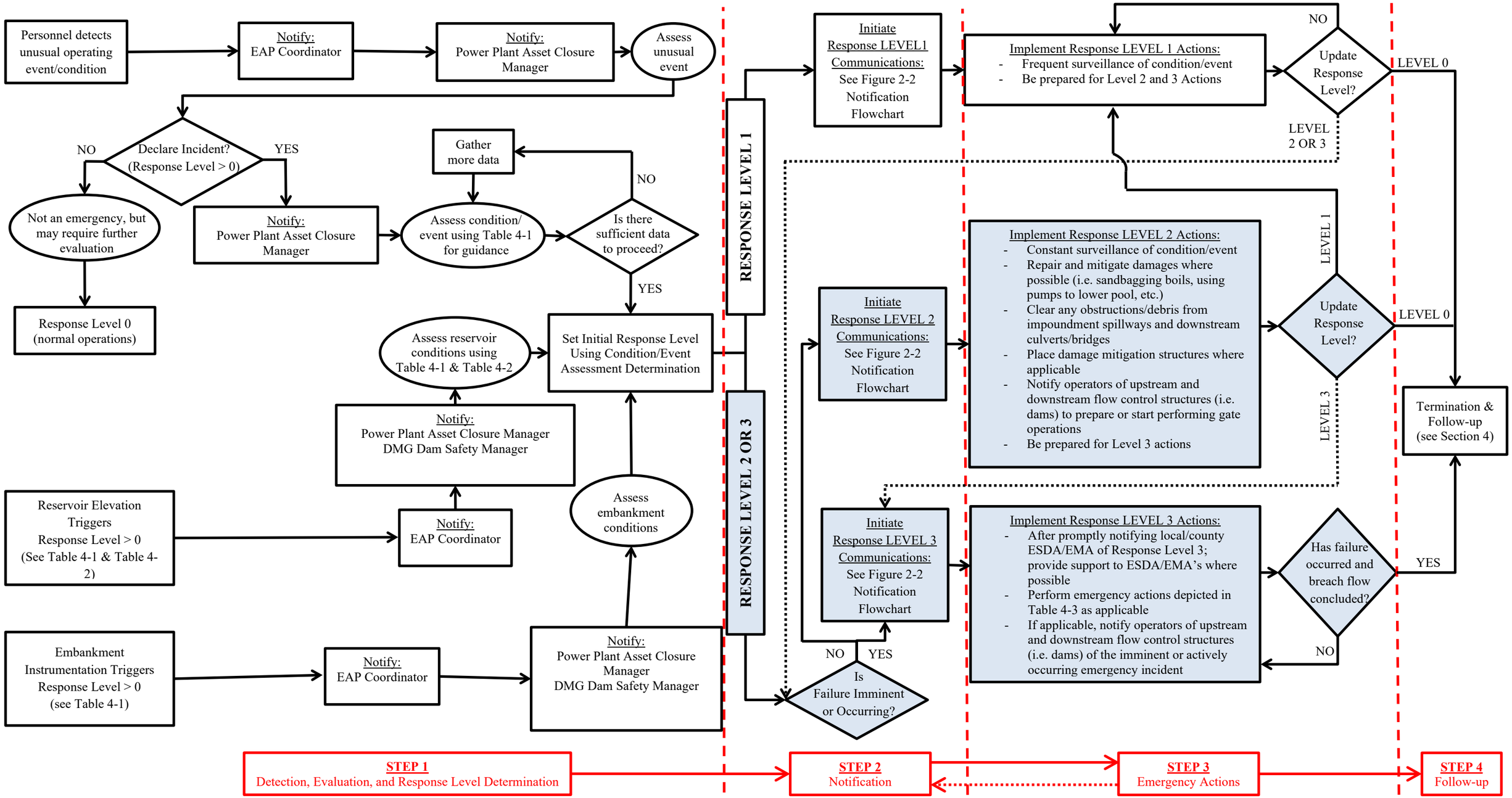

Table 2-1. EAP Emergency Responders

Position / Entity	Contact Information	
Internal Contacts		
Duck Creek Power Plant	**Contact**	
Asset Closure Manager	(903) 577-5207	
EAP Coordinator (Environmental Manager)	(309) 668-3816	
DMG Corporate Operations		
Dam Safety Manager	(618) 792-8488	
External Contacts		
Local/County ESDA/EMA, Police, & Fire	**Phone #**	**Alternate Phone #**
Fulton County Sheriff	(309) 547-2277	911
Fulton County ESDA/EMA	(309) 224-7701	
City of Canton Police Department	(309) 647-5131	
City of Canton Fire Department	(309) 647-0040	
Fulton County Ambulance	(309) 647-5147	
State Emergency Management Agencies & Organizations	**Phone #**	**Alternate Phone #**
IDNR-OWR Dam Safety Section Manager	(217) 782-4427	
Rice Lake State Fish & Wildlife Area	(309) 647-9184	(309) 338-0496
Illinois Conservation Police	(309) 338-1017	
Illinois State Police	(309) 833-4046	

3 EAP ROLES AND RESPONSIBILITIES

Table 3-1 provides a summary of the EAP roles during an emergency event.

Table 3-1. Summary of EAP Roles

Entity	Role Description
DMG Emergency Response Team (ERT)	**ERT:** DMG personnel responsible for EAP implementation, distribution, updates/maintenance, and training activities. The *ERT* is comprised of the following roles; 1. **DMG Corporate:** DMG corporate entity, committee, team, or position with relevant responsibility for a given generating power plant. 2. **Power Plant Management:** Personnel responsible for day-to-day operation and management of the Power Plant. 3. **Dam Safety Manager:** Personnel that is most knowledgeable about the design and technical operation of facilities at a given power plant. 4. **EAP Coordinator:** Personnel responsible for implementing the EAP and associated activities. **Emergency Event – EAP Responsibilities** 1. Respond to emergencies at the Power Plant. 2. Verify and assess emergency conditions. 3. Notify and coordinate as appropriate with participating emergency services disaster agencies or emergency management agencies (ESDA/EMA's), emergency responders, regulatory agencies, and all other entities involved or affected by this EAP. 4. Take corrective action at the Power Plant. 5. Declare termination of emergencies at the Power Plant.
Fulton County ESDA/EMA	1. Receive Response Level reports from *DMG Corporate* through *EAP Coordinator*. 2. Coordinate emergency response activities with local authorities: police, fire and rescue, etc. 3. Coordinate notification of public as necessary through established channels, which may include door-to-door contact. 4. Coordinate notification activities to affected parties within inundation areas. 5. Evaluate risk to areas beyond the inundation areas, communicate needs to the *DMG Corporate* and/or *EAP Coordinator*, and coordinate aid as appropriate. 6. Responsible for declaring termination of an emergency condition off-site upon receiving notification of an emergency status termination from the *DMG Corporate*. 7. If necessary, coordinate with *State ESDA/EMA*.
Canton Police, Fire, and Rescue	1. Receive alert status reports from the *ERT* or the Fulton County *ESDA/EMA*. 2. If necessary, notify affected parties and general public within inundation areas (see Section 7). 3. Render assistance to Fulton County *ESDA/EMA*, as necessary. 4. Render assistance to *DMG Corporate* and *Power Plant Management*, as necessary.
Fulton County Police, Fire and Rescue, and Emergency Services	1. Receive alert status reports from the *ERT* or the Fulton County *ESDA/EMA*. 2. If necessary, notify affected parties within the inundation area. 3. Provide mutual aid to other affected areas, if requested and able.

4 EAP RESPONSE

The 4-Step Incident Response Process is shown in Figure 2-1. The Decision Tree shown in Figure 2-3 provides a flowchart for the various elements of the response process. Upon reaching Step 4 of the response process (termination and follow-up), the EAP Coordinator is responsible for notifying the ESDA/EMA's that the condition of the dam/impoundment has been stabilized. The purpose of this section is to provide specific information that can be used during a response. This information is provided in the following tables:

- Table 4-1 provides guidance for determining the response level.
- Table 4-2 provides impoundment pool level trigger elevations.
- Table 4-3 lists emergency actions to be taken depending on the situation.

Table 4-1. Guidance for Determining the Response Level

Event	Situation	Response Level
Spillway flow (See Table 4-2 for relevant elevations)	Primary spillway flow is not causing active erosion and impoundment water surface elevation is below auxiliary spillway crest elevation (if equipped).	Level 0
	Impoundment water surface elevation is at or above auxiliary spillway crest elevation (if equipped). No active erosion caused by spillway flow.	Level 1
	Spillway flow actively causing minor erosion that is not threatening the control section or dam/impoundment stability.	Level 2
	Spillway flow that could result in flooding of people downstream if the reservoir level continues to rise.	Level 2
	Abnormal operation of the spillway system due to blockage or damage that could lead to flooding.	Level 2
	Spillway flow actively eroding the soil around the spillway that is threatening the control section (e.g. undermining) or dam/impoundment stability.	Level 3
	Spillway flow that is flooding people downstream.	Level 3
Embankment Overtopping (See Table 4-2 for relevant elevations)	Impoundment water surface elevation at or below typical normal pool fluctuation elevation.	Level 0
	Impoundment water surface elevation above typical high pool fluctuation elevation.	Level 1
	Impoundment water surface elevation within 2 feet of the embankment crest elevation	Level 2
	Impoundment water surface elevation at or above embankment crest elevation.	Level 3
Seepage	New seepage areas in or near the dam/impoundment with clear flow.	Level 1
	New seepage areas with cloudy discharge or increasing flow rate.	Level 2
	Heavy seepage with active erosion, muddy flow, and/or sand boils.	Level 3
Sinkholes	Observation of new sinkhole in impoundment area or on embankment.	Level 2
	Rapidly enlarging sinkhole and/or whirlpool in the impoundment.	Level 3
Embankment cracking	New cracks in the embankment greater than ¼ inch wide without seepage.	Level 1
	Any crack in the embankment with seepage.	Level 2
	Enlarging cracks with muddy seepage.	Level 3

Table 4-1. Guidance for Determining the Response Level

Event	Situation	Response Level
Embankment movement	Visual signs of movement/slippage of the embankment slope.	Level 1
	Detectable active movement/slippage of the embankment slope or other related effects (tension cracking, bulges/heaves, etc.) that could threaten the integrity of the embankment.	Level 2
	Sudden or rapidly proceeding slides of the embankment slopes.	Level 3
Embankment Monitoring Equipment (piezometers, inclinometers, surface displacement mounts, etc.)	Instrumentation readings beyond historic normal.	Level 1
	Instrumentation readings indicate the embankment is susceptible to failure.	Level 2
	Instrumentation readings indicate embankment is at threshold of failure or is currently failing.	Level 3
Earthquake or other event	Measurable earthquake felt or reported on or within 100 miles of the impoundment.	Level 1
	Earthquake or other event resulting in visible damage to the impoundment or appurtenances.	Level 2
	Earthquake or other event resulting in uncontrolled release of water or materials from the impoundment.	Level 3
Security threat	Verified bomb threat or other physical threat that, if carried out, could result in damage to the impoundment.	Level 2
	Detonated bomb or other physical damage that has resulted in damage to the impoundment or appurtenances.	Level 3
Sabotage/ vandalism	Damage to impoundment or appurtenance with no impact to the functioning of the impoundment.	Level 1
	Modification to the impoundment or appurtenances that could adversely impact the functioning of the impoundment. This would include unauthorized operation of spillway facilities.	Level 2
	Damage to impoundment or appurtenances that has resulted in seepage flow.	Level 2
	Damage to impoundment or appurtenances that has resulted in uncontrolled water release.	Level 3

Table 4-2. Impoundment Trigger Elevations

Impoundment	Embankment Crest Elevation	Auxiliary Spillway Crest Elevation	Normal Pool Fluctuation	
			Typical	High
Ash Pond No. 1	625 ft.	N/A	N/A	N/A
Ash Pond No. 2	640 ft.	N/A	N/A	N/A
Bottom Ash Pond				
GMF Pond	620 ft.	Not Applicable	616 ft.	618 ft.

Notes:
*Elevation estimated from Digital Elevation Model (DEM) developed by the Illinois State Geological Survey.

Table 4-3. Step 3: Emergency Actions

Condition	Description of Condition	Action to be Taken
High Water Level/ Large Spillway Release	Not applicable to capped impoundments. See Table 4-1 and Table 4-2 for elevations and triggering water levels associated with the impoundments and spillways covered by this EAP.	1. Assess cause of increased reservoir stage, especially during fair weather conditions. 2. Determine Response Level. 3. Make proper notifications as outlined in the Figure 2-2 Notification Flowchart. 4. Perform additional tasks as determined through consultation with the ERT. 5. Make notifications if condition worsens such that downstream flooding is imminent. **Response Level 0**: require enhanced surveillance 3 times per day **Response Level 1**: contact internal chain of command and external response partners as necessary; inspect impoundment minimum 1 time per hour **Response Level 2**: contact internal chain of command; notify ESDA/EMA's and notify external response partners. ESDA/EMA's notify affected parties. **Response Level 3**: contact internal chain of command; notify ESDA/EMA's and notify external response partners. ESDA/EMA's notify affected parties of emergency incident.
Seepage	Localized new seepage or boil(s) observed along downstream face / toe of earthen embankment with muddy discharge and increasing but controllable discharge of water.	1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection notes. 2. Determine Response Level. 3. Make proper notifications as outlined in the Figure 2-2 Notification Flowchart. 4. ERT (with Dam Safety Manager as lead) to determine mitigation actions. The following actions may apply: a) Place a ring of sand bags with a weir at the top towards the natural drainage path to monitor flow rate. If boil becomes too large to sand bag, place a blanket filter over the area using non-woven filter fabric and pea gravel. Attempt to contain flow in such a manner (without performing any excavations) that flow rates can be measured. Stockpile gravel and sand fill for later use, if necessary.

Table 4-3. Step 3: Emergency Actions

Condition	Description of Condition	Action to be Taken
		b) Inspect the embankment and collect piezometer, water level and seepage flow data daily unless otherwise instructed by the Dam Safety Manager. Record any changes of conditions. Carefully observe embankment for signs of depressions, seepage, sinkholes, cracking or movement. c) Maintain continuous monitoring of feature. Record measured flow rate and any changes of condition, including presence or absence of muddy discharge. 5. Make notifications as outlined in the lower portion of the Notification Flowchart (Figure 2-2) if condition worsens such that failure is imminent.
Sabotage and Miscellaneous Other Issues	Criminal action with significant damage to embankment or structures where significant repairs are required and the integrity of the facility is compromised—condition appears stable with time.	1. Contact law enforcement authorities and restrict all access (except emergency responders) to impoundment. Restrict traffic on embankment crest to essential emergency operations only. 2. Determine Response Level. 3. Make internal notifications as outlined in the upper portion of the Notification Flowchart (Figure 2-2). 4. In conjunction with the Dam Safety Manager, assess extent of damage and visually inspect entire embankment and ancillary structures for additional less obvious damage. Based on inspection results, confirm if extent of damage to various components of the impoundment warrants a revised Response Level and additional notifications. 5. Perform additional tasks as directed by the ERT. 6. Make notifications if conditions worsen.
Embankment Deformation	**Cracks:** New longitudinal (along the embankment) or transverse (across the embankment) cracks more than 6 inches deep or more than 3 inches wide or increasing with time. New concave cracks on or near the embankment crest associated with slope movement.	1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection notes. 2. Restrict traffic on embankment crest to essential emergency operations only. 3. Determine Response Level. 4. Make notifications as outlined in the Figure 2-2 Notification Flowchart. 5. ERT (with Dam Safety Manager as lead) to determine mitigation actions. The following actions may apply: a) Place buttress fill against base of slope immediately below surface feature. Stockpile additional fill. b) Place sandbags as necessary around crack area to divert any storm water runoff from flowing into crack(s). 6. As directed by the Dam Safety Manager, additional inspection and monitoring of the dam may be required. Items may include; inspect the dam on a schedule determined by the Dam Safety Manager; collect piezometer and water level data; and record any changes of condition. Carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement. 7. Make notifications as outlined in the Figure 2-2 Notification Flowchart if conditions worsen such that failure is imminent.
	Slides / Erosion: Deep slide / erosion (greater than 2 feet deep) on the embankment that may also extend beyond the	1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection report. 2. Restrict traffic on embankment crest to essential emergency operations only. 3. Determine the Response Level.

Table 4-3. Step 3: Emergency Actions

Condition	Description of Condition	Action to be Taken
	embankment toe but does not encroach onto the embankment crest and appears stable with time.	4. Make notifications as outlined in the Figure 2-2 Notification Flowchart. 5. ERT (with Dam Safety Manager as lead) to determine mitigation actions. Additional actions may include the following items. a) Place sandbags as necessary around slide area to divert any storm water runoff from flowing into slide(s). b) Increase inspections of the dam; collect piezometer and water level data; and record any changes of condition. During inspections, carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement. 6. Make notifications as outlined in the Figure 2-2 Notification Flowchart if conditions worsen such that failure is imminent.
	Sinkholes: Small depression observed on the embankment or within 50 feet of the embankment toe that is less than 5 feet deep and 30 feet wide or which is increasing with time.	1. Slowly open drain gates to lower pool elevation. 2. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection notes. 3. Restrict traffic on embankment crest to essential emergency operations only. 4. Determine Response Level. 5. Make notifications as outlined in the Figure 2-2 Notification Flowchart. 6. ERT (with Dam Safety Manager as lead) to determine mitigation actions. Additional actions may include the following items: a) Backfill the depression with relatively clean earth fill (free of organic materials) generally even with surrounding grade and slightly mounded (6 to 12 inches higher) in the center to shed storm water away from the depression. Stockpile additional fill. b) Increase inspections of the dam; collect piezometer and water level data daily unless otherwise instructed by Dam Safety Manager; and record any changes of condition. Carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement. 7. Make notifications as outlined in the Figure 2-2 Notification Flowchart if conditions worsen such that failure is imminent.
Gate Malfunction or Failure	Sluice gate damaged structurally (sabotage, debris, etc.) with uncontrolled release of water at a constant volume. Condition appears stable.	1. Close any other gates, if open. 2. Determine Response Level. 3. Make notifications as outlined in the Figure 2-2 Notification Flowchart. 4. Obtain instructions from the Dam Safety Manager to determine if there are other methods to stop or slow down the flow of water. 5. If conditions worsen such that failure is imminent, make notifications as outlined in the lower portion of the Figure 2-2 Notification Flowchart.

5 PREPAREDNESS

The intent of this section is to provide information that will be utilized during a response. Established emergency supplies and locations, suppliers, and equipment are provided in Table 5-1. Supplier contact information is listed in Table 5-2.

A coordination meeting shall be conducted annually between representatives of the Illinois Power Resources Generating, LLC and local emergency responders. This meeting may be in the form of a face-to-face meeting, tabletop exercise, or additional training regarding the EAP.

Table 5-1. Emergency Supplies and Equipment

Item	On-site (Yes/No/Occasionally)	Remarks
Flashlights	Yes	Typically, at Duck Creek Power Plant Maintenance Facility: contact Asset Closure Manager for location(s).
Generator		
Extension Cords		
Fire extinguishers		
Floodlights		
Backhoe	Yes	John Deere 301 Backhoe/Loader and Caterpillar 426C Backhoe/Loader; contact Asset Closure Manager for location(s).
Dozer	Yes	Caterpillar D9R Dozer and Caterpillar D10R Dozer; contact Asset Closure Manager for location(s).
Large Equipment (Rental – including excavating equipment, pumps, lighting)	Yes	Two Caterpillar 834 Rubber Tired Bucket Loader, Fiatt Road Grader, two farm tractors with end loaders, and a Caterpillar Skid Steer with end loaders are also available; contact Asset Closure Manager for location(s). Contact Altorfer, Inc., Bolon's Repair, MH Equipment, or Sunbelt Rentals for additional large equipment (see Table 5-2).
Dump Truck	No	Contact Captain Hook Roll-Off Boxes or Done Rite Construction Co. Inc. for additional dump trucks (see Table 5-2).
Pump and Hoses	No	Contact Bolon's Repair or Pratt Lumber Do It Center for additional pumps and hoses (see Table 5-2).
Sandbags and Sand	No	Contact Duck Creek Sand and Gravel, Davis Sand and Gravel, or Pratt Lumber Do It Center for additional sandbags and sand (see Table 5-2).
Fill (Stone, aggregate, sand)	No	Contact Duck Creek Sand and Gravel, Davis Sand and Gravel, or Pratt Lumber Do It Center for additional fill (see Table 5-2).
Concrete/grout	No	Contact Canton Redi-Mix for additional batch plant concrete or Pratt Lumber Do It Center for additional bagged concrete (see Table 5-2).
Geotextile Filter Fabric	Yes	Two rolls of 10-ounce, non-woven filter fabric are available on site; contact Asset Closure Manager for location(s).
Plastic Sheeting	No	Contact Pratt Lumber Do It Center for additional plastic sheeting (see Table 5-2).
Rope	No	Contact Alexander Lumber, Bolon's Repair, and Pratt Lumber Do It Center for additional rope (see Table 5-2).
Personal Flotation Devices	Yes	Typically, at Duck Creek Power Plant Maintenance Facility, contact Asset Closure Manager for location(s).

Table 5-2. Supplier Addresses

Supply/Rental Item(s)	Supplier Contact Information	Distance from Site (miles)	Address
Rope	**Alexander Lumber Co**. (309) 647-0396	8.4	406 South 5th Ave Canton, IL 61520
Large Equipment	**Altorfer, Inc.** (309) 697-1234	33.5	6315 West Fauber Road Bartonville, IL 61607
Large Equipment, Pump and Hoses, Rope	**Bolon's Repair** (309) 647-2203	10.5	999 West Locust Canton, IL 61520
Concrete/grout	**Canton Redi-Mix** (309) 668-2261	13.1	22381 IL-78 Canton, IL 61520
Dump Truck	**Captain Hook Roll-Off Boxes** (309) 565-7676	18.2	309 South Glasford Road Glasford, IL 61533
Sandbags and Sand	**Davis Sand and Gravel** (309) 647-0019	10.7	1130 West Locust Street Canton, IL 61520
Dump Truck	**Done Rite Construction Co Inc**. (309) 331-4983	55.6	10277 IL RT 101 Littleton, IL 61452
Fill (Stone, aggregate, sand)	**Duck Creek Sand and Gravel** (309) 668-2278	5.5	17505 North Duck Island Road Canton, IL 61520
Large Equipment	**MH Equipment** (309) 699-4024	38.4	111 Carver Lane East Peoria, IL 61611
Concrete/grout, Pump and Hoses, Sandbags and Sand, Fill (Stone, aggregate, sand), Plastic Sheeting, Rope	**Pratt Lumber Do It Center** (309) 547-3587	13.4	311 East Avenue E Lewistown, IL 61542
Large Equipment	**Sunbelt Rentals** (309) 694-6201	39.7	1601 North Main Street East Peoria, IL 61611

6 FACILITY/IMPOUNDMENT DESCRIPTION

The impoundments included in this EAP are described as follows and illustrated in Figure 1-2. Table 6-1 contains additional geometric details for each impoundment.

The Duck Creek Power Plant is a retired plant located in Canton, Illinois, roughly 50 miles west of Bloomington, Illinois east of IL-78 and west of US-24.

Ash Pond No. 1 is a diked impoundment that was commissioned in 1976. The main inflow into Ash Pond No. 1 was precipitation, which accumulated and transported through channels around the inside perimeter of the pond, reaching two small internal impoundments. It has a maximum embankment height of 28 feet, a crest elevation of 625 feet above Mean Sea Level (MSL), and a crest width of 20 feet. The total length of the embankment is approximately 6,500 feet. The storage capacity of the pond is approximately 1,300 acre-feet at normal pool elevation. Approximately three-fourths of Ash Pond No. 1 is stacked ash, located on the southern side. Free water volume accounts for approximately one-fourth of the pond and is located on the northern end.

Ash Pond No. 2 is a diked impoundment that was commissioned in 1986. The main inflows into Ash Pond No. 2 are precipitation and stormwater pumped from Ash Pond No. 1. The diked fly ash is constructed in a serpentine channel to direct process water and allow for additional time to filter suspended solids before entering the main pond. The outlet structure is in the northeast corner of the pond and transports water into the Recycle Pond, along with a seepage blanket and pump. It has a maximum embankment height of 30 feet, a crest elevation of 640 feet above MSL, and a crest width of 20 feet. The total length of the embankment is approximately 9,000 feet. The storage capacity of the pond is approximately 1,000 acre-feet at normal pool elevation.

The Bottom Ash Pond…….

The GMF Pond is located directly north of the GMF Recycle Pond, east of North Bethel Cemetery Road. The pond encompasses approximately 30 acres and is graded to the south, where water discharges into a channel to flow into the GMF Recycle Pond. From the GMF Recycle Pond, water exits through piping into the Duck Creek Cooling Pond.

Table 6-1. Power Plant Impoundment Characteristics

Feature/Parameter	Ash Pond No. 1	Ash Pond No. 2	Bottom Ash Pond	GMF Pond
Maximum Embankment Height	28 feet*	30 feet*		11 feet
Length of Dam	6,500 feet*	9,000 feet*		4,560 feet
Crest Width	N/A	N/A		30 feet
Crest Elevation	±625 feet	±640 feet*		±620 feet
Reservoir Area at Top of Dam	N/A	N/A		31.6 acres
Storage Capacity at Top of Dam	N/A	N/A		Unknown
Primary Spillway Type	Stormwater let-down structures are now the spillways	Stormwater let-down structures are now the spillways		Lined open channel
Primary Spillway Crest Elevation	None	None		615 feet
Storage Capacity at Primary Spillway Elevation	None	None		None
Reservoir Area at Normal Water Surface Elevation	N/A	N/A		31 acres
Auxiliary Spillway Type	None	None		None
Auxiliary Spillway Crest Elevation	None	None		None

Notes:
*Source: "COAL ASH IMPOUNDMENT SITE ASSESSMENT FINAL REPORT", May 10, 2011. Elevations are in reference to original construction drawings by Commonwealth Associates, Inc.
All remaining values are GIS estimated.

7 BREACH INUNDATION MAPS AND POTENTIAL IMPACTS

Inundation maps for Ash Pond No. 1, Ash Pond No. 2, Bottom Ash Pond, and the GMF Pond potential breach scenarios are provided in this section. It is the Fulton County ESDA/EMA's responsibility to keep a current list of affected parties/properties to contact in the case of emergencies that result in Response Level 2 or 3. This list should encompass all properties within and adjacent to the probable inundation extents shown in the provided maps.

The methodology used to identify probable inundation extents for potential breach scenarios varied as a function of the impoundment size, location, surrounding topography, and surrounding structures/facilities/waterbodies.

Ash Pond No. 1, Ash Pond No. 2, Bottom Ash Pond, and the GMF Pond inundation maps were developed from visual assessments. Topographic data and basemap imagery were used to identify the mapped inundation areas.

Three failure scenarios were identified at Ash Pond No. 1 and Ash Pond No. 2. At both impoundments, the breach would be contained in either the Duck Creek Cooling Pond or the unnamed body of water west of N. Cilco Road. The Bottom Ash Pond is incised and no failure scenarios were identified. Four failure scenarios were identified at the GMF Pond. Only Duck Creek Power Plant owned structures were identified in the potential breach paths, with a breach contained in the Duck Creek Cooling Pond. The land between the impoundments and the Duck Creek Cooling Pond and unnamed body of water west of N. Cilco Road would also be inundated during a breach.

Approximate inundation areas are illustrated on Figure 7-1, Figure 7-2, Figure 7-3, and Figure 7-4.

Legend

- Disposal Area Approximate Limits
- Approximate Anticipated Inundation Extents

0 1,500 3,000 Feet

1:18,000 (At original document size of 11x17)

Stantec DYNEGY

Project Location
Latitude: 40.466181
Longitude: -89.984236
Fulton County, Illinois

175605019
Prepared by CAJ on 2017-03-06
Technical Review by MAT on 2017-03-10

Client/Project
Duck Creek Power Station
Emergency Action Plan

Figure No.
7-1

Title
Inundation Map
Ash Pond No. 1

Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
2. Aerial Source: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO,
3. USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User

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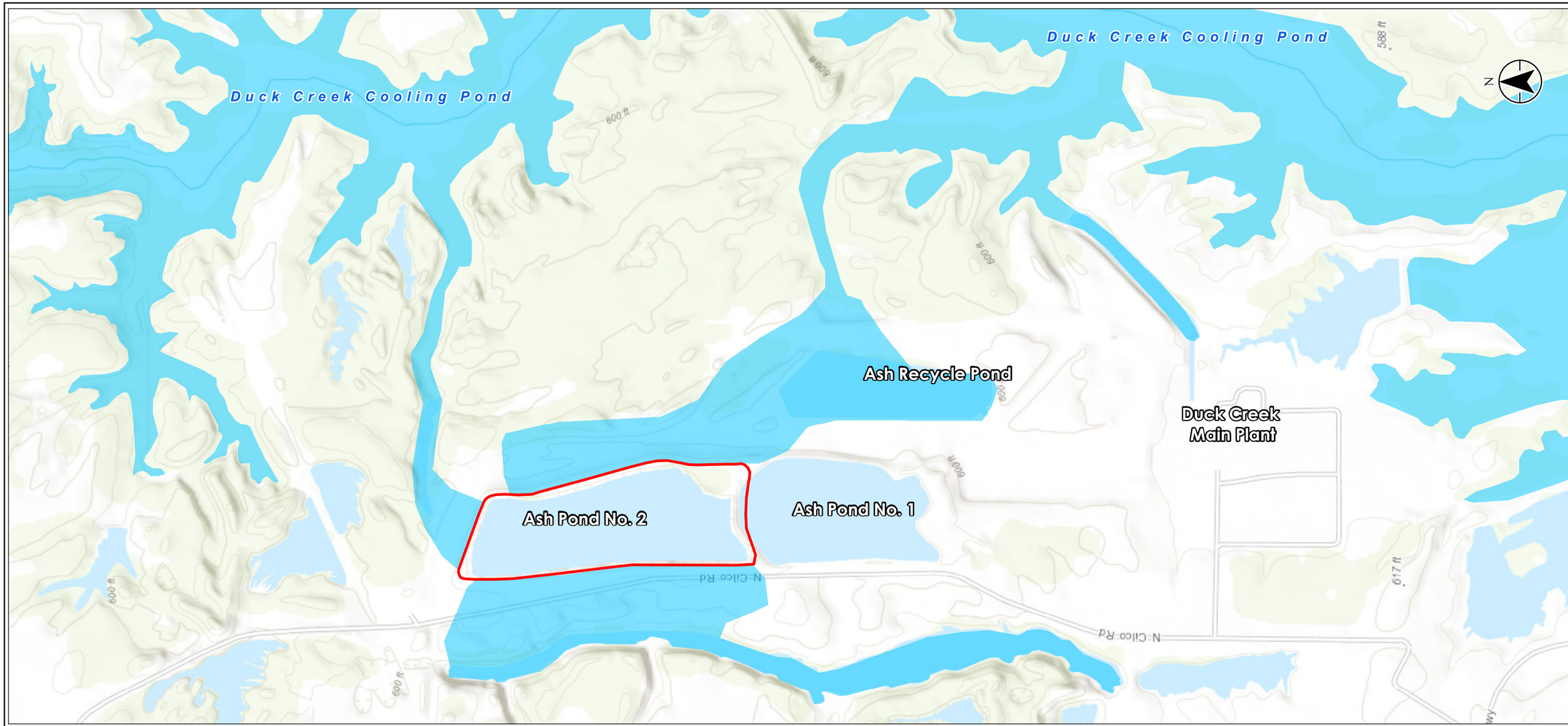

Legend

- Disposal Area Approximate Limits
- Approximate Anticipated Inundation Extents

0 1,500 3,000 Feet

1:18,000 (At original document size of 11x17)

Stantec DYNEGY

Project Location
Latitude: 40.466181
Longitude: -89.984236
Fulton County, Illinois

175605019
Prepared by CAJ on 2017-03-06
Technical Review by MAT on 2017-03-10

Client/Project
Duck Creek Power Station
Emergency Action Plan

Figure No.
7-2

Title
Inundation Map
Ash Pond No. 2

Notes

1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
2. Aerial Source: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO,
3. USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User

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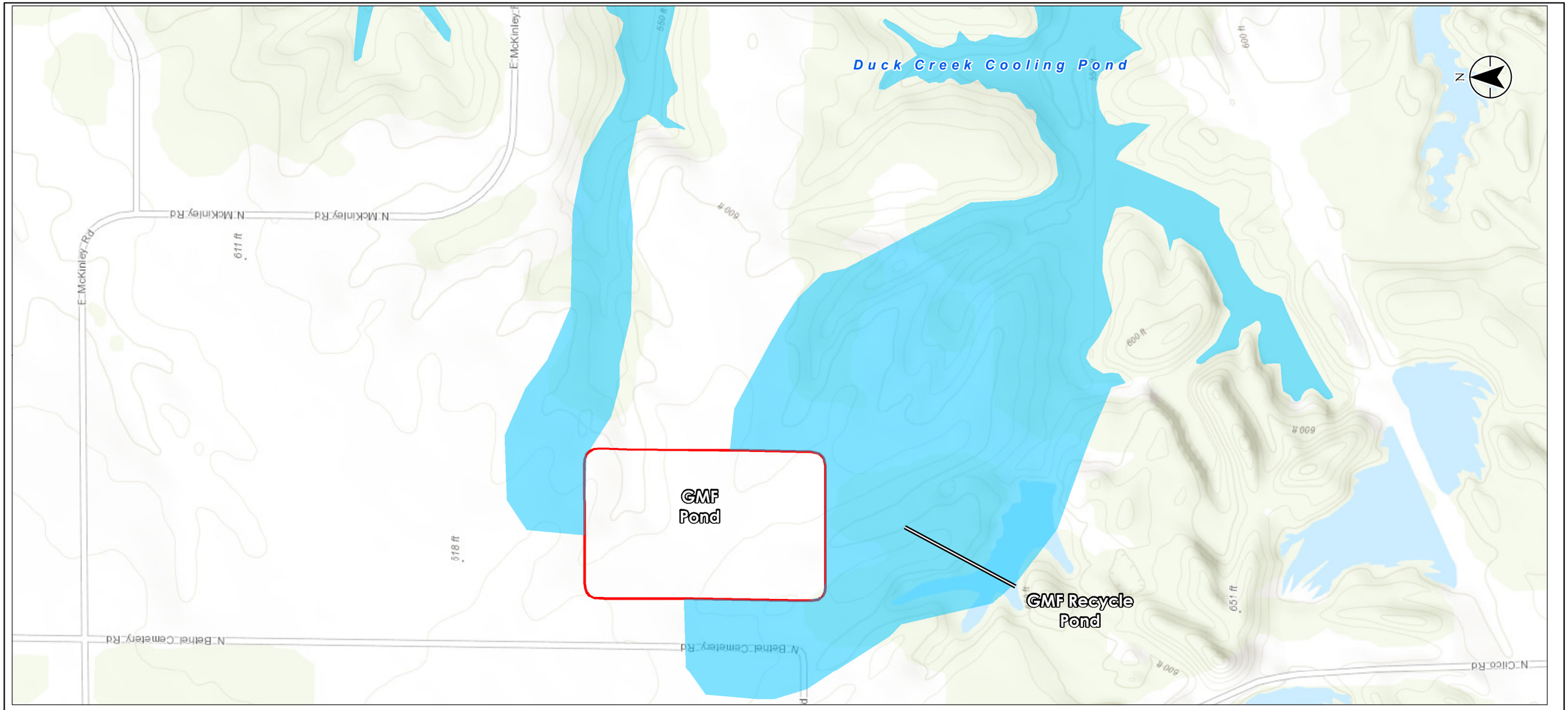

Legend

- Disposal Area Approximate Limits
- Approximate Anticipated Inundation Extents

0 800 1,600 Feet

1:9,600 (At original document size of 11x17)

Stantec DYNEGY

Project Location 175605019
Latitude: 40.466181
Longitude: -89.984236
Fulton County, Illinois

Prepared by CAJ on 2017-03-06
Technical Review by MAT on 2017-03-10
Independent Review by MC on 2017-03-14

Client/Project
Duck Creek Power Station
Emergency Action Plan

Figure No.
7-3

Title
Inundation Map
GMF Pond

Notes

1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
2. Aerial Source: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO,
3. USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User

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U:\175605019-Matt_Hoy\gis\mxd\007_duckck\DuckCreek_GMFBreach_WEB.mxd Revised: 2017-04-12 By: caljohnson

ATTACHMENT G

CCR Fugitive Dust Control Plan

for

Duck Creek Power Plant

Prepared for:

Illinois Power Resources Generating, LLC

Duck Creek Power Plant
17751 North Cilco Road
Canton, IL 61520

Prepared by:

Burns & McDonnell
Kansas City, Missouri

Amendment 1

October 2021

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1 Introduction

This Coal Combustion Residuals (CCR) fugitive dust control plan has been prepared for the Duck Creek Power Plant, located in Fulton County, Illinois. This plan addresses the air criteria in 40 C.F.R. § 257.80 of the United States Environmental Protection Agency's CCR rule, which requires the owner or operator of a CCR unit to "adopt measures that will effectively minimize CCR from becoming airborne at the facility" and to "prepare and operate in accordance with a CCR fugitive dust control plan." The plan also addresses the air criteria in 35 I.A.C. 845.500 of the Illinois Environmental Protection Agency's CCR rule, which contains similar requirements to the federal CCR rule.

1.1 Facility Information

- Facility Name: Duck Creek Power Plant (Retired)
- Facility Address: 17751 North Cilco Road, Canton, IL 61520
- Owner/Operator: Illinois Power Resources Generating, LLC

1.2 Certification

The owner or operator must obtain a certification from a qualified professional engineer that the initial CCR fugitive dust control plan, or any subsequent amendment of it, meets the requirements of 40 C.F.R. § 257.80 and 35 I.A.C. 845.500. See 40 C.F.R. §257.80(b)(7); 35 I.A.C. 845.500(b)(7).

I certify under penalty of law that, to the best of my knowledge, this plan meets the requirements of 40 C.F.R. § 257.80 and 35 I.A.C. 845.500. This certification is based on my review of the document and conditions at the site and on my inquiry of the person or persons who managed the preparation of this document.

John R. Hesemann
Printed Name of Qualified Professional Engineer

John R. Hesemann 9/09/2021
Signature of Qualified Professional Engineer and Date

JOHN ROBERT HESEMANN
062-058523
LICENSED PROFESSIONAL ENGINEER OF
ILLINOIS

062.058523 – Illinois – Expires 11/30/2021
Registration Number and State

2 CCR Fugitive Dust Control Measures and Appropriateness

CCR fugitive dust has the potential to become airborne at the facility during periods of CCR management in the CCR units, CCR handling and CCR transport. Areas at the facility that have the potential for airborne CCR fugitive dust are CCR surface impoundments, a CCR landfill, CCR handling equipment and CCR transport in trucks. This section identifies and describes the control measures selected and adopted by the facility to minimize CCR from becoming airborne at the facility and explains how the selected measures are applicable and appropriate for site conditions. The control measures may be adjusted or modified based on observed effectiveness of minimizing CCR from becoming airborne and weather conditions.

2.1 Management of CCR in the CCR Units

The facility manages CCR in surface impoundments and a landfill located at the facility. Table 2-1 below identifies CCR fugitive dust control measures that have been selected for use by the facility during CCR management in the CCR units, including placement of CCR into the CCR units, and explains how the selected measures are applicable and appropriate for site conditions. The facility will use the identified measures during CCR management in the CCR units to minimize CCR from becoming airborne at the facility.

CCR Activity	CCR Fugitive Dust Control Measure	Applicability and Appropriateness of Control Measure
Management of CCR in the facility's CCR units	Condition CCR to be emplaced in the landfill before emplacement.	Conditioning CCR to be placed in the landfill allows CCR to bind together and thus minimizes the potential for CCR fugitive dust generation when CCR is managed in the landfill. The added moisture content will prevent wind dispersal of the CCR but will not result in free liquids.
	Cover exposed dry CCR in the landfill.	Applying approved cover material, such as conditioned fly ash, minimizes wind entrainment of CCR.
	Wet management of CCR bottom ash and flue gas desulfurization materials in CCR surface impoundments.	Wet management of CCR minimizes the potential for CCR fugitive dust generation.
	Water areas of exposed CCR in CCR units, as necessary.	Water will be applied to areas of exposed CCR to maintain moisture content to minimize the potential for CCR fugitive dust generation in excessively dry or windy conditions. Wetting activities will not generate "free liquids" within the landfill.
	Naturally occurring grass vegetation in areas of exposed CCR in CCR surface impoundments.	Vegetation provides a wind screen and/or cover and reduces wind entrainment of CCR.
	Apply chemical dust suppressant on areas of exposed CCR in CCR units, as necessary.	Mixing an appropriate chemical dust suppressant with water and applying to areas of exposed CCR will minimize the potential for CCR fugitive dust generation in excessively dry or windy conditions.
	Reduce or halt operations during high wind events, as necessary.	Reducing or halting operations during high wind events minimizes the potential for CCR fugitive dust generation.

Table 2-1. Control Measures for CCR Management in CCR Units

2.2 Handling of CCR

Bottom ash may be periodically removed from the CCR surface impoundments and remains sufficiently wet during and after handling activities, including dewatering, associated with transfer of the CCR. Table 2-2 below identifies CCR fugitive dust control measures that have been selected for use by the facility during handling of CCR and explains how the selected measures are applicable and appropriate for site conditions. The facility will use the identified measures when handling CCR to minimize CCR from becoming airborne at the facility.

CCR Activity	CCR Fugitive Dust Control Measure	Applicability and Appropriateness of Control Measure
Handling of CCR at the facility	CCR bottom ash removed from CCR surface impoundments and loaded into trucks for transport remains conditioned during handling.	Conditioned CCR allows CCR to bind together and thus minimizes the potential for CCR fugitive dust generation when CCR is handled.
	CCR to be emplaced in the landfill is conditioned before emplacement.	Conditioning allows CCR to bind together and thus minimizes the potential for CCR fugitive dust generation.
	Condition CCR materials to be transported offsite before they are loaded into trucks, as necessary.	Conditioning allows CCR to bind together and thus minimizes the potential for CCR fugitive dust generation while loading CCR into trucks and during transport.
	Reduce or halt operations during high wind events, as necessary.	Reducing or halting operations during high wind events minimizes the potential for CCR fugitive dust generation.

Table 2-2. Control Measures for Handling CCR

2.2.1 Conditioning of CCR Prior to Emplacement in CCR Landfill

Conditioned CCR is CCR that has been wetted with water or an appropriate chemical dust suppressant. Water or a chemical dust suppressant is added to raise the moisture content of the CCR to prevent wind dispersal but will not result in free liquids. Conditioning allows for the CCR to bind together, which minimizes the potential for CCR fugitive dust.

All CCR generated on site that is placed into the facility's landfill, as well as CCR generated offsite that is authorized for placement in the facility's landfill, is conditioned before emplacement. All CCR that is added to the facility's landfill is emplaced in the landfill as conditioned CCR.

2.3 Transportation of CCR

CCR is transported via truck at the facility using a combination of paved and unpaved facility roads. Table 2-3 below identifies CCR fugitive dust control measures that have been selected for use by the facility during transport of CCR. The facility will use the identified measures when transporting CCR to minimize CCR from becoming airborne at the facility.

CCR Activity	CCR Fugitive Dust Control Measure	Applicability and Appropriateness of Control Measure
Transportation of CCR at the facility	Condition CCR to be emplaced in the landfill before emplacement.	Conditioning CCR increases moisture content of the CCR and minimizes the potential for CCR fugitive dust generation during CCR transport (and emplacement in the landfill).
	Condition CCR materials to be transported offsite before they are loaded into trucks, as necessary.	Conditioning allows CCR to bind together and thus minimizes the potential for CCR fugitive dust generation while loading CCR into trucks and during transport.
	Cover or enclose trucks used to transport CCR fly ash.	Covering or enclosing trucks transporting CCR on facility roads minimizes the potential for CCR fugitive dust generation from the CCR transport trucks.
	Limit the speed of vehicles to no more than 15 mph on facility roads.	Limiting the speed of vehicles traveling on facility roads minimizes the potential for CCR fugitive dust generation from the CCR transport trucks.
	Cover or enclose trucks used to transport CCR other than fly ash, as necessary.	Covering or enclosing trucks transporting CCR on facility roads minimizes the potential for CCR fugitive dust generation from the CCR transport trucks.
	Sweep or rinse CCR off of the outside of the trucks transporting CCR, as necessary.	Removing CCR present on the outside of the truck minimizes the potential for movement of the truck or wind to cause CCR fugitive dust to become airborne.
	Remove CCR, as necessary, deposited on facility road surfaces during transport.	Removing CCR deposited on facility road surfaces as a result of transport minimizes the potential for CCR fugitive dust generation from vehicle traffic.
	Condition CCR haul roads with water or dust suppressant, as necessary.	Watering CCR haul roads minimizes the potential for dust generation to occur as a result of CCR hauling traffic and heavy equipment use.
	Reduce or halt operations during high wind events, as necessary.	Reducing or halting operations during high wind events minimizes the potential for CCR fugitive dust generation.

Table 2-3. Control Measures for Transportation of CCR

3 Procedures for Periodic Assessment of Effectiveness of the Plan

The facility conducts inspections associated with CCR fugitive dust control. The facility also uses the procedures identified in section 5 of this plan to log every citizen complaint involving CCR fugitive dust events at the facility. These inspections and the investigations of citizen complaints will be used to periodically assess the effectiveness of the CCR fugitive dust control plan per 40 C.F.R. § 257.80(b)(4) and 35 I.A.C. 845.500(b)(3).

The facility routinely performs inspections to verify the effectiveness of the CCR fugitive dust control measures used at the facility. Inspections are conducted during daylight working hours and include observing for the presence of CCR fugitive dust emissions from vehicles transporting CCR on facility roads, CCR handling and CCR management activities, including CCR placement in CCR units. Inspection records include information such as the name of the person conducting the inspection, the date and time of the inspection, the results of the inspection, and any corrective action taken.

When a CCR fugitive dust event is observed or a citizen complaint involving a CCR fugitive dust event at the facility is received, current CCR management practices will be reviewed to see that the selected control measures are being properly implemented. If the control measures are not being properly implemented, relevant operating personnel will be notified and, as warranted, re-trained in the proper implementation of CCR fugitive dust control measures. If appropriate, use of revised and/or additional control measures will be evaluated. As warranted, revised and/or additional control measures found to be applicable and appropriate to control CCR fugitive dust emissions will be incorporated into an amended CCR fugitive dust control plan.

The plan also will be reassessed in the event of material changes in site conditions potentially resulting in CCR fugitive dust becoming airborne at the facility.

4 Recordkeeping, Notification, Internet Site

The written CCR fugitive dust control plan, any amendment of the written plan, and the annual CCR fugitive dust control report required by 40 C.F.R. § 257.80(c) and 35 I.A.C. 845.500(c) will be placed in the facility's written operating record and posted to the company's CCR website in accordance with 40 C.F.R. § 257.105(g), § 257.107(g), and 845.800(d)(7), (14), and 845.810(e). Notification of the availability of the CCR fugitive dust control plan, any amendment of the plan, and the annual CCR fugitive dust control report will be provided to IEPA in accordance with 40 C.F.R. § 257.106(g). Any amendment of the fugitive dust control plan will be submitted to IEPA in accordance with 845.500(b)(5).

Additionally, pursuant to 845.500(b)(6), this fugitive dust control plan is being placed in facility's operating record and posted to the company's CCR website prior to the submission of any permits for the Duck Creek Power Plant.

5 Procedures to Log Citizen Complaints

In the event the owner or operator of the facility receives a citizen complaint involving a CCR fugitive dust event at the facility, relevant information about the complaint will be logged. Information that will be recorded includes, as applicable:

- Date/Time the complaint is received
- Date/Time and duration of the CCR fugitive dust event
- Description of the nature of the CCR fugitive dust event
- Name of the citizen entering the complaint
- Address & phone number of citizen entering the complaint
- Name of the personnel who took the complaint
- All actions taken to assess and resolve the complaint

All citizen complaints involving CCR fugitive dust events at the facility will be investigated promptly. As deemed appropriate or necessary, corrective measures will be taken and a follow-up response will be provided to the complainant.

Pursuant to 35 I.A.C. 845.500(b)(2), quarterly reports will be submitted to IEPA no later than 14 days from the end of the quarter for all complaints received in that quarter. At a minimum, the quarterly report will include the date of the complaint, the date of the incident, the name and contact information of the complainant (if given), and all actions taken to assess and resolve the complaint.

6 Amendments

The written CCR fugitive dust control plan may be amended at any time provided the revised plan is placed in the facility's operating record as required by 40 C.F.R. § 257.105(g)(1) and 845.500(b)(6). Any amendment of the fugitive dust control plan will be submitted to IEPA in accordance with 845.500(b)(5). The written CCR fugitive dust control plan must be amended whenever there is a change in conditions that would substantially affect the written plan in effect.

Amendment Number and Date	Pages or Section	Description of Amendment	Professional Engineer Certifying Plan
Version 0 October 2015	--	Initial Plan	Wendy M. Pennington
Amendment 1 October 2021	Various	Administrative changes and adjustments to site condition controls as appropriate.	John R. Hesemann

Table 6-1. CCR Fugitive Dust Control Plan Amendments

ATTACHMENT H

Intended for
Illinois Power Resources Generating, LLC

Date
October 25, 2021

Project No.
1940100806-003

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

GYPSUM MANAGEMENT FACILITY POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

RAMBOLL Bright ideas. Sustainable change.

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT DUCK CREEK POWER PLANT GYPSUM MANAGEMENT FACILITY POND

Project Name	**Duck Creek Power Plant Gypsum Management Facility Pond**
Project No.	**1940100806-003**
Recipient	**Illinois Power Resources Generating, LLC**
Document Type	**Hydrogeologic Site Characterization Report**
Revision	**FINAL**
Date	**October 25, 2021**

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APPENDICES

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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
bgs	below ground surface
CCR	coal combustion residuals
cm/s	centimeters per second
CSM	conceptual site model
CQA	Construction Quality Assurance
DCPP	Duck Creek Power Plant
DWW	Illinois Drinking Water Watch
ESRI	Environmental Systems Research Institute
FEMA	Federal Emergency Management Agency
ft/day	feet per day
ft/ft	feet per feet
GMF	Gypsum Management Facility
GMP	Groundwater Monitoring Plan
GWPS	Groundwater Protection Standard
Hanson	Hanson Professional Services, Inc.
HCR	Hydrogeologic Site Characterization Report
HDPE	high density polyethylene
HMP	Hydrogeologic Monitoring Plan
HUC	Hydrologic Unit Code
ID	identification
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
ILWATER	Illinois Water and Related Wells
IPRG	Illinois Power Resources Generating, LLC
ISAS	Illinois State Archaeological Survey
ISGS	Illinois State Geological Survey
ISWS	Illinois State Water Survey
mg/L	milligrams per liter
mil	millimeter
msl	above mean sea level
NAVD88	North American Vertical Datum of 1988
NGWMN	National Groundwater Monitoring Network
NID	National Inventory of Dams
No.	Number
NRCS	Natural Resources Conservation Service
NRT	Natural Resource Technology, Inc.
NRT/OBG	Natural Resource Technology, Inc., an OBG Company
oz/yd^2	ounce per square yard

Part 845	Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845
pCi/L	picocuries per liter
pcf	Pound per cubic foot
PMP	potential migration pathway
Ramboll	Ramboll Americas Engineering Solutions, Inc.
RCRA	Resource Conservation and Recovery Act
RQD	rock quality designation
SDWIS	Safe Drinking Water Information System
SI	Surface Impoundment
SSURGO	Soil Survey Geographic
SU	standard unit
TDS	total dissolved solids
USCS	Unified Soil Classification System
USFWS	United States Fish and Wildfire Service
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

EXECUTIVE SUMMARY

This Hydrogeologic Site Characterization Report (HCR) for the Gypsum Management Facility (GMF) Pond at Duck Creek Power Plant (DCPP) expands upon the hydrogeology, groundwater quality data, and conceptual site model (CSM) presented in previous hydrogeologic investigation reports prepared for the GMF Pond. 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 GMF Pond, which has been collected from 2015 to 2021. The GMF Pond (Vistra identification [ID] number [No.] 203, Illinois Environmental Protection Agency [IEPA] ID No. W0578010001-04, and National Inventory of Dams [NID] No. IL50573) is located at the DCPP southwest of Canton, Illinois (**Figure 1-1**).

The DCPP is located near the Duck Creek Cooling Pond, which was used as a source of cooling water for the power plant when it was active, and several small ponds which are remnants of the area's surface mining history. Prior to construction of the power plant and associated facilities, strip mining of coal took place within the property boundary of the DCPP. Currently, land use adjacent to the DCPP is agriculture, pasture, and forest with minimal development.

The GMF Pond is a 1500-foot by 900-foot earthen berm double-lined coal combustion residuals (CCR) Surface Impoundment (SI) located north of the former power plant. The GMF Pond decant water discharges to the lined GMF Recycle Pond. Several other CCR units are located on the DCPP property, including the Landfill located due north of the GMF Pond; the closed units, Ash Pond No. 1 and Ash Pond No. 2, located south of the GMF Pond; and the Bottom Ash Basin located between the former power plant and the closed Ash Pond Nos. 1 and 2.

Strip mining has occurred in this area since the 1930s. Strip mining in the site vicinity extracted coal from the Springfield (No. 5) Coal seam. Mining operations in the area have ceased. Strip mining has completely disrupted the natural stratigraphy down to the Springfield (No. 5) coal unit at some portions of the DCPP property. Previous investigations completed outside of the GMF Pond indicated that bedrock in the area is overlain by mine spoil ranging in thickness from approximately 10 to 75 feet. The mine spoil consists of excavated bedrock (weathered shale, shale fragments, and some coal fines) mixed with the sand, silts and silty clays of the unconsolidated glacial and aeolian deposits. The GMF Pond is located immediately adjacent to and downgradient of several former large surface mining areas.

In addition to the CCR within the lined GMF Pond, there are five layers of unlithified material present above the Pennsylvanian-age shaley siltstone and silty shale bedrock (Carbondale Formation). These materials have been categorized into three hydrostratigraphic units presented below in descending order:

- **Uppermost Aquifer:** At the GMF Pond this unit includes the Peoria/Roxanna Loess, the upper Radnor Till, and the shallow sands. These units are hydraulically connected and underlain by a thick till sequence of the Radnor Till (Natural Resource Technology, an OBG Company [NRT/OBG], 2017a). The shallow sands are laterally extensive across the site, vary in thickness from less than 1 to 18 feet, and are generally located at an elevation of 570 to 590 feet above mean sea level (msl). The shallow sand is saturated. During construction of the GMF Pond, sand was completely removed everywhere it was encountered (mainly the

northeast corner and southwest corner of the pond), putting the base of liner in contact with clay of the lower Radnor Till. Sand outside the GMF Pond footprint remains in place.

- **Lower Radnor Till/Lower Confining Unit:** Underlying the uppermost aquifer, the lower Radnor Till is approximately 42 to 58 feet thick.
- **Bedrock Confining Unit:** The thick and low permeability shaley siltstone, silty shale, and coal beds of the Carbondale Formation, are estimated to have a thickness of approximately 300 to 400 feet.

The Peoria/Roxanna Loess within the uppermost aquifer has also been identified as a potential migration pathway (PMP) for contaminant migration. While the primary migration pathway is the shallow sand of the uppermost aquifer, the groundwater within the overlying Peoria/Roxanna Loess has the potential to be impacted and is considered a PMP.

Groundwater migrates downward through the loess and upper Radnor Till into the shallow sands of the uppermost aquifer. Groundwater flow in the sands is generally in a northwest to southeast direction. Seasonal variation of groundwater levels at the GMF Pond are present and may fluctuate approximately 1 to 10 feet. There is no observable seasonal variation of groundwater flow direction at the GMF Pond associated with the elevation changes. Groundwater flows toward the Duck Creek Cooling Pond located approximately 2,100 feet east of the GMF Pond. The surface water elevation of the Cooling Pond is estimated from 562.5 to 565 feet North American Vertical Datum of 1988 (NAVD88). Which is approximately 20 feet lower than downgradient groundwater at the GMF Pond.

Part 845 parameters were monitored in uppermost aquifer and PMP monitoring wells as part of groundwater quality evaluations performed from 2015 to 2021. 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:

- Antimony, arsenic, cobalt, lead, pH, sulfate, and thallium were detected at least once at concentrations greater than the GWPS in downgradient uppermost aquifer wells (including PMP wells). Lead, mercury, pH, and thallium were detected at concentrations greater than the GWPS in upgradient uppermost aquifer wells. Radium 226 and 228 combined was detected once at concentrations greater than the GWPS in the bedrock confining unit well.

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 or 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
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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 B
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 3-2 to 3-5
845.620(b)(3)	Identification of nearby surface water bodies and drinking water intakes;	Sections 3.3.2 & 5.2 Appendix A
845.620(b)(4)	Identification of nearby pumping wells and associated uses of the groundwater;	Section 5.1 Appendix A
845.620(b)(5)	Identification of nearby dedicated nature preserves;	Section 5.3 Appendix A
845.620(b)(6)	Geologic setting;	Section 2 Figures 2-1 to 2-4
845.620(b)(7)	Structural characteristics;	Section 2.4.3 Figure 2-5
845.620(b)(8)	Geologic cross-sections;	Figures 2-7 and 2-8
845.620(b)(9)	Soil characteristics;	Section 2.3 Figure 2-2 Tables 2-1 & 2-4

TABLE ES-1. PART 845 REQUIREMENTS CHECKLIST
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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 & 3.2.3
845.620(b)(12)	Groundwater quality data;	Section 4.2 Table 4-1 & 4-2
845.620(b)(13)	Vertical and horizontal extent of the geologic layers to a minimum depth of 100 feet below land surface, including lithology and stratigraphy;	Section 2.5 Figures 2-7 through 2-9 Appendix B
845.620(b)(14)	A map displaying any known underground mines beneath a CCR surface impoundment;	Section 2.4.5 Appendix A
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 Appendices B & C
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 Appendices C & E
845.620(b)(16)(A)	water table depth;	Section 3.2.4 Figures 3-3 to 3-5
845.620(b)(16)(B)	hydraulic conductivities;	Section 3.2.5 Tables 2-1 & 3-3 Appendix E
845.620(b)(16)(C)	effective and total porosities;	Sections 2.5.1 Table 2-1

TABLE ES-1. PART 845 REQUIREMENTS CHECKLIST
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Part 845 Reference	Part 845 Components	Location of Information in HCR
845.620(b)(16)(D)	direction and velocity of groundwater flow; and	Sections 3.2.4 & 3.2.6 Tables 3-2, 3-4, & 4-2 Figures 3-3 to 3-5 Appendix D
845.620(b)(16)(E)	map of the potentiometric surface;	Figures 3-2 through 3-5
845.620(b)(17)	Groundwater classification pursuant to 35 I.A.C. § 620	Section 3.2.7

[O: EDP 08/24/21, C: LDC 09/16/21]

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: 35 I.A.C. § 845 (Part 845) (IEPA, April 15, 2021), Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this HCR on behalf of DCPP (**Figure 1-1**), operated by Illinois Power Resources Generating, LLC (IPRG). This report will apply specifically to the CCR Unit referred to as the GMF Pond. However, information gathered to evaluate other CCR units in the vicinity regarding geology, hydrogeology, and groundwater quality is included, where appropriate. The GMF Pond consists of a 1,500-foot by 900-foot earthen berm with 3.5:1 side slopes, a maximum elevation of 620 feet, a double geomembrane liner consisting of a 60-millimeter (mil) high-density polyethylene (HDPE) geomembrane liner, 12-inch clay cushion, 4 ounce per square yard (oz/yd^2) non-woven geotextile filter fabric, 12-inch highly permeable granular drainage (sand), 10 oz/yd^2 non-woven geotextile filter fabric, 60-mil HDPE geomembrane liner, reinforced bentonite mat, 36-inch compacted clay, all installed over in-situ foundation soil, and all pipes, pumps, and appurtenances necessary for the storage of approximately 3.6 million tons of gypsum at a maximum elevation of 715 feet with discharge to the GMF Recycle Pond. This HCR includes Part 845 content requirements specific to 35 I.A.C. § 845.620(b) (Hydrogeologic Site Characterization) for the GMF Pond at the DCPP.

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, the rules include procedures for public participation, closure alternatives analyses, and closure prioritization, and provides access to records via public website. The rules also include financial assurance requirements for CCR SIs.

A checklist 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 at the DCPP. The information presented in this HCR includes data collected in support of the monitoring well network established for development of the GMP and supplements comprehensive data collection and evaluations from prior hydrogeologic investigation reports (recent to oldest), including, but not limited to, the following:

- ***Hanson Professional Services, Inc. (Hanson), March 25, 2021. First Quarter 2021 Groundwater Report, Duck Creek Power Station, Gypsum Stack and Recycle Pond, WPC Permit No. 2017-EO-62640, Fulton County.***
  Quarterly comparison of groundwater monitoring results to the relevant groundwater standard and submittal of the quarterly sample results.

- ***Natural Resource Technology, an OBG Company (NRT/OBG), October 17, 2017. Hydrogeologic Monitoring Plan, Duck Creek GMF Pond – CCR Unit ID 203, Duck Creek Landfill – CCR Unit ID 204, Duck Creek Power Station, Canton, Illinois.***
  Hydrogeologic Monitoring Plan (HMP) prepared to provide background information necessary to support the groundwater monitoring system established to comply with Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.91 to regulate the disposal of CCR as solid waste under Subtitle D of the Resource Conservation and Recovery Act (RCRA) [40 C.F.R. § 257 Subpart D; published in 80 FR 21302-21501, April 17, 2015] for the DCPP located in Canton, Illinois.
- ***AECOM, October 2016. History of Construction, USEPA Final CCR Rule, 40 C.F.R. § 257.739(c), Duck Creek Power Station, Canton, Illinois.***
  History of construction for the Ash Pond No. 1, Ash Pond No. 2, and GMF Pond at the DCPP in accordance with 40 C.F.R. § 257.73(c).
- ***Hanson, March 2016. Clay Liner Evaluation Report, Illinois Power Resources Generating LLC, Duck Creek Power Station, Fulton County, Illinois.***
  Evaluation prepared to show that the existing liner in the GMF Pond meets the minimum requirements of the 40 C.F.R. § 257 regulations. Conclusion indicated that the as built liner exceeds the performance standard set by 40 C.F.R. § 257.70(b). Construction Quality Assurance (CQA) documents are presented to verify the integrity of the liner components.
- ***Natural Resource Technology, Inc. (NRT), March 31, 2016. Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan, Duck Creek Ash Ponds 1 and 2, Duck Creek Energy Center, Canton, Illinois.***
  This Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan was prepared to develop hydrogeologic information in support of a Closure Plan for the Duck Creek Energy Center Ash Ponds 1 and 2.
- ***Hanson, February 29, 2016. Ash Pond 1 and Ash Pond 2, Aquifer Evaluation in the Surface (Strip) Mining Area, Duck Creek Power Station, Illinois Power Resources Generating, LLC, Fulton County, IL.***
  Characterization of strip mining areas adjacent to Ash Ponds 1 and 2 at the DCPP.
- ***Hanson, March 2010. Hydrogeologic Report, Ameren Duck Creek Power Generating Station Solid Waste Disposal System (Ash Pond 1, Ash Pond 2, and Recycle Pond).***
  Hydrogeologic site characterization report for multiple ponds at the DCPP.
- ***Hanson, 2009. Section 3 – Hydrogeologic Report, in Support Document for Permit Application, Duck Creek Power Generating Station, Gypsum Management Facility, Springfield, Fulton County, Illinois.***
  An overview prepared to illustrate regional climate, geology, and hydrogeology and site-specific information related to geotechnical, hydrogeological, and geochemical characteristics found at the site.

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

1.4 Site Location and Background

The DCPP is located in Fulton County, Illinois and approximately 6 miles southeast of the town of Canton. The GMF Pond is located north of the power plant in Section 18 of Township 6 North,

Range 5 East (**Figure 1-1**). The GMF Recycle Pond is located just south of the GMF Pond (**Figure 1-2**). The DCPP is located near the Duck Creek Cooling Pond, which was used as a source of cooling water for the power plant when it was active, and several small ponds which are remnants of the area's surface mining history. The Landfill is located due north of the GMF Pond and the closed units, Ash Pond No. 1 and Ash Pond No 2, are located south of the GMF Recycle Pond. Prior to construction of the power plant and associated facilities, strip mining of coal took place within the property boundary of the DCPP (**Figure 1-1**). Currently, land use adjacent to the DCPP is agriculture, pasture, and forest with minimal development.

1.5 Site History and Unit Description

Surface preparation for the GMF Pond began in 2007 and construction took place from 2008 to 2009. The GMF Recycle Pond was constructed at the same time.

The GMF Pond, also referred to as the gypsum stack/management system, operates under an IEPA permit (#2017-E0-62640) issued in December 2017. It consists of a 1,500-foot by 900-foot earthen berm with 3.5:1 side slopes, a maximum elevation of 620 feet, a double geomembrane liner consisting of a 60-mil HDPE geomembrane liner, 12-inch clay cushion, 4 oz/yd^2 non-woven geotextile filter fabric, 12-inch highly permeable granular drainage (sand), 10 oz/yd^2 non-woven geotextile filter fabric, 60-mil HDPE geomembrane liner, reinforced bentonite mat, 36-inch compacted clay, all installed over in-situ foundation soil, and all pipes, pumps, and appurtenances necessary for the storage of approximately 3.6 million tons of gypsum at a maximum elevation of 715 feet with discharge to the GMF Recycle Pond.

The GMF Pond decant water discharges to the GMF Recycle Pond, which has a capacity of 32.6 million gallons. The GMF Recycle Pond is lined with a 60-mil HDPE geomembrane liner, reinforced bentonite mat and 36 inches of compacted clay.

2. REGIONAL AND LOCAL GEOLOGY

2.1 Topography

Topography within the DCPP property (**Figure 1-1**) is significantly influenced by the history of mining in the area. Strip mining has occurred in this area since the 1930s prior to mine reclamation laws; and, where present, has completely disrupted the natural stratigraphy down to the Springfield (No. 5) Coal unit. The strip mining activity has produced rough topography from soil piles and depressions, often ponded with water (Hanson, 2009). As discussed later in this document, soils in the immediate vicinity of the GMF Pond and GMF Recycle Pond do not appear to have been disturbed by surface mining activities; however, areas surrounding these ponds have been disturbed. Topography adjacent to the GMF Pond is provided in **Figure 2-1**.

2.2 Regional Geomorphology

The DCPP lies near the east edge of Fulton County in north central Illinois. The study area lies along the southeast edge of the Galesburg Plain Division of the Central Lowland Physiographic Province. The area consists of flat to gently rolling uplands that are dissected by many, deeply incised streams that are tributaries to major river systems. The erosional landforms have developed primarily within deposits of glacial drift that blanket Pennsylvanian-aged bedrock. The Pennsylvanian bedrock generally controls the landforms, particularly drainage ways and rivers in the area (Hanson, 2009).

The Illinois River delineates the southeast border of the Galesburg Plain and is the main drainage for the region. The physiography of many areas in the Galesburg Plain has been affected by strip mining of coal. Strip mines have altered the natural landforms and drainage systems. Unreclaimed strip mine areas are usually very hummocky with mine spoils and are pocked with ponds and depressions (Hanson, 2009).

2.3 Soils

Surficial soils at the Site and vicinity are shown on **Figure 2-2**, based on the soil survey performed in Fulton County in 1994 available in the Soil Survey Geographic database (SSURGO) by the United States Department of Agriculture Natural Resources Conservation Service (NRCS) provided by the Environmental Systems Research Institute (ESRI) web-hosted layer (NRCS, 1997).

Former soils underlying the Site are identified as Fayette Silt Loam (#280E2 and #280gD2), Keomah Silt Loam (#17A), and Rozetta Silt Loam (#279B and #279C2). The Fayette series consists of well drained loess on sideslopes along upland drainageways. This soil is well suited for and used as habitat for openland and woodland wildlife. These soils are moderately suitable for cultivated crops due to crusting and water erosion and unsuitable for dwellings due to flooding. The Keomah series consists of somewhat poorly drained loess in interfluvial areas. This soil is well suited for and used as habitat for openland wildlife. These soils are moderately suitable for cultivated crops due to crusting and flooding and only moderately suitable to unsuitable for dwellings due to slope. The Rozetta series consists of well drained loess in interfluvial areas, head slopes, and sideslopes along upland drainageways. This soil is well suited for and used as habitat for openland and woodland wildlife. These soils are moderately suitable for cultivated crops due to crusting and water erosion and only moderately suitable for dwellings due to flooding.

Areas surrounding the GMF Pond are classified as Hickory Silt Loam (#8cF), Elco Silt Loam (#119E2), and Clarksdale Silt Loam (#257A). The Hickory series consists of well-drained till. These soils formed on sideslopes along upland drainageways. Most areas of this association are moderately unsuitable for cultivated crops due to frost heave, low pH, and water erosion. The Elco series consists of moderately well drained loess and underlying paleosol. These soils formed in loess and till on sideslopes along upland drainageways. Most areas of this association are moderately suitable for cultivated crops due to frost heave, low pH, and water erosion. The Clarksdale series consists of somewhat poorly drained loess. These soils formed in interfluvial areas. Most areas of this association are moderately suitable for cultivated crops due to frost heave, low pH, and wetness.

2.4 Regional Geology

Regionally, the DCPP is positioned on the glacial uplands above the Illinois River in the Ancient Illinois Floodplain of the Till Plains Section of the Central Lowland Province.

2.4.1 Regional Unlithified Geology

Upper unlithified materials consist of Wisconsinan Stage materials overlying Illinoian Stage deposits. The undisturbed unlithified materials consist of loess, diamictons, and lacustrine/alluvial deposits. The area is flat to gently rolling uplands that are dissected by deeply incised streams that are tributaries to major river systems. The erosional landforms have developed primarily within deposits of glacial drift that blanket Pennsylvanian-aged bedrock (NRT/OBG, 2017a).

Areas near the GMF Pond are part of several large surface coal mines (**Figure 2-3**) where unlithified materials are present in the excavated strip mine spoils, but have been mixed due to the surface mining activities. Mining operations in the area have ceased (NRT/OBG, 2017a).

The Radnor Till is the only surficial Quaternary geologic deposit regionally mapped in the vicinity of the GMF Pond and is shown on **Figure 2-4**.

2.4.2 Regional Bedrock Geology

The uppermost bedrock stratum in the area is the Carbondale Formation of the Kewanee Group of the Pennsylvanian System. The Carbondale Formation consists of interbedded sequences of shale, sandstone, limestone, and coal with associated underclay. These sediments were deposited in shallow marine, deltaic, and swamp environments. Some of the shales are fossiliferous (containing either plant or marine fossils), and some contain sideritic nodules and bands. The sandstones are mostly subgraywackes and occur in elongated channel facies. The limestones are generally gray to dark gray, argillaceous, and normally fossiliferous. Thin black fissile shales are commonly associated with the limestones. The Carbondale Formation includes the principle Illinois economic coals: the Herrin (No. 6), the Springfield (No. 5), the Colchester (No. 2), and the Danville (No. 7). Underclays occur at the base of the coal seams. Strip mining in the site vicinity extracted coal from the Springfield (No. 5) coal seam (Hanson, 2009).

2.4.3 Structure

The bedrock surface in the site area has been mapped at about elevation 560 feet NAVD88. The bedrock mapping indicates the beds dip to the east-southeast at about 60 feet per mile. The St. Davis anticline occurs within the Pennsylvanian sequence and passes through the landfill area which explains the lack of strip mining activity in this portion of the DCPP (Hanson, 2005).

2.4.4 Seismic Setting

The major geologic structural features within Illinois are depicted on **Figure 2-5**. Fulton County is not located in a seismic impact zone. The nearest areas of present-day fault-related, seismic activity are the Northern Illinois Seismic Source Zone and the Wabash Valley Fault Zone near southwestern Indiana and the New Madrid Fault Zone along the Ohio and Mississippi River Valleys in southeastern Illinois. Records dating from 1811 indicate that earthquakes greater than a Richter Scale Magnitude 6.0 occurred in or near the New Madrid Fault line. Away from the fault, all earthquakes have been a 5.9 magnitude or less. The earthquake epicenters appear to be the result of modern regional stress fields and are not related to the nearby inactive faults (Hanson, 2009).

2.4.5 Mining Activities

Strip mining has occurred in this area since the 1930s. Strip mining in the site vicinity extracted coal from the Springfield (No. 5) Coal seam. Mining operations in the area have ceased. As indicated above, strip mining has completely disrupted the natural stratigraphy down to the Springfield (No. 5) Coal unit at some portions of the Site. Previous investigations completed outside of the GMF Pond at the Site also indicated that bedrock in the area is overlain by mine spoil ranging in thickness from approximately 10 to 75 feet (as observed at monitoring well OM24D and OM15 near the ash ponds). The mine spoil consists of excavated bedrock (weathered shale, shale fragments, and some coal fines) mixed with the sand, silts and silty clays of the unconsolidated glacial and aeolian deposits. The GMF Pond is located immediately adjacent to several former large surface mining areas (**Figure 2-3** and **Appendix A**).

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 from 2021 are shown on **Figure 2-6**. The major geomorphic features occurring within and nearby the GMF Pond include Peoria/Roxanna Loess overlying Glasford Formation clayey diamictons (till).

2.5.1 Site-Specific Unlithified Geology

The unlithified stratigraphy within and immediately surrounding the GMF Pond consists of the following in descending order: fill material and CCR; silt and clayey silt loess (Peoria/Roxanna Loess); weathered till (upper Radnor Till); shallow, medium-grained sand to silt zone within the Radnor Till; and till (lower Radnor Till). The unlithified units overlay Pennsylvanian-age shaley siltstone and silty shale bedrock (Carbondale Formation). Boring logs and monitoring well and piezometer construction forms obtained from investigations at the GMF Pond are provided in **Appendix B**. Cross-sections showing the subsurface materials encountered at the GMF Pond are included in **Figures 2-7 and 2-8**. Samples for geotechnical analysis were collected from interpreted geologic units and composited to obtain a representative sample of the entire geologic unit prior to submittal (**Table 2-1**).

2.5.1.1 Fill and CCR

Gypsum is present within the GMF Pond at a maximum thickness of approximately 22 feet, as estimated from topography and the elevation of the base of the liner from available construction details (**Figure 2-9**). The range of gypsum thickness is estimated from less than 1 to 22 feet.

The thickest areas of gypsum are to the north and west within the GMF Pond and thin toward the south end of the GMF Pond. The base of the liner rests on top of the lower Radnor Till.

Geotechnical analysis results from two grab samples (sample IDs Gypsum and LSN-3781/Gypsum) collected from the GMF Pond near XTPW01 are summarized in **Table 2-1**. Sample locations are shown on **Figure 2-6**, and geotechnical laboratory reports are included in **Appendix C**. Geotechnical results from grab samples near XTPW01 indicated the following:

- Average moisture content of 30.7 percent, with a range of 28.8 to 32.5 percent.
- Total porosity (calculated) of 56.1 percent.
- Dry density of 73.9 pounds per cubic foot (pcf).
- Average specific gravity of 2.51, with a range of 2.310 to 2.700.
- Grain size composition of 0 percent gravel, 4 percent sand, and 96 percent fines (silt and clay).
- Vertical hydraulic conductivity of 6.7×10^{-4} centimeters per second (cm/s).

Solid samples were collected from grab samples near XTPW01 in 2021 for chemical analysis. The results of solid samples collected from within the gypsum are summarized in **Table 2-2**.

To sample porewater, a piezometer (pre-pack well, XTPW02) was installed by Golder Associates, Inc. 5.5 feet into the gypsum on June 23, 2021. XTPW02 is located approximately 132 feet east of the western edge of the GMF Pond and is shown on **Figure 2-6**. The piezometer was installed using hand tools (no drilling log). A porewater sample was collected from XTPW02 on June 23, 2021. The results of porewater sample are summarized in **Table 2-3.**

2.5.1.2 Peoria/Roxanna Loess

The Wisconsinan Stage Peoria/Roxanna Loess extends from beneath the topsoil developed in the loess to depths ranging from 11 to 21 feet. The loess consists predominantly of silt and clayey silt with minor amounts of sand. The loess exhibits iron staining, concretions, and some fracturing. The Loess Unit is saturated below depths varying from approximately 3.5 to 11 feet.

Geotechnical analysis results from samples collected from Peoria/Roxanna Loess yielded Unified Soil Classification System (USCS) soil classifications of lean clay. Sample locations are shown on **Figure 2-6,** the geotechnical results from the most recent investigation are summarized in **Table 2-1**, and geotechnical laboratory reports are included in **Appendix C**. Geotechnical results indicated the following:

- Average moisture content of 22.0 percent, with a range of 18.6 to 25.9 percent.
- Average total porosity (calculated) of 37 percent, with a range of 32.4 to 41.8 percent.
- Average dry density of 103.8 pcf, with a range of 97.3 to 113.1 pcf.
- Average specific gravity of 2.67, with a range of 2.650 to 2.680.
- Average grain size composition of 0.1 percent gravel, 8.6 percent sand, and 91.4 percent fines (silt and clay). The fines content ranged from 88.2 to 97.4 percent, with a median value of 88.5 percent.

- Geometric mean vertical hydraulic conductivity of 2.1 x 10^{-7} cm/s and ranged from 7.1 x 10^{-8} to 6.3 x 10^{-7} cm/s.

Solid samples were also collected in 2021 for chemical analysis. The results of solid samples collected from the loess are summarized in **Table 2-4**.

2.5.1.3 Upper Radnor Till

The loess is generally underlain by a relatively thin till sequence consisting of the Berry Clay (where present) and the Illinoian Stage upper Radnor Till. The till sequence ranges in thickness from 9 to 21 feet in the area of the GMF Pond. This shallow till is generally weathered and exhibits signs of oxidation and fracturing. The till is primarily clayey silt with minor amounts of sand and gravel.

Geotechnical analysis results from samples collected from the upper Radnor Till yielded USCS soil classifications of lean clay. Sample locations are shown on **Figure 2-6,** the geotechnical results from the most recent investigation are summarized in **Table 2-1**, and geotechnical laboratory reports are included in **Appendix C**. Geotechnical results indicated the following:

- Average moisture content of 22.4 percent, with a range of 21.1 to 24.6 percent.
- Average total porosity (calculated) of 36.8 percent, with a range of 30.7 to 41.4 percent.
- Average dry density of 106.1 pcf, with a range of 98.0 to 116.7 pcf.
- Average specific gravity of 2.69, with a range of 2.680 to 2.700.
- Average grain size composition of 1.5 percent gravel, 22.6 percent sand, and 75.9 percent fines (silt and clay). The fines content ranged from 77 to 80.6 percent, with a median value of 75.4 percent.
- Geometric mean vertical hydraulic conductivity of 7.7 x 10^{-7} cm/s and ranged from 2.6 x 10^{-7} to 2.3 x 10^{-6} cm/s.

Solid samples were also collected in 2021 for chemical analysis. The results of solid samples collected from the upper Radnor Till are summarized in **Table 2-4**.

2.5.1.4 Shallow Sand Zone

The Shallow Sand Zone is laterally extensive within the Radnor Till across the site and varies in thickness from less than 1 to 18 feet near the GMF Pond. The top of the Shallow Sand Zone is generally located at an elevation of 570 to 590 feet msl. The Shallow Sand Zone exhibits lateral facies changes across the site and varies from a medium-grained sand to a silt and often contains intercalated till seams, as shown in the hydrogeologic cross sections (**Figures 2-7 and 2-8**). The Shallow Sand Zone is saturated. The Shallow Sand Zone is the most laterally extensive at the GMF Pond, with other zones having either an unsaturated component, intermittent presence, or entirely absent.

During construction, shallow sand was encountered and completely removed from underneath the northeast corner and southwest corner of the GMF Pond, putting the liner in contact with clay of the lower Radnor Till (**Figures 2-7 and 2-8**). Sand outside the GMF Pond footprint remains.

Geotechnical analysis results from samples collected from the Shallow Sand Zone yielded USCS soil classifications of silty lean clay and lean clay. These USCS classifications contain more fines

than expected, and are likely a result of difficulty targeting a thin sand zone within largely fine-grained materials. Sample locations are shown on **Figure 2-6**, the geotechnical results from the most recent investigation are summarized in **Table 2-1**, and geotechnical laboratory reports are included in **Appendix C**. Geotechnical results indicated the following:

- Average moisture content of 17.5 percent, with a range of 14.5 to 21.9 percent.
- Average total porosity (calculated) of 29.5 percent, with a range of 27.4 to 31.4 percent.
- Average dry density of 115.0 pcf, with a range of 105.1 to 122.3 pcf.
- Average specific gravity of 2.663, with a range of 2.640 to 2.700.
- Average grain size composition of 5.7 percent gravel, 27.1 percent sand, and 67.2 percent fines (silt and clay). The fines content ranged from 63.6 to 73.7 percent, with a median value of 64.4 percent.
- Geometric mean vertical hydraulic conductivity of 9.0×10^{-7} cm/s and ranged from 7.5×10^{-7} to 1.1×10^{-6} cm/s.

Solid samples were also collected in 2021 for chemical analysis. The results of solid samples collected from the Shallow Sand Zone are summarized in **Table 2-4**.

2.5.1.5 Lower Radnor Till

Till sequences underlying the Shallow Sand Zone consist of clay, silt, and sand of the Illinoian Stage lower Radnor Till. The till ranges in thickness from 42 to 58 feet. In some areas of the site, including the area near the GMF Pond, the till sequences typically extend from the base of the shallow sand to the bedrock surface. In other areas of the site, the till sequences extend to intermediate or deep sands. The till sequences are typically high in silt content with varying amounts of clay, sand, and gravel, and are often calcareous.

Geotechnical analysis results from samples collected from the lower Radnor Till at soil borings yielded USCS soil classifications of silty clayey sand, silty lean clay, and lean clay. Sample locations are shown on **Figure 2-6**, the geotechnical results from the most recent investigation are summarized in **Table 2-1**, and geotechnical laboratory reports are included in **Appendix C**. Geotechnical results indicated the following:

- Average moisture content of 10.5 percent, with a range of 7.7 to 12.6 percent.
- Average total porosity (calculated) of 22.3 percent, with a range of 20.6 to 23.5 percent.
- Average dry density of 127.5 pcf, with a range of 123.2 to 133.8 pcf.
- Average specific gravity of 2.670, with a range of 2.640 to 2.700.
- Average grain size composition of 7.7 percent gravel, 38.2 percent sand, and 54 percent fines (silt and clay). The fines content ranged from 49.3 to 56.5 percent, with a median value of 64.4 percent.
- Geometric mean vertical hydraulic conductivity of 4.7×10^{-7} cm/s and ranged from 4.1×10^{-8} to 5.4×10^{-6} cm/s.

Solid samples were also collected in 2021 for chemical analysis. The results of solid samples collected from the lower Radnor Till are summarized in **Table 2-4**.

2.5.2 Site Specific Bedrock Geology

Pennsylvanian bedrock was encountered at greatly varying depths across the site. Bedrock depths ranged from a minimum of 52 feet to a maximum of 108 feet. Bedrock was encountered at boring locations B-54, B-60, and G54C at 84 feet bgs, 88 feet bgs, and 90 feet bgs, respectively, in the vicinity of the GMF Pond (**Appendix D** for boring locations). The bedrock shows little compositional variation across the site and consists primarily of shaley siltstone and silty shale. The shale bedrock unit is typically weathered near the surface, has low hydraulic conductivity, and underlies the glacial till sequences. These units often contain thin dolomite ledges and nodules and some fractures.

3. REGIONAL AND LOCAL HYDROGEOLOGY

3.1 Regional Hydrogeology

As discussed in **Section 2**, unlithified materials consist of Wisconsinan Stage materials overlying Illinoian Stage deposits. The undisturbed unlithified materials consist of loess, diamictons, and lacustrine/alluvial deposits overlying Pennsylvanian-aged bedrock. The area is flat to gently rolling uplands that are dissected by deeply incised streams that are tributaries to major river systems in areas that have not been disturbed by strip mining activity.

Available records of wells within one mile of the site indicate potable water may be obtained from unconsolidated materials or from deep bedrock. Estimated specific capacity (used to approximate the transmissivity of a formation) indicated shallow sands near the GMF Pond provide a very modest specific capacity and groundwater yield (Hanson, 2009).

3.2 Site Hydrogeology

Wells used for groundwater monitoring at the GMF Pond have been constructed in phases since 2008. Prior to 2021, there were more than 30 wells used to monitor the GMF Pond. In 2021, one additional well (G54C) was installed in bedrock to provide information to meet the requirements of Part 845. Construction details for monitoring wells and piezometers associated with the GMF Pond are provided in **Table 3-1** and depicted in **Figure 3-1**. Boring logs, monitoring well and piezometer construction forms are provided in **Appendix B**.

3.2.1 Hydrostratigraphic Units

Three distinct water-bearing layers have been identified at the Site based on stratigraphic relationships and common hydrogeologic characteristics which are summarized and discussed in subsequent sections:

- **The Uppermost Aquifer**: At the GMF Pond this unit includes the Peoria/Roxanna Loess, the upper Radnor Till, and the shallow sands described in detail in **Section 2.5.1**. These units are hydraulically connected and underlain by a thick till sequence of the Radnor Till (NRT/OBG, 2017a). The shallow sands are laterally extensive across the site, vary in thickness from less than 1 to 18 feet, and are generally located at an elevation of 570 to 590 feet msl. The shallow sand is saturated. During construction of the GMF Pond, sand was completely removed everywhere it was encountered (mainly the northeast corner and southwest corner of the pond), putting the base of liner in contact with clay of the lower Radnor Till. Sand outside the GMF Pond footprint remains in place.
- **Lower Radnor Till/Lower Confining Unit**: Underlying the uppermost aquifer, the lower Radnor Till is approximately 42 to 58 feet thick. Previous hydrogeologic studies indicate discontinuous sand lenses observed within the till are not hydraulically connected to the shallow sand unit (NRT/OBG, 2017a).
- **Bedrock Confining Unit**: The thick and low permeability shaley siltstone, silty shale, and coal beds of the Carbondale Formation, are estimated to have a thickness of approximately 300 to 400 feet. The boring for monitoring well G54C extends 11.5 feet into the bedrock. Additional bedrock detail is provided in **Section 2.5.2**.

3.2.2 Uppermost Aquifer

As stated above, this unit includes the Peoria/Roxanna Loess, the upper Radnor Till, and the shallow sand zone. The shallow sand zone is the primary migration pathway within these hydraulically connected formations. In places where the shallow sand unit is absent (such as beneath the GMF Pond Liner) the uppermost aquifer may be functionally absent, as the liner is in contact with clay till. Groundwater monitoring is focused in the shallow sand unit because it is the most permeable and laterally continuous unit at the Site. The top of the uppermost aquifer is presented in **Figure 3-2.** The base of the uppermost aquifer is the lower confining unit (the lower Radnor Till).

3.2.3 Potential Migration Pathway

The Peoria/Roxanna Loess within the uppermost aquifer has also been identified as a PMP. While the primary migration pathway is the shallow sand of the uppermost aquifer, impacts have the potential to migrate within groundwater in the overlying Peoria/Roxanna Loess. The PMP is saturated at depths of 3.5 to 11 feet bgs. While the PMP and uppermost aquifer are hydraulically connected, groundwater flow in the PMP is expected to be primarily vertical, with the majority of the horizontal migration expected to occur within the uppermost aquifer. Monitoring wells with the suffix "L" are screened within the loess and provide representative data on the hydraulic properties and groundwater quality of the PMP.

3.2.4 Water Table Elevation and Groundwater Flow Direction

Groundwater flow across the GMF Pond within the uppermost aquifer is consistently in a southeast direction toward the Duck Creek Cooling Pond (**Figures 3-3 and 3-4**). Groundwater elevations of the uppermost aquifer vary seasonally although flow directions are generally consistent (additional contour maps are included in **Appendix D**).

Groundwater elevations in the PMP wells are generally higher than those in the uppermost aquifer and reflect the groundwater flow in the underlying uppermost aquifer wells. Surface water elevations within the GMF Pond are higher than the groundwater.

3.2.4.1 Vertical Hydraulic Gradients

Vertical hydraulic gradients were calculated using available groundwater elevation data from April to August 2021 at wells screened in the PMP, uppermost aquifer, and bedrock (**Table 3-2**). The results of the vertical hydraulic gradient calculations between these hydrostratigraphic units are summarized below:

- Uppermost aquifer to PMP:
  - Vertical hydraulic gradients between wells G51L (PMP) and G51S (uppermost aquifer) ranged from -0.01 to -0.03 feet per feet (ft/ft), upward, averaging 0.02 ft/ft upward
  - G54L (PMP) and G54S (uppermost aquifer) ranged from 0.01 to 0.09 ft/ft downward, averaging 0.04 ft/ft downward
  - G57L (PMP) and G57S (uppermost aquifer) ranged from -0.04 ft/ft upward to 0.12 ft/ft downward, averaging 0.02 ft/ft downward
  - G60L (PMP) and G60S (uppermost aquifer) ranged from 1.2 to 1.6 ft/ft downward, averaging 1.3 ft/ft downward

- Bedrock confining unit to uppermost aquifer:
  - Vertical hydraulic gradients between wells G54C (bedrock confining unit) and G54S (uppermost aquifer) ranged from 0.17 to 0.27 ft/ft, downward, averaging a downward vertical gradient of 0.20 ft/ft

The downward gradients observed between downgradient wells G54L and G54S, and G60L and G60S, are consistent with vertical gradients reported by Hanson in 2009. The slightly upward gradient between upgradient wells G51L and G51S, and the variable gradients between downgradient wells G57L and G57S did not have a comparable measurement from previous studies.

3.2.4.2 Impact of Existing Ponds and Ash Saturation

The GMF Pond is lined, as described in **Section 1.5,** and the shallow sands of the uppermost aquifer were removed from within the footprint of the pond. The phreatic surface measured from a transducer at location X301 within the GMF Pond ranges from approximately 613 to 617 feet NAVD88 with an average around 614 feet (**Appendix D**), whereas groundwater elevations measured in monitoring wells located around the GMF Pond and screened within the uppermost aquifer range from approximately 590 to 578 feet NAVD88. Groundwater elevation contours indicate groundwater generally flow to the southeast, with no indication of radial flow. The elevation difference between the phreatic surface and groundwater elevations, in addition to no observations of radial flow, provide evidence that the GMF Pond does not impact groundwater flow directions via recharge to groundwater. Given the low permeability of the liner system, it is more likely that the GMF Pond is a barrier to groundwater flow within the uppermost aquifer, deflecting flow from upgradient areas around the perimeter of the pond toward the downgradient areas.

With the relatively stable phreatic surface elevation within the pond around 614 feet, the thickness of saturated CCR (gypsum) in the pond will correspond with the thickness of gypsum in the pond. Thicker accumulations of gypsum are present in the north end of the pond and thin to the south.

3.2.4.3 Impact of Surface Water Bodies

The nearest surface water body to the GMF Pond is the Duck Creek Cooling Pond, which is located approximately 2,100 feet east of the GMF Pond. The surface water elevation of the Cooling Pond is estimated to be from 562.5 to 565 feet NAVD88. Which is approximately 20 feet lower than downgradient groundwater at the GMF Pond, indicating that groundwater in the vicinity of the GMF Pond is flowing toward the Cooling Pond. The shoreline of the Cooling Pond is very irregular (**Figure 1-1**) as it occupies the former surface water drainage features associated with Duck Creek (which was impounded to create the Cooling Pond).

3.2.5 Hydraulic Conductivities

3.2.5.1 Field Hydraulic Conductivities

Field hydraulic conductivity tests were performed in the uppermost aquifer by Hanson in 2021. Hydraulic conductivity test analyses and results are summarized in **Table 3-3** and provided in **Appendix E**. Field hydraulic conductivity tests from monitoring wells G50L, G51L, G53L, G54L, G60L, G50S, G51S, G53S, G54S, G57S, G60S, and G63S indicated hydraulic conductivities from 3.0×10^{-5} to 3.9×10^{-3} cm/s with a geometric mean of 3.6×10^{-4} cm/s.

Results of field hydraulic conductivity tests conducted in 2021 in the bedrock confining unit by Hanson at monitoring well G54C ranged from 1.4 x 10^{-4} to 1.6 x10^{-4} cm/s, with a geometric mean of 1.5 x 10^{-4} cm/s. This is higher in comparison to the horizontal hydraulic conductivity range of 1.3 x 10^{-6} cm/s to 1.3 x 10^{-9} cm/s, established by Hanson in 2015, which used pressure testing on borehole OM32. The higher values observed at G54C are attributed to the highly weathered nature of the bedrock in the screen interval which is supported by the low rock quality designation (RQD) N values ranging from 14-22 (lower numbers indicating lower percentage of intact rock core recovered).

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 on **Figure 2-6**. The geotechnical laboratory report from the most recent investigation and previous investigations (AECOM, 2016) are provided in **Appendix C**. The results are summarized in **Table 2-1** and discussed below.

- One CCR sample (LSN-3781) was collected from gypsum boring XTPW01. Laboratory falling head permeability test results in the CCR indicated a vertical hydraulic conductivity of 6.7 x 10^{-4} cm/s.
- Two samples were collected from the lower Radnor Till from soil boring G54C. Laboratory falling head permeability test results in the lower Radnor Till indicated a vertical hydraulic conductivity ranging from 4.1 x 10^{-8} to 5.4 x 10^{-6} cm/s.
- Seven samples were collected from the uppermost aquifer from soil borings G54C, SB50, and SB62. Laboratory falling head permeability test results in the uppermost aquifer indicated vertical hydraulic conductivities ranging from 7.1 x 10^{-8} to 1.1 x 10^{-6} cm/s, and a geometric mean vertical hydraulic conductivity of 4.6 x 10^{-7} cm/s.

3.2.6 Horizontal Groundwater Gradients and Flow Velocities

Groundwater flow around the GMF is generally in a southeast direction (**Figures 3-3 through 3-4**). Seasonal variation of groundwater levels at the GMF Pond are indicated in the series of 2015 to 2020 groundwater elevation contour maps and groundwater elevation table (**Appendix D**). Observed groundwater elevations may fluctuate seasonally by 1 to 10 feet. There is no observable seasonal variation of groundwater flow direction at the GMF Pond.

Horizontal hydraulic gradients and groundwater velocities for the uppermost aquifer were calculated based upon groundwater elevation measurements from April through August 2021 between G50S and G60S, G51S and G54S, and G50S and G64S (**Table 3-4**). Horizontal hydraulic gradients are slight across the GMF Pond and ranged from 0.0111 ft/ft between G50S and G64S in August 2021 to 0.0225 ft/ft between G51S and G54S in May 2021. The hydraulic gradients are consistent with previous calculations of horizontal gradients at upgradient locations (NRT/OBG, 2017a).

Horizontal hydraulic gradients calculated to the north of the GMF Pond, between G50S and G64S, were on average 0.0121 ft/ft with an average groundwater velocity of 0.045 feet per day (ft/day). Horizontal hydraulic gradients calculated through the center of the GMF Pond, between G50S and G60S, were on average 0.0172 ft/ft with an average groundwater velocity of 0.625 ft/day. Horizontal hydraulic gradients calculated to the south of the GMF Pond, between G51S

and G54S, were on average 0.0199 ft/ft, with an average groundwater velocity of 0.041 ft/day. From April to June 2021, average groundwater flow velocities at the GMF Pond were 0.024 ft/day and from July to August 2021, groundwater flow velocities at the GMF Pond were on average 0.023 ft/day. Horizontal hydraulic gradients and groundwater flow velocities are presented in **Table 3-4**.

3.2.7 Groundwater Classification

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

- Groundwater in the uppermost aquifer extends 10 feet or more below the land surface.
- Hydraulic conductivity exceeds the 1×10^{-4} cm/s criterion (**Table 3-3**).

Field hydraulic conductivity tests performed on the unlithified geologic materials that include loess, shallow sand, and intermediate sand at the GMF Pond had geometric mean hydraulic conductivities exceeding 1×10^{-4} cm/s. Based on this information groundwater is classified as Class I – Potable Resource Groundwater.

However, background (upgradient) groundwater originates from areas north and west of the GMF Pond that have been surface mined and present a significant alternative source for groundwater impacts.

3.3 Surface Water Hydrology

Surface water drainage over much of the site flows east or southeast into the Duck Creek Cooling Pond. The Duck Creek Cooling Pond was formed by damming a portion of Duck Creek, a minor tributary of the Illinois River, and was used for thermal treatment of cooling water discharged from the DCPP.

3.3.1 Climate

The climate in Canton is humid and annual precipitation generally exceeds evapotranspiration. Illinois State Water Survey (ISWS) records from 1989 through 2020 at Peoria, Illinois, which is located approximately 35 miles northeast of the DCPP, indicates precipitation averages 35.3 inches per year. Monthly precipitation averages higher than 3 inches from April through August, and 1 to 3 inches in September through March. On average 16 inches of precipitation occur as snowfall.

As shown in **Table A** below, ISWS temperature records show average maximum daily temperatures for 1989 to 2020 ranging from above 70 degrees Fahrenheit (°F) in May through September and minimum average daily temperatures that are below freezing December through March.

Table A. Average Monthly Temperature Extremes and Precipitation for Peoria, Illinois

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Maximum Temperature (ºF)	33.3	37.6	49.9	62.5	72.6	81.3	84.4	82.5	76.9	64.5	50.1	37.2	61.2
Minimum Temperature (ºF)	18.3	21.5	31.6	41.8	52.2	61.7	65.4	63.2	55.4	44.1	33.3	22.7	42.7
Precipitation (inches)	1.71	1.60	2.08	3.42	3.93	3.18	3.02	3.10	2.97	2.64	2.35	1.84	35.3
https://www.isws.illinois.edu/warm/stationmeta.asp?site=ICC&from=wx													

3.3.2 Surface Waters

Duck Creek formerly bordered the east perimeter of the DCPP. In this area, Duck Creek has been dammed for use for thermal treatment of cooling water discharge from the DCPP and is now the predominant surface water body in the vicinity of the GMF Pond. Surface water elevations of the Cooling Pond are from 562.5 to 565 feet NAVD88. Other surface waters in the vicinity include Buckheart Creek to the west, and Rice Lake, Miserable Lake, Big Lake, and Goose Lake to the east, all of which are backwater lakes located between Duck Creek and the Illinois River. The distance between the GMF Pond and the Illinois River is sufficient to eliminate influence on local flow conditions at the site; therefore, site-specific flow conditions are not subject to surface water conditions of the Illinois River. Other surface waters in the vicinity of the GMF Pond include freshwater emergent wetland to the east, and various freshwater ponds to the northeast, south, southeast, and southwest.

4. GROUNDWATER QUALITY

4.1 Summary of Groundwater Monitoring Activities

Groundwater monitoring programs are currently being conducted at the GMF Pond as required by USEPA and IEPA. Additional monitoring was completed in 2021 for development of the Part 845 monitoring program. These programs are summarized below.

4.1.1 40 C.F.R. § 257 Program Monitoring and Well Network

The 40 C.F.R. § 257 Well Network consists of seven monitoring wells screened in the uppermost aquifer nearby and adjacent to the GMF Pond including: three background monitoring wells (G02S, G50S, and G51S) and four compliance monitoring wells (G54S, G57S, G60S, and G64S). The boring logs, well construction forms, and other related monitoring well forms for the GMF Pond 40 C.F.R. § 257 Well Network are included in **Appendix B** of this HCR. The well locations are shown on **Figure 3-1**.

Groundwater is being monitored at the GMF Pond 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 GMF Pond (NRT/OBG, 2017b). Results are discussed in **Section 4.2**.

The 40 C.F.R. § 257 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]		
pH	Groundwater Elevation	
Appendix III Parameters (Total, except total dissolved solids [TDS])		
Boron	Chloride	Sulfate
Calcium	Fluoride	TDS

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

4.1.2 IEPA Groundwater Monitoring

Routine quarterly groundwater monitoring is completed at GMF Pond wells G50L/S, G51L/S, G52L/S, G53L/S, G54L/S, G55L/S, G56L/S, G57L/S, G58L/S, G59L/S, G60L/S, R61L/G61S, G62L, G63L/S, and G64L/S at the GMF Pond, in accordance with Water Pollution Control Permit No. 2017-E0-62640. This permit also requires sampling G65L/S, G66L/S, G67L/S, G70L, G71L/S, and G72L/S at the GMF Recycle Pond. The boring logs, well construction forms, and other related monitoring well forms for the GMF Pond well network are included in **Appendix B** of this HCR. The GMF Pond well locations are shown on **Figure 3-1**. Quarterly and annual samples are analyzed for the following field and laboratory parameters listed in **Table C** below.

Table C. IEPA Groundwater Monitoring Program Parameters

Field Parameters			
pH	Temperature	Specific Conductance	
Groundwater Elevation	Depth to Water (bmp)	Bottom of Well Elevation	
Quarterly Parameters (Dissolved)			
Arsenic	Cadmium	Lead	Sulfate
Boron	Chloride	Manganese	TDS
Annual Parameters (Dissolved)			
Alkalinity, bicarbonate	Chromium	Mercury	Selenium
Alkalinity, carbonate	Cobalt	Nickel	Sodium
Ammonia as Nitrogen	Iron	Nitrate nitrogen	Zinc
Calcium	Magnesium	Potassium	

4.1.3 Part 845 Well Installation and Groundwater Monitoring

In 2021, one additional monitoring well (G54C) was installed between the GMF Pond and the Gypsum Recycling Pond to assess the vertical and horizontal lithology, stratigraphy, chemical properties, and physical properties of geologic layers to a minimum of 100 feet bgs as specified in 35 I.A.C. § 845.620(b). Additionally, a porewater sample was collected from temporary leachate monitoring location (XTPW02) installed within the GMF Pond to characterize the CCR materials.

Prospective Part 845 monitoring wells were sampled for eight rounds from February to August 2021 and the results were assessed for selection of the GMF Pond Part 845 monitoring well network presented in the groundwater monitoring plan. Samples were collected from the new monitoring points and analyzed for 35 I.A.C. § 845.600 parameters summarized in **Table D** below. Part 845 groundwater monitoring results are included below in **Section 4.2**.

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 were recorded during sample collection.

4.2 Groundwater Monitoring Results and Analysis

Groundwater data collected from the GMF Pond 40 C.F.R. § 257 network monitoring wells from 2015 to 2021 were supplemented with sampling of additional locations in 2021 and 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. 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].

4.2.1 Total Antimony

Total antimony was detected greater than the GWPS (0.006 milligrams per liter [mg/L]) in one of eight samples collected from downgradient well G57S. The other seven samples were non-detect. No other exceedances for total antimony were observed.

4.2.2 Total Arsenic

Total arsenic was detected greater than the GWPS (0.01 mg/L) in eleven downgradient wells G52S, G35S, G54L, G56S, G57L, G58L, G59L, G59S, G60S, G64S and P60. Total arsenic concentrations ranged from 0.001 to 0.051 mg/L. G52S is commonly in a side-gradient or upgradient position.

4.2.3 Total Cobalt

Total cobalt was detected greater than the GWPS (0.006 mg/L) in one of eight samples collected from downgradient well 60L. The other seven samples ranged from non-detect to 0.0052 mg/L. No other exceedances of total cobalt were observed.

4.2.4 Total Lead

Total lead was detected greater than the GWPS (0.0075 mg/L) in nine downgradient wells (G52S, G55S, G56S, G58L, G58S, G59L, G59S, G60S, G63L, and P60); and one background well G51S. Total lead concentrations in downgradient wells ranged from non-detect to 0.041 mg/L. Total lead concentrations in the upgradient well ranged from non-detect to 0.015 mg/L. G52S is commonly in a side-gradient or upgradient position.

4.2.5 Total Mercury

Total mercury was detected greater than the GWPS (0.002 mg/L) in one of 16 samples collected from upgradient well G02S. The other 15 samples were non-detect. No other exceedances for total mercury were observed.

[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.

4.2.6 pH (Lower Limit)

The GWPS lower standard for pH (6.5 standard units [SU]) was exceeded at four downgradient wells (G52L, G54L, G60L, and P60); and one background well G02S. Measurements of pH ranged from 6 to 7.1 SU in downgradient wells. Measurements ranged from 6.4 to 7.1 SU in the background well. G52L is commonly in a side-gradient or upgradient position.

4.2.7 Radium 226 and 228 Combined

Radium 226 and 228 combined was detected greater than the GWPS (5 picocuries per liter [pCi/L]) in one of five samples collected from bedrock well G54C. Observations ranged from non-detect to 5.38 pCi/L. No other exceedances for radium 226 and 228 combined were observed.

4.2.8 Total Sulfate

Sulfate can be a primary indicator parameter of CCR leachate impacts on groundwater quality. Total sulfate has been detected greater than the GWPS (400 mg/L) at downgradient well G58S in two of four samples. Total sulfate concentrations ranged from 250 to 540 mg/L. No other exceedances of total sulfate were observed.

4.2.9 Total Thallium

Total thallium was detected greater than the GWPS (0.002 mg/L) in one downgradient well (G57S); and one background well G51S. One of eight samples collected for total thallium from downgradient well G57S exceeded the GWPS; the other seven samples were non-detect. One of 16 samples collected for total thallium from background well G51S exceeded the GWPS; the other 15 samples were non-detect. No other exceedances for total thallium were observed.

5. EVALUATION OF POTENTIAL RECEPTORS

5.1 Water Well Survey

A water well survey was conducted for a 1,000 meter radius of the GMF Pond (Hanson, 2021; Ramboll, 2021). Additionally, a potable water well inventory was completed in 2021 utilizing federal and state databases to assess nearby pumping wells, drinking water receptors, and other uses of water in the vicinity of the GMF Pond. The following sources of information were queried to identify well locations, drinking water receptors, and other uses of water within 1,000 meters of the GMF Pond boundary:

- United States Geological Survey (USGS) National Groundwater Monitoring Network (NGWMN)[1]
- Illinois State Geological Survey (ISGS) Illinois Water and Related Wells (ILWATER) Map[2]
- USEPA Safe Drinking Water Information System (SDWIS)[3]
- IEPA Illinois Drinking Water Watch (DWW)[4]

According to the ISGS ILWATER Map, USEPA SDWIS, and IEPA DWW available records, there is one private well located southwest of the GMF Pond and within 1,000-meters of the GMF Pond. There is no data for Fulton County available from USGS NGWMN.

5.2 Surface Water

A search was performed utilizing the United States Fish and Wildlife Service (USFWS) Wetlands Mapper[5] and the USGS National Map[6] for surface water bodies within 1,000 meters of the GMF Pond.

As indicated on the USFWS Wetlands Mapper and USGS National Map, various surface water features were identified within a 1,000-meter radius of the GMF Pond. Surface waters in the vicinity of the GMF Pond include freshwater emergent wetland to the east, and various freshwater ponds to the northeast, south, southeast, and southwest (**Appendix A**).

The predominant surface water body in the region is the Illinois River and associated lowland backwater lakes. Duck Creek, a minor tributary of the Illinois River, formerly bordered the east perimeter of the DCPP. In this area, Duck Creek has been dammed for use for thermal treatment of cooling water discharge from the DCPP and is now the predominant surface water body in the vicinity of the GMF Pond. The distance between the GMF Pond and the Illinois River is sufficient to eliminate influence on local flow conditions at the site; therefore, site-specific flow conditions are not subject to surface water conditions of the Illinois River. Other surface waters in the vicinity of the GMF Pond include freshwater emergent wetland to the east, and various freshwater ponds to the northeast, south, southeast, and southwest. The USGS National Map places the DCPP within the lower Illinois-Lake Chautauqua watershed subbasin (Hydrologic Unit Code [HUC] 07130003) (**Appendix A**).

[1] USGS NGWMN: https://cida.usgs.gov/ngwmn/index.jsp
[2] ISGS ILWATER Map: https://prairieresearch.maps.arcgis.com/apps/webappviewer/index.html?id=e06b64ae0c814ef3a4e43a191cb57f87
[3] USEPA SDWIS: https://www.epa.gov/enviro/sdwis-search
[4] IEPA Illinois DWW: http://water.epa.state.il.us/dww/index.jsp
[5] USFWS Wetlands Mapper: https://www.fws.gov/wetlands/data/mapper.html
[6] USGS National Map: https://apps.nationalmap.gov/viewer/

A Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map for Fulton County Unincorporated Areas, Illinois (Map No. 17057C0375E, effective on 02/04/2011) is attached in **Appendix F**. The flood hazard areas to the east of the DCPP are defined as those areas subject to inundation by the 1 percent annual chance flood (*i.e.,* 100-year flood), also known as the base flood, that has a 1 percent chance of being equaled or exceeded in any given year.

5.3 Nature Preserves, Historic Sites, Endangered/Threatened Species

A search of the Illinois Department of Natural Resources (IDNR) Natural Heritage Database[7] for natural areas and protected areas within 1,000 meters of the GMF Pond was performed. According to the IDNR Natural Heritage Database, there are 15 Natural Areas in Fulton County, including two Category III - Nature Preserves (Harper-Rector Woods Nature Preserve [34.67 acres] and Kedzior Woodlands Land and Water Reserve [163.64 acres]). No natural areas were identified within 1,000 meters of the GMF Pond.

The IDNR Natural Heritage Database Threatened and Endangered Species by County[8] lists 11 state threatened and 12 state endangered species in Fulton County. The USFWS Environmental Conservation Online System[9] lists three federally threatened and one federally endangered species in Fulton County (**Appendix A**).

Additionally, a search of the IDNR Historic Preservation Division[10] database for historic sites in the vicinity of the Site yielded no results within 1,000 meters of the GMF Pond. The Illinois State Archaeological Survey (ISAS)[11] databases that do not require credentials to access were also searched and yielded no results within 1,000 meters of the GMF Pond.

[7] IDNR Natural Heritage Database: https://www2.illinois.gov/dnr/conservation/NaturalHeritage/Pages/NaturalHeritageDatabase.aspx
[8] Illinois Threatened and Endangered Species by County: https://www2.illinois.gov/dnr/ESPB/Documents/ET_by_County.pdf
[9] Illinois Threatened and Endangered Species by County: https://www2.illinois.gov/dnr/ESPB/Documents/ET_by_County.pdf
[10] IDNR Historic Preservation Division: https://www2.illinois.gov/dnrhistoric/Pages/default.aspx
[11] ISAS: https://www.isas.illinois.edu/

6. CONCLUSIONS

Hydrogeologic characterization of the GMF Pond was originally developed as part of the *Hydrogeologic Report, in Support Document for Permit Application, Duck Creek Power Generating Station, Gypsum Management Facility, Fulton County, Illinois* (Hanson, 2009) and most recently updated for this HCR. Results of these hydrogeologic studies were reintroduced in this HCR and updated to include geologic, hydrogeologic, and groundwater quality data collected with a focus on the GMF Pond (Part 845 regulated) CCR Unit.

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

The results of the hydrogeologic and groundwater quality evaluation are:

- The unlithified stratigraphy within and immediately surrounding the GMF Pond consists of the following in descending order: fill material and CCR (gypsum); silt and clayey silt loess (Peoria/Roxanna Loess); weathered till (upper Radnor Till); shallow, medium-grained sand to silt zone; and till (lower Radnor Till).
- The unlithified units overlay Pennsylvanian-age shaley siltstone and silty shale bedrock (Carbondale Formation). Bedrock was encountered approximately 90 feet bgs at the GMF Pond.
- Strip mining has occurred in this area since the 1930s. Strip mining in the site vicinity extracted coal from the Springfield (No. 5) Coal seam. Mining operations in the area have ceased. Strip mining has completely disrupted the natural stratigraphy down to the Springfield (No. 5) Coal unit at some portions of the DCPP property. Previous investigations completed outside of the GMF Pond indicated that bedrock in the area is overlain by mine spoil ranging in thickness from approximately 10 to 75 feet. The mine spoil consists of excavated bedrock (weathered shale, shale fragments, and some coal fines) mixed with the sand, silts and silty clays of the unconsolidated glacial and aeolian deposits. The GMF Pond is located immediately adjacent to and downgradient of several former large surface mining areas.
- Three distinct water-bearing layers have been identified at the Site based on stratigraphic relationships and common hydrogeologic characteristics:
  - **Uppermost Aquifer:** At the GMF Pond this unit includes the Peoria/Roxanna Loess, the upper Radnor Till, and the Shallow Sand Zone. These units are hydraulically connected and underlain by a thick till sequence of the Radnor Till (NRT/OBG, 2017a). The shallow sands are laterally extensive across the site, vary in thickness from less than 1 to 18 feet, and are generally located at an elevation of 570 to 590 feet msl. The shallow sand is saturated. During construction of the GMF Pond, sand was completely removed everywhere it was encountered (mainly the northeast corner and southwest corner of the pond), putting the base of the liner in contact with clay of the lower Radnor Till. Sand outside the GMF Pond footprint remains in place.
  - **Lower Radnor Till/Lower Confining Unit:** Underlying the uppermost aquifer, the lower Radnor Till is approximately 42 to 58 feet thick.

  - **Bedrock Confining Unit:** The thick and low permeability shaley siltstone, silty shale, and coal beds of the Carbondale Formation, are estimated to have a thickness of approximately 300 to 400 feet.

- Groundwater flow around the GMF Pond is generally in a southeast direction. Seasonal variation of groundwater levels at the GMF Pond are present and may fluctuate approximately 1 to 10 feet. There is no observable seasonal variation of groundwater flow direction at the GMF Pond associated with the elevation changes.
- Surface water drainage over much of the site flows east or southeast into the Duck Creek Cooling Pond. The Duck Creek Cooling Pond was formed by damming a portion of Duck Creek, a minor tributary of the Illinois River.
- The nearest surface water body to the GMF Pond is the Duck Creek Cooling Pond, which is located approximately 2,100 feet east of the GMF Pond. The surface water elevation of the Cooling Pond is estimated from 562.5 to 565 feet NAVD88. Which is approximately 20 feet lower than downgradient groundwater at the GMF Pond, indicating that groundwater in the vicinity of the GMF Pond is flowing toward the Cooling Pond.
- Groundwater flow velocities in the uppermost aquifer are estimated from 3.1×10^{-2} to 6.5×10^{-1} ft/day.
- The GMF Pond is lined and the shallow sands of the uppermost aquifer were removed from within the footprint of the pond during construction. The GMF Pond does not appear to impact groundwater flow directions via recharge to groundwater. Given the low permeability of the liner system and the removal of sand below the unit, it is more likely that the GMF Pond is a barrier to groundwater flow within the uppermost aquifer deflecting flow from upgradient areas around the perimeter of the pond toward the downgradient areas south and east of the pond toward the Cooling Pond.
- Based on the detailed geologic information provided, and the hydrogeologic and groundwater quality data, groundwater within the uppermost aquifer at the GMF Pond is classified as Class I – Potable Resource Groundwater. However, background (upgradient) groundwater originates from areas north and west of the GMF Pond that have been extensively surface mined and present a significant alternative source for groundwater impacts.
- Antimony, arsenic, cobalt, lead, pH, sulfate, and thallium were detected at least once at concentrations greater than the GWPS in downgradient uppermost aquifer wells (including PMP wells). Lead, mercury, pH, and thallium were detected at concentrations greater than the GWPS in upgradient uppermost aquifer wells. Radium 226 and 228 combined was detected once at concentrations greater than the GWPS in the bedrock confining unit well.

Groundwater 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 GMP.

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

7. REFERENCES

Federal Emergency Management Agency (FEMA), 2021. Flood Insurance Rate Map for Fulton County Unincorporated Areas, Illinois (Map No. 17057C0375E, effective on 02/04/2011). Accessed on August 27, 2021 from URL: https://msc.fema.gov/portal/search?AddressQuery=17751%20North%20Cilco%20Rd%2C%20Canton%2C%20IL#searchresultsanchor

Hanson Professional Services, Inc. (Hanson), 2005. *Geology and Hydrogeology Report* in Illinois EPA Bureau of Land Permit Application – Log No. 2005-121-LF. Hanson Professional Services Inc., Springfield, IL, 115 pp + App.

Hanson Professional Services, Inc. (Hanson), 2009. Section 3 – *Hydrogeologic Report*, in Support Document for Permit Application, Duck Creek Power Generating Station, Gypsum Management Facility, Springfield, Fulton County, Illinois.

Hanson Professional Services, Inc. (Hanson), 2015. *Aquifer Evaluation in the Surface Strip Mining Area (Ash Ponds 1 and 2).* December 22, 2015.

Hanson Professional Services, Inc. (Hanson), 2021. *First Quarter 2021 Groundwater Report, Duck Creek Power Station, Gypsum Stack and Recycle Pond*, WPC Permit No. 2017-EO-62640, Fulton County. March 25, 2021.

Illinois Department of Natural Resources (IDNR), 2021. Natural Heritage Database. Accessed from URL: https://www2.illinois.gov/dnr/conservation/NaturalHeritage/Pages/NaturalHeritageDatabase.aspx

Illinois Environmental Protection Agency (IEPA), 2021. Illinois Drinking Water Watch (DWW). Accessed from URL: http://water.epa.state.il.us/dww/index.jsp

Illinois Environmental Protection Agency (IEPA), 2021. *In the Matter of: Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed New Title 35 Illinois Administration Code 845, Addendum*. April 15, 2021.

Illinois State Geological Survey (ISGS), 2021. Fulton County Coal Data, including Mine Map and Mine Directory. Accessed on August 27, 2021 from URL: https://isgs.illinois.edu/research/coal/maps/county/fulton

Illinois State Geological Survey (ISGS), 2021. Fulton County Coal Data, including Mine Map and Mine Directory. Accessed on August 27, 2021 from URL: https://isgs.illinois.edu/research/coal/maps/county/fulton

Illinois State Geological Survey (ISGS), 2021. *Illinois Water & Related Wells Map (ILWATER) for 17751 North Cilco Rd Canton, IL 61520*. Accessed from URL: https://prairie-research.maps.arcgis.com/apps/webappviewer/index.html?id=e06b64ae0c814ef3a4e43a191cb57f87

Illinois State Geological Survey (ISGS), 2021. ILMINES Interactive Map. Accessed from URL: https://isgs.illinois.edu/illinois-coal-mines-ilmines

Illinois State Water Survey (ISWS), 2021. *Official Climate Network: Station Data: Peoria. 1989-2020.* Accessed from URL: https://www.isws.illinois.edu/warm/stationmeta.asp?site=ICC&from=wx

NRCS, 1997. *Soil Survey of Fulton County, Illinois, Part 1*. Natural Resources Conversation Service. 1997.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017a. *Hydrogeologic Monitoring Plan, Duck Creek GMF Pond – CCR Unit ID 203 and Duck Creek Landfill – CCR Unit ID 204.* October 17, 2017.

Natural Resource Technology, an OBG Company. (NRT/OBG), 2017b. *Sampling and Analysis Plan, Final, Duck Creek GMF Pond, Duck Creek Power Station, Canton, Illinois, Project No. 2285, Revision 0.* October 17, 2017.

United States Environmental Protection Agency (USEPA), 2021. Safe Drinking Water Information System (SDWIS). Accessed from URL: https://www.epa.gov/enviro/sdwis-search

United States Fish and Wildlife Service (USFWS), 2021. Environmental Conservation Online System. Listed species believed to or known to occur in Fulton County, Illinois. Accessed from URL: https://ecos.fws.gov/ecp/report/species-listings-by-current-range-county?fips=17057

United States Fish and Wildlife Service (USFWS), 2021. Wetlands Mapper, National Wetlands Inventory, surface waters and wetlands. Accessed from URL: https://www.fws.gov/wetlands/data/mapper.html

United States Geological Survey (USGS), 2021. Daily Gauge Height January 1, 2018 to May 31, 2021 for USGS Gaging Station 05568615 at the Illinois River at Copperas Creek, Illinois. Accessed from URL: https://waterdata.usgs.gov/nwis/inventory?agency_code=USGS&site_no=05568615

United States Geological Survey (USGS), 2021. National Groundwater Monitoring Network (NGWMN). Accessed from URL: https://cida.usgs.gov/ngwmn/index.jsp

United States Geological Survey (USGS), 2021. National Map Viewer. Accessed from URL: https://apps.nationalmap.gov/viewer/

TABLES

TABLE 2-1. GEOTECHNICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample ID	Field Location ID	Top of Sample (ft bgs)	Bottom of Sample (ft bgs)	Moisture Content (%)	Dry Density (pcf)	Specific Gravity	Total Porosity[1] (%)	Vertical Hydraulic Conductivity (cm/s)	LL	PL	PI	Laboratory USCS	Gravel (%)	Sand (%)	Fines (%)
Peoria/Roxana Loess															
G54C-Comp 1	G54C	7	19	18.6	113.1	2.680	32.4	--	35	22	13	CL	0.2	11.6	88.2
G54C-ST14-16	G54C	14	16	22.2	104.0	--	--	7.10E-08	--	--	--	--	--	--	--
SB50/ST10-12	SB50	10	12	25.9	98.0	--	--	6.30E-07	--	--	--	--	--	--	--
SB50-Comp 1	SB50	5	19	24.9	97.3	2.680	41.8	--	32	23	9	CL	0.0	2.6	97.4
SB62/ST12-14	SB62	12	14	21.1	105.5	--	--	1.90E-07	--	--	--	--	--	--	--
SB62-Comp 1	SB62	7	19	19.3	104.7	2.650	36.7	--	35	22	13	CL	0.0	11.5	88.5
Upper Radnor Till															
G54C-Comp 2	G54C	25	33	24.6	98.0	2.680	41.4	--	40	18	22	CL	1.0	18.4	80.6
SB50/ST22-24	SB50	22	24	21.8	106.3	--	--	2.60E-07	--	--	--	--	--	--	--
SB50-Comp 2	SB50	21	31	21.1	116.7	2.700	30.7	--	28	18	10	CL	3.4	26.5	70.1
SB62/ST26-28	SB62	26	28	23.2	105.3	--	--	2.30E-06	--	--	--	--	--	--	--
SB62-Comp 2	SB62	23	33	21.5	104.1	2.700	38.2	--	29	17	12	CL	0.0	23	77
Shallow Sand Zone															
G54C-Comp 3	G54C	35	41	18.2	113.0	2.640	31.4	--	24	19	5	CL-ML	10.6	25.8	63.6
G54C-ST32-34	G54C	32	34	21.9	105.1	--	--	7.50E-07	--	--	--	--	--	--	--
SB50-Comp 3	SB50	31	39	17.1	122.3	2.700	27.4	--	27	18	9	CL	3.6	32	64.4
SB62/ST38-40	SB62	38	40	15.6	118.4	--	--	1.10E-06	--	--	--	--	--	--	--
SB62-Comp 3	SB62	33	39	14.5	116.1	2.650	29.8	--	26	19	7	CL-ML	2.9	23.4	73.7
Lower Radnor Till															
G54C-Comp 4	G54C	47	73	9.8	128.4	2.670	22.9	--	21	13	8	CL	7.4	36.3	56.3
G54C-ST44-46	G54C	44	46	12.2	126.1	--	--	5.40E-06	--	--	--	--	--	--	--
G54C-ST76-78	G54C	76	78	12.6	123.2	--	--	4.10E-08	--	--	--	--	--	--	--
SB50-Comp 4	SB50	41	51	7.7	133.8	2.700	20.6	--	21	15	6	SC-SM	12.9	37.8	49.3
SB62-Comp 4	SB62	41	51	10.0	126.1	2.640	23.5	--	21	15	6	CL-ML	2.8	40.7	56.5
CCR															
Gypsum	XTPW01[2]	grab	grab	32.5	--	2.310	--	--	--	--	--	Gypsum	0.0	4	96
LSN-3781/Gypsum	XTPW01[2]	grab	grab	28.8	73.9	2.700	56.1	6.70E-04	--	--	--	--	--	--	--

[O:FPO 7/13/21, U: EDP 8/25/21, C:LDC 09/07/21, C:SSW 09/16/21]

Notes:
[1] Porosity calculated as relationship of bulk density (p_b) to particle density (p_d) (n = 100[1- (p_b/p_d)])
[2] Gypsum grab samples were collected near location XTPW01
-- = Not Analyzed
% = Percent
bgs = below ground surface
CCR = coal combustion residuals
cm/s = centimeters per second
ft = foot/feet
GMF = Gypsum Management Facilty
LL = Liquid limit
pcf = pounds per cubic foot
PI = Plasticity Index
PL = Plastic Limit

USCS = Unified Soil Classification System
CL = lean clay
CL-ML = silty lean clay
SC-SM = Silty Clayey Sand

HSU = Hydrostratigraphic Unit
LCU = lower confining unit
UA = uppermost aquifer

RAMBOLL

TABLE 2-2. CCR ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Plant	Sample Location	Sample Depth (ft)	Sample Date	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Boron (mg/kg)	Cadmium (mg/kg)	Calcium (mg/kg)	Chloride (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Fluoride (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Molybdenum (mg/kg)	Selenium (mg/kg)	Sulfate (mg/kg)	Thallium (mg/kg)
DC	GMF Gypsum	0-0	03/08/2021	<3	<1	6	<1	16	<1	100000	64	<4	<2	20	<1	<5	2.9	2.3	14000	<1

Notes:
-- = data not available
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method.
ft = feet
mg/kg = milligrams per kilogram

TABLE 2-3. POREWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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)
XTPW02	06/23/2021	<0.003	0.0026	0.059	<0.001	63	0.0066	750	3900	<0.004	0.0064	22.6	<0.001	0.26	0.00054	1.4	6.6	2.65	2.1	4300	0.0015

Notes:
Field readings are reported with as many significant figures as provided by analytical laboratory.
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method.
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units

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TABLE 2-4. SOIL ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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)	Chloride (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Fluoride (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Selenium (mg/kg)	Sulfate (mg/kg)	Thallium (mg/kg)
SB-50	Peoria/Roxana Loess	4-18	02/02/2021	<2.8	<0.95	75	<0.95	<9.5	<0.95	<1	18	4	<0.25	6.7	6.7	<0.19	<0.95	<0.95	3	<0.95
SB-50	Upper Radnor Till	20-30	02/02/2021	<2.7	1.6	36	<0.91	<9.1	<0.91	<1	12	6.3	<0.25	10	12	<0.18	<0.91	<0.91	<1	<0.91
SB-50	Shallow Sand Zone	30-38	02/02/2021	<3	8.1	29	<1	<10	<1	<1	8.8	5.4	<0.25	7	11	<0.2	1.8	<1	<1	<1
SB-50	Lower Radnor Till	40-50	02/02/2021	<3	3.1	17	<1	<10	<1	<10	6.1	3.5	<2.5	4.3	14	<0.2	<1	<1	270	<1
SB-62	Peoria/Roxana Loess	6-18	02/03/2021	<3	4.6	87	<1	<10	<1	<10	16	3.5	<2.5	7.2	6.4	<0.2	<1	<1	27	<1
SB-62	Upper Radnor Till	22-32	02/03/2021	<3	3.2	30	<1	<10	<1	<10	8.3	4.3	<2.5	6.6	9.5	<0.2	<1	<1	12	<1
SB-62	Shallow Sand Zone	32-38	02/03/2021	<3	3.2	26	<1	<10	<1	<10	8.1	5.4	<2.5	7.2	9.3	<0.2	<1	<1	11	<1
SB-62	Lower Radnor Till	40-50	02/03/2021	<3.3	2.3	20	<1.1	12	<1.1	<11	6	2.7	<2.7	5	20	<0.22	<1.1	<1.1	130	<1.1
G54C	Peoria/Roxana Loess	6-18	02/03/2021	<2.8	2.5	100	<0.93	<9.3	<0.93	10	17	4.1	3	6.6	9.4	<0.19	<0.93	<1.9	37	<0.93
G54C	Upper Radnor Till	24-32	02/03/2021	<3	1.7	21	<1	<10	<1	<10	9.1	5.6	3.7	9.5	8.5	<0.2	<1	<1	11	<1
G54C	Shallow Sand Zone	34-40	02/04/2021	<2.4	3	33	<0.79	<7.9	<0.79	<10	9	5	<2.5	6	11	<0.16	1.7	<0.79	13	<0.79
G54C	Lower Radnor Till	46-80	02/04/2021	<2.1	9.4	86	0.87	<7.2	<0.72	<10	13	7	5.7	11	7	<0.14	<0.72	<0.72	<10	<0.72

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
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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)
G02L	--	12/10/2003	--	621.94	Top of Disk	619.50	10.00	15.00	609.50	604.50	15.00	603.50	5	2	40.512901	-89.991114
G02S	UA	09/29/2003	--	621.66	Top of Disk	619.18	23.00	28.00	596.18	591.18	28.00	589.20	5	2	40.512879	-89.991105
G50L	UA/PMP	03/13/2007	623.52	623.52	Top of Riser	620.85	11.61	16.32	609.24	604.53	16.70	604.10	4.7	2	40.508688	-89.990606
G50S	UA	03/13/2007	623.65	623.65	Top of Riser	620.83	29.17	33.98	591.66	586.85	34.30	586.50	4.8	2	40.508672	-89.990607
G51L	UA/PMP	01/28/2008	619.74	619.74	Top of Riser	616.84	12.04	16.83	604.80	600.01	17.21	599.10	4.8	2	40.506573	-89.990864
G51S	UA	01/28/2008	619.66	619.66	Top of Riser	616.83	24.01	28.79	592.82	588.04	29.16	587.70	4.8	2	40.50656	-89.990864
G52L	UA/PMP	01/22/2008	619.55	619.55	Top of Riser	616.70	29.21	33.80	587.49	582.90	34.17	582.50	4.6	2	40.504515	-89.990871
G52S	UA	01/22/2008	619.62	619.62	Top of Riser	616.56	39.15	43.93	577.41	572.63	44.20	570.60	4.8	2	40.504502	-89.990869
G53L	UA/PMP	02/05/2009	623.24	623.24	Top of Riser	620.34	16.97	26.32	603.37	594.02	26.79	593.60	9.4	2	40.508739	-89.988768
G53S	UA	02/05/2009	623.05	623.05	Top of Riser	620.36	30.64	35.13	589.72	585.23	35.56	584.30	4.5	2	40.508739	-89.988753
G54C	BR	02/05/2021	622.72	622.72	Top of PVC	619.59	91.59	101.50	528.00	518.09	102.00	517.59	9.07	2	40.504533	-89.988975
G54L	UA/PMP	02/12/2009	622.95	622.95	Top of Riser	620.18	27.32	36.75	592.86	583.43	37.22	583.00	9.4	2	40.504524	-89.988927
G54S	UA	02/12/2009	622.98	622.98	Top of Riser	620.25	43.50	47.97	576.75	572.28	48.41	571.80	4.5	2	40.504525	-89.98894
G55L	UA/PMP	02/19/2009	623.20	623.20	Top of Riser	620.45	36.12	36.60	584.33	583.85	36.60	583.90	0.5	2	40.504532	-89.988061
G55S	UA	02/19/2009	622.89	622.89	Top of Riser	620.11	41.04	45.49	579.07	574.62	45.96	574.20	4.5	2	40.504522	-89.988062
G56L	UA/PMP	02/16/2009	622.42	622.42	Top of Riser	619.96	13.77	22.11	606.19	597.85	22.89	597.10	8.3	2	40.504643	-89.987075
G56S	UA	02/16/2009	622.71	622.71	Top of Riser	619.84	33.17	37.66	586.67	582.18	38.29	579.80	4.5	2	40.504633	-89.987076
G57L	UA/PMP	01/30/2009	622.90	622.90	Top of Riser	620.22	16.17	25.62	604.05	594.60	26.00	594.20	9.5	2	40.50562	-89.987044
G57S	UA	01/30/2009	622.76	622.76	Top of Riser	620.20	29.65	34.18	590.55	586.02	34.62	582.20	4.5	2	40.505608	-89.987043
G58L	UA/PMP	01/26/2009	622.95	622.95	Top of Riser	620.17	20.69	30.10	599.48	590.07	30.56	589.60	9.4	2	40.506004	-89.987036
G58S	UA	01/26/2009	622.93	622.93	Top of Riser	620.06	31.32	35.80	588.74	584.26	36.43	583.60	4.5	2	40.505993	-89.987033
G59L	UA/PMP	01/23/2009	622.35	622.35	Top of Riser	620.11	22.91	32.33	597.20	587.78	33.03	587.10	9.4	2	40.506386	-89.987023
G59S	UA	01/23/2009	622.79	622.79	Top of Riser	620.11	37.38	41.88	582.73	578.23	42.49	577.60	4.5	2	40.506375	-89.987023

TABLE 3-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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)
G60L	UA/PMP	01/17/2008	615.39	615.39	Top of Riser	612.69	20.12	24.91	592.57	587.78	25.28	587.40	4.8	2	40.506745	-89.986816
G60S	UA	01/16/2008	615.03	615.03	Top of Riser	612.33	31.12	35.91	581.21	576.42	36.29	574.30	4.8	2	40.506732	-89.986815
G61S	UA	01/21/2009	622.58	622.58	Top of Riser	620.11	30.19	34.63	589.92	585.48	35.26	582.10	4.4	2	40.507213	-89.987013
G62L	UA/PMP	01/22/2009	623.48	623.48	Top of Riser	620.37	20.31	29.66	600.06	590.71	30.12	582.40	9.4	2	40.507597	-89.987012
G63L	UA/PMP	02/02/2009	623.03	623.03	Top of Riser	620.27	18.47	27.89	601.80	592.38	28.36	591.90	9.4	2	40.507992	-89.987
G63S	UA	02/02/2009	623.00	623.00	Top of Riser	619.98	34.52	39.01	585.46	580.97	39.47	580.00	4.5	2	40.50798	-89.986998
G64L	UA/PMP	01/22/2009	622.46	622.46	Top of Riser	620.24	18.12	27.48	602.12	592.76	27.95	592.30	9.4	2	40.508378	-89.987007
G64S	UA	01/22/2009	623.06	623.06	Top of Riser	620.25	34.50	38.99	585.75	581.26	39.48	580.30	4.5	2	40.508365	-89.987011
G65L	UA/PMP	01/15/2008	612.76	612.76	Top of Riser	610.29	17.28	22.08	593.01	588.21	22.45	587.80	4.8	2	40.50266	-89.987293
G65S	UA	01/15/2008	612.94	612.94	Top of Riser	610.09	26.92	31.70	583.17	578.39	32.08	577.40	4.8	2	40.502657	-89.987313
G66L	UA/PMP	02/04/2009	617.93	617.93	Top of Riser	614.98	9.84	19.27	605.14	595.71	19.74	595.20	9.4	2	40.503359	-89.987127
G66S	UA	02/04/2009	617.83	617.83	Top of Riser	615.04	35.10	39.59	579.94	575.45	40.59	574.50	4.5	2	40.503346	-89.987129
G67L	--	02/03/2009	617.26	617.26	Top of Riser	614.77	7.36	16.72	607.41	598.05	17.18	597.60	9.4	2	40.504146	-89.987257
G67S	--	02/03/2009	617.77	617.77	Top of Riser	614.81	31.09	35.58	583.72	579.23	36.21	576.80	4.5	2	40.504154	-89.98727
G68L	--	02/09/2009	616.31	616.31	Top of Riser	614.28	15.48	24.85	598.80	589.43	25.31	589.00	9.4	2	40.504213	-89.988407
G68S	--	02/09/2009	616.93	616.93	Top of Riser	614.24	34.75	39.22	579.49	575.02	39.88	568.20	4.5	2	40.50421	-89.988421
G69L	--	02/10/2009	616.95	616.95	Top of Riser	614.56	15.31	24.68	599.25	589.88	25.15	589.40	9.4	2	40.504194	-89.989567
G69S	--	02/10/2009	617.65	617.65	Top of Riser	614.68	36.08	40.58	578.60	574.10	41.01	573.70	4.5	2	40.504194	-89.989552
G70L	--	11/18/2008	617.76	617.76	Top of Riser	615.08	20.19	29.54	594.89	585.54	30.00	585.10	9.4	2	40.503721	-89.990033
G71L	--	11/20/2008	617.52	617.52	Top of Riser	615.13	19.80	29.29	595.33	585.84	30.20	584.90	9.5	2	40.502994	-89.989596
G71S	--	11/20/2008	617.81	617.81	Top of Riser	615.24	33.96	37.96	581.28	577.28	38.40	575.20	4	2	40.503005	-89.989603
G72L	--	11/19/2008	617.71	617.71	Top of Riser	614.86	14.65	24.01	600.21	590.85	24.79	590.10	9.4	2	40.502439	-89.988767
G72S	--	11/19/2008	617.61	617.61	Top of Riser	615.03	30.16	34.64	584.87	580.39	35.09	575.60	4.5	2	40.502439	-89.988785

TABLE 3-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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)
G73L	--	02/06/2009	617.64	617.64	Top of Riser	614.78	24.63	33.98	590.15	580.80	34.76	580.00	9.4	2	40.502492	-89.987727
P60	UA/PMP	03/15/2017	622.22	622.22	Top of Riser	619.82	29.55	34.14	590.27	585.68	34.60	585.20	4.6	2	40.506753	-89.987023
P61	UA/PMP	09/23/2021	613.96	613.96	Top of PVC	611.09	7.55	18.37	602.38	592.72	18.76	591.09	9.66	2	40.507167	-89.986146
P62	UA/PMP	09/23/2021	613.54	613.54	Top of PVC	610.81	11.18	15.78	599.63	595.03	16.30	594.51	4.6	2	40.507762	-89.986782
P63	UA/PMP	09/23/2021	614.47	614.47	Top of PVC	612.33	13.04	17.63	599.29	594.70	18.25	594.08	4.59	2	40.508145	-89.986768
P64	UA/PMP	09/23/2021	616.47	616.47	Top of PVC	614.04	6.17	15.96	607.87	598.08	16.47	597.57	9.79	2	40.508911	-89.986794
R61L	PMP	03/14/2017	622.39	622.39	Top of Riser	619.66	18.54	28.17	601.12	591.49	28.70	591.00	9.6	2	40.507228	-89.987014
R72S	--	11/09/2016	617.57	617.57	Top of Riser	614.81	29.83	34.49	584.98	580.32	35.00	579.90	4.7	2	40.502442	-89.988803
X301	S	--	--	--	--	--	--	--	--	--	--	--	--	--	40.504777	-89.990046
XTPW02	CCR	06/23/2021	617.20	617.20	Top of PVC Casing	615.00	3.02	5.02	611.98	609.98	5.14	609.50	2	1	40.519976	-89.98991

Notes:
All elevation data are presented relative to the North American Vertical Datum 1988 (NAVD88), GEOID 12A
-- = data not available
BGS = below ground surface
BR = bedrock
CCR = coal combustion residuals
ft = foot or feet
HSU = Hydrostratigraphic Unit
PMP = potential migration pathway
PVC = polyvinyl chloride
S = source water
UA = uppermost aquifer
UA/PMP = uppermost aquifer/potential migration pathway

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TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

DUCK CREEK POWER PLANT

GMF POND

CANTON, ILLINOIS

Date	G51L Groundwater Elevation (ft NAVD88)	G51S Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	PMP	UA				
4/14/2021	610.50	610.69	-0.19	12.68	-0.01	up
4/28/2021	609.12	609.35	-0.23	12.68	-0.02	up
5/10/2021	610.72	610.93	-0.21	12.68	-0.02	up
6/1/2021	609.14	609.44	-0.30	12.68	-0.02	up
6/10/2021	606.57	606.98	-0.41	12.68	-0.03	up
6/21/2021	608.97	609.37	-0.40	12.68	-0.03	up
7/12/2021	610.66	610.91	-0.25	12.68	-0.02	up
7/26/2021	608.51	608.84	-0.33	12.68	-0.03	up
8/5/2021	605.95	606.34	-0.39	12.68	-0.03	up
			Middle of screen elevation G51L			602.4
			Middle of screen elevation G51S			589.7

Date	G54L Groundwater Elevation (ft NAVD88)	G54S Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	PMP	UA				
4/14/2021	591.47	590.44	1.03	16.97	0.06	down
4/28/2021	591.11	590.52	0.59	16.61	0.04	down
5/10/2021	591.22	590.53	0.69	16.72	0.04	down
6/1/2021	591.52	590.80	0.72	17.02	0.04	down
6/10/2021	591.78	591.07	0.71	17.28	0.04	down
6/21/2021	592.11	591.23	0.88	17.61	0.05	down
7/12/2021	592.97	591.76	1.21	13.66	0.09	down
7/26/2021	592.50	591.98	0.52	18.00	0.03	down
8/5/2021	592.79	592.55	0.24	18.29	0.01	down
			Middle of screen elevation G54L			588.2
			Middle of screen elevation G54S			574.5

RAMBOLL

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

DUCK CREEK POWER PLANT

GMF POND

CANTON, ILLINOIS

Date	G54S Groundwater Elevation (ft NAVD88)	G54C Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UA	BCU				
4/14/2021	590.44	581.99	8.45	51.04	0.17	down
4/28/2021	590.52	581.10	9.42	51.04	0.18	down
5/10/2021	590.53	580.11	10.42	51.04	0.20	down
6/1/2021	590.80	581.00	9.80	51.04	0.19	down
6/10/2021	591.07	580.47	10.60	51.04	0.21	down
6/21/2021	591.23	579.83	11.40	51.04	0.22	down
7/12/2021	591.76	582.36	9.40	51.04	0.18	down
7/26/2021	591.98	581.64	10.34	51.04	0.20	down
8/5/2021	592.55	578.99	13.56	51.04	0.27	down
			Middle of screen elevation G54S			574.5
			Middle of screen elevation G54C			523.5

Date	G57L Groundwater Elevation (ft NAVD88)	G57S Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	PMP	UA				
4/14/2021	603.07	601.83	1.24	13.35	0.09	down
4/28/2021	602.15	601.99	0.16	12.43	0.01	down
5/10/2021	604.41	602.61	1.80	14.69	0.12	down
6/1/2021	603.88	603.89	-0.01	14.16	0.00	flat
6/10/2021	603.17	603.20	-0.03	13.45	0.00	up
6/21/2021	602.45	602.52	-0.07	12.73	-0.01	up
7/12/2021	604.81	604.68	0.13	12.68	0.01	down
7/26/2021	604.43	604.41	0.02	14.71	0.00	flat
8/5/2021	603.00	603.51	-0.51	13.28	-0.04	up
			Middle of screen elevation G57L			602.4
			Middle of screen elevation G57S			589.7

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

DUCK CREEK POWER PLANT

GMF POND

CANTON, ILLINOIS

Date	G60L Groundwater Elevation (ft NAVD88)	G60S Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	PMP	UA				
4/14/2021	606.78	590.16	16.62	11.36	1.5	down
4/28/2021	603.75	589.76	13.99	11.36	1.2	down
5/10/2021	606.16	590.34	15.82	11.36	1.4	down
6/1/2021	605.20	590.54	14.66	11.36	1.3	down
6/10/2021	603.76	590.02	13.74	11.36	1.2	down
6/21/2021	603.43	589.48	13.95	11.36	1.2	down
7/12/2021	609.27	591.02	18.25	11.36	1.6	down
7/26/2021	605.97	590.71	15.26	11.36	1.3	down
8/5/2021	604.40	590.05	14.35	11.36	1.3	down
			Middle of screen elevation G60L			590.2
			Middle of screen elevation G60S			578.8

[O:EDP 8/26/21 U: LDC 09/09/21, C: SSW 09/17/21]

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.

-- = Not calculated
BCU = bedrock confining unit
dh = head change
dl = distance change
ft = feet
NAVD88 = North American Vertical Datum of 1988
PMP = potential migration pathway
UA = uppermost aquifer

TABLE 3-3. FIELD HYDRAULIC CONDUCTIVITIES
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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)
Uppermost Aquifer (Peoria/Roxana Loess, Upper Radnor Till, Shallow Sand)											
G50L	U	604.53	4.70	ML/CL	Solid	KGS Model	2.30E-03	2.10E-03	3.00E-05	3.90E-03	3.6E-04
G51L	U	600.01	4.80	ML/CL	Solid	KGS Model	3.00E-05	---			
G53L	D	594.02	9.40	CL/ML	Solid	KGS Model	1.10E-04	1.10E-04			
G54L	D	583.43	9.40	CL/ML	Solid	Bouwer-Rice	4.90E-05	2.20E-04			
G60L	D	587.78	4.80	CL/ML	Solid	KGS Model	2.30E-04	2.60E-04			
G50S	U	586.85	4.80	S(ML), CL/ML	Solid	KGS Model	6.50E-05	1.50E-04			
G51S	U	588.04	4.80	CL/ML, SP	Solid	Bouwer-Rice / KGS Model	7.20E-05	1.10E-04			
G53S	D	585.23	4.50	ML/CL, SP	Solid	KGS Model	3.80E-03	3.20E-03			
G54S	D	572.28	4.50	ML/CL, SP	Solid	Bouwer-Rice	1.20E-04	2.10E-04			
G57S	D	586.02	4.50	SP, S(CL), ML/CL	Solid	KGS Model	2.60E-03	6.80E-04			
G60S	D	576.42	4.80	ML/CL, SP	Solid	KGS Model	3.90E-03	3.50E-03			
G63S	D	580.97	4.50	ML, ML/CL, SP	Solid	KGS Model	3.00E-04	2.90E-04			
Bedrock Confining Unit											
G54C	D	518.09	9.07	Shale	Solid	Hvorslev	1.60E-04	1.40E-04	1.40E-04	1.60E-04	1.50E-04

[O: EDP 8/25/21, C: SSW 09/17/21]

Notes:
1. All wells are constructed from 2 inch PVC with 0.01 inch slotted screens.
- - - = no data collected on date / no vertical gradient calculated
CL/ML = Silty clay
cm/s = centimeters per second
D = downgradient
GMF = Gypsum Management Facility
ft = foot/feet
K = hydraulic conductivity
KGS = Kansas Geological Survey
ML = Silt
NAVD88 = North American Vertical Datum of 1988
U = upgradient

USCS = Unified Soil Classification System
ML/CL = Clayey silt
S(CL) = Sandy clay
S(ML) = Sandy silt
SM = Silty sand
SP= Poorly graded sand

TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

$\mathbf{V = K\,i\ /\ n_e}$ V = Groundwater Velocity
K = Hydraulic Conductivity [1]
i = hydraulic gradient
n_e = Effective Porosity [2]

Northern GMF Pond Uppermost Aquifer (G50S to G64S)

Distance between Wells (ft): 1008
Hydraulic Conductivity (ft/day): 0.66
Effective Porosity (%): 17.5 Assumes: clay/sand

Date	G50S Groundwater Elevation (ft NAVD88)	G64S Groundwater Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/day)
	UA	UA			
4/14/2021	612.98	599.04	13.94	0.0138	0.052
4/28/2021	611.54	599.38	12.16	0.0121	0.045
5/10/2021	612.71	599.64	13.07	0.0130	0.049
6/1/2021	611.87	600.28	11.59	0.0115	0.043
6/10/2021	611.15	599.97	11.18	0.0111	0.042
6/21/2021	611.57	599.51	12.06	0.0120	0.045
7/12/2021	613.25	600.50	12.75	0.0126	0.048
7/26/2021	612.06	600.60	11.46	0.0114	0.043
8/5/2021	611.21	600.04	11.17	0.0111	0.042
			Average	0.0121	0.045

Central GMF Pond Uppermost Aquifer (G50S to G60S)

Distance between Wells (ft): 1269
Hydraulic Conductivity (ft/day): 5.46
Effective Porosity (%): 15 Assumes: silt/sand

Date	G50S Groundwater Elevation (ft NAVD88)	G60S Groundwater Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/day)
	UA	UA			
4/14/2021	612.98	590.16	22.82	0.0180	0.654
4/28/2021	611.54	589.76	21.78	0.0172	0.624
5/10/2021	612.71	590.34	22.37	0.0176	0.641
6/1/2021	611.87	590.54	21.33	0.0168	0.611
6/10/2021	611.15	590.02	21.13	0.0167	0.606
6/21/2021	611.57	589.48	22.09	0.0174	0.633
7/12/2021	613.25	591.02	22.23	0.0175	0.637
7/26/2021	612.06	590.71	21.35	0.0168	0.612
8/5/2021	611.21	590.05	21.16	0.0167	0.606
			Average	0.0172	0.625

TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Southern GMF Pond Uppermost Aquifer (G51S to G54S)

Distance between Wells (ft): 906
Hydraulic Conductivity (ft/day): 0.36
Effective Porosity (%): 17.5 Assumes: clay/sand

Date	G51S Groundwater Elevation (ft NAVD88)	G54S Groundwater Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/day)
	UA	UA			
4/14/2021	610.69	590.44	20.25	0.0224	0.046
4/28/2021	609.35	590.52	18.83	0.0208	0.042
5/10/2021	610.93	590.53	20.40	0.0225	0.046
6/1/2021	609.44	590.80	18.64	0.0206	0.042
6/10/2021	606.98	591.07	15.91	0.0176	0.036
6/21/2021	609.37	591.23	18.14	0.0200	0.041
7/12/2021	610.91	591.76	19.15	0.0211	0.043
7/26/2021	608.84	591.98	16.86	0.0186	0.038
8/5/2021	606.34	592.55	13.79	0.0152	0.031
			Average	0.0199	0.041

[O: EDP 8/28/21, C: LDC 09/17/21]

Notes:
[1] Hydraulic conductivity values used above are the geometric mean of hydrostratigraphic unit hydraulic conductivity values calculated from slug tests completed in April 2021 by Ramboll.
[2] Effective porosity used in these calculations was derived from an average between estimated values of 0.20 for silt material, 0.267 for gravel, 0.07 for clay, and 0.28 for sand from Morris, D.A and A.I. Johnson, 1967. Summary of hydrologic and physical properties of rock and soil materials as analyzed by the Hydrologic Laboratory of the U.S. Geological Survey. 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 (56%) calculated in Table 2-1.
% = percent
ft/day = feet per day
ft/ft = feet per feet
ft= feet
NAVD88 = North American Vertical Datum of 1988
UA = uppermost aquifer

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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
G02S	12/02/2015	<0.003	0.0077	0.2	<0.001	0.13	<0.001	97	3.2	<0.004	<0.002	0.359	0.0015	<0.01	<0.0002	<0.001	6.6	1.86	<0.001	<1	<0.001	400
G02S	02/03/2016	<0.003	0.0071	0.22	<0.001	0.044	<0.001	92	3	0.0046	<0.002	0.274	0.002	<0.01	<0.0002	0.0042	6.6	0.371	<0.001	<1	<0.001	390
G02S	04/20/2016	<0.003	0.0059	0.23	<0.001	0.039	<0.001	110	2.7	<0.004	<0.002	0.365	0.0011	<0.01	<0.0002	<0.001	6.6	0.827	<0.001	<1	<0.001	600
G02S	08/18/2016	<0.003	0.0041	0.17	<0.001	0.03	<0.001	98	2.6	<0.004	<0.002	0.33	0.0012	<0.01	<0.0002	<0.001	6.8	2.26	<0.001	<1	<0.001	350
G02S	10/19/2016	<0.003	0.0069	0.19	<0.001	0.034	<0.001	97	2.5	<0.004	<0.002	0.366	0.0011	<0.01	<0.0002	<0.001	6.9	0.191	<0.001	<1	<0.001	400
G02S	01/12/2017	<0.003	0.0077	0.22	<0.001	0.039	<0.001	94	3.7	<0.004	<0.002	0.564	<0.001	<0.01	<0.0002	<0.001	6.9	1.18	<0.001	<1	<0.001	420
G02S	04/22/2017	<0.003	0.0051	0.16	<0.001	0.04	<0.001	89	2.9	<0.004	<0.002	0.315	<0.001	<0.01	0.0024	<0.001	6.8	0.347	<0.001	<1	<0.001	440
G02S	06/28/2017	<0.003	0.0067	0.22	<0.001	0.042	<0.001	89	2.6	<0.004	<0.002	0.374	<0.001	<0.01	<0.0002	<0.001	6.8	0.761	<0.001	<1	<0.001	370
G02S	11/10/2017	--	--	--	--	0.036	--	95	3.1	--	--	0.41	--	--	--	--	6.9	--	--	2.9	--	390
G02S	01/17/2018	--	--	--	--	--	--	--	2.7	--	--	--	--	--	--	--	6.9	--	--	--	--	--
G02S	06/06/2018	--	--	--	--	0.042	--	95	2.4	--	--	0.369	--	--	--	--	6.9	--	--	<1	--	340
G02S	07/06/2018	--	--	--	--	--	--	--	2.9	--	--	--	--	--	--	--	7.0	--	--	--	--	--
G02S	10/04/2018	--	--	--	--	0.046	--	97	2.7	--	--	0.285	--	--	--	--	7.1	--	--	<1	--	340
G02S	02/06/2019	--	--	--	--	0.048	--	99	2.5	--	--	0.379	--	--	--	--	7.0	--	--	<1	--	400
G02S	07/08/2019	--	--	--	--	0.05	--	96	<5	--	--	0.394	--	--	--	--	7.0	--	--	<1	--	420
G02S	01/06/2020	--	--	--	--	0.044	--	100	<5	--	--	0.476	--	--	--	--	6.6	--	--	<1	--	440
G02S	08/11/2020	--	--	--	--	0.049	--	97	<5	--	--	0.27	--	--	--	--	6.4	--	--	<1	--	420
G02S	02/19/2021	--	--	--	--	0.037	--	95	2.6	--	--	0.411	--	--	--	--	6.5	--	--	<1	--	340
G02S	04/14/2021	<0.003	0.0092	0.29	<0.001	0.11	<0.001	89	2.3	<0.004	<0.002	0.336	<0.001	<0.02	<0.0002	<0.001	6.7	0.992	<0.001	<1	<0.001	380
G02S	04/29/2021	<0.003	0.0059	0.16	<0.001	0.047	<0.001	96	1.6	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	<0.001	6.8	0.194	<0.001	<1	<0.001	370
G02S	05/12/2021	<0.003	0.0061	0.15	<0.001	0.091	<0.001	96	2.5	<0.004	<0.002	0.35	<0.001	<0.02	<0.0002	<0.001	6.7	0	<0.001	<1	<0.001	290
G02S	06/01/2021	<0.003	0.0069	0.17	<0.001	0.12	<0.001	94	8.2	<0.004	<0.002	0.358	<0.001	<0.02	<0.0002	<0.001	6.8	0.0133	<0.001	2.7	<0.001	450

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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
G02S	06/15/2021	<0.003	0.0078	0.18	<0.001	0.064	<0.001	100	4	<0.004	<0.002	0.307	<0.001	<0.02	<0.0002	<0.001	6.8	0.618	<0.001	2.1	<0.001	390
G02S	06/21/2021	<0.003	0.0063	0.17	<0.001	0.11	<0.001	98	3.5	<0.004	<0.002	0.498	<0.001	<0.02	<0.0002	<0.001	6.8	0.268	<0.001	1.1	<0.001	440
G02S	07/12/2021	<0.003	0.0064	0.18	<0.001	0.043	<0.001	96	1.9	<0.004	<0.002	0.322	<0.001	<0.02	<0.0002	<0.001	6.7	0.372	<0.001	<1	<0.001	420
G02S	07/28/2021	<0.003	0.0059	0.17	<0.001	0.17	<0.001	99	1.4	<0.004	<0.002	0.324	<0.001	<0.02	<0.0002	<0.001	6.9	2	0.0012	<1	<0.001	440
G50S	01/30/2015	--	0.0016	--	--	0.021	--	94	4.5	--	--	--	0.0011	--	--	--	6.8	--	--	25	--	--
G50S	04/17/2015	--	<0.001	--	--	0.02	--	91	4.6	--	--	--	<0.001	--	--	--	7.3	--	--	23	--	--
G50S	07/24/2015	--	0.0012	--	--	0.015	--	96	5.4	--	--	--	0.0014	--	--	--	7.4	--	--	23	--	--
G50S	10/15/2015	--	<0.001	--	--	0.025	--	85	5.2	--	--	--	<0.001	--	--	--	7.4	--	--	19	--	--
G50S	12/03/2015	<0.003	0.005	0.12	<0.001	0.022	<0.001	98	6	<0.004	<0.002	0.311	0.0015	<0.01	<0.0002	0.001	6.9	0.865	<0.001	22	<0.001	340
G50S	01/29/2016	<0.003	<0.001	0.072	<0.001	0.024	<0.001	77	5.4	<0.004	<0.002	<0.25	<0.001	<0.01	<0.0002	<0.001	7.4	0.652	<0.001	21	<0.001	300
G50S	04/25/2016	<0.003	<0.001	0.063	<0.001	0.025	<0.001	81	5.3	<0.004	<0.002	0.373	<0.001	<0.01	<0.0002	<0.001	7.3	0.325	<0.001	21	<0.001	360
G50S	08/10/2016	<0.003	<0.001	0.074	<0.001	0.017	<0.001	86	6.3	<0.004	<0.002	0.284	<0.001	<0.01	0.00031	<0.001	7.3	0.455	<0.001	22	<0.001	320
G50S	10/21/2016	<0.003	<0.001	0.073	<0.001	<0.01	<0.001	76	5.9	<0.004	<0.002	0.297	<0.001	<0.01	<0.0002	<0.001	7.3	0.733	<0.001	23	<0.001	280
G50S	01/21/2017	<0.003	<0.001	0.07	<0.001	0.018	<0.001	60	6	<0.004	<0.002	0.261	<0.001	<0.01	<0.0002	<0.001	7.3	0.0182	<0.001	23	<0.001	340
G50S	04/07/2017	<0.003	0.0016	0.089	<0.001	0.011	<0.001	90	5.6	0.0058	<0.002	0.284	0.0016	<0.01	<0.0002	0.001	7.3	0.529	<0.001	24	<0.001	340
G50S	06/28/2017	<0.003	<0.001	0.08	<0.001	<0.01	<0.001	75	6.6	<0.004	<0.002	0.255	0.0017	<0.01	<0.0002	0.0015	7.1	0.371	<0.001	26	0.001	330
G50S	11/08/2017	--	--	--	--	0.012	--	83	5.9	--	--	0.369	--	--	--	--	7.1	--	--	22	--	310
G50S	06/04/2018	--	--	--	--	0.067	--	87	7.3	--	--	0.301	--	--	--	--	7.1	--	--	33	--	320
G50S	07/13/2018	--	--	--	--	0.018	--	88	--	--	--	0.333	--	--	--	--	7.1	--	--	--	--	350
G50S	10/11/2018	--	--	--	--	0.018	--	97	9.6	--	--	0.264	--	--	--	--	7.2	--	--	34	--	340
G50S	02/05/2019	--	--	--	--	0.016	--	86	7.6	--	--	<0.25	--	--	--	--	7.1	--	--	27	--	360
G50S	07/08/2019	--	--	--	--	0.018	--	88	9.6	--	--	0.351	--	--	--	--	7.4	--	--	34	--	420

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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
G50S	01/13/2020	--	--	--	--	0.018	--	97	8.6	--	--	0.311	--	--	--	--	6.9	--	--	30	--	360
G50S	08/10/2020	--	--	--	--	0.016	--	91	8.5	--	--	0.28	--	--	--	--	6.8	--	--	38	--	370
G50S	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	--
G50S	02/19/2021	--	--	--	--	0.015	--	95	12	--	--	0.335	--	--	--	--	7.0	--	--	41	--	330
G50S	04/14/2021	<0.003	<0.001	0.071	<0.001	0.034	<0.001	88	15	<0.004	<0.002	0.279	<0.001	<0.02	<0.0002	<0.001	7.2	0.644	<0.001	52	<0.001	400
G50S	04/29/2021	<0.003	<0.001	0.071	<0.001	0.025	<0.001	98	14	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	<0.001	7.1	0.0455	<0.001	50	<0.001	350
G50S	05/13/2021	<0.003	0.0011	0.076	<0.001	0.016	<0.001	95	13	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	<0.001	7.2	0	<0.001	47	<0.001	380
G50S	06/01/2021	<0.003	<0.001	0.066	<0.001	0.041	<0.001	93	12	<0.004	<0.002	0.3	<0.001	<0.02	<0.0002	0.0023	7.0	0.798	<0.001	49	<0.001	410
G50S	06/10/2021	<0.003	<0.001	0.068	<0.001	0.016	<0.001	93	16	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	<0.001	7.2	0.342	<0.001	48	<0.001	390
G50S	06/21/2021	<0.003	<0.001	0.071	<0.001	0.04	<0.001	94	11	<0.004	<0.002	0.372	<0.001	<0.02	<0.0002	<0.001	7.1	0	<0.001	44	<0.001	430
G50S	07/13/2021	<0.003	<0.001	0.071	<0.001	0.023	<0.001	92	13	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	<0.001	7.2	0.884	<0.001	46	<0.001	420
G50S	07/28/2021	<0.003	<0.001	0.071	<0.001	0.015	<0.001	95	13	<0.004	<0.002	0.323	<0.001	<0.02	<0.0002	<0.001	7.1	1.13	<0.001	46	<0.001	390
G51L	01/30/2015	--	<0.001	--	--	0.18	--	130	18	--	--	--	<0.001	--	--	--	6.9	--	--	130	--	--
G51L	04/17/2015	--	<0.001	--	--	0.14	--	120	15	--	--	--	<0.001	--	--	--	7.0	--	--	120	--	--
G51L	07/24/2015	--	0.0042	--	--	0.047	--	98	17	--	--	--	<0.001	--	--	--	7.1	--	--	110	--	--
G51L	10/15/2015	--	<0.001	--	--	0.17	--	100	15	--	--	--	<0.001	--	--	--	7.1	--	--	95	--	--
G51L	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.9	--	--	--	--	--
G51L	02/19/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	--	--	--
G51S	01/30/2015	--	0.0061	--	--	0.015	--	100	11	--	--	--	<0.001	--	--	--	7.0	--	--	53	--	--
G51S	04/17/2015	--	0.0094	--	--	0.017	--	100	9.1	--	--	--	<0.001	--	--	--	7.2	--	--	51	--	--
G51S	07/24/2015	--	0.0085	--	--	<0.01	--	92	11	--	--	--	<0.001	--	--	--	7.1	--	--	40	--	--
G51S	10/15/2015	--	0.0051	--	--	0.021	--	91	8.5	--	--	--	<0.001	--	--	--	7.2	--	--	38	--	--

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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
G51S	12/03/2015	<0.003	0.0086	0.13	<0.001	0.02	<0.001	110	10	<0.004	<0.002	0.277	0.002	<0.01	<0.0002	0.0023	7.0	1.28	<0.001	39	<0.001	400
G51S	01/29/2016	<0.003	0.0042	0.097	<0.001	0.02	<0.001	89	11	<0.004	<0.002	<0.25	<0.001	<0.01	0.0004	0.0021	7.0	1.21	<0.001	52	<0.001	380
G51S	04/25/2016	<0.003	0.0048	0.096	<0.001	<0.01	<0.001	92	13	<0.004	<0.002	0.337	<0.001	<0.01	<0.0002	0.0016	7.1	0.517	<0.001	45	<0.001	400
G51S	08/10/2016	<0.003	0.0047	0.11	<0.001	0.014	<0.001	92	25	<0.004	<0.002	0.29	<0.001	<0.01	<0.0002	<0.001	7.1	0.921	<0.001	97	<0.001	350
G51S	10/21/2016	<0.003	0.0054	0.11	<0.001	<0.01	<0.001	89	13	<0.004	<0.002	0.27	<0.001	<0.01	<0.0002	0.0012	7.4	1.46	<0.001	44	<0.001	300
G51S	01/21/2017	<0.003	0.0034	0.083	<0.001	<0.01	<0.001	67	13	<0.004	<0.002	<0.25	<0.001	<0.01	<0.0002	0.0017	7.3	0.719	<0.001	48	<0.001	380
G51S	04/07/2017	<0.003	0.0029	0.089	<0.001	0.01	<0.001	94	13	<0.004	<0.002	<0.25	<0.001	<0.01	<0.0002	0.002	7.0	0.313	<0.001	50	<0.001	380
G51S	06/28/2017	<0.003	0.005	0.11	0.0013	<0.01	<0.001	82	14	<0.004	<0.002	<0.25	0.0015	<0.01	0.00034	0.0029	6.8	1.11	0.0014	41	0.0028	400
G51S	11/08/2017	--	--	--	--	0.013	--	96	12	--	--	0.368	--	--	--	--	7.1	--	--	34	--	320
G51S	06/04/2018	--	--	--	--	0.039	--	97	11	--	--	0.266	--	--	--	--	7.0	--	--	52	--	380
G51S	07/13/2018	--	--	--	--	0.014	--	96	--	--	--	0.31	--	--	--	--	6.9	--	--	--	--	390
G51S	10/11/2018	--	--	--	--	0.015	--	99	13	--	--	0.264	--	--	--	--	7.1	--	--	51	--	380
G51S	02/05/2019	--	--	--	--	0.012	--	90	14	--	--	0.33	--	--	--	--	6.8	--	--	50	--	380
G51S	07/08/2019	--	--	--	--	0.039	--	100	16	--	--	0.332	--	--	--	--	7.0	--	--	48	--	460
G51S	01/14/2020	--	--	--	--	0.016	--	100	13	--	--	<0.25	--	--	--	--	7.1	--	--	53	--	440
G51S	08/10/2020	--	--	--	--	0.01	--	99	8.2	--	--	<0.25	--	--	--	--	6.9	--	--	26	--	390
G51S	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	--
G51S	02/19/2021	--	--	--	--	0.022	--	100	19	--	--	0.316	--	--	--	--	7.2	--	--	52	--	410
G51S	04/14/2021	<0.003	0.0042	0.1	<0.001	0.017	<0.001	88	14	<0.004	<0.002	0.258	0.012	<0.02	<0.0002	0.0012	7.1	0	<0.001	51	<0.001	380
G51S	04/29/2021	<0.003	0.0038	0.11	<0.001	0.019	<0.001	100	15	0.0059	<0.002	0.25	0.015	<0.02	<0.0002	0.0013	7.1	0.825	<0.001	51	<0.001	400
G51S	05/13/2021	<0.003	0.0012	0.089	<0.001	0.013	<0.001	94	15	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	<0.001	7.2	0	<0.001	55	<0.001	350
G51S	06/01/2021	<0.003	0.0017	0.091	<0.001	0.022	<0.001	94	17	<0.004	<0.002	0.292	0.0046	<0.02	<0.0002	0.002	7.2	0.655	<0.001	51	<0.001	400

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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
G51S	06/15/2021	<0.003	0.0023	0.11	<0.001	0.022	<0.001	110	12	<0.004	<0.002	<0.25	0.0019	<0.02	<0.0002	<0.001	7.0	0.0656	<0.001	54	<0.001	410
G51S	06/21/2021	<0.003	0.0013	0.092	<0.001	0.037	<0.001	96	14	<0.004	<0.002	0.415	0.0017	<0.02	<0.0002	<0.001	7.1	0	<0.001	53	<0.001	410
G51S	07/12/2021	<0.003	0.0055	0.11	<0.001	0.014	<0.001	95	16	<0.004	<0.002	<0.25	0.0056	<0.02	<0.0002	0.0013	7.0	0.75	<0.001	51	<0.001	460
G51S	07/27/2021	<0.003	0.002	0.12	<0.001	0.016	<0.001	85	14	<0.004	<0.002	0.265	0.0017	<0.02	0.00098	<0.001	7.1	0.281	<0.001	51	<0.001	360
G52L	01/30/2015	--	<0.001	--	--	0.03	--	190	27	--	--	--	<0.001	--	--	--	6.6	--	--	160	--	--
G52L	04/17/2015	--	0.0015	--	--	0.021	--	230	22	--	--	--	<0.001	--	--	--	6.6	--	--	140	--	--
G52L	07/24/2015	--	<0.001	--	--	0.011	--	220	23	--	--	--	<0.001	--	--	--	6.6	--	--	120	--	--
G52L	10/15/2015	--	<0.001	--	--	0.026	--	220	22	--	--	--	<0.001	--	--	--	7.1	--	--	120	--	--
G52L	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.5	--	--	--	--	--
G52L	02/19/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.4	--	--	--	--	--
G52S	01/30/2015	--	0.019	--	--	0.04	--	150	14	--	--	--	0.041	--	--	--	6.8	--	--	110	--	--
G52S	04/17/2015	--	0.023	--	--	1.9	--	180	11	--	--	--	0.041	--	--	--	6.9	--	--	95	--	--
G52S	07/24/2015	--	0.012	--	--	0.019	--	160	12	--	--	--	0.023	--	--	--	6.9	--	--	97	--	--
G52S	10/15/2015	--	0.0083	--	--	0.036	--	150	9.7	--	--	--	0.01	--	--	--	6.9	--	--	89	--	--
G53L	01/30/2015	--	<0.001	--	--	0.12	--	110	65	--	--	--	<0.001	--	--	--	6.8	--	--	120	--	--
G53L	04/16/2015	--	<0.001	--	--	0.097	--	110	72	--	--	--	<0.001	--	--	--	6.9	--	--	140	--	--
G53L	07/24/2015	--	<0.001	--	--	0.11	--	110	70	--	--	--	<0.001	--	--	--	6.9	--	--	120	--	--
G53L	10/16/2015	--	<0.001	--	--	0.17	--	110	75	--	--	--	<0.001	--	--	--	6.9	--	--	140	--	--
G53L	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.6	--	--	--	--	--
G53L	02/22/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	--	--	--
G53S	01/30/2015	--	0.03	--	--	0.027	--	110	15	--	--	--	0.0049	--	--	--	7.0	--	--	79	--	--
G53S	04/16/2015	--	0.022	--	--	0.02	--	110	16	--	--	--	0.0056	--	--	--	7.1	--	--	86	--	--

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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
G53S	07/24/2015	--	0.0096	--	--	0.012	--	120	12	--	--	--	0.003	--	--	--	7.0	--	--	71	--	--
G53S	10/16/2015	--	0.02	--	--	0.024	--	110	11	--	--	--	0.0011	--	--	--	7.2	--	--	75	--	--
G53S	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.9	--	--	--	--	--
G53S	02/22/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	--	--	--
G54C	04/14/2021	<0.003	0.0038	0.43	<0.001	0.16	<0.001	110	2.9	0.0081	0.0026	0.41	0.0014	<0.02	<0.0002	0.041	7.3	0.714	<0.001	50	<0.001	660
G54C	04/29/2021	<0.003	0.002	0.39	<0.001	0.13	<0.001	110	2.7	<0.004	<0.002	0.384	<0.001	<0.02	<0.0002	0.032	7.3	1.32	<0.001	45	<0.001	640
G54C	05/12/2021	<0.003	0.0029	0.47	<0.001	0.35	<0.001	110	2.9	<0.004	<0.002	0.465	0.0011	<0.02	<0.0002	0.035	7.2	0	0.0018	55	<0.001	630
G54C	06/01/2021	<0.003	0.0046	0.37	<0.001	0.12	<0.001	110	1.8	<0.004	<0.002	0.404	<0.001	<0.02	<0.0002	0.03	7.3	0.51	<0.001	47	<0.001	650
G54C	06/14/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.38	--	--	--	--
G54L	10/14/2015	--	0.028	--	--	0.041	--	180	11	--	--	--	0.0035	--	--	--	6.6	--	--	1.2	--	--
G54L	11/17/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.5	--	--	--	--	--
G54L	02/22/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.6	--	--	--	--	--
G54L	04/14/2021	<0.003	0.0058	0.18	<0.001	0.022	<0.001	150	21	<0.004	0.0044	<0.25	<0.001	<0.02	<0.0002	0.0027	6.6	0.299	<0.001	95	<0.001	900
G54L	04/29/2021	<0.003	0.01	0.21	<0.001	0.023	<0.001	170	20	<0.004	0.0026	<0.25	<0.001	<0.02	<0.0002	0.0011	6.6	0.516	<0.001	81	<0.001	800
G54L	05/12/2021	<0.003	0.014	0.24	<0.001	0.031	<0.001	160	21	0.0079	<0.002	<0.25	<0.001	<0.02	<0.0002	0.002	6.5	0.873	<0.001	70	<0.001	520
G54L	06/01/2021	<0.003	0.0069	0.16	<0.001	0.024	<0.001	160	21	<0.004	0.0029	<0.25	<0.001	<0.02	<0.0002	<0.001	6.6	0.508	<0.001	65	<0.001	780
G54L	06/14/2021	<0.003	0.006	0.16	<0.001	0.018	<0.001	160	22	<0.004	0.0021	<0.25	<0.001	<0.02	<0.0002	<0.001	6.7	0.766	<0.001	55	<0.001	750
G54L	06/21/2021	<0.003	0.0056	0.19	<0.001	0.03	<0.001	160	19	<0.004	0.0022	0.383	<0.001	<0.02	<0.0002	<0.001	6.5	1.21	<0.001	46	<0.001	700
G54L	07/13/2021	<0.003	0.0033	0.13	<0.001	0.023	<0.001	140	23	<0.004	0.0029	<0.25	<0.001	<0.02	<0.0002	0.002	6.4	0.246	<0.001	97	<0.001	850
G54L	07/27/2021	<0.003	0.0017	0.15	<0.001	0.027	<0.001	120	5.2	<0.004	<0.002	<0.25	<0.001	<0.02	0.00027	0.0047	6.6	1.65	<0.001	100	<0.001	720
G54S	01/30/2015	--	0.0013	--	--	0.045	--	120	<5	--	--	--	<0.001	--	--	--	6.8	--	--	47	--	--
G54S	04/16/2015	--	0.0014	--	--	0.029	--	140	2.2	--	--	--	<0.001	--	--	--	6.8	--	--	51	--	--

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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
G54S	07/23/2015	--	0.0011	--	--	0.05	--	130	2.3	--	--	--	<0.001	--	--	--	6.9	--	--	40	--	--
G54S	10/14/2015	--	0.0021	--	--	0.048	--	140	2.3	--	--	--	<0.001	--	--	--	6.9	--	--	41	--	--
G54S	12/04/2015	<0.003	<0.001	0.2	<0.001	0.027	<0.001	130	4.5	<0.004	<0.002	<0.25	<0.001	0.01	<0.0002	0.0016	6.5	1.28	<0.001	43	<0.001	600
G54S	01/29/2016	<0.003	0.0014	0.25	<0.001	0.046	<0.001	130	2.6	<0.004	<0.002	<0.25	<0.001	0.01	<0.0002	0.0019	6.9	0.787	<0.001	47	<0.001	570
G54S	05/02/2016	<0.003	<0.001	0.23	<0.001	0.036	<0.001	140	3	<0.004	<0.002	<0.25	<0.001	<0.01	<0.0002	0.0019	6.7	1.01	<0.001	45	<0.001	520
G54S	08/12/2016	<0.003	0.002	0.24	<0.001	0.03	<0.001	120	2.3	<0.004	<0.002	0.269	<0.001	0.012	<0.0002	0.0019	7.1	0.476	<0.001	43	<0.001	480
G54S	10/21/2016	<0.003	0.0023	0.27	<0.001	0.022	<0.001	120	2.5	<0.004	<0.002	0.259	<0.001	<0.01	0.00021	0.0023	7.2	1.27	<0.001	43	<0.001	520
G54S	01/24/2017	<0.003	0.0017	0.25	<0.001	0.03	<0.001	120	2	<0.004	<0.002	<0.25	<0.001	<0.01	<0.0002	0.0017	7.5	0.661	<0.001	44	<0.001	550
G54S	04/07/2017	<0.003	0.001	0.22	<0.001	0.028	<0.001	120	2.6	<0.004	<0.002	<0.25	<0.001	<0.01	<0.0002	0.0017	6.9	0.44	<0.001	45	<0.001	540
G54S	06/28/2017	<0.003	0.0059	0.28	<0.001	0.022	<0.001	110	2.5	<0.004	<0.002	<0.25	<0.001	<0.01	<0.0002	0.0025	7.1	1.19	<0.001	43	<0.001	520
G54S	11/08/2017	--	--	--	--	0.035	--	130	2.2	--	--	0.342	--	--	--	--	7.1	--	--	42	--	480
G54S	01/18/2018	--	--	--	--	0.052	--	120	--	--	--	--	--	--	--	--	6.9	--	--	--	--	380
G54S	06/04/2018	--	--	--	--	0.059	--	130	2.3	--	--	<0.25	--	--	--	--	7.1	--	--	43	--	500
G54S	07/13/2018	--	--	--	--	0.033	--	130	--	--	--	0.29	--	--	--	--	7.1	--	--	--	--	540
G54S	10/16/2018	--	--	--	--	0.037	--	130	2.5	--	--	<0.25	--	--	--	--	7.2	--	--	44	--	460
G54S	02/05/2019	--	--	--	--	0.032	--	130	2.3	--	--	0.283	--	--	--	--	7.1	--	--	44	--	590
G54S	07/15/2019	--	--	--	--	0.057	--	130	1.5	--	--	<0.25	--	--	--	--	7.1	--	--	46	--	590
G54S	01/14/2020	--	--	--	--	0.043	--	150	2.6	--	--	<0.25	--	--	--	--	6.9	--	--	45	--	620
G54S	08/10/2020	--	--	--	--	0.034	--	140	1.1	--	--	<0.25	--	--	--	--	6.8	--	--	21	--	460
G54S	11/17/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	--	--	--
G54S	02/22/2021	--	--	--	--	0.045	--	120	2.5	--	--	<0.25	--	--	--	--	6.8	--	--	39	--	500
G54S	06/21/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	590

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HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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
G55L	01/30/2015	--	<0.001	--	--	0.018	--	100	17	--	--	--	<0.001	--	--	--	6.8	--	--	56	--	--
G55L	04/16/2015	--	<0.001	--	--	<0.01	--	130	23	--	--	--	<0.001	--	--	--	6.8	--	--	67	--	--
G55L	07/23/2015	--	<0.001	--	--	0.02	--	130	20	--	--	--	<0.001	--	--	--	6.9	--	--	59	--	--
G55L	10/14/2015	--	<0.001	--	--	0.02	--	130	18	--	--	--	<0.001	--	--	--	6.9	--	--	63	--	--
G55L	11/17/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.5	--	--	--	--	--
G55L	02/22/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	--	--	--
G55S	01/30/2015	--	0.0053	--	--	0.046	--	130	5.1	--	--	--	0.0075	--	--	--	6.9	--	--	33	--	--
G55S	04/16/2015	--	0.0086	--	--	0.05	--	150	5.1	--	--	--	0.015	--	--	--	7.0	--	--	37	--	--
G55S	07/23/2015	--	0.0033	--	--	0.046	--	140	4.8	--	--	--	0.0047	--	--	--	7.1	--	--	27	--	--
G55S	10/14/2015	--	0.0033	--	--	0.031	--	130	5.5	--	--	--	0.0042	--	--	--	7.0	--	--	28	--	--
G55S	11/17/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.6	--	--	--	--	--
G55S	02/22/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	--	--	--
G56L	07/22/2015	--	<0.001	--	--	0.062	--	130	29	--	--	--	0.0012	--	--	--	6.9	--	--	46	--	--
G56L	10/16/2015	--	0.0047	--	--	0.028	--	130	27	--	--	--	0.0062	--	--	--	7.0	--	--	44	--	--
G56L	11/17/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	--	--	--
G56L	02/22/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.6	--	--	--	--	--
G56S	02/04/2015	--	0.014	--	--	0.049	--	120	--	--	--	--	0.0057	--	--	--	7.2	--	--	58	--	--
G56S	04/16/2015	--	0.013	--	--	0.019	--	190	17	--	--	--	0.014	--	--	--	6.8	--	--	65	--	--
G56S	07/22/2015	--	0.051	--	--	0.053	--	150	13	--	--	--	0.0086	--	--	--	6.9	--	--	57	--	--
G56S	10/16/2015	--	0.012	--	--	0.022	--	130	11	--	--	--	0.0046	--	--	--	6.9	--	--	56	--	--
G56S	11/17/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	--	--	--
G56S	02/22/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.6	--	--	--	--	--

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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
G57L	02/04/2015	--	0.018	--	--	0.05	--	120	19	--	--	--	0.0047	--	--	--	7.2	--	--	320	--	--
G57L	02/25/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.2	--	--	--	--	--
G57L	04/16/2015	--	0.0069	--	--	0.019	--	150	22	--	--	--	0.0026	--	--	--	6.9	--	--	300	--	--
G57L	07/22/2015	--	0.0034	--	--	0.083	--	97	13	--	--	--	0.0026	--	--	--	6.9	--	--	96	--	--
G57L	10/16/2015	--	0.0054	--	--	0.042	--	100	13	--	--	--	0.0026	--	--	--	6.7	--	--	110	--	--
G57L	11/17/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	--
G57L	02/22/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	--	--	--
G57S	02/04/2015	--	<0.001	--	--	0.019	--	100	19	--	--	--	<0.001	--	--	--	7.1	--	--	53	--	--
G57S	04/16/2015	--	<0.001	--	--	<0.01	--	130	23	--	--	--	<0.001	--	--	--	7.2	--	--	64	--	--
G57S	07/22/2015	--	0.0019	--	--	0.05	--	140	18	--	--	--	0.0058	--	--	--	7.0	--	--	53	--	--
G57S	10/16/2015	--	<0.001	--	--	0.013	--	110	17	--	--	--	<0.001	--	--	--	7.1	--	--	56	--	--
G57S	12/04/2015	<0.003	<0.001	0.14	<0.001	<0.01	<0.001	130	18	<0.004	<0.002	<0.25	0.0012	<0.01	<0.0002	<0.001	6.8	0.804	<0.001	54	<0.001	570
G57S	01/29/2016	<0.003	<0.001	0.13	<0.001	0.021	<0.001	110	19	<0.004	<0.002	<0.25	<0.001	<0.01	<0.0002	<0.001	6.8	0.194	<0.001	58	<0.001	510
G57S	05/02/2016	<0.003	<0.001	0.13	<0.001	<0.01	<0.001	120	20	<0.004	<0.002	0.277	<0.001	<0.01	<0.0002	<0.001	6.9	0.471	<0.001	56	<0.001	500
G57S	08/12/2016	<0.003	<0.001	0.13	<0.001	<0.01	<0.001	120	20	<0.004	<0.002	0.304	<0.001	<0.01	<0.0002	<0.001	7.0	0.302	<0.001	58	<0.001	480
G57S	10/28/2016	<0.003	<0.001	0.14	<0.001	0.019	<0.001	100	19	<0.004	<0.002	0.321	<0.001	<0.01	<0.0002	<0.001	7.1	0.124	<0.001	55	<0.001	550
G57S	02/03/2017	<0.003	<0.001	0.13	<0.001	<0.01	<0.001	120	20	<0.004	<0.002	0.268	<0.001	<0.01	<0.0002	<0.001	7.2	1.32	<0.001	52	<0.001	530
G57S	05/01/2017	0.0064	<0.001	0.13	0.0027	<0.01	0.0016	110	18	<0.004	<0.002	0.284	0.0032	<0.01	<0.0002	0.0034	7.1	0.0112	<0.001	52	0.0033	510
G57S	06/28/2017	<0.003	<0.001	0.13	<0.001	<0.01	<0.001	130	22	<0.004	<0.002	0.276	<0.001	<0.01	<0.0002	<0.001	7.3	0.607	<0.001	53	<0.001	520
G57S	11/08/2017	--	--	--	--	<0.01	--	120	19	--	--	0.39	--	--	--	--	7.0	--	--	51	--	450
G57S	01/18/2018	--	--	--	--	--	--	180	--	--	--	<0.25	--	--	--	--	7.1	--	--	--	--	370
G57S	06/04/2018	--	--	--	--	0.027	--	120	19	--	--	0.28	--	--	--	--	7.2	--	--	52	--	500

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DUCK CREEK POWER PLANT
GMF POND
CANTON, 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
G57S	07/21/2018	--	--	--	--	0.024	--	110	--	--	--	<0.25	--	--	--	--	7.2	--	--	--	--	540
G57S	10/17/2018	--	--	--	--	0.014	--	130	22	--	--	<0.25	--	--	--	--	7.3	--	--	53	--	470
G57S	02/06/2019	--	--	--	--	0.016	--	130	23	--	--	0.349	--	--	--	--	7.2	--	--	54	--	520
G57S	07/15/2019	--	--	--	--	0.055	--	140	18	--	--	0.327	--	--	--	--	7.1	--	--	55	--	680
G57S	01/14/2020	--	--	--	--	0.011	--	150	20	--	--	<0.25	--	--	--	--	6.8	--	--	55	--	700
G57S	08/10/2020	--	--	--	--	<0.01	--	150	15	--	--	0.292	--	--	--	--	6.6	--	--	51	--	600
G57S	11/17/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	590
G57S	02/22/2021	--	--	--	--	0.013	--	120	1.8	--	--	0.313	--	--	--	--	6.9	--	--	54	--	680
G58L	04/15/2015	--	0.026	--	--	0.016	--	150	27	--	--	--	0.0072	--	--	--	6.9	--	--	320	--	--
G58L	07/22/2015	--	0.0027	--	--	0.051	--	120	29	--	--	--	0.0023	--	--	--	7.0	--	--	180	--	--
G58L	10/14/2015	--	0.013	--	--	0.024	--	140	23	--	--	--	0.012	--	--	--	7.0	--	--	190	--	--
G58L	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	--
G58L	02/22/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	--	--	--
G58S	02/04/2015	--	<0.001	--	--	0.018	--	180	20	--	--	--	<0.001	--	--	--	6.8	--	--	520	--	--
G58S	04/15/2015	--	<0.001	--	--	0.014	--	190	21	--	--	--	<0.001	--	--	--	6.6	--	--	540	--	--
G58S	07/22/2015	--	0.0092	--	--	0.044	--	180	19	--	--	--	0.018	--	--	--	6.8	--	--	250	--	--
G58S	10/14/2015	--	0.0025	--	--	0.18	--	170	17	--	--	--	0.0033	--	--	--	6.9	--	--	300	--	--
G58S	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.6	--	--	--	--	--
G58S	02/22/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.6	--	--	--	--	--
G59L	07/22/2015	--	0.0029	--	--	0.057	--	100	<25	--	--	--	0.0023	--	--	--	6.7	--	--	110	--	--
G59L	10/14/2015	--	0.013	--	--	0.043	--	110	19	--	--	--	0.014	--	--	--	7.0	--	--	84	--	--
G59L	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	--	--	--

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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
G59L	02/22/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	--	--	--
G59S	02/04/2015	--	0.02	--	--	0.038	--	210	8.8	--	--	--	0.016	--	--	--	6.9	--	--	110	--	--
G59S	04/15/2015	--	0.011	--	--	0.026	--	190	9.3	--	--	--	0.012	--	--	--	6.9	--	--	110	--	--
G59S	07/22/2015	--	0.0061	--	--	0.071	--	150	15	--	--	--	0.0046	--	--	--	6.9	--	--	150	--	--
G59S	10/14/2015	--	0.021	--	--	0.056	--	230	12	--	--	--	0.014	--	--	--	7.1	--	--	95	--	--
G59S	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	--	--	--
G59S	02/22/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	--	--	--
G60L	11/17/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.3	--	--	--	--	--
G60L	02/23/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.2	--	--	--	--	--
G60L	04/14/2021	<0.003	<0.001	0.019	<0.001	0.034	<0.001	110	19	<0.004	0.0052	<0.25	<0.001	<0.02	<0.0002	<0.001	6.2	1.14	<0.001	<250	<0.001	550
G60L	04/29/2021	<0.003	<0.001	0.017	<0.001	0.029	<0.001	120	19	<0.004	0.0038	<0.25	<0.001	<0.02	<0.0002	<0.001	6.1	0.0999	<0.001	160	<0.001	580
G60L	05/13/2021	<0.003	<0.001	0.017	<0.001	0.025	<0.001	110	19	<0.004	0.0023	<0.25	<0.001	<0.02	<0.0002	<0.001	6.2	0	<0.001	180	<0.001	580
G60L	06/01/2021	<0.003	<0.001	0.014	<0.001	0.029	<0.001	110	20	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	<0.001	6.3	1.08	<0.001	170	<0.001	560
G60L	06/15/2021	<0.003	<0.001	0.015	<0.001	0.029	<0.001	110	16	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	<0.001	6.2	0.347	<0.001	180	<0.001	530
G60L	06/21/2021	<0.003	<0.001	0.018	<0.001	0.068	<0.001	110	18	<0.004	0.0031	<0.25	<0.001	<0.02	<0.0002	<0.001	6.2	0.8	<0.001	180	<0.001	580
G60L	07/12/2021	<0.003	<0.001	0.027	<0.001	0.027	<0.001	110	18	<0.004	0.008	<0.25	<0.001	<0.02	<0.0002	<0.001	6.0	0.168	<0.001	180	<0.001	580
G60L	07/28/2021	<0.003	<0.001	0.019	<0.001	0.022	<0.001	110	15	<0.004	0.0039	<0.25	<0.001	<0.02	<0.0002	<0.001	6.2	2.36	<0.001	160	<0.001	530
G60S	02/04/2015	--	0.0042	--	--	0.024	--	120	12	--	--	--	0.0046	--	--	--	6.8	--	--	62	--	--
G60S	04/15/2015	--	0.018	--	--	0.028	--	250	11	--	--	--	0.022	--	--	--	6.8	--	--	63	--	--
G60S	07/22/2015	--	0.0032	--	--	0.035	--	150	9.6	--	--	--	0.003	--	--	--	6.8	--	--	58	--	--
G60S	10/14/2015	--	0.002	--	--	0.064	--	130	8.6	--	--	--	<0.001	--	--	--	7.1	--	--	60	--	--
G60S	12/04/2015	<0.003	0.0097	0.24	<0.001	0.024	<0.001	180	8.4	0.012	0.0049	0.264	0.0099	0.018	<0.0002	0.0016	6.6	1.74	0.0031	61	<0.001	610

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DUCK CREEK POWER PLANT
GMF POND
CANTON, 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
G60S	01/29/2016	<0.003	0.0016	0.14	<0.001	0.024	<0.001	120	8.8	<0.004	<0.002	<0.25	0.0012	<0.01	<0.0002	<0.001	6.7	0.987	<0.001	65	<0.001	500
G60S	05/02/2016	<0.003	0.0032	0.17	<0.001	0.015	<0.001	160	7.9	0.0052	<0.002	0.276	0.0024	<0.01	<0.0002	<0.001	6.7	0.34	<0.001	64	<0.001	550
G60S	08/20/2016	<0.003	<0.001	0.14	<0.001	<0.01	<0.001	130	8.6	<0.004	<0.002	0.307	<0.001	<0.01	<0.0002	<0.001	6.7	0.876	<0.001	62	<0.001	560
G60S	10/28/2016	<0.003	0.004	0.18	<0.001	0.029	<0.001	120	8.1	<0.004	<0.002	0.331	<0.001	<0.01	<0.0002	0.001	6.6	1.29	<0.001	64	<0.001	540
G60S	02/03/2017	<0.003	<0.001	0.13	<0.001	0.011	<0.001	130	11	<0.004	<0.002	0.268	<0.001	<0.01	<0.0002	<0.001	6.5	1.27	<0.001	60	<0.001	580
G60S	04/25/2017	<0.003	<0.001	0.14	<0.001	0.01	<0.001	120	8.7	<0.004	<0.002	0.287	<0.001	<0.01	<0.0002	<0.001	6.8	0.946	<0.001	61	<0.001	580
G60S	06/29/2017	<0.003	0.0021	0.15	<0.001	<0.01	<0.001	110	10	<0.004	<0.002	0.328	<0.001	<0.01	<0.0002	<0.001	7.0	1.54	<0.001	68	<0.001	580
G60S	11/08/2017	--	--	--	--	0.01	--	120	11	--	--	0.351	--	--	--	--	6.9	--	--	67	--	460
G60S	01/19/2018	--	--	--	--	--	--	100	--	--	--	0.313	--	--	--	--	6.9	--	--	--	--	520
G60S	06/04/2018	--	--	--	--	0.035	--	150	11	--	--	0.316	--	--	--	--	6.9	--	--	73	--	490
G60S	07/21/2018	--	--	--	--	0.022	--	120	--	--	--	<0.25	--	--	--	--	7.0	--	--	--	--	540
G60S	10/17/2018	--	--	--	--	0.018	--	120	12	--	--	<0.25	--	--	--	--	6.9	--	--	72	--	440
G60S	02/06/2019	--	--	--	--	0.04	--	270	19	--	--	0.327	--	--	--	--	7.0	--	--	200	--	760
G60S	04/08/2019	--	--	--	--	--	--	160	13	--	--	--	--	--	--	--	7.0	--	--	240	--	860
G60S	07/15/2019	--	--	--	--	0.024	--	140	10	--	--	0.319	--	--	--	--	6.8	--	--	190	--	800
G60S	01/14/2020	--	--	--	--	0.026	--	150	11	--	--	<0.25	--	--	--	--	6.7	--	--	200	--	790
G60S	08/10/2020	--	--	--	--	0.015	--	140	6.8	--	--	<0.25	--	--	--	--	6.6	--	--	120	--	600
G60S	11/17/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	110	--	630
G60S	02/23/2021	--	--	--	--	0.019	--	130	9.1	--	--	<0.25	--	--	--	--	6.6	--	--	67	--	620
G61S	02/04/2015	--	0.002	--	--	0.051	--	150	22	--	--	--	0.003	--	--	--	7.0	--	--	330	--	--
G61S	04/15/2015	--	0.0022	--	--	0.034	--	120	22	--	--	--	0.0028	--	--	--	7.0	--	--	220	--	--
G61S	07/21/2015	--	0.0012	--	--	0.029	--	120	18	--	--	--	0.0012	--	--	--	6.9	--	--	140	--	--

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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
G61S	10/13/2015	--	0.0012	--	--	0.027	--	140	20	--	--	--	<0.001	--	--	--	7.0	--	--	160	--	--
G61S	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.6	--	--	--	--	--
G61S	02/23/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.5	--	--	--	--	--
G62L	02/04/2015	--	0.0031	--	--	0.083	--	120	19	--	--	--	0.0029	--	--	--	6.8	--	--	89	--	--
G62L	04/15/2015	--	0.0025	--	--	0.068	--	160	20	--	--	--	0.0015	--	--	--	6.9	--	--	150	--	--
G62L	07/22/2015	--	0.0016	--	--	0.13	--	68	9.2	--	--	--	0.0011	--	--	--	7.0	--	--	57	--	--
G62L	10/13/2015	--	0.0018	--	--	0.12	--	140	12	--	--	--	0.0023	--	--	--	7.2	--	--	87	--	--
G62L	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	--	--	--
G62L	02/24/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	--	--	--
G63L	04/15/2015	--	0.0033	--	--	0.03	--	210	26	--	--	--	0.0035	--	--	--	6.9	--	--	350	--	--
G63L	07/22/2015	--	0.0021	--	--	0.091	--	190	13	--	--	--	0.0011	--	--	--	6.9	--	--	230	--	--
G63L	10/13/2015	--	0.0063	--	--	0.04	--	210	24	--	--	--	0.0083	--	--	--	7.2	--	--	270	--	--
G63L	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	--
G63L	02/24/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	--	--	--
G63S	02/04/2015	--	0.003	--	--	0.023	--	110	3.6	--	--	--	0.0016	--	--	--	7.1	--	--	40	--	--
G63S	04/15/2015	--	<0.001	--	--	0.017	--	110	3.2	--	--	--	<0.001	--	--	--	7.0	--	--	36	--	--
G63S	07/22/2015	--	0.0018	--	--	0.036	--	110	3.4	--	--	--	<0.001	--	--	--	7.2	--	--	38	--	--
G63S	10/13/2015	--	0.0013	--	--	0.02	--	110	3.7	--	--	--	<0.001	--	--	--	7.3	--	--	45	--	--
G63S	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	--
G63S	02/24/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	--
G64L	02/04/2015	--	0.0019	--	--	0.014	--	100	3.1	--	--	--	0.0023	--	--	--	6.9	--	--	26	--	--
G64L	04/15/2015	--	<0.001	--	--	0.012	--	96	2.9	--	--	--	<0.001	--	--	--	7.1	--	--	25	--	--

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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
G64L	07/22/2015	--	<0.001	--	--	0.034	--	110	4.5	--	--	--	<0.001	--	--	--	7.0	--	--	120	--	--
G64L	10/13/2015	--	0.0031	--	--	0.11	--	110	3.9	--	--	--	0.0037	--	--	--	7.1	--	--	93	--	--
G64L	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.1	--	--	--	--	--
G64L	02/25/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	--
G64S	02/04/2015	--	0.0033	--	--	0.023	--	100	4.1	--	--	--	0.0034	--	--	--	7.1	--	--	28	--	--
G64S	04/15/2015	--	0.0038	--	--	0.018	--	110	3.9	--	--	--	0.0033	--	--	--	7.0	--	--	25	--	--
G64S	07/22/2015	--	0.011	--	--	0.037	--	120	3.7	--	--	--	0.0049	--	--	--	7.0	--	--	27	--	--
G64S	10/13/2015	--	0.0037	--	--	0.022	--	110	4.4	--	--	--	<0.001	--	--	--	7.1	--	--	77	--	--
G64S	12/04/2015	<0.003	0.004	0.2	<0.001	0.017	<0.001	110	3.6	<0.004	<0.002	0.3	0.0017	<0.01	<0.0002	0.0019	6.8	0.607	0.0013	25	<0.001	500
G64S	01/29/2016	<0.003	0.0031	0.17	<0.001	0.03	<0.001	98	4.1	<0.004	<0.002	<0.25	0.0033	<0.01	<0.0002	0.0018	7.0	0.634	<0.001	27	<0.001	420
G64S	05/02/2016	<0.003	0.0017	0.17	<0.001	0.017	<0.001	110	4.1	<0.004	<0.002	0.303	0.0015	<0.01	<0.0002	0.0018	7.1	1.43	<0.001	27	<0.001	400
G64S	08/20/2016	<0.003	0.0035	0.21	<0.001	0.011	<0.001	110	4	0.015	<0.002	0.317	0.0028	<0.01	<0.0002	0.0023	7.1	0.782	<0.001	26	<0.001	430
G64S	10/28/2016	<0.003	0.0045	0.22	<0.001	0.036	<0.001	92	3.7	<0.004	<0.002	0.375	0.0051	<0.01	<0.0002	0.002	7.2	1.08	<0.001	28	<0.001	440
G64S	02/03/2017	<0.003	0.0023	0.18	<0.001	0.015	<0.001	99	3.6	<0.004	<0.002	0.314	<0.001	<0.01	<0.0002	0.0016	7.2	1.11	<0.001	26	<0.001	460
G64S	05/01/2017	0.0037	0.0037	0.2	<0.001	0.015	<0.001	100	3.7	<0.004	<0.002	0.32	<0.001	<0.01	<0.0002	0.0023	6.9	0.748	<0.001	32	<0.001	450
G64S	06/29/2017	<0.003	0.0028	0.17	<0.001	<0.01	<0.001	80	3.7	<0.004	<0.002	0.376	<0.001	<0.01	<0.0002	0.0013	6.8	1.19	<0.001	26	<0.001	460
G64S	11/08/2017	--	--	--	--	0.014	--	95	3.5	--	--	0.401	--	--	--	--	6.8	--	--	25	--	380
G64S	01/19/2018	--	--	--	--	--	--	--	--	--	--	0.367	--	--	--	--	6.9	--	--	--	--	--
G64S	06/04/2018	--	--	--	--	0.029	--	91	3.6	--	--	0.316	--	--	--	--	6.9	--	--	25	--	380
G64S	07/21/2018	--	--	--	--	0.019	--	83	--	--	--	0.318	--	--	--	--	6.9	--	--	--	--	390
G64S	10/20/2018	--	--	--	--	0.021	--	98	3.8	--	--	0.256	--	--	--	--	6.9	--	--	28	--	420
G64S	02/06/2019	--	--	--	--	0.024	--	140	4.1	--	--	0.38	--	--	--	--	6.8	--	--	25	--	420

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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
G64S	07/15/2019	--	--	--	--	0.023	--	100	3.2	--	--	0.333	--	--	--	--	7.2	--	--	25	--	490
G64S	01/15/2020	--	--	--	--	0.024	--	110	3.4	--	--	0.34	--	--	--	--	6.8	--	--	21	--	480
G64S	08/11/2020	--	--	--	--	0.019	--	100	3.7	--	--	0.287	--	--	--	--	7.0	--	--	26	--	440
G64S	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	--
G64S	02/24/2021	--	--	--	--	0.021	--	100	3.6	--	--	0.385	--	--	--	--	7.0	--	--	22	--	500
G64S	06/21/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.1	--	--	--	--	450
P60	02/24/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.3	--	--	--	--	--
P60	03/24/2021	--	0.02	--	--	0.056	<0.001	150	32	--	--	--	0.036	--	--	--	6.6	--	--	53	--	--
R61L	11/18/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	--	--	--
R61L	02/23/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.6	--	--	--	--	--

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
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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)
G02S	12/02/2015	0	-103	6.6	785	12.7	226
G02S	02/03/2016	0	-90	6.6	750	11.4	495
G02S	04/20/2016	0	-105	6.6	812	13.2	1000
G02S	08/18/2016	0	-101	6.8	922	16.5	1000
G02S	10/19/2016	0	-126	6.9	829	15.8	1000
G02S	01/12/2017	0	-148	6.9	920	13.0	1000
G02S	04/22/2017	0	-154	6.8	957	13.9	1000
G02S	06/28/2017	0	-137	6.8	892	18.8	1000
G02S	11/10/2017	0	-146	6.9	917	12.9	1000
G02S	01/17/2018	0	-115	6.9	961	10.8	1000
G02S	06/06/2018	0	-118	6.9	1060	16.2	792
G02S	07/06/2018	0	-119	7.0	1020	14.1	779
G02S	10/04/2018	0	-120	7.1	1080	16.3	790
G02S	02/06/2019	0	-122	7.0	1028	12.0	104
G02S	07/08/2019	0	-128	7.0	1028	16.3	97.9
G02S	01/06/2020	0.12	-144	6.6	792.1	10.8	39.7
G02S	08/11/2020	1.00	-54.7	6.4	801	14.2	70.7
G02S	02/19/2021	0.08	-53.1	6.5	766.2	8.3	116
G02S	04/14/2021	0.32	-79.8	6.7	788.2	11.8	85.6
G02S	04/29/2021	1.00	-83.5	6.8	697	13.0	19.5
G02S	05/12/2021	0.16	-64.1	6.6	789	14.5	38.9
G02S	06/01/2021	0.02	-123	6.8	789	15.4	7.5
G02S	06/15/2021	0.34	-116	6.8	673	13.7	6.07
G02S	06/21/2021	0.09	-125	6.8	788.8	12.8	5.68
G02S	07/12/2021	0.14	-108	6.7	796	17.7	0
G02S	07/28/2021	0.58	-88.5	6.9	766	16.8	20.7
G50S	01/30/2015	--	--	6.8	704	--	--
G50S	04/17/2015	--	--	7.3	1118	--	--
G50S	07/24/2015	--	--	7.4	622	--	--
G50S	10/15/2015	--	--	7.4	718	--	--
G50S	12/03/2015	0	-76	6.9	622	13.1	38.7
G50S	01/29/2016	0	-70	7.4	710	11.3	49.3
G50S	04/25/2016	0	-77	7.3	841	13.3	62.1
G50S	08/10/2016	0	-95	7.3	930	17.0	46.1
G50S	10/21/2016	0	-92	7.3	860	15.7	48.5
G50S	01/21/2017	0	-101	7.3	935	14.2	59
G50S	04/07/2017	0	-79	7.3	701	13.4	38.8
G50S	06/28/2017	0	-87	7.1	796	19.2	50.1
G50S	11/08/2017	0	-84	7.1	782	12.5	8.5
G50S	06/04/2018	0	-77	7.1	790	15.3	57.1
G50S	07/13/2018	0	-78	7.1	820	15.0	48
G50S	10/11/2018	0	-86	7.2	780	15.4	34.3
G50S	02/05/2019	0	-90	7.1	819	12.0	47.1
G50S	07/08/2019	0	-64	7.4	654	16.0	48.1

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
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DUCK CREEK POWER PLANT
GMF POND
CANTON, 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)
G50S	01/13/2020	0.95	67.2	6.9	707.5	11.4	69
G50S	08/10/2020	2.30	80.1	6.8	720	16.1	9.83
G50S	11/18/2020	--	--	7.0	656	--	--
G50S	02/19/2021	1.20	50.7	7.0	573.7	9.4	304
G50S	04/14/2021	4.00	119	7.2	699.8	12.4	27.8
G50S	04/29/2021	6.20	41.3	7.1	738.9	13.5	4.44
G50S	05/13/2021	5.00	112	7.2	677	15.0	54.5
G50S	06/01/2021	4.20	78.7	7.0	702.4	14.9	4.89
G50S	06/10/2021	3.60	109	7.2	699	18.6	60.2
G50S	06/21/2021	2.50	53.8	7.1	611	14.9	0.46
G50S	07/13/2021	2.50	82.5	7.2	575	17.2	15.2
G50S	07/28/2021	3.00	73.4	7.1	737	22.1	6.7
G51L	01/30/2015	--	--	6.9	942	--	--
G51L	04/17/2015	--	--	7.0	1390	--	--
G51L	07/24/2015	--	--	7.1	772	--	--
G51L	10/15/2015	--	--	7.1	823	--	--
G51L	11/18/2020	--	--	6.9	845	--	--
G51L	02/19/2021	--	--	6.8	566	--	--
G51S	01/30/2015	--	--	7.0	766	--	--
G51S	04/17/2015	--	--	7.2	1061	--	--
G51S	07/24/2015	--	--	7.1	720	--	--
G51S	10/15/2015	--	--	7.2	758	--	--
G51S	12/03/2015	0	-95	7.0	700	12.7	738
G51S	01/29/2016	0	-69	7.0	780	11.9	539
G51S	04/25/2016	0	-60	7.1	870	12.8	1000
G51S	08/10/2016	0	-67	7.1	863	17.3	1000
G51S	10/21/2016	0	-92	7.4	928	14.9	1000
G51S	01/21/2017	0	-82	7.3	935	14.5	1000
G51S	04/07/2017	0	-72	7.0	852	13.3	8.5
G51S	06/28/2017	0	-74	6.8	880	17.6	3.8
G51S	11/08/2017	0	-61	7.1	848	12.9	4.2
G51S	06/04/2018	0	-42	7.0	902	16.1	8.9
G51S	07/13/2018	0	-71	6.9	910	14.2	11
G51S	10/11/2018	8.60	-110	7.1	812	15.3	22.1
G51S	02/05/2019	0	-59	6.8	900	11.9	14.1
G51S	07/08/2019	0	-60	7.0	716	16.3	52.1
G51S	01/14/2020	4.40	62.7	7.1	686.6	11.4	111
G51S	08/10/2020	2.30	-9.5	6.9	752.8	20.7	42.5
G51S	11/18/2020	--	--	7.0	673	--	--
G51S	02/19/2021	5.80	-9	7.2	686.9	9.3	299
G51S	04/14/2021	1.90	-8.3	7.1	559	15.1	48.5
G51S	04/29/2021	1.80	4.3	7.1	728.8	17.0	17.9
G51S	05/13/2021	2.20	-5.8	7.2	720	13.8	10.6
G51S	06/01/2021	1.10	50.1	7.2	720.1	16.2	25.6

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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)
G51S	06/15/2021	1.90	-29.4	7.0	747	15.4	19.6
G51S	06/21/2021	0.30	-38.8	7.1	713	14.2	26
G51S	07/12/2021	0.36	-59.4	7.0	720	16.6	72.7
G51S	07/27/2021	1.60	53.9	7.1	688	19.8	20.2
G52L	01/30/2015	--	--	6.6	1807	--	--
G52L	04/17/2015	--	--	6.6	2220	--	--
G52L	07/24/2015	--	--	6.5	1277	--	--
G52L	10/15/2015	--	--	7.1	922	--	--
G52L	11/18/2020	--	--	6.5	1642	--	--
G52L	02/19/2021	--	--	6.4	1444	--	--
G52S	01/30/2015	--	--	6.8	1064	--	--
G52S	04/17/2015	--	--	6.9	1099	--	--
G52S	07/24/2015	--	--	6.9	873	--	--
G52S	10/15/2015	--	--	6.9	845	--	--
G53L	01/30/2015	--	--	6.8	942	--	--
G53L	04/16/2015	--	--	6.9	890	--	--
G53L	07/24/2015	--	--	6.9	858	--	--
G53L	10/16/2015	--	--	6.9	952	--	--
G53L	11/18/2020	--	--	6.6	1312	--	--
G53L	02/22/2021	--	--	6.8	1235	--	--
G53S	01/30/2015	--	--	7.0	903	--	--
G53S	04/16/2015	--	--	7.1	814	--	--
G53S	07/24/2015	--	--	7.0	763	--	--
G53S	10/16/2015	--	--	7.2	893	--	--
G53S	11/18/2020	--	--	6.9	988	--	--
G53S	02/22/2021	--	--	6.8	698	--	--
G54C	04/14/2021	0.99	-103	7.3	1158	13.3	167
G54C	04/29/2021	0.50	-79.9	7.3	1200	14.5	76.7
G54C	05/12/2021	1.60	-66.9	7.2	1172	15.8	39.2
G54C	06/01/2021	1.60	-70.3	7.3	1200	16.8	27.6
G54L	10/14/2015	--	--	6.6	992	--	--
G54L	11/17/2020	--	--	6.5	1290	--	--
G54L	02/22/2021	--	--	6.6	1216	--	--
G54L	04/14/2021	0.64	-14	6.6	1508	14.1	35.7
G54L	04/29/2021	0.71	-32.1	6.6	1426	15.9	16
G54L	05/12/2021	2.20	-40.2	6.5	1423	19.5	26.6
G54L	06/01/2021	1.20	-72.4	6.6	1370	21.7	5.74
G54L	06/14/2021	1.80	-82.6	6.7	1344	20.8	16.4
G54L	06/21/2021	1.60	-44.6	6.5	1329	15.3	25.8
G54L	07/13/2021	2.00	-23.9	6.4	1351	25.1	33
G54L	07/27/2021	2.20	37.9	6.6	1383	16.4	24.7
G54S	01/30/2015	--	--	6.8	1044	--	--
G54S	04/16/2015	--	--	6.8	936	--	--
G54S	07/23/2015	--	--	6.9	885	--	--

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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)
G54S	10/14/2015	--	--	6.9	806	--	--
G54S	12/04/2015	0	-15	6.5	992	12.6	8.4
G54S	01/29/2016	0	-17	6.9	925	11.6	8.5
G54S	05/02/2016	0	-21	6.7	951	13.1	7.3
G54S	08/12/2016	0	-29	7.1	980	17.7	12.8
G54S	10/21/2016	0	-52	7.2	970	16.0	11.4
G54S	01/24/2017	0	-60	7.5	1115	15.6	25.1
G54S	04/07/2017	0	-63	6.9	840	13.5	14.2
G54S	06/28/2017	0	-58	7.1	913	19.2	17.9
G54S	11/08/2017	0	-61	7.1	799	13.3	19.4
G54S	01/18/2018	0	-72	6.9	855	11.3	24.2
G54S	06/04/2018	0	-52	7.1	930	15.6	15
G54S	07/13/2018	0	-58	7.1	910	14.8	25.4
G54S	10/16/2018	0	-59	7.2	898	14.1	17.8
G54S	02/05/2019	0	-61	7.1	892	12.0	20.3
G54S	07/15/2019	0	-71	7.1	960	15.9	15.2
G54S	01/14/2020	4.80	27.7	6.9	1010	10.8	111
G54S	08/10/2020	1.90	-12.8	6.8	1046	20.6	28.7
G54S	11/17/2020	--	--	6.7	999	--	--
G54S	02/22/2021	1.00	-10	6.8	961.2	12.2	43.3
G54S	06/21/2021	0.39	-23.6	7.0	875	15.0	17.1
G55L	01/30/2015	--	--	6.8	956	--	--
G55L	04/16/2015	--	--	6.8	663	--	--
G55L	07/23/2015	--	--	6.9	843	--	--
G55L	10/14/2015	--	--	6.9	747	--	--
G55L	11/17/2020	--	--	6.5	1023	--	--
G55L	02/22/2021	--	--	6.7	1020	--	--
G55S	01/30/2015	--	--	6.9	893	--	--
G55S	04/16/2015	--	--	7.0	808	--	--
G55S	07/23/2015	--	--	7.1	788	--	--
G55S	10/14/2015	--	--	7.0	696	--	--
G55S	11/17/2020	--	--	6.6	801	--	--
G55S	02/22/2021	--	--	6.8	843	--	--
G56L	07/22/2015	--	--	6.9	885	--	--
G56L	10/16/2015	--	--	7.0	803	--	--
G56L	11/17/2020	--	--	6.7	1266	--	--
G56L	02/22/2021	--	--	6.5	1253	--	--
G56S	02/04/2015	--	--	7.2	918	--	--
G56S	04/16/2015	--	--	6.8	855	--	--
G56S	07/22/2015	--	--	6.9	760	--	--
G56S	10/16/2015	--	--	6.9	885	--	--
G56S	11/17/2020	--	--	6.7	878	--	--
G56S	02/22/2021	--	--	6.6	900	--	--
G57L	02/04/2015	--	--	7.2	570	--	--

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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)
G57L	02/25/2015	--	--	7.2	570	--	--
G57L	04/16/2015	--	--	6.9	908	--	--
G57L	07/22/2015	--	--	6.9	825	--	--
G57L	10/16/2015	--	--	6.7	932	--	--
G57L	11/17/2020	--	--	7.0	797	--	--
G57L	02/22/2021	--	--	6.8	978	--	--
G57S	02/04/2015	--	--	7.1	973	--	--
G57S	04/16/2015	--	--	7.2	920	--	--
G57S	07/22/2015	--	--	7.0	803	--	--
G57S	10/16/2015	--	--	7.1	888	--	--
G57S	12/04/2015	10.00	13	6.8	925	13.0	7.6
G57S	01/29/2016	0	19	6.8	880	12.9	9.1
G57S	05/02/2016	0	30	6.9	930	13.4	11.9
G57S	08/12/2016	0	56	7.0	970	18.9	19.2
G57S	10/28/2016	0	75	7.1	1046	14.6	19.4
G57S	02/03/2017	0	69	7.2	1005	14.8	18
G57S	05/01/2017	0	62	7.1	932	14.2	12.1
G57S	06/28/2017	0	79	7.3	1040	18.3	15.9
G57S	11/08/2017	0	78	7.0	1020	13.1	12.1
G57S	01/18/2018	0	64	7.1	895	12.7	16
G57S	06/04/2018	0	89	7.2	1100	17.0	14.3
G57S	07/21/2018	0	73	7.2	1005	15.0	38.1
G57S	10/17/2018	0	71	7.3	1060	14.0	17
G57S	02/06/2019	0	79	7.2	1033	11.7	18.5
G57S	07/15/2019	0	-60	7.1	1096	16.1	18.6
G57S	01/14/2020	0.83	159	6.8	1115	12.0	128
G57S	08/10/2020	0.67	60.8	6.6	1161	16.3	18.3
G57S	11/17/2020	2.30	56.9	7.0	1029	12.8	3.86
G57S	02/22/2021	2.10	12.5	6.9	1236	11.0	10.9
G58L	04/15/2015	--	--	6.9	1294	--	--
G58L	07/22/2015	--	--	7.0	935	--	--
G58L	10/14/2015	--	--	7.0	955	--	--
G58L	11/18/2020	--	--	7.0	1063	--	--
G58L	02/22/2021	--	--	6.8	1087	--	--
G58S	02/04/2015	--	--	6.8	1487	--	--
G58S	04/15/2015	--	--	6.5	1450	--	--
G58S	07/22/2015	--	--	6.8	946	--	--
G58S	10/14/2015	--	--	6.9	996	--	--
G58S	11/18/2020	--	--	6.6	949	--	--
G58S	02/22/2021	--	--	6.6	974	--	--
G59L	07/22/2015	--	--	6.7	871	--	--
G59L	10/14/2015	--	--	7.0	1043	--	--
G59L	11/18/2020	--	--	6.8	983	--	--
G59L	02/22/2021	--	--	6.6	971	--	--

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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)
G59S	02/04/2015	--	--	6.9	949	--	--
G59S	04/15/2015	--	--	6.9	967	--	--
G59S	07/22/2015	--	--	6.9	877	--	--
G59S	10/14/2015	--	--	7.1	1032	--	--
G59S	11/18/2020	--	--	6.7	842	--	--
G59S	02/22/2021	--	--	6.8	913	--	--
G60L	11/17/2020	--	--	6.3	998	--	--
G60L	02/23/2021	--	--	6.2	1069	--	--
G60L	04/14/2021	2.50	144	6.2	959.1	11.5	55.1
G60L	04/29/2021	2.10	111	6.1	974	12.4	60.6
G60L	05/13/2021	1.70	86	6.2	899.4	15.2	1.97
G60L	06/01/2021	2.40	111	6.3	917	14.6	1.01
G60L	06/15/2021	1.30	90.1	6.2	908	15.9	1.28
G60L	06/21/2021	0.97	87.7	6.2	914.4	13.8	11.8
G60L	07/12/2021	0.42	64.1	6.0	937	17.3	11.5
G60L	07/28/2021	0.63	106	6.2	840	17.0	22.4
G60S	02/04/2015	--	--	6.8	973	--	--
G60S	04/15/2015	--	--	6.8	999	--	--
G60S	07/22/2015	--	--	6.8	804	--	--
G60S	10/14/2015	--	--	7.1	849	--	--
G60S	12/04/2015	0	-41	6.6	958	12.3	75.9
G60S	01/29/2016	0	-65	6.7	990	12.1	38.9
G60S	05/02/2016	0	-42	6.7	1040	12.7	63.6
G60S	08/20/2016	0	-51	6.7	1015	18.0	56
G60S	10/28/2016	0	-45	6.6	916	14.1	70.8
G60S	02/03/2017	0	-47	6.5	948	14.4	70.2
G60S	04/25/2017	0	-62	6.8	735	14.1	30.5
G60S	06/29/2017	0	-58	7.0	710	17.5	36.4
G60S	11/08/2017	0	-52	6.9	718	13.6	27.4
G60S	01/19/2018	0	-60	6.9	701	12.6	39.7
G60S	06/04/2018	0	-68	6.9	802	15.9	43.4
G60S	07/21/2018	0	-60	7.0	724	15.2	41.8
G60S	10/17/2018	0	-51	6.9	764	14.4	38.4
G60S	02/06/2019	0	-65	7.0	698	12.0	42.4
G60S	04/08/2019	0	-60	7.0	1030	14.5	41.7
G60S	07/15/2019	0	-60	6.8	1150	15.8	14
G60S	01/14/2020	0.57	122	6.6	1226	12.2	33.5
G60S	08/10/2020	1.90	57.4	6.6	1110	21.0	1230
G60S	11/17/2020	0.99	-0.6	6.8	978	11.8	75.3
G60S	02/23/2021	1.20	-2.1	6.6	937.2	11.9	15.7
G61S	02/04/2015	--	--	7.0	1679	--	--
G61S	04/15/2015	--	--	7.0	1533	--	--
G61S	07/21/2015	--	--	6.9	1059	--	--
G61S	10/13/2015	--	--	7.0	1095	--	--

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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)
G61S	11/18/2020	--	--	6.6	1514	--	--
G61S	02/23/2021	--	--	6.5	1511	--	--
G62L	02/04/2015	--	--	6.8	1356	--	--
G62L	04/15/2015	--	--	6.9	1507	--	--
G62L	07/22/2015	--	--	7.0	643	--	--
G62L	10/13/2015	--	--	7.2	790	--	--
G62L	11/18/2020	--	--	6.8	1578	--	--
G62L	02/24/2021	--	--	6.7	1275	--	--
G63L	04/15/2015	--	--	6.9	1767	--	--
G63L	07/22/2015	--	--	6.9	1117	--	--
G63L	10/13/2015	--	--	7.2	852	--	--
G63L	11/18/2020	--	--	7.0	1615	--	--
G63L	02/24/2021	--	--	6.7	1123	--	--
G63S	02/04/2015	--	--	7.1	866	--	--
G63S	04/15/2015	--	--	7.0	890	--	--
G63S	07/22/2015	--	--	7.2	718	--	--
G63S	10/13/2015	--	--	7.3	919	--	--
G63S	11/18/2020	--	--	7.0	548	--	--
G63S	02/24/2021	--	--	7.0	918	--	--
G64L	02/04/2015	--	--	6.9	818	--	--
G64L	04/15/2015	--	--	7.1	818	--	--
G64L	07/22/2015	--	--	7.0	858	--	--
G64L	10/13/2015	--	--	7.1	955	--	--
G64L	11/18/2020	--	--	7.1	1054	--	--
G64L	02/25/2021	--	--	7.0	1009	--	--
G64S	02/04/2015	--	--	7.1	819	--	--
G64S	04/15/2015	--	--	7.0	881	--	--
G64S	07/22/2015	--	--	7.0	807	--	--
G64S	10/13/2015	--	--	7.1	870	--	--
G64S	12/04/2015	2.80	-60	6.8	773	12.7	234
G64S	01/29/2016	0	-57	7.0	788	11.3	296
G64S	05/02/2016	0	-79	7.1	695	13.1	124
G64S	08/20/2016	0	-70	7.1	688	18.9	97.3
G64S	10/28/2016	0	-84	7.2	731	15.0	110
G64S	02/03/2017	0	-62	7.2	710	14.5	101
G64S	05/01/2017	0	-65	6.9	859	14.3	15.3
G64S	06/29/2017	0	-90	6.8	818	19.2	21.6
G64S	11/08/2017	0	-79	6.8	798	13.9	21.9
G64S	01/19/2018	0	-72	6.9	825	12.6	21.7
G64S	06/04/2018	0	-68	6.9	851	16.1	21.4
G64S	07/21/2018	0	-91	6.9	840	15.4	25.1
G64S	10/20/2018	0	-74	6.9	855	13.7	24.5
G64S	02/06/2019	0	-91	6.8	802	11.8	27.5
G64S	07/15/2019	0	70	7.2	750	16.0	14.7

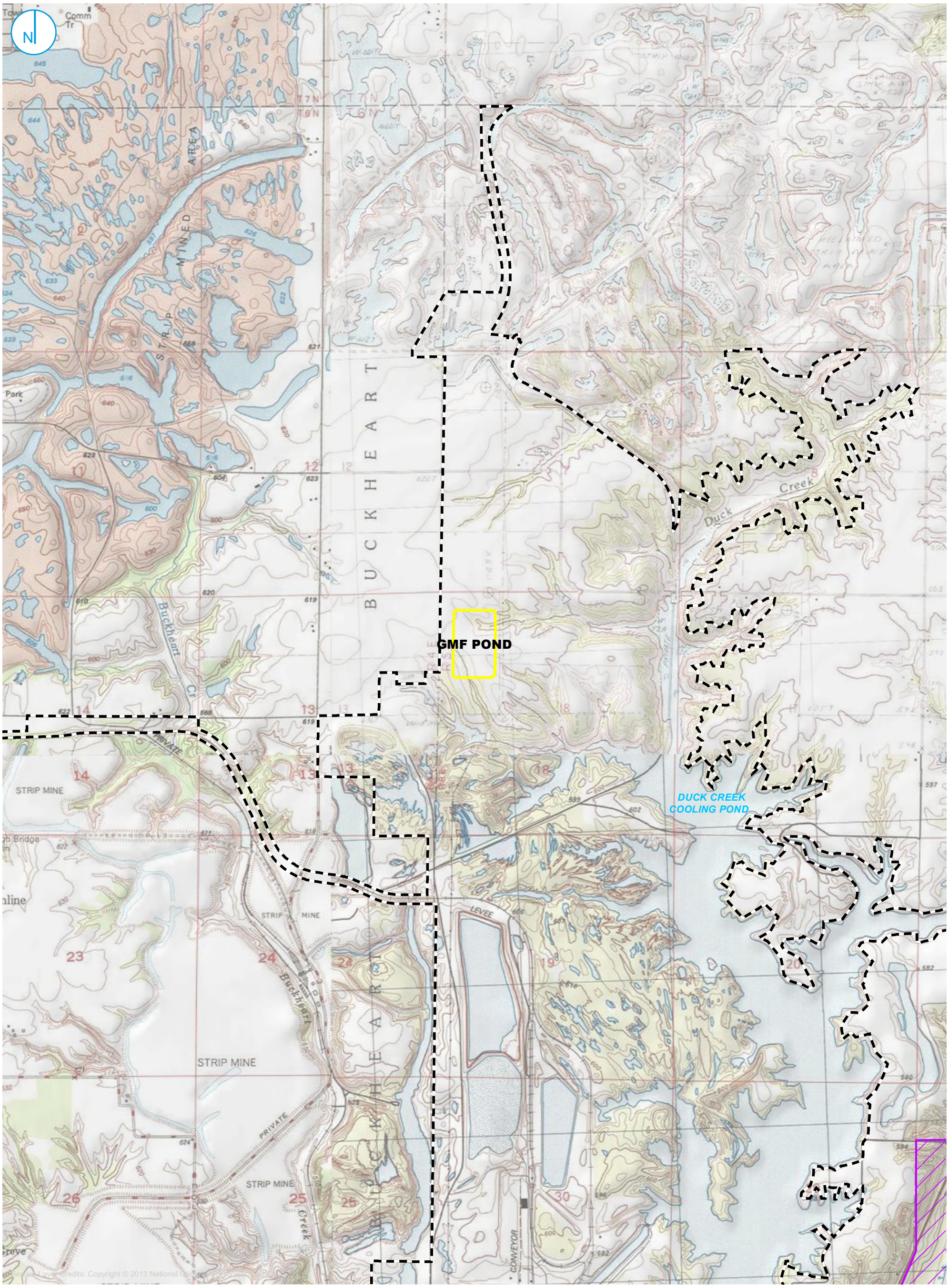
TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
G64S	01/15/2020	0.83	-12.3	6.8	781.2	11.4	41.4
G64S	08/11/2020	4.30	-1.3	7.0	688.9	18.5	42.8
G64S	11/18/2020	--	--	7.0	769	--	--
G64S	02/24/2021	3.00	-55.9	7.0	727.4	11.4	60.7
G64S	06/21/2021	0.76	-57.1	7.1	761	16.2	21.3
P60	02/24/2021	3.40	54	6.3	830	16.4	236
P60	03/24/2021	3.60	41.4	6.6	862	--	1620
R61L	11/18/2020	--	--	6.7	1162	--	--
R61L	02/23/2021	--	--	6.6	1058	--	--

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 10/06/2021, 3:14:31 PM CDT

FIGURES



PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY
COFFEEN LAKE STATE FISH AND WILDLIFE AREA

0 1,000 2,000 Feet

SITE LOCATION MAP

FIGURE 1-1

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
PROPERTY BOUNDARY

0 150 300 Feet

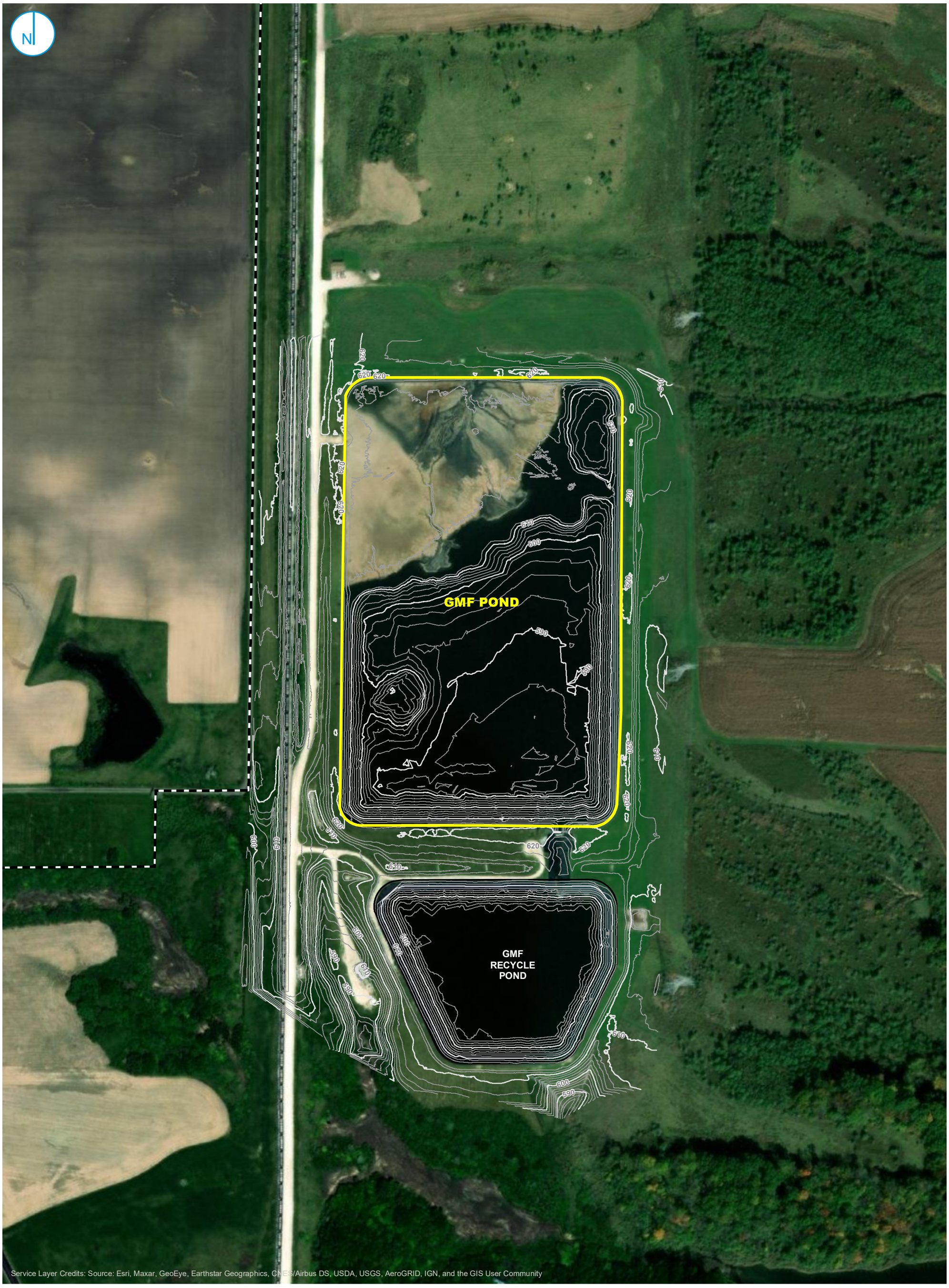
SITE MAP

FIGURE 1-2

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



10 FOOT ELEVATION CONTOUR (NAVD88)
2 FOOT ELEVATION CONTOUR (NAVD88)
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
PROPERTY BOUNDARY

0 150 300 Feet

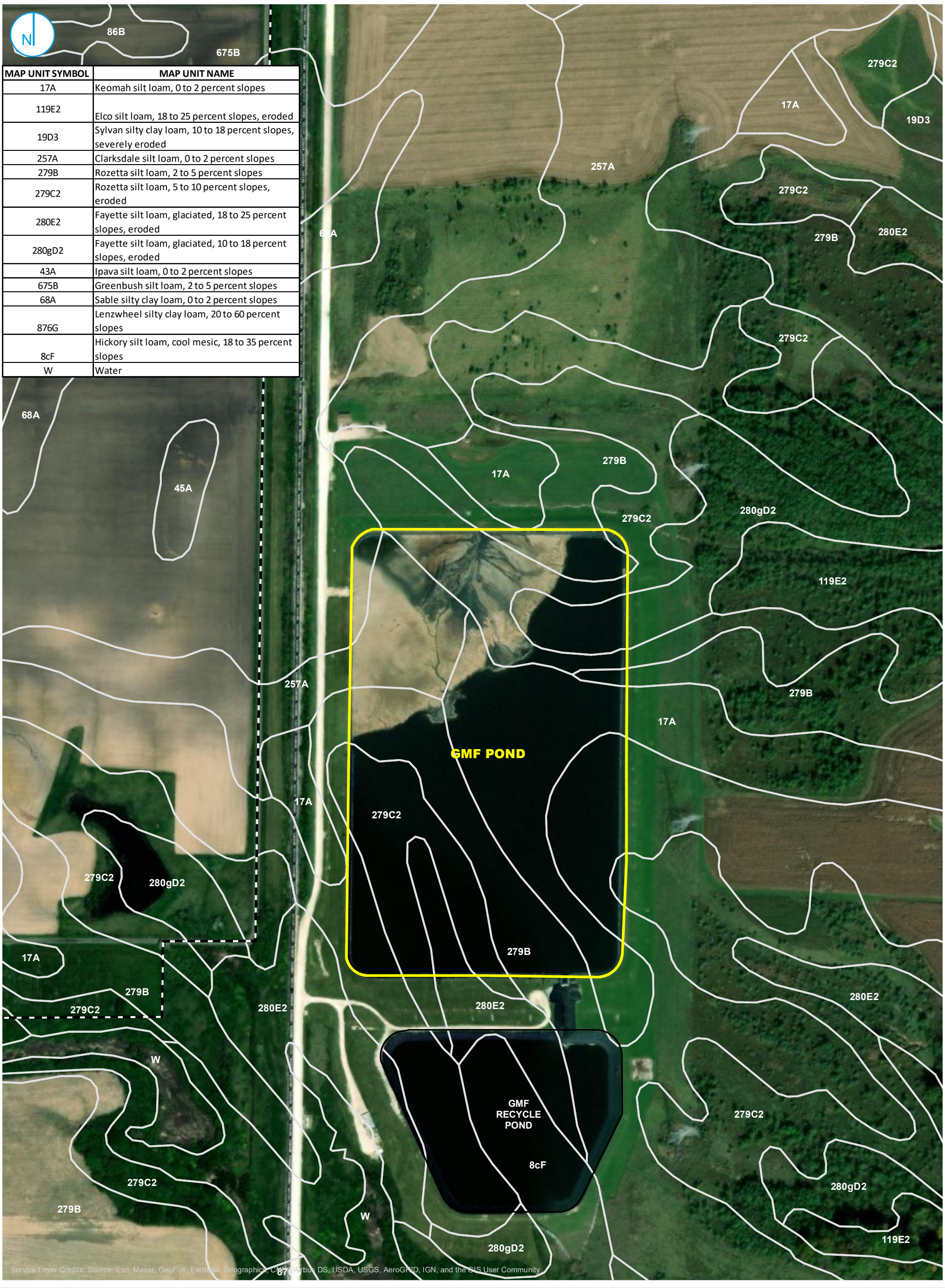
SITE TOPOGRAPHIC MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



MAP UNIT SYMBOL	MAP UNIT NAME
17A	Keomah silt loam, 0 to 2 percent slopes
119E2	Elco silt loam, 18 to 25 percent slopes, eroded
19D3	Sylvan silty clay loam, 10 to 18 percent slopes, severely eroded
257A	Clarksdale silt loam, 0 to 2 percent slopes
279B	Rozetta silt loam, 2 to 5 percent slopes
279C2	Rozetta silt loam, 5 to 10 percent slopes, eroded
280E2	Fayette silt loam, glaciated, 18 to 25 percent slopes, eroded
280gD2	Fayette silt loam, glaciated, 10 to 18 percent slopes, eroded
43A	Ipava silt loam, 0 to 2 percent slopes
675B	Greenbush silt loam, 2 to 5 percent slopes
68A	Sable silty clay loam, 0 to 2 percent slopes
876G	Lenzwheel silty clay loam, 20 to 60 percent slopes
8cF	Hickory silt loam, cool mesic, 18 to 35 percent slopes
W	Water

PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
PROPERTY BOUNDARY
NRCS SOIL SURVEY MAP UNIT BOUNDARY

0 150 300 Feet

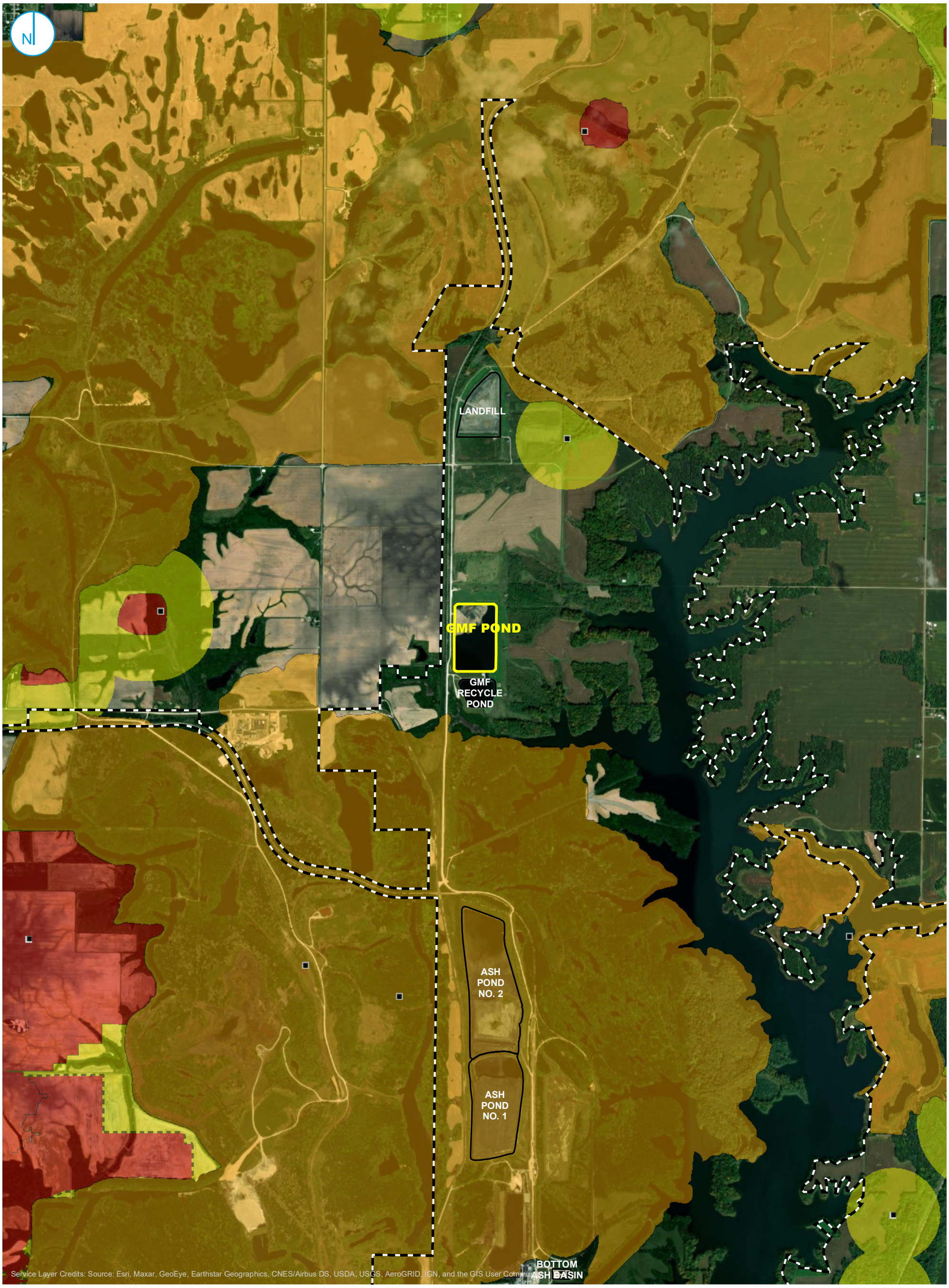
SOIL SURVEY MAP

FIGURE 2-2

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



- COAL MINE SHAFT
- SURFACE COAL MINE
- UNDERGROUND COAL MINE
- UNDERGROUND MINE BUFFER REGION
- PART 845 REGULATED UNIT (SUBJECT UNIT)
- SITE FEATURE
- PROPERTY BOUNDARY

0 1,000 2,000 Feet

COAL MINE COVERAGE AREA

FIGURE 2-3

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
PROPERTY BOUNDARY
RADNOR TILL MEMBER

0 150 300 Feet

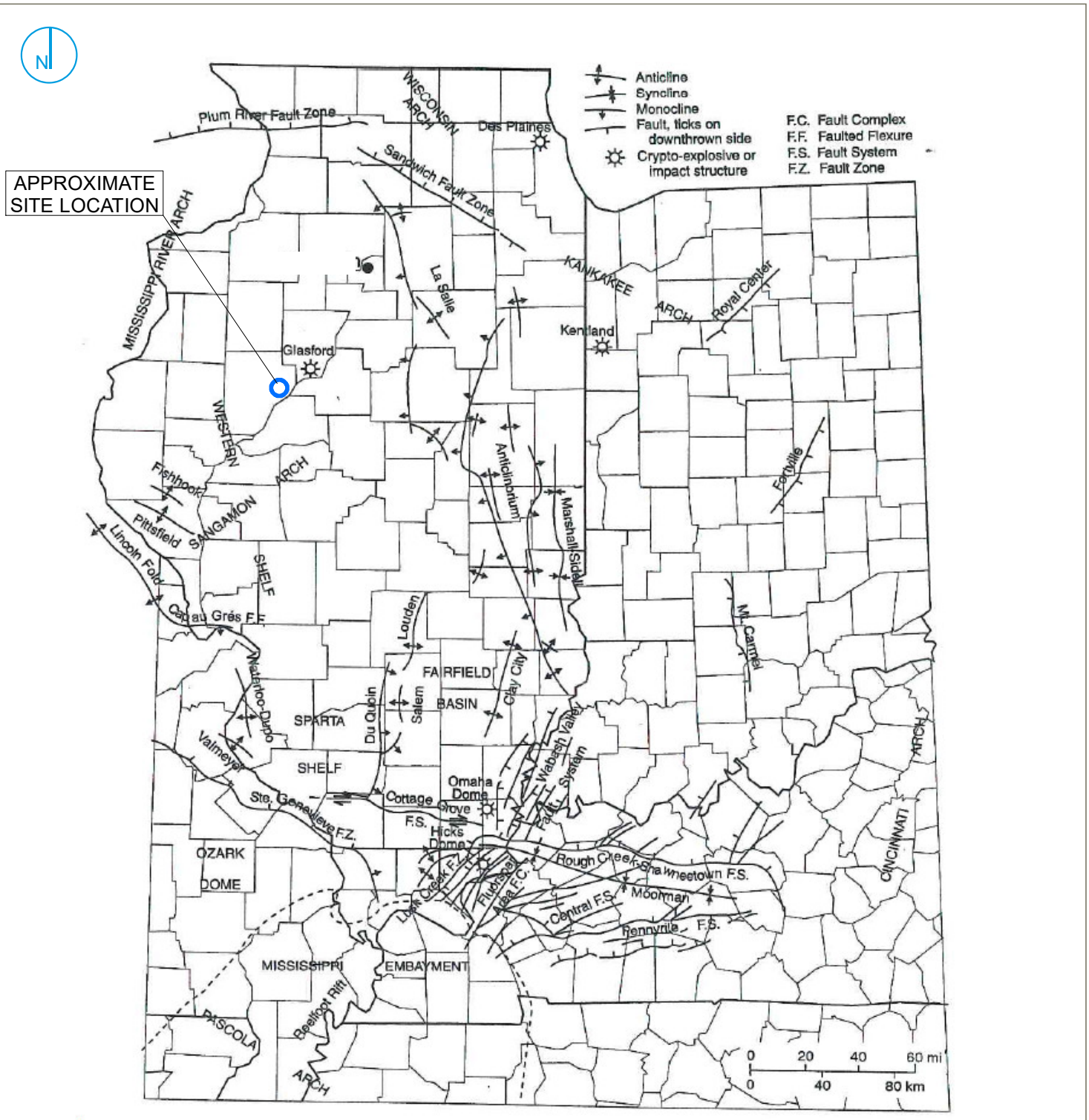
SURFICIAL GEOLOGIC DEPOSITS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

FIGURE 2-4

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



SOURCE NOTE: MODIFIED FROM "NELSON, W.J. 1995, STRUCTURAL FEATURES IN ILLINOIS, ILLINOIS STATE GEOLOGICAL SURVEY, BULLETIN 100, CHAMPAIGN, ILLINOIS."

Service Layer Credits:

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Duck_Creek\GMF_Pond\Figure 2-5_Major Structural Features of Illinois.mxd

PROJECT: 169000XXXX | DATED: 9/17/2021 | DESIGNER: STOLZSD

MAJOR STRUCTURAL FEATURES OF ILLINOIS

FIGURE 2-5

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

MONITORING WELL
SOLID SAMPLE LOCATION
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
PROPERTY BOUNDARY

0 150 300 Feet

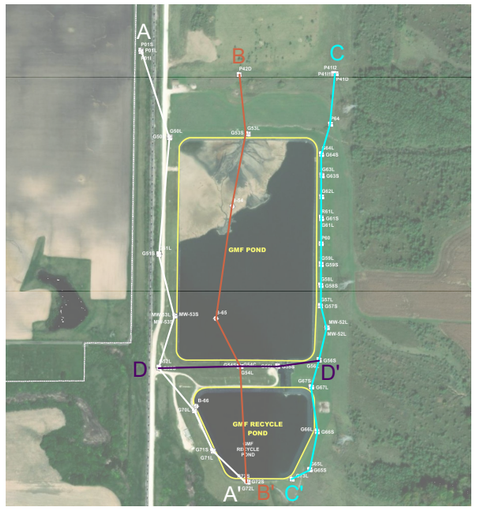
FIELD INVESTIGATION LOCATION MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

FIGURE 2-6

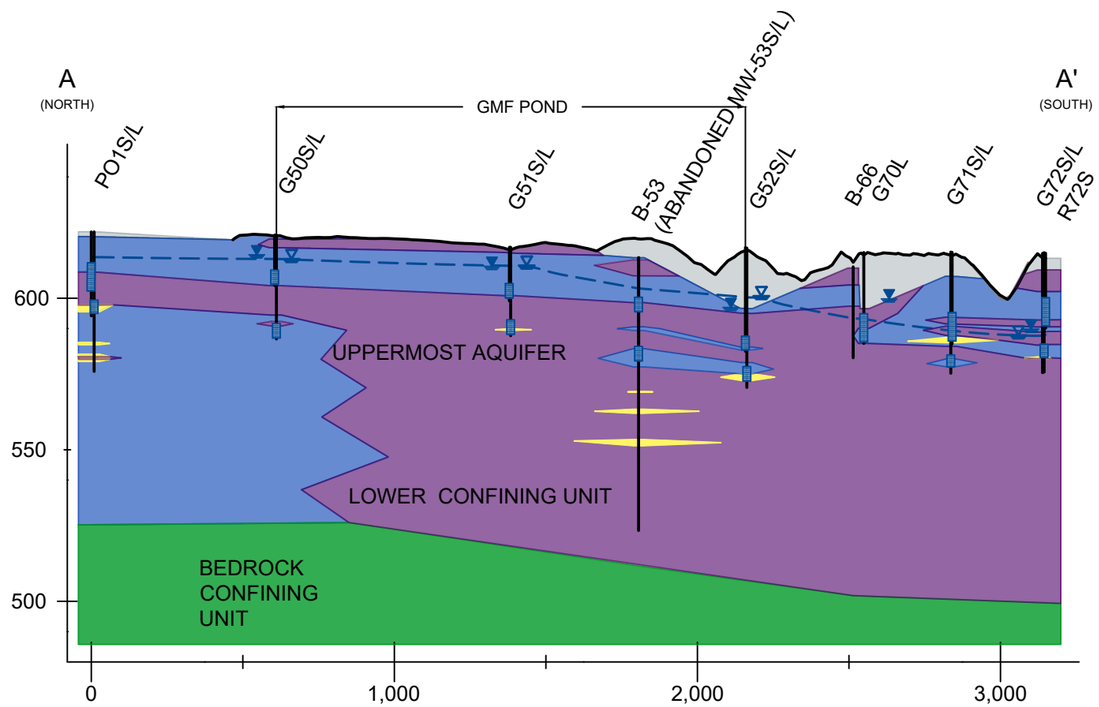
RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

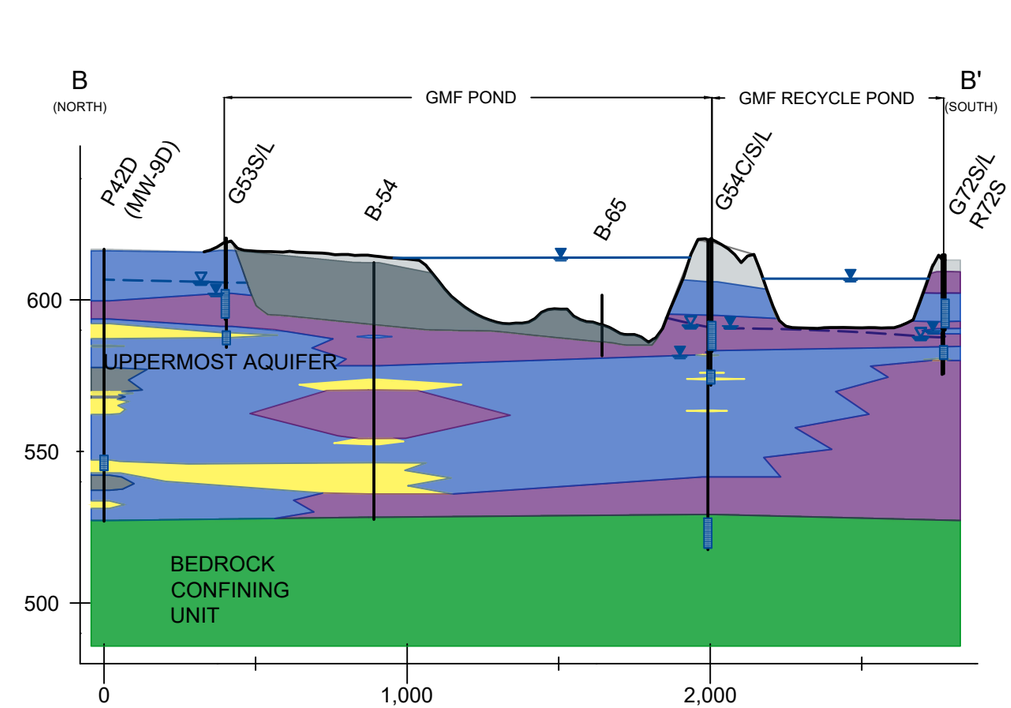
RAMBOLL



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 April 14, 2021.





LEGEND

- COAL COMBUSTION RESIDUAL (CCR) (GYPSUM)
- FILL
- CLAY (CL/CH)
- SILT (ML)
- SAND (SP/SM/SW)
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPER AQUIFER GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)
- SURFACE WATER

50' 0 500'

GEOLOGIC CROSS SECTIONS
A-A' & B-B'

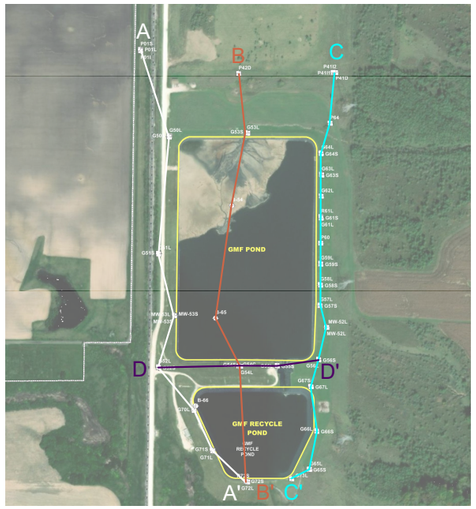
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

FIGURE 2-7

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

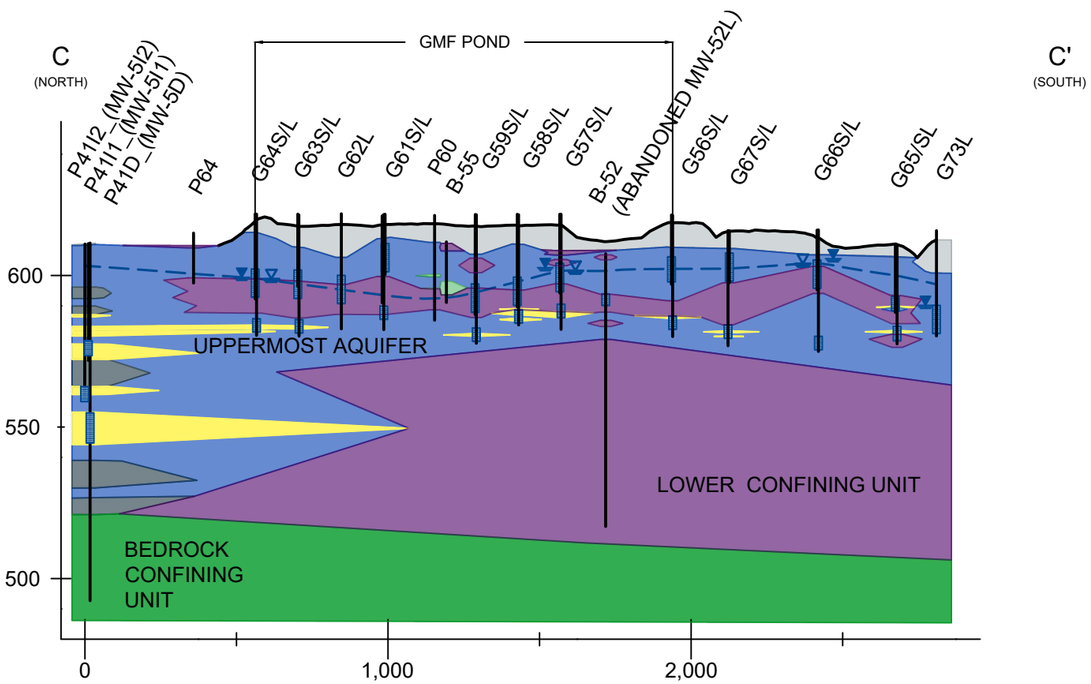
RAMBOLL

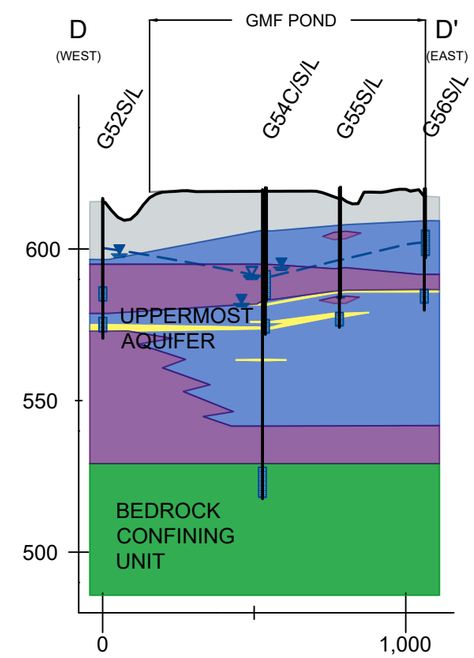
PROJECT: 1940100806 \\ramboll.sharepoint.com@SSL\DavWWWRoot\sites\vistra\Shared Documents\-CCR GW\Deliverables\Part 845 Operating Permits\Sites\Duck Creek\EVS\working files\CAD\Cross Sections\DC-GMF cross sections.dwg



NOTES

1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 10X.
4. Groundwater elevations measured on April 14, 2021.





LEGEND

- COAL COMBUSTION RESIDUAL (CCR) (GYPSUM)
- FILL
- CLAY (CL/CH)
- SILT (ML)
- SAND (SP/SM/SW)
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
- PEAT
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPER AQUIFER GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)

50' 0 500'

GEOLOGIC CROSS SECTIONS
C-C' & D-D'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

FIGURE 2-8

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT:1940100806 \\ramboll-sharepoint.com@SSL\DavWWWRoot\sites\vistra\Shared Documents\-CCR GW\Deliverables\Part 845 Operating Permits\Sites\Duck Creek\EVS\working files\CAD\Cross Sections\DC-GMF cross sections.dwg

10 FOOT CONSTRUCTION ELEVATION CONTOUR
2 FOOT CONSTRUCTION ELEVATION CONTOUR
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
PROPERTY BOUNDARY

0 150 300 Feet

BOTTOM OF CCR MAP

FIGURE 2-9

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

- BACKGROUND WELL
- MONITORING WELL
- SOURCE SAMPLE LOCATION
- PART 845 REGULATED UNIT (SUBJECT UNIT)
- SITE FEATURE
- PROPERTY BOUNDARY

0 150 300 Feet

MONITORING WELL LOCATION MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

FIGURE 3-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

UPPERMOST AQUIFER ELEVATION, TOP OF SAND (2-FOOT CONTOUR)

INFERRED UPPERMOST AQUIFER ELEVATION, TOP OF SAND (2-FOOT CONTOUR)

PART 845 REGULATED UNIT (SUBJECT UNIT)

SITE FEATURE

PROPERTY BOUNDARY

0 150 300 Feet

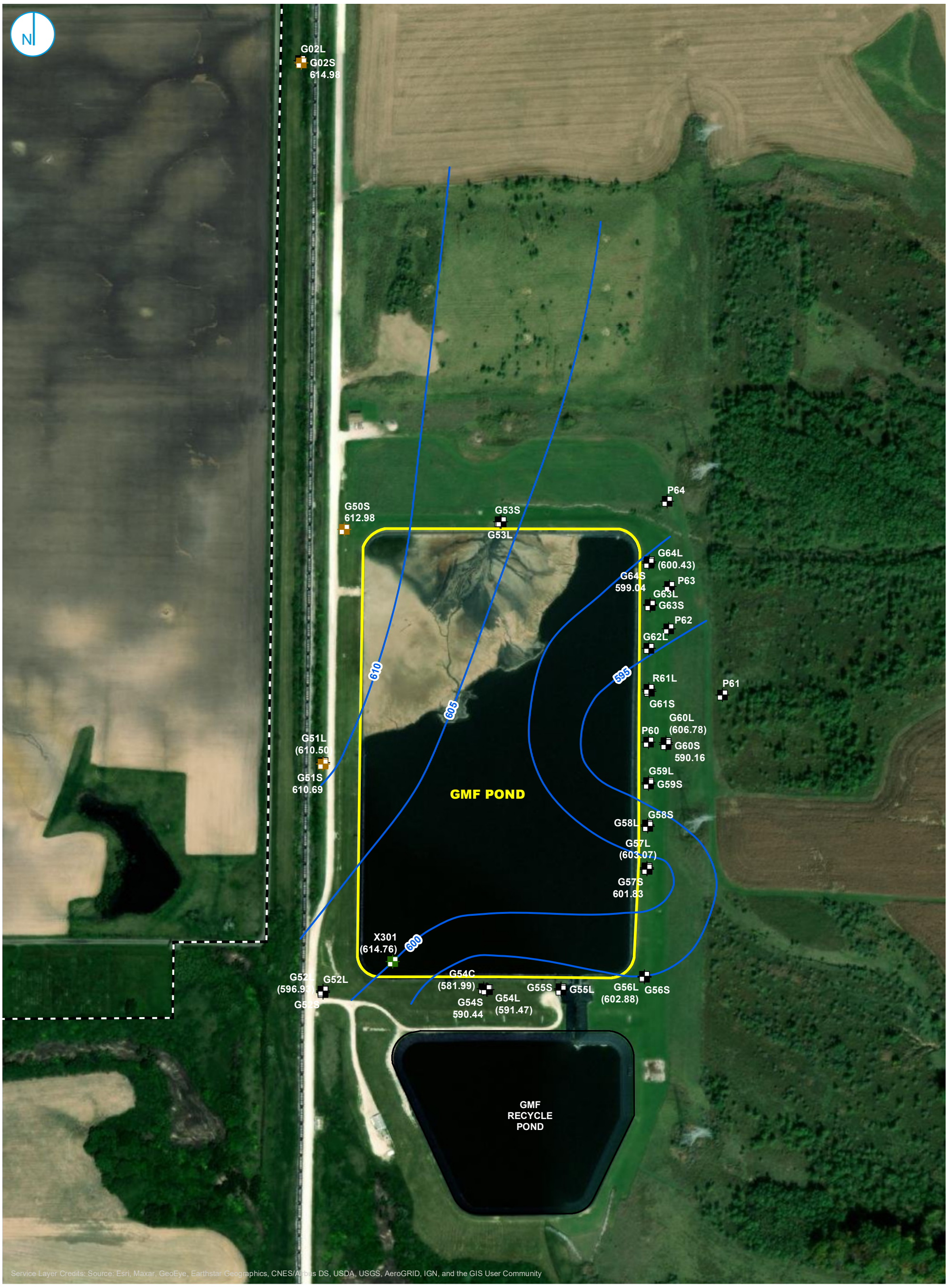
TOP OF UPPERMOST AQUIFER

FIGURE 3-2

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
PROPERTY BOUNDARY

0 150 300 Feet

UPPERMOST AQUIFER GROUNDWATER ELEVATION CONTOURS APRIL 14, 2021

FIGURE 3-3

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
PROPERTY BOUNDARY

0 150 300 Feet

UPPERMOST AQUIFER GROUNDWATER ELEVATION CONTOURS MAY 10, 2021

FIGURE 3-4

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

APPENDICES

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

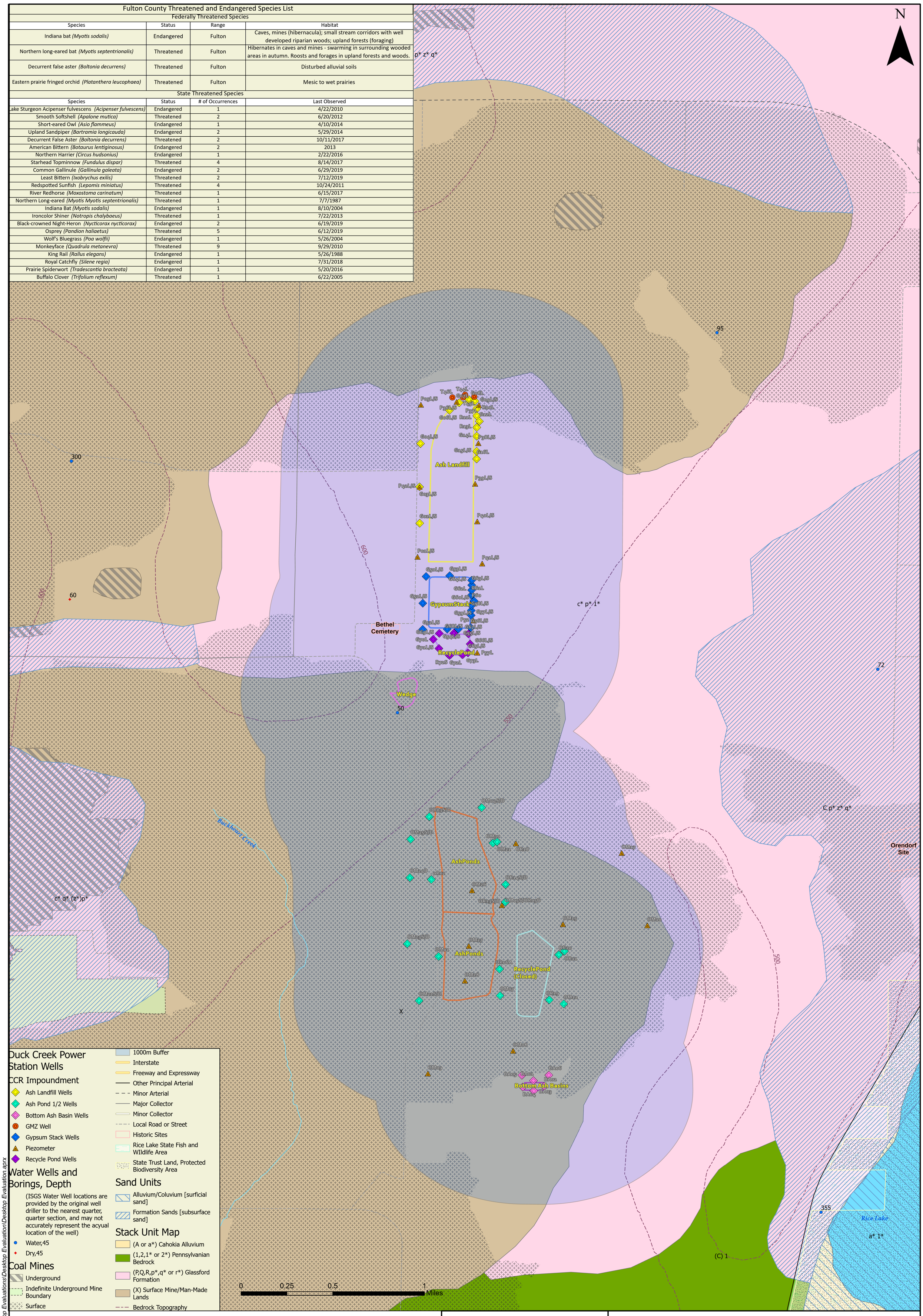
Fulton County Threatened and Endangered Species List

Federally Threatened Species

Species	Status	Range	Habitat
Indiana bat *(Myotis sodalis)*	Endangered	Fulton	Caves, mines (hibernacula); small stream corridors with well developed riparian woods; upland forests (foraging)
Northern long-eared bat *(Myotis septentrionalis)*	Threatened	Fulton	Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests and woods.
Decurrent false aster *(Boltonia decurrens)*	Threatened	Fulton	Disturbed alluvial soils
Eastern prairie fringed orchid *(Platanthera leucophaea)*	Threatened	Fulton	Mesic to wet prairies

State Threatened Species

Species	Status	# of Occurrences	Last Observed
Lake Sturgeon Acipenser fulvescens *(Acipenser fulvescens)*	Endangered	1	4/22/2010
Smooth Softshell *(Apalone mutica)*	Threatened	2	6/20/2012
Short-eared Owl *(Asio flammeus)*	Endangered	1	4/10/2014
Upland Sandpiper *(Bartramia longicauda)*	Endangered	2	5/29/2014
Decurrent False Aster *(Boltonia decurrens)*	Threatened	2	10/11/2017
American Bittern *(Botaurus lentiginosus)*	Endangered	2	2013
Northern Harrier *(Circus hudsonius)*	Endangered	1	2/22/2016
Starhead Topminnow *(Fundulus dispar)*	Threatened	4	8/14/2017
Common Gallinule *(Gallinula galeata)*	Endangered	2	6/29/2019
Least Bittern *(Ixobrychus exilis)*	Threatened	2	7/12/2019
Redspotted Sunfish *(Lepomis miniatus)*	Threatened	4	10/24/2011
River Redhorse *(Moxostoma carinatum)*	Threatened	1	6/15/2017
Northern Long-eared *(Myotis Myotis septentrionalis)*	Threatened	1	7/7/1987
Indiana Bat *(Myotis sodalis)*	Endangered	1	8/10/2004
Ironcolor Shiner *(Notropis chalybaeus)*	Threatened	1	7/22/2013
Black-crowned Night-Heron *(Nycticorax nycticorax)*	Endangered	2	6/19/2019
Osprey *(Pandion haliaetus)*	Threatened	5	6/12/2019
Wolf's Bluegrass *(Poa wolfii)*	Endangered	1	5/26/2004
Monkeyface *(Quadrula metanevra)*	Threatened	9	9/29/2010
King Rail *(Rallus elegans)*	Endangered	1	5/26/1988
Royal Catchfly *(Silene regia)*	Endangered	1	7/31/2018
Prairie Spiderwort *(Tradescantia bracteata)*	Endangered	1	5/20/2016
Buffalo Clover *(Trifolium reflexum)*	Threatened	1	6/22/2005



HANSON®
Hanson Professional Services Inc.

Duck Creek Power Station

Work Plan Desktop Evaluation
Fulton County
Canton, Illinois

Job Number: 20E0111A

Sheet 1

I:\20jobs\20E0111A\CAD\GIS\Projects\Desktop Evaluations\Desktop Evaluation\Desktop Evaluation.aprx

APPENDIX B
BORING LOGS AND WELL CONSTRUCTION LOGS

BORING AND WELL LOCATIONS MAP

- BACKGROUND WELL
- MONITORING WELL
- SOURCE SAMPLE LOCATION
- PART 845 REGULATED UNIT (SUBJECT UNIT)
- SITE FEATURE
- PROPERTY BOUNDARY

0 150 300 Feet

SOIL BORING AND WELL LOCATION MAP

FIGURE B-1

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

BORING LOGS

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/3/2021
Finish: 2/5/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: G54C
Well ID: G54C
Surface Elev: 619.59 ft. MSL
Completion: 102.00 ft. BGS
Station: 1,384,885.21N
2,348,250.14E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	18/24 75%	SS	2-2 4-5 N=6			1.5		Fill - Yellowish brown (10YR5/4) with 15% gray (10YR6/1) and 5% yellowish brown (10YR4/6) mottles, moist SILT with little clay, trace roots, and trace sand.	618	
	21/24 88%	SS	2-5 6-7 N=11			2.0	2	Fill - Yellowish brown (10YR5/6) with 30% light brownish gray (10YR6/2) mottles, moist, soft SILT with little clay, trace sand, and trace gravel.	616	
	22/24 92%	SS	2-7 10-12 N=17			2.5	4	Fill - Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) mottles, moist, firm SILT with little clay and trace sand.	614	
	19/24 79%	SS	3-7 9-11 N=16			4.5	6	Fill - Yellowish brown (10YR5/4) firm SILT with little clay, trace sand, and trace gravel.	612	
	20/24 83%	SS	3-7 9-10 N=16			4.5	8	Grayish brown (10YR5/2) firm SILT with little clay, trace sand, and trace gravel.	610	
	21/24 88%	SS	3-4 7-10 N=11			4.5	10	Grayish brown (10YR5/2) with 30% yellowish brown (10YR5/6) mottles, firm SILT with little clay, trace sand, and trace gravel.	608	
	21/24 88%	SS	3-7 12-15 N=19			4.5	12	Yellowish brown (10YR5/4) firm SILT with little clay, trace sand, and trace gravel.	606	
ST8	20/24 83%	SH				4.0	14		604	
	18/24 75%	SS	1-4 4-5 N=8			0.5	16	Yellowish brown (10YR5/6) with 10% gray (10YR6/1) mottles, moist, soft SILT with little clay.	602	
	19/24 79%	SS	1-3 4-4 N=7			1.0	18		600	
							20			

Borehole Detail

NOTE(S):

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/3/2021
Finish: 2/5/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: G54C
Well ID: G54C
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Station: 1,384,885.21N
2,348,250.14E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	18/24 75%	SS	1-2 4-5 N=6			1.0				
	20/24 83%	SS	1-3 4-7 N=7			1.0	22	Gray (10YR6/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft SILT with little clay.	598	
	19/24 79%	SS	1-3 3-4 N=6			1.5	24	Gray (10YR5/1) with 30% dark gray (10YR4/1) mottles, moist, soft SILT with little clay.	596	
	22/24 92%	SS	woh-1 3-3 N=4			1.5	26	Grayish brown (10YR5/2) moist, soft, CLAY with little silt.	594	
	21/24 88%	SS	1-2 3-4 N=5			1.0	28	Gray (10YR5/1) moist, soft, CLAY with little silt.	592	
	22/24 92%	SS	1-3 5-5 N=8			2.0	30	Gray (10YR5/1) with 30% yellowish brown (10YR5/8) soft CLAY with little silt.	590	
ST17	24/24 100%	SH				0.5	32		588	
	21/24 88%	SS	2-3 4-3 N=7			1.0	34		586	
	21/24 88%	SS	1-4 5-8 N=9			1.5	36	Gray (10YR6/1) wet, soft CLAY with little silt and trace sand.	584	
	20/24 83%	SS	woh-1 3-4 N=4			1.0	38	Dark gray (10YR4/1) wet, fine SAND with trace silt.	582	
							40	Dark gray (10YR4/1) very moist, soft SILT with little clay and trace sand.	580	

NOTE(S):

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/3/2021
Finish: 2/5/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: G54C
Well ID: G54C
Surface Elev: 619.59 ft. MSL
Completion: 102.00 ft. BGS
Station: 1,384,885.21N
2,348,250.14E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type
	4/24 17%	SS	1-2 5-10 N=7			
	23/24 96%	SS	2-6 12-11 N=18			3.0
ST23	23/24 96%	SH				4.5
	24/24 100%	SS	3-6 8-14 N=14			4.5
	24/24 100%	SS	3-8 13-20 N=21			4.5
	24/24 100%	SS	3-10 14-19 N=24			4.5
	24/24 100%	SS	6-9 15-16 N=24			4.5
	24/24 100%	SS	4-10 28-50/3" N=38			4.5
	24/24 100%	SS	10-47 50/3.25-50/1.25			2.5
	24/24 100%	SS	19-29 44-72 N=73			4.5

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark gray (10YR4/1) very moist, soft SILT with little clay and trace sand. *[Continued from previous page]*	578
42		
44	Dark grayish brown (10YR4/2) moist, firm SILT with little clay, trace sand, and trace gravel.	576
		574
46		
48		572
50	Dark gray (10YR4/1) moist, firm SILT with little clay, trace sand, and trace gravel.	570
52		568
54		566
	Dark gray (10YR4/1) moist, firm SILT with little clay, trace sand, and trace gravel.	564
56	Dark gray (10YR4/1) wet, soft SAND with little clay and trace silt.	
58	Dark gray (10YR4/1) moist, firm SILT with little clay, trace sand, and trace gravel.	562
60		560

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/3/2021
Finish: 2/5/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: G54C
Well ID: G54C
Surface Elev: 619.59 ft. MSL
Completion: 102.00 ft. BGS
Station: 1,384,885.21N
2,348,250.14E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	24/24 100%	SS	14-29 42-54 N=71			4.5					
	23/24 96%	SS	12-14 30-48 N=44			4.5	62	Dark gray (10YR4/1) moist, firm SILT with little clay, trace sand, and trace gravel. *[Continued from previous page]*		558	
	23/24 96%	SS	10-22 25-34 N=47			4.5	64			556	
	24/24 100%	SS	10-19 26-34 N=45			4.5	66			554	
	24/24 100%	SS	11-19 24-33 N=43			4.5	68			552	
	23/24 96%	SS	11-22 22-34 N=44			4.5	70	Dark gray (10YR4/1) firm SILT with little clay, trace sand, and trace gravel.		550	
	24/24 100%	SS	9-13 20-22 N=33			4.5	72			548	
	24/24 100%	SS	6-8 12-15 N=20			4.5	74			546	
ST39	11/24 46%	SH				4.5	76	Dark grayish olive (10Y4/2) firm, slick CLAY with trace silt.		544	
	14/24 58%	SS	7-10 17-20 N=27			4.5	78	Dark grayish olive (10Y4/2) firm, slick CLAY with trace silt and gravel.		542	
							80			540	

NOTE(S):

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/3/2021
Finish: 2/5/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: G54C
Well ID: G54C
Surface Elev: 619.59 ft. MSL
Completion: 102.00 ft. BGS
Station: 1,384,885.21N
2,348,250.14E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	24/24 100%	SS	6-8 11-15 N=19			4.5		Dark grayish olive (10Y4/2) firm, slick CLAY with trace silt and gravel. *[Continued from previous page]*		
	24/24 100%	SS	3-7 9-10 N=16			4.5	82	Dark gray (10YR4/1) firm CLAY with trace silt and gravel.	538	
	24/24 100%	SS	4-8 12-15 N=20			4.5	84	Dark gray (10YR4/1) with 5% gray (10YR5/1) mottles, firm, CLAY with little silt, trace sand, and trace gravel.	536	
	24/24 100%	SS	5-7 11-14 N=18			4.0	86		534	
	24/24 100%	SS	5-8 11-14 N=19			4.5	88	Dark gray (10YR4/1) CLAY with little silt, trace sand, and trace gravel.	532	
	24/24 100%	SS	5-9 13-15 N=22			4.5	90		530	
	24/24 100%	SS	4-7 10-13 N=17			4.5	92	Grayish green (5GY5/2) with 30% dark grayish green (5GY4/2) mottles, firm, CLAY with trace silt and gravel. (WEATHERED SHALE)	528	
	24/24 100%	SS	3-6 8-11 N=14			4.0	94		526	
	24/24 100%	SS	4-8 11-13 N=19			3.0	96	Very dark grayish green (5GY3/2) firm, CLAY with trace silt. (WEATHERED SHALE)	524	
	21/24 88%	SS	5-7 10-12 N=17			3.0	98	Very dark grayish green (5GY3/2) firm, CLAY with trace silt and gravel. (WEATHERED SHALE)	522	
							100		520	

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/3/2021
Finish: 2/5/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: G54C
Well ID: G54C
Surface Elev: 619.59 ft. MSL
Completion: 102.00 ft. BGS
Station: 1,384,885.21N
2,348,250.14E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

SAMPLE			TESTING							
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Water Content (%)	Dry Density (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	24/24 *100%*	ss	*3-7* *9-11* N=16			*2.5*		Very dark grayish green (5GY3/2) firm, CLAY with trace silt and gravel. (WEATHERED SHALE) *[Continued from previous page]*		518	
							102	**End of boring = 102 feet**			

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/24/2021
Finish: 2/24/2021
WEATHER: Sunny, cool (lo-40's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Doug
Eng/Geo: R. Hasenyager

BOREHOLE ID: P61
Well ID: P61
Surface Elev: 611.09 ft. MSL
Completion: 20.00 ft. BGS
Station: 1,398,670.81N
2,346,779.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▽ = 8.00 - durring drilling
▼ =
▼ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	0/24 *0%*	SS	--- ---					Yellowish brown (10YR5/6), moist, medium, CLAY with some silt and trace sand.	610	
2A	19/24 *79%*	SS	*1-3* *3-3* N=6				2	Yellowish brown (10YR5/6) with 5% gray (10YR5/1) mottles, moist, medium CLAY with some silt and trace sand.	608	
3A	21/24 *88%*	SS	*2-4* *4-5* N=8				4	Yellowish brown (10YR5/6) with 25% gray (10YR5/1) mottles, moist, medium, SILT with few clay and trace sand.	606	
4A	19/24 *79%*	SS	*woh-2* *4-4* N=6				6	Gray (10YR5/1) with 20% yellowish brown (10YR5/6) mottles, moist, soft, SILT with few clay and trace sand.	604	
5A	10/24 *42%*	SS	*1-2* *2-3* N=4				▽ 8	Gray (10YR5/1) with 20% yellowish brown (10YR5/6) mottles, wet, soft, SILT with few clay and trace sand.	602	
6A	17/24 *71%*	SS	*2-2* *3-3* N=5				10	Yellowish brown (10YR5/8), moist, soft, SILT with few clay and trace sand. Gray (10YR5/1) with 25% yellowish brown (10YR5/8) mottles, wet, soft, SILT with few clay and trace sand.	600	
7A	24/24 *100%*	SS	*woh-1* *2-2* N=3				12	Brown (10YR4/3), wet, soft, SILT with few clay and trace sand.	598	
8A	24/24 *100%*	SS	*1-2* *3-3* N=5				14	Black (10YR2/1), moist, medium, CLAY with few silt and trace sand.	596	
9A	24/24 *100%*	SS	*1-3* *3-4* N=6				16		594	
10A	24/24 *100%*	SS	*1-1* *3-3* N=4				18	Gray (10YR5/1), moist, medium CLAY with some silt and trace sand.	592	
							20	**End of boring = 20 ft.**		

NOTE(S):

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/24/2021
Finish: 2/24/2021
WEATHER: Sunny, cool (lo-40's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Doug
Eng/Geo: R. Hasenyager

BOREHOLE ID: P62
Well ID: P62
Surface Elev: 610.81 ft. MSL
Completion: 16.30 ft. BGS
Station: 1,398,887.32N
2,346,602.30E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
= Dry - durring drilling
=
=

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	0/24 0%	SS	--- ---					Yellowish brown (10YR5/6), moist, medium, SILT with some clay and trace sand.	610	
							2	Yellowish brown (10YR5/6), moist, hard, CLAY with some silt, trace sand, and trace gravel.		
2A	23/24 96%	SS	1-7 9-9 N=16					Yellowish brown (10YR5/6), moist, hard, SILT with few clay, trace sand, and trace gravel.	608	
							4			
3A	24/24 100%	SS	2-5 5-6 N=10					Gray (10YR5/1), moist, medium, SILT with few clay, trace sand, and trace gravel.	606	
							6			
4A	24/24 100%	SS	4-4 7-8 N=11						604	
							8	Yellowish brown (10YR5/6), moist, medium, SILT with few clay and trace sand.		
5A	24/24 100%	SS	2-5 5-6 N=10						602	
							10			
6A	24/24 100%	SS	3-4 6-10 N=10					Yellowish brown (10YR5/6) with 15% gray (10YR5/1) mottles, moist, medium, SILT with few clay and trace sand.	600	
							12			
7A	23/24 96%	SS	2-3 5-6 N=8					Dark yellowish brown (10YR4/6), moist, medium, SILT with few clay and trace sand.	598	
							14			
8A	24/24 100%	SS	1-2 3-4 N=5					Gray (10YR5/1) with 5% yellowish brown (10YR5/8) mottles, moist, soft, CLAY with some silt, trace sand, and trace gravel	596	
	0/4 0%	BD					16			

Borehole Detail

End of boring = 16.3 ft.

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/24/2021
Finish: 2/24/2021
WEATHER: Sunny, cool (lo-40's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Doug
Eng/Geo: R. Hasenyager

BOREHOLE ID: P63
Well ID: P63
Surface Elev: 612.33 ft. MSL
Completion: 18.25 ft. BGS
Station: 1,399,026.62N
2,346,605.85E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▽ = 8.00 - durring drilling
▼ =
▼ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	0/24 *0%*	SS	--- ---					Grayish brown (10R5/2), moist, medium, CLAY with some silt, trace sand, and trace gravel.	612	
2A	24/24 *100%*	SS	*3-7* *7-10* N=14				2	Yellowish brown (10YR5/6), moist, hard, CLAY with some silt, trace sand, and trace gravel.	610	
3A	24/24 *100%*	SS	*2-4* *4-4* N=8				4	Gray (10YR5/1) with 20% yellowish brown (10YR5/6) mottles, moist, medium, CLAY with some silt and trace sand.	608	
4A	22/24 *92%*	SS	*1-1* *4-5* N=5				6	Yellowish brown (10YR5/8) with 25% gray (10YR5/1) mottles, moist, soft, SILT with few clay and trace sand.	606	
5A	21/24 *88%*	SS	*2-2* *3-4* N=5				▽ 8		604	
6A	23/24 *96%*	SS	*2-3* *3-5* N=6				10	Yellowish brown (10YR5/8) with 25% gray (10YR5/1) mottles, wet, soft, SILT with few clay and trace sand.	602	
7A	20/24 *83%*	SS	*2-2* *3-4* N=5				12	Dark yellowish brown (10YR3/4), moist, medium SILT with few clay and trace sand.	600	
8A	24/24 *100%*	SS	*2-2* *3-3* N=5				14	Gray (10YR5/1) with 35% yellowish brown (10YR5/6) mottles, wet, soft, SILT with few clay and trace sand.	598	
9A	24/24 *100%*	SS	*1-2* *3-3* N=5				16	Yellowish brown(10YR5/6), moist, soft, CLAY with some silt, trace sand, and trace gravel.	596	
	0/4 *0%*	BD					18			

End of boring = 18.25 ft.

NOTE(S):

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/25/2021
Finish: 2/25/2021
WEATHER: Sunny, cool (lo-40's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Doug
Eng/Geo: R. Hasenyager

BOREHOLE ID: P64
Well ID: P64
Surface Elev: 614.04 ft. MSL
Completion: 16.47 ft. BGS
Station: 1,399,305.91N
2,346,597.96E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▽ = 6.70 - durring drilling
▽ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	0/24 0%	SS	--- ---					Yellowish brown (10YR5/6), medium CLAY with some silt and trace sand.		
2A	23/24 96%	SS	2-4 4-5 N=8				2	Yellowish brown (10YR5/6) with 10% gray (10YR5/1) mottles, moist, medium, CLAY with some silt and trace sand.	612	
3A	23/24 96%	SS	2-2 2-3 N=4				4	Yellowish brown (10YR5/6) with 15% gray (10YR5/1) mottles, moist, soft, SILT with few clay, trace sand, and trace wood fragments.	610	
4A	20/24 83%	SS	1-2 4-4 N=6				6 ▽	Gray (10YR5/1) with 20% yellowish brown (10YR5/6) mottles, wet, soft, SILT with few clay and trace sand.	608	
5A	15/24 63%	SS	1-2 2-3 N=4				8		606	
6A	19/24 79%	SS	1-2 2-3 N=4				10		604	
7A	24/24 100%	SS	1-1 2-3 N=3				12	Yellowish brown (10YR5/6), moist, soft, SILT with some clay and trace sand.	602	
8A	24/24 100%	SS	1-2 2-3 N=4				14	Yellowish brown (10YR5/6) with 25% gray (10YR5/1) mottles, moist, soft, CLAY with some silt and trace sand.	600	
	0/6 0%	BD					16		598	

End of boring = 16.5 ft.

NOTE(S):

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/2/2021
Finish: 2/2/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: SB50
Well ID: n/a
Surface Elev: 620.9 ft. MSL
Completion: 50.0 ft. BGS
Station: 1,399,205.58N
2,345,536.13E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	20/24 83%	SS	1-4 5-6 N=9			2.5		Very dark brown (10YR2/2) with 15% brownish yellow (10YR6/8) mottles, soft, SILT with trace roots, and gravel.	620	
	15/24 63%	SS	1-5 5-6 N=10			3.5	2	Very dark brown (10YR2/2) with 50% yellowish brown (10YR5/8) mottles, soft, CLAY with little silt and trace roots.	618	
	22/24 92%	SS	2-2 3-4 N=5			2.5	4	Yellowish brown (10YR6/8) with 30% light brownish gray (10YR6/2) mottles, firm SILT with little clay.	616	
	17/24 71%	SS	0-2 3-4 N=5			1.0	6	Light brownish gray (10YR6/2) with 30% yellowish brown (10YR6/8) mottles, firm, wet CLAY with little silt and trace black oxidation.	614	
	14/24 58%	SS	1-3 2-4 N=5			1.0	8		612	
ST6	23/24 96%	SH				1.0	10	Grayish brown (10YR5/2) with 30% yellowish brown (10YR6/8) mottles, firm SILT with little clay and trace black oxidation.	610	
	20/24 83%	SS	1-2 3-4 N=5			1.5	12	Light brownish gray (10YR6/2) with 15% brownish yellow (10YR6/1) mottles, firm, wet, SILT with little clay and trace black oxidation.	608	
	24/24 100%	SS	1-2 3-3 N=5			1.0	14	Brown (10YR5/3) firm, moist SILT with little clay and trace black oxidation.	606	
	24/24 100%	SS	1-2 2-3 N=4			1.0	16	Yellowish brown (10YR5/4) firm, moist SILT with little clay and trace black oxidation.	604	
	24/24 100%	SS	1-2 3-4 N=5			2.0	18	Yellowish brown (10YR5/4) with 15% yellowish brown (10YR5/8) mottles, firm, moist CLAY.	602	
							20			

Borehole Detail

NOTE(S): Borehole sealed with high solids bentonite grout.

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/2/2021
Finish: 2/2/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: SB50
Well ID: n/a
Surface Elev: 620.9 ft. MSL
Completion: 50.0 ft. BGS
Station: 1,399,205.58N
2,345,536.13E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	24/24 100%	SS	2-2 3-4 N=5			1.8				600	
							22	Dark gray (10YR4/1), wet, CLAY with trace gravel.			
ST12	23/24 96%	SH				1.5				598	
							24				
	24/24 100%	SS	1-1 1-4 N=2			0.5		Gray (10YR6/1) with 30% brownish yellow (10YR6/6) mottles, firm, wet CLAY		596	
								Brownish yellow (10YR6/6) firm, wet CLAY with little silt.			
							26				
	24/24 100%	SS	woh-3 3-5 N=6			1.0		Brownish yellow (10YR6/6) firm, wet CLAY with trace gravel.		594	
							28				
	23/24 96%	SS	1-5 6-6 N=11			3.5		Brownish yellow (10YR6/8) with 15% gray (10YR6/1) mottles, firm CLAY with trace gravel.		592	
							30				
	23/24 96%	SS	1-3 7-8 N=10			4.5				590	
								Grayish brown (10YR5/2) firm CLAY.			
								Dark gray (10YR4/1) wet, firm CLAY with trace gravel.			
							32				
	18/24 75%	SS	1-2 2-4 N=4			1.5		Dark gray (10YR4/1) wet, firm CLAY with little silt and trace gravel.		588	
							34				
	22/24 92%	SS	3-5 10-16 N=15			4.0		Gray (10YR5/1) firm CLAY with trace gravel.		586	
							36				
	21/24 88%	SS	4-8 12-17 N=20			4.5		Gray (10YR5/1) firm CLAY with trace sand and trace gravel.		584	
							38				
	20/24 83%	SS	4-17 29-50 N=46			4.5		Dark grayish brown (10YR4/2) hard SILT with little clay, trace sand, and trace gravel.		582	
							40				

NOTE(S): Borehole sealed with high solids bentonite grout.

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/2/2021
Finish: 2/2/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: SB50
Well ID: n/a
Surface Elev: 620.9 ft. MSL
Completion: 50.0 ft. BGS
Station: 1,399,205.58N
2,345,536.13E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Water Content (%)	Dry Density (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	24/24 *100%*	ss	*7-35* *40-42* N=75			*4.5*		Grayish brown (10YR5/2) with 5% brownish yellow (10YR6/6) mottles, hard SILT with little clay, trace sand, and trace gravel.	580	
							42			
	24/24 *100%*	ss	*9-24* *32-40* N=56			*4.5*		Gray (10YR5/1) hard SILT with little clay, trace sand, and trace gravel.	578	
							44			
	24/24 *100%*	ss	*12-35* *41-43* N=76			*4.5*		Dark gray (10YR4/1) hard SILT with little clay, trace sand, and trace gravel.	576	
							46			
	24/23 *104%*	ss	*7-22* *50-50* N=72			*4.5*			574	
							48	Grayish brown (10YR5/2) hard SILT with little clay, trace sand, and trace gravel.		
	24/24 *100%*	ss	*6-21* *26-36* N=47			*4.5*			572	
							50			

End of boring = 50 feet

NOTE(S): Borehole sealed with high solids bentonite grout.

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/3/2021
Finish: 2/3/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: SB62
Well ID: n/a
Surface Elev: 619.8 ft. MSL
Completion: 50.0 ft. BGS
Station: 1,398,819.94N
2,346,534.64E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	16/24 67%	SS	2-3 5-4 N=8			2.0	2	Fill - Yellowish brown (10YR5/6) with 5% Gray (10YR6/1) and 15% dark yellowish brown (10YR4/6) mottles, soft SILT with little clay, and trace roots.	618	
	19/24 79%	SS	1-6 9-10 N=15			2.5	4		616	
	23/24 96%	SS	4-9 10-9 N=19			4.5	6	Fill - Dark yellowish brown (10YR4/6) with 5% light brownish gray (10YR6/2) mottles, soft SILT with little clay, trace sand, and trace gravel.	614	
	23/24 96%	SS	3-6 7-9 N=13			3.5	8	Fill - Yellowish brown (10YR5/4) with 10% light brownish gray (10YR6/2) mottles, firm SILT with little clay, trace sand, and trace gravel.	612	
	23/24 96%	SS	2-5 7-8 N=12			2.5	10		610	
	23/24 96%	SS	2-5 7-8 N=12			3.0	12	Grayish brown (10YR5/2) firm SILT with little clay, trace sand, and trace gravel.	608	
ST7	15/24 63%	SH				2.5	14		606	
	21/24 88%	SS	1-4 8-12 N=12			3.0	16	Grayish brown (10YR5/2) with 30% dark yellowish brown(10YR4/6) mottles, hard SILT with little clay and trace gravel.	604	
	22/24 92%	SS	6-11 7-7 N=18			1.0	18	Gray (10YR6/1) with 25% dark yellowish brown (10YR4/6) mottles, slightly moist, soft SILT with little clay.	602	
	19/24 79%	SS	1-3 4-3 N=7			1.0	20		600	

NOTE(S): Borehole sealed with high solids bentonite grout

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/3/2021
Finish: 2/3/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: SB62
Well ID: n/a
Surface Elev: 619.8 ft. MSL
Completion: 50.0 ft. BGS
Station: 1,398,819.94N
2,346,534.64E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type
	24/24 100%	SS	1-3 4-4 N=7			1.5
	21/24 88%	SS	1-2 2-4 N=4			1.0
	24/24 100%	SS	1-2 2-3 N=4			1.0
ST14	23/24 96%	SH				1.5
	24/24 100%	SS	1-3 2-3 N=5			1.0
	24/24 100%	SS	woh-1 1-2 N=2			1.0
	21/24 88%	SS	2-2 4-6 N=6			2.0
	24/24 100%	SS	3-5 7-9 N=12			4.5
	24/24 100%	SS	3-6 7-10 N=13			4.5
ST20	16/24 67%	SH				4.5

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
22	Gray (10YR5/1) with 10% dark gray (10YR4/1) mottles, slightly moist, soft SILT with little clay.	598	
24	Dark grayish brown (10YR4/2) CLAY with little silt and trace gravel.	596	
26	Dark gray (10YR4/1) with 3% reddish yellow (10YR6/8) mottles, soft CLAY with little silt and trace gravel	594	
28		592	
30	Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, soft CLAY with little silt, trace sand, and trace gravel.	590	
32	Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, wet, soft CLAY with little silt, trace sand, and trace gravel.	588	
34	Grayish green (5GY5/2) with 5% olive gray (5Y4/2) soft CLAY with little silt, trace sand, and trace gravel.	586	
36	Dark gray (10YR4/1) hard SILT with little clay, trace sand, and trace gravel.	584	
38		582	
40		580	

NOTE(S): Borehole sealed with high solids bentonite grout

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/3/2021
Finish: 2/3/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: SB62
Well ID: n/a
Surface Elev: 619.8 ft. MSL
Completion: 50.0 ft. BGS
Station: 1,398,819.94N
2,346,534.64E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Water Content (%)	Dry Density (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	23/24 *96%*	ss	*3-12* *21-19* N=33			*4.0*		Gray (10YR5/1) hard SILT with little clay, trace sand, and trace gravel.		
								Gray (10YR5/1) wet, fine SAND with trace silt.	578	
							42			
	23/24 *96%*	ss	*6-11* *12-18* N=23			*4.5*		Gray (10YR5/1) moist, hard SILT with little clay, trace sand, and trace gravel.		
									576	
							44			
	24/24 *100%*	ss	*4-18* *19-23* N=37			*4.5*		Gray (10YR5/1) with 15% grayish olive (10Y5/2) mottles, moist, hard SILT with little clay, trace sand, and trace gravel.		
									574	
							46			
	24/24 *100%*	ss	*8-24* *39-48* N=63			*4.5*		Gray (10YR5/1) with 40% grayish olive (10Y5/2) mottles, hard SILT with little clay, trace sand, and trace gravel.		
									572	
							48			
	20/24 *83%*	ss	*5-25* *50-50/5"* N=75			*4.5*		Dark grayish brown (10YR4/2) hard SILT with little clay, trace sand, and trace gravel.		
									570	
							50			

End of boring = 50 feet

NOTE(S): Borehole sealed with high solids bentonite grout

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/14/2007
Finish: 3/20/2007
WEATHER: Overcast, rainy, cool

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-52
Well ID: hole abandoned
Surface Elev: 607.19 ft. MSL
Completion: 90.00 ft. BGS
Station: 14,919.6N
1,033.2E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 16.00 - during drilling
▼ = 18.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
1A	24/24 100%	SS	2-3 3-4 N=6	24		2.52 B
1B				27		
	20/24 83%	SS	3-3 5-6 N=8			
2A				22		1.75 BSh
	20/24 83%	SS	3-7 6-6 N=13			
3A				23		1.96 Sh
	22/24 92%	SS	6-6 6-5 N=12			
4A				29		1.24 B
	18/24 75%	SH				
	20/24 83%	SS	1-2 3-3 N=5			
6A				23		2.27 B
	24/24 100%	SS	5-5 6-7 N=11			
7A				25		1.75 B
7B				25		1.35 B
	24/24 100%	SS	1-3 4-5 N=7			
8A				23		1.31 B
9A	24/24 100%	SS	4-6 6-7 N=12	20		2.27 BSh
9B				19		1.24 BSh
10A	24/24 100%	SS	1-3 4-5 N=7	16		1.75 BSh
10B				13		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Very dark brown (10YR2/2) clayey SILT, trace sand	
	Grayish brown (10YR5/2) with 30% yellowish brown (10YR5/8) mottles, silty CLAY, trace sand	606
2	Yellowish brown (10YR5/8) with 40% dark yellowish brown (10YR4/6) mottles, very silty CLAY, trace sand	
	Gray (10YR6/1) with 40% yellowish brown (10YR5/8) mottles, clayey SILT, trace sand	604
4	Light brownish gray (10YR6/2) with 15% yellowish brown (10YR5/8) mottles, clayey SILT, trace sand	
		602
6	Dark yellowish brown (10YR4/6) with 5% very dark brown (10YR2/2) mottles, clayey SILT, trace sand	
		600
8		
	Dark grayish brown (10YR4/2) with 45% yellowish brown (10YR5/6) mottles, clayey SILT, trace sand	598
10		
	Grayish brown (10YR5/2) with 50% yellowish brown (10YR5/8)mottles, clayey SILT, trace sand	596
12		
	Yellowish brown (10YR5/8) with 10% grayish brown (10YR5/2) mottles, clayey SILT, trace sand	594
14	Grayish brown (10YR5/2) with 50% yellowish brown (10YR5/8) silty CLAY, trace sand	
		592
16	Dark grayish brown (10YR4/2) with 20% yellowish brown (10YR5/8) mottles, silty CLAY, trace sand and gravel	
		590
18	Dark greenish gray (10GY4/1) with 10% grayish green (5G4/1) mottles, silty CLAY, trace sand and gravel	
		588
20	Greenish gray (10Y5/1), clayey SILT, little sand and gravel	

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/14/2007
Finish: 3/20/2007
WEATHER: Overcast, rainy, cool

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-52
Well ID: hole abandoned
Surface Elev: 607.19 ft. MSL
Completion: 90.00 ft. BGS
Station: 14,919.6N
1,033.2E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 16.00 - during drilling
▼ = 18.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
11-1						
11-2	19/24 79%	SH		17		
11-3						
	24/24 100%	SS	4-5 8-9 N=13			
12A				13		5.77 B
	24/24 100%	SS	4-10 8-8 N=18			
13A				12		6.30 Sh
	24/24 100%	SS	5-6 9-9 N=15			
14A				25		3.30 SP
	24/24 100%	SS	5-7 13-16 N=20			
15A				11		11.56 Sh
	48/60 80%	CS				
16A				13		
	3/60 5%	CS				
17A				11		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Greenish gray (10Y5/1), clayey SILT, little sand and gravel *[Continued from previous page]*	
	Dark greenish gray (10Y4/1), clayey SILT, little sand and gravel	586
22	Dark gray (N4/1), silty CLAY, trace sand and gravel	584
24	Dark gray (N4/1), clayey SILT, little sand and gravel	582
26	Dark gray (N4/1), clayey SILT, trace sand and gravel	580
28	Dark gray (N4/1), silty CLAY, trace sand, gravel and cobbles	578
30		576
32		574
34		572
36	Very dark greenish gray (10Y3/1), silty CLAY, trace sand and gravel	570
38		568
40		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/14/2007
Finish: 3/20/2007
WEATHER: Overcast, rainy, cool

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-52
Well ID: hole abandoned
Surface Elev: 607.19 ft. MSL
Completion: 90.00 ft. BGS
Station: 14,919.6N
1,033.2E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 16.00 - during drilling
▼ = 18.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
	0/24 *0%*	ss	*27-38 37-54* N=75			
18A				13		13.52 *Sh*
	0/24 *0%*	ss	*18-28 47-56* N=75			
19A				14		16.00 *None*
20A						
	24/24 *100%*	ss	*30-39 48-59* N=87			
	24/24 *100%*	ss	*25-19 33-40* N=52			
21A				17		8.24 *BSh*
	24/24 *100%*	ss	*4-8 16-22* N=24			
22A				12		11.56 *Sh*
	24/24 *100%*	ss	*10-12 14-19* N=26			
23A				15		9.16 *Sh*
	24/24 *100%*	ss				
24A				15		10.72 *B*
	24/24 *100%*	ss				
25A				12		14.02 *Sh*
	24/24 *100%*	ss				
26A				9		
	24/24 *100%*	ss				
27A				17		

Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
42			566	
44			564	
46			562	
48			560	
50	Very dark greenish gray (10Y3/1), silty CLAY, trace sand and gravel *[Continued from previous page]*		558	
52			556	
54			554	
56			552	
58			550	
60			548	

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/14/2007
Finish: 3/20/2007
WEATHER: Overcast, rainy, cool

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-52
Well ID: hole abandoned
Surface Elev: 607.19 ft. MSL
Completion: 90.00 ft. BGS
Station: 14,919.6N
1,033.2E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 16.00 - during drilling
▼ = 18.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	24/24 100%	ss	6-6 11-14 N=17						546	
28A							62	Dark greenish gray (10Y3/1) with 35% dark greenish gray (5G3/1) mottles, silty CLAY, trace sand and gravel		
	24/24 100%	ss							544	
29A							64			
	24/24 100%	ss							542	
30A							66	Dark green gray (10GY4/1) with 15% dark yellowish brown (10YR3/4) mottles, silty CLAY, trace sand and gravel		
	24/24 100%	ss							540	
31A							68			
	24/24 100%	ss							538	
32A							70	Dark green gray (10GY4/1) with 50% dark yellowish brown (10YR3/4) mottles, silty CLAY, trace sand and gravel		
	24/24 100%	ss							536	
33A							72			
	24/24 100%	ss						Dark yellowish brown (10YR3/4) with 20% dark greenish gray (10GY4/1) mottles, silty CLAY, trace sand and gravel	534	
34A							74			
	24/24 100%	ss							532	
35A							76			
	24/24 100%	ss						Very dark gray (N3/1), silty CLAY, trace sand and gravel	530	
36A							78			
	24/24 100%	ss						Dark yellowish brown (10YR3/4) with 30% dark greenish gray (10GY4/1) mottles, silty CLAY, trace sand and gravel	528	
37A							80			

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/14/2007
Finish: 3/20/2007
WEATHER: Overcast, rainy, cool

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-52
Well ID: hole abandoned
Surface Elev: 607.19 ft. MSL
Completion: 90.00 ft. BGS
Station: 14,919.6N
1,033.2E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 16.00 - during drilling
▼ = 18.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
38A	24/24 100%	ss					82	Dark yellowish brown (10YR3/4) with 30% dark greenish gray (10GY4/1) mottles, silty CLAY, trace sand and gravel *[Continued from previous page]*		526	
39A	24/24 100%	ss					84			524	
40A	24/24 100%	ss					86	Dark greenish gray (10Y4/1) with 15% dark yellowish brown (10YR3/4) mottles, silty CLAY, trace sand and gravel		522	
41A	24/24 100%	ss					88	Dark greenish gray (10Y4/1), silty CLAY, trace sand and gravel		520	
42A	24/24 100%	ss					90	Very dark gray (N3/1), silty CLAY, trace sand and gravel		518	

End of Boring = 90.0 ft. BGS

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/20/2007
Finish: 3/22/2007
WEATHER: sunny, windy, mild

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-53
Well ID: hole abandoned
Surface Elev: 613.36 ft. MSL
Completion: 90.00 ft. BGS
Station: 14,987.8N
30.2E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ = 21.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
1A	22/24 92%	SS	2-2 4-4 N=6	20		3.49 BSh
1B				25		3.71 Sh
2A	24/24 100%	SS	2-4 5-5 N=9	25		3.27 BSh
2B				27		1.85 B
3A	20/24 83%	SS	3-7 6-6 N=13	24		2.47 B
4A	24/24 100%	SS	2-4 4-3 N=8	25		2.06 B
	24/24 100%	SH				
6A	19/24 79%	SS	2-2 3-4 N=5	25		
6B				25		
7A	19/24 79%	SS	4-4 4-4 N=8	26		2.18 BSh
7B				25		2.52 BSh
8A	24/24 100%	SS	1-2 3-3 N=5	25		2.27 B
8B				26		2.13 B
9A	24/24 100%	SS	3-4 5-6 N=9	25		2.13 B
10A	22/24 92%	SS	1-3 3-5 N=6	25		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Very dark brown (10YR2/2), clayey SILT, trace sand	
	Dark grayish brown (10YR4/2), silty CLAY, trace sand	612
2	Light brownish gray (10YR6/2) with 30% yellowish brown (10YR5/8) mottles, silty CLAY, trace sand	
	Light brownish gray (10YR6/2) with 30% yellowish brown (10YR5/8) and trace very dark gray (10YR3/1) mottles, silty CLAY, trace sand	610
4		
	Brownish yellow (10YR6/8) with 20% light gray (10YR7/1) mottles, very silty CLAY, trace sand	608
6		
		606
8	Yellowish brown (10YR5/8) with trace light gray (10YR7/1) mottles, clayey SILT, trace sand	
		604
▼ 10		
		602
12		
	Light gray (10YR7/1) with 50% yellowish brown (10YR5/8)mottles, clayey SILT, trace sand	
		600
	Dark grayish brown (10YR4/2), clayey SILT, trace sand	
14	Dark yellowish brown (10YR4/6) with 50% brown (10YR4/3) mottles, clayey SILT, trace sand	
		598
16	Grayish brown (10YR5/2) with 5% yellowish brown (10YR5/6) mottles, silty CLAY, trace sand	
		596
18		
	Dark grayish brown (10YR4/2) with 50% dark yellowish brown (10YR4/6) mottles, silty CLAY, trace sand and gravel	594
20		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/20/2007
Finish: 3/22/2007
WEATHER: sunny, windy, mild

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-53
Well ID: hole abandoned
Surface Elev: 613.36 ft. MSL
Completion: 90.00 ft. BGS
Station: 14,987.8N
30.2E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ = 21.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
	24/24 100%	SH				
12A	24/24 100%	SS	3-4 5-6 N=9	21		0.39 B
12B				16		1.75 BSh
	22/24 92%	SS	3-3 3-4 N=6			
13A				17		2.13 B
13B				13		7.20 BSh
	24/24 100%	SS	1-2 3-4 N=5			
14A				17		3.50 B
	24/24 100%	SS	4-6 6-8 N=12			
15A				14		5.24 B
	24/24 100%	SS	2-3 3-3 N=6			
16A				30		1.16 B
	8/24 33%	SH				
17-1						
17-2				440		
	24/24 100%	SS	3-4 7-9 N=11			
18A				13		5.04 B
	20/24 83%	SS	2-3 7-9 N=10			
19A				14		5.24 B
	15/24 63%	SS	3-3 5-6 N=8			
20A				13		7.86

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark grayish brown (10YR4/2) with 50% dark yellowish brown (10YR4/6) mottles, silty CLAY, trace sand and gravel *[Continued from previous page]*	592
22	Dark greenish gray (5GY4/1), silty CLAY, trace sand and gravel	
	Greenish gray (10Y5/1), sandy SILT, trace clay	590
24	Greenish gray (5GY6/1), sandy CLAY, trace silt	
	Dark greenish gray (10Y4/1), sandy CLAY, trace gravel	588
26		
		586
28	Very dark greenish gray (10Y3/1), sandy CLAY, trace gravel	
		584
30		
		582
32	Dark gray (10YR4/1), sandy SILT, trace gravel	
		580
34		
	Dark green gray (10Y4/1), sandy SILT, trace clay	578
36		
		576
38	Dark green gray (10Y4/1), sandy CLAY, trace gravel	
		574
40		

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/20/2007
Finish: 3/22/2007
WEATHER: sunny, windy, mild

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-53
Well ID: hole abandoned
Surface Elev: 613.36 ft. MSL
Completion: 90.00 ft. BGS
Station: 14,987.8N
30.2E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ = 21.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
						Sh
	47/60 *78%*	CS				
21A				18		
21B				14		
21C				12		
22A	53/60 *88%*	CS		12		4.83 *B*
22B				9		4.48 *B*
23A				16		
	44/48 *92%*	CS				
23B				11		6.40 *Sh*
23C						
	24/24 *100%*	SS				
24A				11		13.52 *Sh*
	24/24 *100%*	SS				
25A				10		11.78 *None*
	24/24 *100%*	SS				
26A				11		8.73

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark green gray (10Y4/1), sandy CLAY, trace gravel	
42	Dark green gray (10Y4/1), sandy CLAY, trace gravel *[Continued from previous page]*	572
		570
44	Dark green gray (10Y4/1), silty, fine to medium SAND	
		568
46	Dark greenish gray (10Y4/1), sandy CLAY, trace gravel	
		566
48		
		564
50	Gray (10Y4/1), fine to medium SAND, trace silt	
		562
52	Dark green gray (10Y4/1), sandy CLAY, trace silt and gravel	
		560
54	Dark gray (10YR4/1), silty CLAY, little sand, trace gravel	
		558
56		
		556
58		
		554
60		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/20/2007
Finish: 3/22/2007
WEATHER: sunny, windy, mild

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-53
Well ID: hole abandoned
Surface Elev: 613.36 ft. MSL
Completion: 90.00 ft. BGS
Station: 14,987.8N
30.2E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ = 21.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
						BSh				
	16/24 67%	ss						Dark gray (10YR4/1), silty, fine to medium SAND	552	
27A				20			62			
	19/24 79%	ss							550	
28A				14		9.16 BSh	64			
	22/24 92%	ss							548	
29A				17		8.07 BSh	66			
	24/24 100%	ss							546	
30A				15		11.33 B	68			
	24/24 100%	ss							544	
31A				15		6.59 B	70			
	24/24 100%	ss						Dark gray (10YR4/1) with 15% dark greenish gray (5GY4/1) mottles, silty CLAY, trace sand and gravel	542	
32A				17		4.85 B	72			
	24/24 100%	ss							540	
33A				19		5.43 B	74			
	24/24 100%	ss							538	
34A				15		5.43 B	76			
	24/24 100%	ss							536	
35A				15		7.76 B	78			
	24/24 100%	ss							534	
36A				15		6.59	80			

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/20/2007
Finish: 3/22/2007
WEATHER: sunny, windy, mild

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-53
Well ID: hole abandoned
Surface Elev: 613.36 ft. MSL
Completion: 90.00 ft. BGS
Station: 14,987.8N
30.2E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ = 21.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
						B					
	24/24 *100%*	ss								532	
37A				16		8.53 *BSh*	82	Dark gray (10YR4/1), silty CLAY, trace sand and gravel			
	24/24 *100%*	ss								530	
38A				19		6.59 *BSh*	84				
	24/24 *100%*	ss								528	
39A				17		5.04 *BSh*	86				
	24/24 *100%*	ss						Dark gray (10YR4/1) with trace yellowish brown (10YR5/6) mottles, silty CLAY, trace sand and gravel		526	
40A				17		4.12 *BSh*	88				
	24/24 *100%*	ss								524	
41A				15		8.92 *B*	90				

End of Boring = 83.3 ft. BGS

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/29/2007
Finish: 3/29/2007
WEATHER: Overcast, cool

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-54
Well ID: hole abandoned
Surface Elev: 617.28 ft. MSL
Completion: 84.67 ft. BGS
Station: 15,718.2N
404.6E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 7.00 - during drilling
▼ = 13.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
1A	24/24 100%	ss	1-3 2-3 N=5	24		
1B				30		2.33 B
2A	24/24 100%	ss	2-3 2-6 N=5	32		2.13 B
2B				28		1.94 B
	24/24 100%	ss	2-2 2-3 N=4			
3A				30		0.58 B
	18/24 75%	ss	3-4 4-5 N=8			
4A				24		1.55 B
	20/24 83%	ss	1-2 3-3 N=5			
5A				25		
	20/24 83%	ss	0-2 3-3 N=5			
6A				31		1.75 B
7A	21/24 88%	ss	3-4 4-4 N=8	28		4.07 BSh
7B				39		1.36 B
8A	24/24 100%	ss	1-2 3-5 N=5	25		1.16 B
8B				25		1.75 B
	24/24 100%	ss	2-4 3-3 N=7			
9A				28		1.16 B
10A	24/24 100%	ss	2-3 3-4 N=6	29		2.18 B
10B				27		1.36

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Very dark grayish brown (10YR3/2) with 15% very dark gray (10YR3/1)mottles, silty CLAY, trace sand	
2	Brown (10YR4/3) with 40% very dark grayish brown (10YR3/2) mottles, silty CLAY, trace sand	616
4	Yellowish brown (10YR5/8) with 30% gray (10YR6/1) and 15% dark gray brown (10YR4/2) mottles, silty CLAY, trace sand	614
6	Brownish yellow (10YR6/8) with 40% light brownish gray (10YR6/2) mottles, clayey SILT, trace sand	612
8		610
10	Dark yellowsih brown (10YR4/6) with 30% gray (10YR6/1) mottles, clayey SILT, trace sand	608
12	Gray (10YR6/1) with 10% yellowish brown (10YR5/8) mottles, clayey SILT, trace sand	606
	Grayish brown (10YR5/2) with 15% yellowish brown (10YR5/8) mottles, very silty CLAY, trace sand	604
14	Black (10YR2/1) with 40% dark yellowish brown (10YR4/4) mottles, clayey SILT, trace sand	
	Dark grayish brown (10YR4/2) with trace yellowish brown (10YR5/6) mottles, very silty CLAY, trace sand	602
16	Dark grayish brown (10YR4/2), silty CLAY, trace sand	600
18	Dark gray (10YR4/1) with 35% dark yellowish brown (10YR3/6) mottles, silty CLAY, trace sand	
20	Dark gray (10YR4/1), silty CLAY, trace sand	598

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/29/2007
Finish: 3/29/2007
WEATHER: Overcast, cool

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-54
Well ID: hole abandoned
Surface Elev: 617.28 ft. MSL
Completion: 84.67 ft. BGS
Station: 15,718.2N
404.6E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 7.00 - during drilling
▼ = 13.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
						B
	24/24 100%	ss	0-0 5-2 N=5			
11A				22		0.58 B
	24/24 100%	ss	0-0 1-2 N=1			
12A				18		
13A	24/24 100%	ss	2-2 4-5 N=6	21		
13B				17		3.10 B
	24/24 100%	ss	3-3 4-4 N=7			
14A				15		1.55 B
15A	20/24 83%	ss	2-3 3-5 N=6	18		2.83 B
15B				17		3.49 BSh
	24/24 100%	ss				
16A				17		5.36 BSh
	24/24 100%	ss				
17A				17		4.65 B
	22/24 92%	ss				
18A				21		3.49 B
	21/24 88%	ss				
19A				12		
	6/24 25%	ss				
20A				14		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Greenish gray (5G5/1) with 50% greenish gray (10Y5/1) mottles, sandy CLAY, trace gravel	596
22	Greenish gray (5GY5/1), sandy CLAY, little silt, trace gravel	594
24	Green gray (10Y6/1), sandy SILT	
	Green gray (5G6/1), sandy CLAY, trace gravel	592
26	Dark gray (N4/1), very silty CLAY, trace sand and gravel	590
28	Greenish gray (10Y5/1), sandy CLAY, trace gravel	588
30	Dark greenish gray (10Y4/1), very silty CLAY, trace sand and gravel	586
32		584
34	Dark greenish gray (10Y4/1), sandy SILT	582
36	Dark greenish gray (10Y4/1) with 20% pale red (10R6/3) mottles, sandy SILT, trace gravel	580
38	Gray (10Y4/1), fine to coarse SAND, trace gravel and silt	578
40		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/29/2007
Finish: 3/29/2007
WEATHER: Overcast, cool

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-54
Well ID: hole abandoned
Surface Elev: 617.28 ft. MSL
Completion: 84.67 ft. BGS
Station: 15,718.2N
404.6E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 7.00 - during drilling
▼ = 13.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
	3/24 *13%*	ss				
21A				11		
	24/24 *100%*	ss				
22A				16		6.21 *BSh*
	24/24 *100%*	ss				
23A				14		8.34 *B*
	24/24 *100%*	ss				
24A				19		7.56 *BSh*
	24/24 *100%*	ss				
25A				14		
	24/24 *100%*	ss				
26A				17		5.36 *BSh*
	22/24 *92%*	ss				
27A				14		3.93 *Sh*
	23/24 *96%*	ss				
28A				16		4.27 *BSh*
	16/24 *67%*	ss				
29A				19		
	4/24 *17%*	ss				
30A				17		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Gray (10Y4/1), fine to coarse SAND, trace gravel and silt *[Continued from previous page]*	576
42		
		574
44		
		572
46		
		570
48		
		568
50	Dark gray (N4/1), silty CLAY, trace sand and gravel	
		566
52		
		564
54		
		562
56		
		560
58		
	Gray (10Y4/1), silty fine to medium SAND	558
60		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/29/2007
Finish: 3/29/2007
WEATHER: Overcast, cool

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-54
Well ID: hole abandoned
Surface Elev: 617.28 ft. MSL
Completion: 84.67 ft. BGS
Station: 15,718.2N
404.6E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 7.00 - during drilling
▼ = 13.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
31A	8/8 100%	ss	31-50/2"	12		
32A	12/12 100%	ss	33-50/6"	9		7.37 B
33A	7/7 100%	ss	39-50/1"	12		
34A	20/24 83%	ss		18		
35A	18/24 75%	ss		19		
36A	15/24 63%	ss		21		
37A	15/24 63%	ss		21		
38A	16/24 67%	ss		19		
39A	10/24 42%	ss		14		
40A	18/24 75%	ss		11		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Green gray (10Y5/1) with trace yellowish brown (10YR5/6) mottles, sandy SILT, trace clay and gravel	556
62		
	Green gray (10Y5/1), sandy SILT, trace gravel and clay	554
64		
		552
66		
	Greenish gray (10Y5/1), silty, fine SAND	550
68		
		548
70		
		546
72		
		544
74		
	Greenish gray (10Y5/1), silty, fine to medium SAND	542
76		
	Greenish gray (10GY5/1), sandy CLAY, trace gravel	540
78		
	Dark gray (10YR4/1), sandy CLAY, trace gravel	538
80		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/29/2007
Finish: 3/29/2007
WEATHER: Overcast, cool

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-54
Well ID: hole abandoned
Surface Elev: 617.28 ft. MSL
Completion: 84.67 ft. BGS
Station: 15,718.2N
404.6E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 7.00 - during drilling
▼ = 13.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	14/24 58%	ss								536	
41A				9			82	Dark gray (10YR4/1), sandy CLAY, trace gravel *[Continued from previous page]*			
	10/24 42%	ss								534	
42A						6.55 BSh	84				
43A	8/8 100%	ss				6.33 BSh		Gray (N6/1), SHALE			

End of Boring = 84.7 ft. BGS

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 4/1/407
Finish: 4/4/2007
WEATHER: Overcast, cool

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler

FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-55
Well ID: hole abandoned
Surface Elev: 611.07 ft. MSL
Completion: 20.00 ft. BGS
Station: 15,438.7N
987.3E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 13.00 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
1A	15/18 83%	ss	2-3 3 N=6	29		1.75 B
2A	16/18 89%	ss	3-4 5 N=9	22		0.78 BSh
3A	16/18 89%	ss	3-4 4 N=8	26		
4A	15/18 83%	ss	3-4 5 N=9	26		1.94 BSh
5A	18/18 100%	ss	2-3 4 N=7	33		1.32 B
6A	18/18 100%	ss	3-4 5 N=9	20		1.16 BSh

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark brown, clayey TOPSOIL (OL)	
2	Brown-gray, silty CLAY, trace sand (CL)	610
4	Brown-gray, clayey SILT, trace sand (ML)	608
6		606
8		604
10	Gray-brown, clayey SILT, trace sand (ML)	602
12		600
▼ 14	Black, PEAT (PT)	598
16		596
18	Gray, silty CLAY, trace sand and gravel (CL)	594
20	**End of Boring = 20.0 ft. BGS**	592

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 4/5/2007
Finish: 4/5/2007
WEATHER: Ptly sunny, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler

FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-65
Well ID: hole abandoned
Surface Elev: 601.57 ft. MSL
Completion: 20.00 ft. BGS
Station: 14,972.6N
301.1E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 5.50 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
1A	16/18 89%	ss	0-0 2 N=2	30		1.16 B
2A	12/18 67%	ss	3-3 3 N=6	37		
3A	18/18 100%	ss	2-3 4 N=7	27		1.55 B
4A	14/18 78%	ss	3-4 4 N=8	26		2.06 B
5A	16/18 89%	ss	3-3 7 N=10	19		
6A	15/18 83%	ss	4-6 10 N=16	15		9.16 Sh

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark brown, clayey TOPSOIL (OL)	
2	Dark brown-brown, very silty CLAY, trace sand (CL)	600
4	Dark brown, clayey SILT, trace sand, (ML)	598
6	Gray-brown, silty CLAY, trace sand (CL)	596
8	Brown-gray, silty CLAY, trace sand (CL)	594
10		592
12		590
14	Gray-brown, silty, fine SAND, little medium to coarse sand, trace gravel (SM)	588
16		586
18	Gray, very silty CLAY, trace sand and gravel (CL)	584
20		582

End of Boring = 20.0 ft. BGS

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 4/5/2007
Finish: 4/5/2007
WEATHER: Ptly sunny, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler

FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-66
Well ID: hole abandoned
Surface Elev: 610.34 ft. MSL
Completion: 30.00 ft. BGS
Station: 14,397.6N
173.1E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 16.00 - during drilling
▼ = 5.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
1A	14/18 78%	ss	2-3 4 N=7	27		2.89 BSh
2A	18/18 100%	ss	2-2 3 N=5	29		1.16 B
3A	13/18 72%	ss	2-4 5 N=9	28		2.47 Sh
4A	16/18 89%	ss	2-2 3 N=5	28		2.68 Sh
5A	15/18 83%	ss	1-2 3 N=5	27		1.75 B
6A	15/18 83%	ss	2-3 4 N=7	21		1.55

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark brown, clayey TOPSOIL (OL)	610
2	Brown-gray, silty CLAY, trace sand (CL)	608
4 ▼	Brown-gray-black, very silty CLAY, trace sand (CL)	606
6	Brown-gray, clayey SILT, trace sand (ML)	604
8		602
10	Gray-brown, clayey SILT, trace sand (ML)	600
12		598
14	Brown, very silty CLAY, trace sand (CL)	596
16 ▼		594
18	Brown-gray, silty CLAY, trace sand and gravel (CL)	592
20		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 4/5/2007
Finish: 4/5/2007
WEATHER: Ptly sunny, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler

FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-66
Well ID: hole abandoned
Surface Elev: 610.34 ft. MSL
Completion: 30.00 ft. BGS
Station: 14,397.6N
173.1E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 16.00 - during drilling
▼ = 5.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
						B		Brown-gray, silty CLAY, trace sand and gravel (CL) *[Continued from previous page]*	590	
							22			
									588	
	18/18 *100%*	SS	*3-5* *6* N=11				24	Gray-brown, very silty CLAY, little sand, trace gravel (CL)	586	
7A				15		2.13 *B*				
							26		584	
							28	Gray, very silty CLAY, trace sand and gravel (CL)	582	
	18/18 *100%*	SS	*3-4* *5* N=9							
8A				18		4.65 *B*	30			

End of Boring = 30.0 ft. BGS

NOTE(S):

G02L (MW-4L)

HANSON

RECORD OF SOIL EXPLORATION

Project Name	Ameren Duck Creek	Sheet	1 of 3
Job #	03S5010	Boring #	B-10/MW-4
Location	CCB Landfill - Phase II Site Invest.	Station	-
Driller	Western Environmental Drilling Inc.	Surface Elevation	619.4
Foreman	Randy Howard	Drilling Method	HSA
Engineer/Geologist	OMI	Sampling Method	SS/Core
Weather & Temp.	Upper 60's, Cloudy	Hammer Type	Auto
Date: Start	9/22/2003 0900	Water Depth: DD	25
Finish	9/23/2003 1605	AAR	-
		Delayed	-

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
0.0	2.0	Top soil, brn. silt w/clay, moist.	SS-1	1.5	3.5	2-3-5-6 Rec = 18" Qp = 2.0
2.0	4.0	Brn. and gray clayey silt and silty clay, so sand.	SS-2	4.0	6.0	1-2-2-2 Rec = 24" Qp = 0.25
4.0	7.8	Reddish brn and gray silty clay, soft.	SS-3	6.5	8.5	0-2-2-2 Rec = 19.5" Qp = -
7.8	9.8	Reddish brn. and gray clayey silt, v. soft.	SS-4	9.0	11.0	1-2-3-4 Rec = 22" Qp = 3.0
9.8	12.1	Gray (sl. red) silt, tr. clay, stiff, moist.	SS-5	11.5	13.5	1-1-2-4 Rec = 24" Qp = -
12.1	15.0	Dk. brn. silty sand w/ small wood pieces, moist.	SS-6	14.0	16.0	3-3-6-5 Rec = 24" Qp = 3.0
15.0	16.5	Dk. brn. sandy silty clay (till) to sandy clayey silt, moist.	SS-7	16.5	18.5	1-1-2-2 Rec = 24" Qp = -
16.5	19.8	Dk. brn. clay, w/ so. sand and silt, soft.	SS-8	19.0	21.0	1-2-2-2 Rec = 24" Qp = 0.25
19.8	24.6	Gray sandy clay, so. silt, v. soft and moist. More sand at 21.5' (gets coarser w/ depth).	SS-9	21.5	23.5	1-2-3-5 Rec = Qp = 0.75
24.6	25.0	Gray v. coarse sand w/ clay, wet.	SS-10	24.0	26.0	1-2-2-3 Rec = 23" Qp = -
25.0	26.9	Gray sandy clayey silt (till), wet.	SS-11	26.5	28.5	1-2-2-4 Rec = 24" Qp = 3.0 (in cohesive)

General Remarks:

Project Name Ameren Duck Creek - Phase II Site Invest. **Boring #** B-10/MW-4

Sheet 2 of 3

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
26.9	28.2	Gray v. coarse sand w/gravel, wet.	SS-12	29.0	31.0	1-2-4-7 Rec = 24" Qp = 3.0
28.2	31.5	Gray sandy clayey silt (till), wet.	SS-13	31.5	33.5	3-6-8-10 Rec = 24" Qp = 4.5
31.5	36.2	Gray sandy silt, tr. gravel, v. stiff.	SS-14	34.0	36.0	2-4-6-8 Rec = 24" Qp = 4.5+
36.2	36.8	Red and gray clayey silty sand.	SS-15	36.5	38.5	4-7-9-13 Rec = 24" Qp = 0.5 to 4.5+
36.8	46.5	Gray sandy silt, tr. gravel, v stiff, more sand and gravel from 41.5' to 44.1'.	SS-16	39.0	41.0	3-6-10-13 Rec = 24" Qp = 3.5
46.5	52.0	Gray silt w/gravel, sl. dry w/rough surface structure, breaks down w/small pressure.	SS-17	41.5	43.5	3-4-9-11 Rec = 24" Qp = 4.0
52.0	54.8	Brn. and gray sandy clayey silt, tr. gravel, reddish brown at bottom, sl. moist.	SS-18	44.0	46.0	6-9-15-20 Rec = 24" Qp = 4.5+
54.8	56.5	Gray v. coarse sand w/gravel, v. dense, wet.	SS-19	46.5	48.5	11-21-29-40 Rec = 24" Qp = -
56.5	57.0	Gray v.f. sand, medium dense, moist.	SS-20	49.0	50.5	19-47-50/5" Rec = Qp = -
57.0	57.5	V. coarse sand w/gravel, wet.	SS-21	51.5	53.5	22-42-31-43 Rec = Qp = 2.5
57.5	61.5	Gray v.f. sand, so. gravel, v. dense, moist. No gravel from 58.6'.	SS-22	54.0	55.75	20-42-47-50/3" Rec = 24" Qp = -
61.5	64.9	Gray v.f. sandy silt, v. dense, so. gravel from 64.5' to 64.9', wet.	SS-23	56.5	57.8	13-28-50/4" Rec = 24" Qp = -
64.9	68.4	Gray silty clay and clayey silt, v. stiff, moist. So. gravel from 66.5' to 68.4'.	SS-24	59.0	60.3	15-29-50/4" Rec = 15" Qp = -
68.4	68.5	Limestone fragments.	SS-25	61.5	62.8	20-45-50/4" Rec = 15" Qp = -
68.5	77.5	Gray clayey sandy silt w/gravel, v. stiff.	SS-26	64.0	66.0	20-16-20-31 Rec = 24" Qp = 4.5

General Remarks:

Project Name Ameren Duck Creek - Phase II Site Invest.

Boring # B-10/MW-4

Sheet 3 of 3

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
77.5	80.5	Dk. gray silty sand.	SS-27	66.5	68.5	11-15-21-33 Rec = 24" Qp = 4.5+
80.5	81.5	Gray sandy silt, stiff, moist.	SS-28	69.0	71.0	15-20-37-50/5" Rec = 24" Qp = 4.5+
81.5	85.0	Gray silty sand, moist. Coal at 83.4'.	SS-29	71.5	73.5	16-29-33-38 Rec = 24" Qp = 4.5+
85.0	89.0	V. coarse sand w/rock fragments.	SS-30	74.0	76.0	12-23-32-50 Rec = 24" Qp = 4.5+
89.0	91.5	Gray siltstone, hard, moist. Auger refusal. Will core using a tricone to 91.5' and try to get another sample. SPT refusal at 91.5'.	SS-31	76.5	78.5	12-18-27-31 Rec = 24" Qp = -
		Begin Coring at 91.5'.	SS-32	79.0	81.0	12-24-35-50 Rec = 24" Qp = 2.0 (in silt)
			SS-33	81.5	83.5	9-19-28-34 Rec = 24" Qp = -
			SS-34	84.0	86.0	34-32-21-42 Rec = 18" Qp = -
			SS-35	86.5	88.5	11-13-26-20 Rec = 17" Qp = -
			SS-36	89.0	89.3	50/3" Rec = 2" Qp = -
			SS-37	91.5	91.7	50/2" Rec = Qp = -

General Remarks:

HANSON

BORING NO.	B-10/MW-4
PROJECT No. 03S5010	SHEET 1 OF 2

PROJECT NAME:	DATE	Engineer/Geologist:
Ameren Duck Creek	9/23/2003	Brett Carney

Depth In Feet	ROCK, COLOR, HARDNESS, WEATHERING, GRAIN OR CRYSTALLINITY, BEDDING, VOIDS (OTHER: THICKNESS & LOCATION OF CLAY/SHALE SEAMS)	Sample or Run Number	% REC -------- % RQD	Box Number	Time	DWR %	DWRC	Down Pressure	Depth In Feet
	Start Coring at 91.5 ft.	1	100% ------- 89%	1		100%	Dk. Gray	490	
92.5	Gray silty shale; thin bedded; v. soft and weathered 91.5 - 91.9 (may be slough); mod. soft; micaceous; so. plant fossils.								
93.5	Gray shaley sandstone, w/so. lt. gray partings below 91.9 ft.								
94.5									
95.5									
96.5									
97.5									
98.5		98.5'							
	Same as above.	2	100% ------- 99%		1' 26"	100%		500	
99.5	Core barrel plugged as soon as we resumed at 98.5 ft.							600 @ 105.5 ft	
	Temporarily plugged at 103.7 ft.				1' 30"				
100.5	Lost 2.7 ft of core (likely fell out the bottom upon retrieval). Recovered remaining 2.7 ft as part of Run #3. RQD & REC includes recovery in Run #3.			100.8' / 2	1' 51"				
101.5									

HANSON

BORING NO.	B-10/MW-4
PROJECT No. 03S5010	SHEET 2 OF 2

PROJECT NAME:	DATE	Engineer/Geologist:
Ameren Duck Creek	9/23/2003	Brett Carney

Depth In Feet	ROCK, COLOR, HARDNESS, WEATHERING, GRAIN OR CRYSTALLINITY, BEDDING, VOIDS (OTHER: THICKNESS & LOCATION OF CLAY/SHALE SEAMS)	Sample or Run Number	% REC -------- % RQD	Box Number	Time	DWR %	DWRC	Down Pressure	Depth In Feet
	Same as above.	2		1					
					1' 42"				
102.5									
					1' 25"				
103.5									
					4' 10"				
104.5									
					47"				
105.5									
					47"				
106.5									
					45"				
107.5									
					50"				
108.5		108.5'							
		3	100% ------- 100%	2	1' 23"	100%	Dk Gray	500	
109.5									
					1' 10"				
110.5									
					1' 14"				
111.5	End Run #3 @ 111.5 ft. E.O.B. @ 111.5 ft.								

G02S (P02S, MW-4S)

HANSON

RECORD OF SOIL EXPLORATION

Project Name	Ameren Duck Creek	Sheet	1 of 3
Job #	03S5010	Boring #	B-10/MW-4 G02S
Location	CCB Landfill - Phase II Site Invest.	Station	-
Driller	Western Environmental Drilling Inc.	Surface Elevation	619.4
Foreman	Randy Howard	Drilling Method	HSA
Engineer/Geologist	OMI	Sampling Method	SS/Core
Weather & Temp.	Upper 60's, Cloudy	Hammer Type	Auto
Date: Start	9/22/2003 0900	Water Depth: DD	25
Finish	9/23/2003 1605	AAR	-
		Delayed	-

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
0.0	2.0	Top soil, brn. silt w/clay, moist.	SS-1	1.5	3.5	2-3-5-6 Rec = 18" Qp = 2.0
2.0	4.0	Brn. and gray clayey silt and silty clay, so sand.	SS-2	4.0	6.0	1-2-2-2 Rec = 24" Qp = 0.25
4.0	7.8	Reddish brn and gray silty clay, soft.	SS-3	6.5	8.5	0-2-2-2 Rec = 19.5" Qp = -
7.8	9.8	Reddish brn. and gray clayey silt, v. soft.	SS-4	9.0	11.0	1-2-3-4 Rec = 22" Qp = 3.0
9.8	12.1	Gray (sl. red) silt, tr. clay, stiff, moist.	SS-5	11.5	13.5	1-1-2-4 Rec = 24" Qp = -
12.1	15.0	Dk. brn. silty sand w/ small wood pieces, moist.	SS-6	14.0	16.0	3-3-6-5 Rec = 24" Qp = 3.0
15.0	16.5	Dk. brn. sandy silty clay (till) to sandy clayey silt, moist.	SS-7	16.5	18.5	1-1-2-2 Rec = 24" Qp = -
16.5	19.8	Dk. brn. clay, w/ so. sand and silt, soft.	SS-8	19.0	21.0	1-2-2-2 Rec = 24" Qp = 0.25
19.8	24.6	Gray sandy clay, so. silt, v. soft and moist. More sand at 21.5' (gets coarser w/ depth).	SS-9	21.5	23.5	1-2-3-5 Rec = Qp = 0.75
24.6	25.0	Gray v. coarse sand w/ clay, wet.	SS-10	24.0	26.0	1-2-2-3 Rec = 23" Qp = -
25.0	26.9	Gray sandy clayey silt (till), wet.	SS-11	26.5	28.5	1-2-2-4 Rec = 24" Qp = 3.0 (in cohesive)

General Remarks:

Project Name Ameren Duck Creek - Phase II Site Invest. **Boring #** B-10/MW-4

Sheet 2 of 3

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
26.9	28.2	Gray v. coarse sand w/gravel, wet.	SS-12	29.0	31.0	1-2-4-7 Rec = 24" Qp = 3.0
28.2	31.5	Gray sandy clayey silt (till), wet.	SS-13	31.5	33.5	3-6-8-10 Rec = 24" Qp = 4.5
31.5	36.2	Gray sandy silt, tr. gravel, v. stiff.	SS-14	34.0	36.0	2-4-6-8 Rec = 24" Qp = 4.5+
36.2	36.8	Red and gray clayey silty sand.	SS-15	36.5	38.5	4-7-9-13 Rec = 24" Qp = 0.5 to 4.5+
36.8	46.5	Gray sandy silt, tr. gravel, v stiff, more sand and gravel from 41.5' to 44.1'.	SS-16	39.0	41.0	3-6-10-13 Rec = 24" Qp = 3.5
46.5	52.0	Gray silt w/gravel, sl. dry w/rough surface structure, breaks down w/small pressure.	SS-17	41.5	43.5	3-4-9-11 Rec = 24" Qp = 4.0
52.0	54.8	Brn. and gray sandy clayey silt, tr. gravel, reddish brown at bottom, sl. moist.	SS-18	44.0	46.0	6-9-15-20 Rec = 24" Qp = 4.5+
54.8	56.5	Gray v. coarse sand w/gravel, v. dense, wet.	SS-19	46.5	48.5	11-21-29-40 Rec = 24" Qp = -
56.5	57.0	Gray v.f. sand, medium dense, moist.	SS-20	49.0	50.5	19-47-50/5" Rec = Qp = -
57.0	57.5	V. coarse sand w/gravel, wet.	SS-21	51.5	53.5	22-42-31-43 Rec = Qp = 2.5
57.5	61.5	Gray v.f. sand, so. gravel, v. dense, moist. No gravel from 58.6'.	SS-22	54.0	55.75	20-42-47-50/3" Rec = 24" Qp = -
61.5	64.9	Gray v.f. sandy silt, v. dense, so. gravel from 64.5' to 64.9', wet.	SS-23	56.5	57.8	13-28-50/4" Rec = 24" Qp = -
64.9	68.4	Gray silty clay and clayey silt, v. stiff, moist. So. gravel from 66.5' to 68.4'.	SS-24	59.0	60.3	15-29-50/4" Rec = 15" Qp = -
68.4	68.5	Limestone fragments.	SS-25	61.5	62.8	20-45-50/4" Rec = 15" Qp = -
68.5	77.5	Gray clayey sandy silt w/gravel, v. stiff.	SS-26	64.0	66.0	20-16-20-31 Rec = 24" Qp = 4.5

General Remarks:

Project Name Ameren Duck Creek - Phase II Site Invest.

Boring # B-10/MW-4

Sheet 3 of 3

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
77.5	80.5	Dk. gray silty sand.	SS-27	66.5	68.5	11-15-21-33 Rec = 24" Qp = 4.5+
80.5	81.5	Gray sandy silt, stiff, moist.	SS-28	69.0	71.0	15-20-37-50/5" Rec = 24" Qp = 4.5+
81.5	85.0	Gray silty sand, moist. Coal at 83.4'.	SS-29	71.5	73.5	16-29-33-38 Rec = 24" Qp = 4.5+
85.0	89.0	V. coarse sand w/rock fragments.	SS-30	74.0	76.0	12-23-32-50 Rec = 24" Qp = 4.5+
89.0	91.5	Gray siltstone, hard, moist. Auger refusal. Will core using a tricone to 91.5' and try to get another sample. SPT refusal at 91.5'.	SS-31	76.5	78.5	12-18-27-31 Rec = 24" Qp = -
		Begin Coring at 91.5'.	SS-32	79.0	81.0	12-24-35-50 Rec = 24" Qp = 2.0 (in silt)
			SS-33	81.5	83.5	9-19-28-34 Rec = 24" Qp = -
			SS-34	84.0	86.0	34-32-21-42 Rec = 18" Qp = -
			SS-35	86.5	88.5	11-13-26-20 Rec = 17" Qp = -
			SS-36	89.0	89.3	50/3" Rec = 2" Qp = -
			SS-37	91.5	91.7	50/2" Rec = Qp = -

General Remarks:

HANSON

BORING NO.	B-10/MW-4
PROJECT No. 03S5010	SHEET 1 OF 2

PROJECT NAME:	DATE	Engineer/Geologist:
Ameren Duck Creek	9/23/2003	Brett Carney

Depth In Feet	ROCK, COLOR, HARDNESS, WEATHERING, GRAIN OR CRYSTALLINITY, BEDDING, VOIDS (OTHER: THICKNESS & LOCATION OF CLAY/SHALE SEAMS)	Sample or Run Number	% REC -------- % RQD	Box Number	Time	DWR %	DWRC	Down Pressure	Depth In Feet
	Start Coring at 91.5 ft.	1	100% ------- 89%	1		100%	Dk. Gray	490	
92.5	Gray silty shale; thin bedded; v. soft and weathered 91.5 - 91.9 (may be slough); mod. soft; micaceous; so. plant fossils.								
93.5	Gray shaley sandstone, w/so. lt. gray partings below 91.9 ft.								
94.5									
95.5									
96.5									
97.5									
98.5		98.5'							
	Same as above.	2	100% ------- 99%		1' 26"	100%		500	
99.5	Core barrel plugged as soon as we resumed at 98.5 ft.							600 @ 105.5 ft	
	Temporarily plugged at 103.7 ft.				1' 30"				
100.5	Lost 2.7 ft of core (likely fell out the bottom upon retrieval). Recovered remaining 2.7 ft as part of Run #3. RQD & REC includes recovery in Run #3.			100.8' / 2	1' 51"				
101.5									

HANSON

BORING NO.	B-10/MW-4
PROJECT No. 03S5010	SHEET 2 OF 2

PROJECT NAME:	DATE	Engineer/Geologist:
Ameren Duck Creek	9/23/2003	Brett Carney

Depth In Feet	ROCK, COLOR, HARDNESS, WEATHERING, GRAIN OR CRYSTALLINITY, BEDDING, VOIDS (OTHER: THICKNESS & LOCATION OF CLAY/SHALE SEAMS)	Sample or Run Number	% REC -------- % RQD	Box Number	Time	DWR %	DWRC	Down Pressure	Depth In Feet
	Same as above.	2		1					
					1' 42"				
102.5									
					1' 25"				
103.5									
					4' 10"				
104.5									
					47"				
105.5									
					47"				
106.5									
					45"				
107.5									
					50"				
108.5		108.5'							
		3	100% ------- 100%	2	1' 23"	100%	Dk Gray	500	
109.5									
					1' 10"				
110.5									
					1' 14"				
111.5	End Run #3 @ 111.5 ft. E.O.B. @ 111.5 ft.								

FIELD BORING LOG

G50L (MW51L)

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/13/2007
Finish: 3/13/2007
WEATHER: Sunny, windy, mild

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 4½" hollow stem auger - blind drilled within 10 ft of B-51

FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~B-51a~~
Well ID: ~~MW51L~~
Surface Elev: 620.84 ft. MSL
Completion: 16.71 ft. BGS
Station: 16,174.9N
-5.3E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 8.20 - during drilling
▼ = 5.57 - 3/29/2007
▽ =

SAMPLE			TESTING				Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Failure Type*					
								Very dark brown (10YR2/2), clayey SILT, trace sand		620	
							2	Yellowish brown (10YR5/6) with 40% very dark grayish brown (10YR2/3) mottles, silty CLAY, trace sand			
								Pale brown (10YR6/3) with 40% yellowish brown (10YR5/8) silty CLAY, trace sand		618	
							4			616	
							▽ 6			614	
							▼ 8	Pale brown (10YR6/3) and yellowish brown (10YR5/8) clayey SILT, trace sand		612	
							10			610	
							12			608	
								Grayish brown (10YR5/2), clayey SILT, trace sand			
							14			606	
								Brown (10YR4/3), clayey SILT, trace sand			
							16				

End of Boring = 16.7 ft. BGS

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/12/2007
Finish: 3/13/2007
WEATHER: Sunny, windy, mild

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3½" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-51
Well ID: hole abandoned
Surface Elev: 620.84 ft. MSL
Completion: 80.00 ft. BGS
Station: 16,177.5N
-5.3E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 8.20 - during drilling
▼ = 7.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
	24/24 100%	ss	2-3 4-5 N=7			
1A				21		1.28 BSh
	22/24 92%	ss	6-3 5-6 N=8			
2A				30		1.78 BSh
2B				29		1.67 BSh
	18/24 75%	ss	1-3 3-3 N=6			
3A				24		
	24/24 100%	ss	5-4 5-6 N=9			
4A				22		1.71 B
	13/24 54%	ss	1-3 5-4 N=8			
5A				26		1.28 BSh
	15/24 63%	ss	0-1 3-3 N=4			
6A				27		1.36 BSh
	14/24 58%	ss	4-3 5-6 N=8			
7A				24		
	20/24 83%	ss	0-2 2-3 N=4			
8A				26		
	24/24 100%	ss	4-5 5-5 N=10			
9A				25		
	23/24 96%	ss	0-2 3-3 N=5			
10A				26		
	20/24		1-3			

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Very dark brown (10YR2/2), clayey SILT, trace sand	620
2	Yellowish brown (10YR5/6) with 40% very dark grayish brown (10YR2/3) mottles, silty CLAY, trace sand	
	Pale brown (10YR6/3) with 40% yellowish brown (10YR5/8) silty CLAY, trace sand	618
4		
		616
6		
▼		614
▼ 8	Pale brown (10YR6/3) and yellowish brown (10YR5/8) clayey SILT, trace sand	
		612
10		
		610
12		
		608
	Grayish brown (10YR5/2), clayey SILT, trace sand	
14		
		606
	Brown (10YR4/3), clayey SILT, trace sand	
16		
		604
	Dark yellowish brown (10YR4/4) with 30% yellowish brown (10YR5/6) mottles, very silty CLAY, trace sand	
18		
		602
	Dark grayish brown (10YR4/2) with 50% yellowish brown (10YR5/6) mottles, silty CLAY, trace sand and gravel	
20		
		600

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/12/2007
Finish: 3/13/2007
WEATHER: Sunny, windy, mild

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3½" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-51
Well ID: hole abandoned
Surface Elev: 620.84 ft. MSL
Completion: 80.00 ft. BGS
Station: 16,177.5N
-5.3E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 8.20 - during drilling
▼ = 7.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*
	83%	SS	*3-4* N=6			
11A				27		
	22/24 *92%*	SS	*1-3* *4-4* N=7			
12A				24		
	20/24 *83%*	SS	*2-3* *5-2* N=8			
13A				28		
	19/24 *79%*	SS	*0-2* *2-2* N=4			
14A				19		
	20/24 *83%*	SS	*1-3* *5-6* N=8			
15A				15		
	24/60 *40%*	CS				
16A				13		4.29 *BSh*
	38/60 *63%*	CS				
17A				13		6.70 *None*

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
22	Dark grayish brown (10YR4/2) with 50% yellowish brown (10YR5/6) mottles, silty CLAY, trace sand and gravel *[Continued from previous page]*	
	Dark yellowish brown (10YR4/6) with 30% very dark grayish brown (10YR3/2) and 10% gray (10YR5/1) mottles, silty CLAY, trace sand and gravel	598
24		
	Greenish gray (5GY5/1) with 50% yellowish brown (10YR5/6) mottles, very silty CLAY, trace sand and gravel	596
26		
	Light brownish gray (10YR6/2) with 30% yellowish brown (10YR5/6) mottles, clayey SILT, trace sand and gravel	594
28		
	Dark gray (N4/1), very silty CLAY, trace sand and gravel	592
30		
	Dark gray (N4/1), sandy SILT, trace clay	590
32		
		588
34		
	Dark gray (N4/1), silty CLAY, trace sand and gravel	586
36		
		584
38	Brown (10YR4/3), silty, fine to medium SAND, little gravel	
		582
40		
	Brown (10YR4/3), silty, fine SAND	580
42		

Borehole Detail

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/12/2007
Finish: 3/13/2007
WEATHER: Sunny, windy, mild

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3½" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-51
Well ID: hole abandoned
Surface Elev: 620.84 ft. MSL
Completion: 80.00 ft. BGS
Station: 16,177.5N
-5.3E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 8.20 - during drilling
▼ = 7.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	19/60 32%	CS						Brown (10YR4/3), fine to medium SAND	578	
								Brown (10YR4/3), silty, fine to coarse SAND, little gravel		
							44	Dark yellow brown (10YR4/4), SANDSTONE		
18A				13		6.70 None			576	
							46	Very dark gray (N3/1), sandy SILT, trace clay and gravel		
									574	
	48/60 80%	CS					48			
								Dark gray (N4/1), SHALE	572	
19A				14		6.70 None	50			
									570	
								Very dark gray (N3/1), silty CLAY, trace sand and gravel		
							52			
	60/60 100%	CS							568	
							54			
20A				17		6.70 None			566	
							56	Very dark greenish gray (10Y3/1), silty CLAY, trace sand and gravel		
									564	
	60/60 100%	CS					58			
									562	
								Very dark greenish gray (10Y3/1), silty, fine to coarse SAND, little gravel		
21A				14			60			
22A				15						
22B	18/24 75%	SS	8-15 25-32 N=40	11				Very dark gray (N3/1), sandy CLAY, little gravel	560	
22C				15				Very dark gray (N3/1), silty, fine SAND, trace medium sand		
							62	Very dark gray (N3/1), sandy CLAY, trace gravel		
	24/24		15-31					Very dark gray (N3/1), silty, fine to medium SAND, trace gravel	558	

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/12/2007
Finish: 3/13/2007
WEATHER: Sunny, windy, mild

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3½" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-51
Well ID: hole abandoned
Surface Elev: 620.84 ft. MSL
Completion: 80.00 ft. BGS
Station: 16,177.5N
-5.3E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 8.20 - during drilling
▼ = 7.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
23A	100%	SS	29-19 N=60	15		5.24 BSh
24A	24/24 100%	SS	7-10 14-23 N=24	15		5.24 BSh
24B				15		3.30 B
	24/24 100%	SS	8-17 24-22 N=41			
25A				16		5.13 B
	24/24 100%	SS	7-9 16-15 N=25			
26A				12		2.57 BSP
	12/12 100%	CS				
27A				11		
	12/12 100%	CS				
28A				12		
	36/36 100%	CS				
29				12		
	60/60 100%	CS				
30A				19		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Very dark gray (N3/1), sandy CLAY, trace gravel *[Continued from previous page]*	
64	Very dark gray (N3/1), silty, fine to coarse SAND, trace gravel	556
66	Very dark gray (N3/1), silty CLAY, trace sand and gravel	554
68	Very dark gray (N3/1), sandy CLAY, trace gravel	552
70	Very dark gray (N3/1), sandy CLAY	550
72	Very dark gray (N3/1), silty, fine to coarse SAND, little gravel	548
74		546
76	Very dark gray (N3/1), silty, fine SAND, trace gravel	544
78		542
80		

End of Boring = 80.0 ft. BGS

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

G50S (MW51S)

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 3/13/2007
Finish: 3/13/2007
WEATHER: Sunny, windy, mild

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-650 Track Drill
Drilling Method: 4½" hollow stem auger - blind drilled within 10 ft of B-51
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~B-51b~~
Well ID: ~~MW51S/G50S~~
Surface Elev: 620.84 ft. MSL
Completion: 34.32 ft. BGS
Station: 16,180.78N
-5.07E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 8.20 - during drilling
▼ = 5.86 - 3/29/2007
▽ =

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	Elevation ft. MSL	Remarks
								Very dark brown (10YR2/2), clayey SILT, trace sand	620	
							2	Yellowish brown (10YR5/6) with 40% very dark grayish brown (10YR2/3) mottles, silty CLAY, trace sand		
								Pale brown (10YR6/3) with 40% yellowish brown (10YR5/8) silty CLAY, trace sand	618	
							4			
									616	
							▽ 6			
									614	
							▼ 8	Pale brown (10YR6/3) and yellowish brown (10YR5/8) clayey SILT, trace sand		
									612	
							10			
									610	
							12			
									608	
								Grayish brown (10YR5/2), clayey SILT, trace sand		
							14			
									606	
								Brown (10YR4/3), clayey SILT, trace sand		
							16			
									604	
								Dark yellowish brown (10YR4/4) with 30% yellowish brown (10YR5/6) mottles, very silty CLAY, trace sand		
							18			
									602	
								Dark grayish brown (10YR4/2) with 50% yellowish brown (10YR5/6) mottles, silty CLAY, trace sand and gravel		
							20			
									600	

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 3/13/2007
Finish: 3/13/2007
WEATHER: Sunny, windy, mild

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-650 Track Drill
Drilling Method: 4½" hollow stem auger - blind drilled within 10 ft of B-51
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-51b
Well ID: MW51S/G50S
Surface Elev: 620.84 ft. MSL
Completion: 34.32 ft. BGS
Station: 16,180.78N
-5.07E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 8.20 - during drilling
▼ = 5.86 - 3/29/2007
▽ =

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	Dark grayish brown (10YR4/2) with 50% yellowish brown (10YR5/6) mottles, silty CLAY, trace sand and gravel *[Continued from previous page]*			
							24	Dark yellowish brown (10YR4/6) with 30% very dark grayish brown (10YR3/2) and 10% gray (10YR5/1) mottles, silty CLAY, trace sand and gravel		598	
							26	Greenish gray (5GY5/1) with 50% yellowish brown (10YR5/6) mottles, very silty CLAY, trace sand and gravel		596	
							28	Light brownish gray (10YR6/2) with 30% yellowish brown (10YR5/6) mottles, clayey SILT, trace sand and gravel		594	
							30	Dark gray (N4/1), very silty CLAY, trace sand and gravel		592	
							32	Dark gray (N4/1), sandy SILT, trace clay		590	
							34			588	

End of Boring = 34.3 ft. BGS

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/12/2007
Finish: 3/13/2007
WEATHER: Sunny, windy, mild

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3½" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-51
Well ID: hole abandoned
Surface Elev: 620.84 ft. MSL
Completion: 80.00 ft. BGS
Station: 16,177.5N
-5.3E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 8.20 - during drilling
▼ = 7.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
	24/24 100%	ss	2-3 4-5 N=7			
1A				21		1.28 BSh
	22/24 92%	ss	6-3 5-6 N=8			
2A				30		1.78 BSh
2B				29		1.67 BSh
	18/24 75%	ss	1-3 3-3 N=6			
3A				24		
	24/24 100%	ss	5-4 5-6 N=9			
4A				22		1.71 B
	13/24 54%	ss	1-3 5-4 N=8			
5A				26		1.28 BSh
	15/24 63%	ss	0-1 3-3 N=4			
6A				27		1.36 BSh
	14/24 58%	ss	4-3 5-6 N=8			
7A				24		
	20/24 83%	ss	0-2 2-3 N=4			
8A				26		
	24/24 100%	ss	4-5 5-5 N=10			
9A				25		
	23/24 96%	ss	0-2 3-3 N=5			
10A				26		
	20/24		1-3			

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Very dark brown (10YR2/2), clayey SILT, trace sand	620
2	Yellowish brown (10YR5/6) with 40% very dark grayish brown (10YR2/3) mottles, silty CLAY, trace sand	
	Pale brown (10YR6/3) with 40% yellowish brown (10YR5/8) silty CLAY, trace sand	618
4		
		616
6		
▼		614
▼ 8	Pale brown (10YR6/3) and yellowish brown (10YR5/8) clayey SILT, trace sand	
		612
10		
		610
12		
		608
	Grayish brown (10YR5/2), clayey SILT, trace sand	
14		
		606
	Brown (10YR4/3), clayey SILT, trace sand	
16		
		604
	Dark yellowish brown (10YR4/4) with 30% yellowish brown (10YR5/6) mottles, very silty CLAY, trace sand	
18		
		602
	Dark grayish brown (10YR4/2) with 50% yellowish brown (10YR5/6) mottles, silty CLAY, trace sand and gravel	
20		
		600

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/12/2007
Finish: 3/13/2007
WEATHER: Sunny, windy, mild

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3½" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-51
Well ID: hole abandoned
Surface Elev: 620.84 ft. MSL
Completion: 80.00 ft. BGS
Station: 16,177.5N
-5.3E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 8.20 - during drilling
▼ = 7.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*
	83%	SS	*3-4* N=6			
11A				27		
	22/24 *92%*	SS	*1-3* *4-4* N=7			
12A				24		
	20/24 *83%*	SS	*2-3* *5-2* N=8			
13A				28		
	19/24 *79%*	SS	*0-2* *2-2* N=4			
14A				19		
	20/24 *83%*	SS	*1-3* *5-6* N=8			
15A				15		
	24/60 *40%*	CS				
16A				13		4.29 *BSh*
	38/60 *63%*	CS				
17A				13		6.70 *None*

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
22	Dark grayish brown (10YR4/2) with 50% yellowish brown (10YR5/6) mottles, silty CLAY, trace sand and gravel *[Continued from previous page]*	
	Dark yellowish brown (10YR4/6) with 30% very dark grayish brown (10YR3/2) and 10% gray (10YR5/1) mottles, silty CLAY, trace sand and gravel	598
24		
	Greenish gray (5GY5/1) with 50% yellowish brown (10YR5/6) mottles, very silty CLAY, trace sand and gravel	596
26		
	Light brownish gray (10YR6/2) with 30% yellowish brown (10YR5/6) mottles, clayey SILT, trace sand and gravel	594
28		
	Dark gray (N4/1), very silty CLAY, trace sand and gravel	592
30		
	Dark gray (N4/1), sandy SILT, trace clay	590
32		
		588
34		
	Dark gray (N4/1), silty CLAY, trace sand and gravel	586
36		
		584
38	Brown (10YR4/3), silty, fine to medium SAND, little gravel	
		582
40		
	Brown (10YR4/3), silty, fine SAND	580
42		

Borehole Detail

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/12/2007
Finish: 3/13/2007
WEATHER: Sunny, windy, mild

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3½" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-51
Well ID: hole abandoned
Surface Elev: 620.84 ft. MSL
Completion: 80.00 ft. BGS
Station: 16,177.5N
-5.3E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 8.20 - during drilling
▼ = 7.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	19/60 32%	CS						Brown (10YR4/3), fine to medium SAND	578	
								Brown (10YR4/3), silty, fine to coarse SAND, little gravel		
							44	Dark yellow brown (10YR4/4), SANDSTONE		
18A				13		6.70 None			576	
							46	Very dark gray (N3/1), sandy SILT, trace clay and gravel		
									574	
	48/60 80%	CS					48			
								Dark gray (N4/1), SHALE	572	
19A				14		6.70 None	50			
									570	
								Very dark gray (N3/1), silty CLAY, trace sand and gravel		
							52			
	60/60 100%	CS							568	
							54			
20A				17		6.70 None			566	
							56	Very dark greenish gray (10Y3/1), silty CLAY, trace sand and gravel		
									564	
	60/60 100%	CS					58			
									562	
								Very dark greenish gray (10Y3/1), silty, fine to coarse SAND, little gravel		
21A				14			60			
22A				15						
22B	18/24 75%	SS	8-15 25-32 N=40	11				Very dark gray (N3/1), sandy CLAY, little gravel	560	
22C				15				Very dark gray (N3/1), silty, fine SAND, trace medium sand		
							62	Very dark gray (N3/1), sandy CLAY, trace gravel		
	24/24		15-31					Very dark gray (N3/1), silty, fine to medium SAND, trace gravel	558	

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren
Site: Gypsum Stack
Location: Duck Creek Generating Station
Project: 03S5010
DATES: Start: 3/12/2007
Finish: 3/13/2007
WEATHER: Sunny, windy, mild

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3½" hollow stem auger w/split spoon and split barrel sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: B-51
Well ID: hole abandoned
Surface Elev: 620.84 ft. MSL
Completion: 80.00 ft. BGS
Station: 16,177.5N
-5.3E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 8.20 - during drilling
▼ = 7.00 - end of boring
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
23A	100%	SS	29-19 N=60	15		5.24 BSh
24A	24/24 100%	SS	7-10 14-23 N=24	15		5.24 BSh
24B				15		3.30 B
	24/24 100%	SS	8-17 24-22 N=41			
25A				16		5.13 B
	24/24 100%	SS	7-9 16-15 N=25			
26A				12		2.57 BSP
	12/12 100%	CS				
27A				11		
	12/12 100%	CS				
28A				12		
	36/36 100%	CS				
29				12		
	60/60 100%	CS				
30A				19		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Very dark gray (N3/1), sandy CLAY, trace gravel *[Continued from previous page]*	
64	Very dark gray (N3/1), silty, fine to coarse SAND, trace gravel	556
66	Very dark gray (N3/1), silty CLAY, trace sand and gravel	554
68	Very dark gray (N3/1), sandy CLAY, trace gravel	552
70	Very dark gray (N3/1), sandy CLAY	550
72	Very dark gray (N3/1), silty, fine to coarse SAND, little gravel	548
74		546
76	Very dark gray (N3/1), silty, fine SAND, trace gravel	544
78		542
80		

End of Boring = 80.0 ft. BGS

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/28/2008
Finish: 1/28/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 4¼" hollow stem auger - blind drilled within 10 ft of of BG51
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~BG51b~~
Well ID: G51L
Surface Elev: 616.9 ft. MSL
Completion: 17.7 ft. BGS
Station: 15,409.75N
-75.67E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 9.30 - during drilling
▼ = 10.57 - 1/30/2008
▽ =

SAMPLE			TESTING				
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Failure Type*	

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	Dark gray (10YR4/2) silty CLAY, moist, trace sand	616	
	Light brown gray (10YR6/2) with 25% brown yellow (10YR6/6) mottles, moist, silty CLAY, trace sand		
2	Brown yellow (10YR6/6) with 50% light yellow brown (10YR6/4) mottles, moist, clayey SILT, trace sand	614	
4		612	
6		610	
8	Gray (10YR6/1) with 20% brown yellow (10YR6/6) mottles, moist, clayey SILT, trace sand	608	
▼ 10		606	
▽ 12		604	
14	Brown yellow (10YR5/4) with 30% yellow brown (10YR5/8) mottles, moist, clayey SILT, trace sand	602	
16	Brown (10YR5/3) with 30% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand and gravel	600	

End of Boring = 17.72 ft. BGS

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/23/2008
Finish: 1/23/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG51
Well ID: hole abandoned
Surface Elev: 616.8 ft. MSL
Completion: 46.0 ft. BGS
Station: 15,400.00N
-75.00E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 9.30 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
1A	24/24 100%	ss	4-5 5-6 N=10	21		1.05 Sh
1B				31		0.81 Sh
	23/24 96%	ss	2-3 3-5 N=6			
2A				23		1.24 Sh
	21/24 88%	ss	1-3 2-3 N=5			
3A				27		0.74 BSh
	24/24 100%	ss	2-3 1-3 N=4			
4A				29		0.74 BSh
	22/24 92%	ss	1-2 3-3 N=5			
5A				30		0.78 B
	24/24 100%	ss	0-2 1-2 N=3			
6A				28		0.62 Sh
7A				28		0.81 BSh
	24/24 100%	ss	0-2 2-3 N=4			
	24/24 100%	ss	0-1 2-2 N=3			
8A				27		0.81 BSh
	23/24 96%	ss	1-2 3-4 N=5			
9A				26		1.09 BSh
	24/24 100%	ss	2-2 4-4 N=6			
10A				25		1.09

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark gray (10YR4/2) silty CLAY, moist, trace sand	616
	Light brown gray (10YR6/2) with 25% brown yellow (10YR6/6) mottles, moist, silty CLAY, trace sand	
2	Brown yellow (10YR6/6) with 50% light yellow brown (10YR6/4) mottles, moist, clayey SILT, trace sand	614
4		612
6		610
8	Gray (10YR6/1) with 20% brown yellow (10YR6/6) mottles, moist, clayey SILT, trace sand	608
10		606
12		604
14	Brown yellow (10YR5/4) with 30% yellow brown (10YR5/8) mottles, moist, clayey SILT, trace sand	602
16		600
18	Brown (10YR5/3) with 30% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand and gravel	598
20		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/23/2008
Finish: 1/23/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG51
Well ID: hole abandoned
Surface Elev: 616.8 ft. MSL
Completion: 46.0 ft. BGS
Station: 15,400.00N
-75.00E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 9.30 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
						BSh
	24/24 100%	ss	1-2 2-3 N=4			
11A				22		
12A	24/24 100%	ss	3-4 3-4 N=7	26		0.39 B
12B				21		0.50 B
	24/24 100%	ss	0-2 3-3 N=5			
13A				20		1.75 B
14A	24/24 100%	ss	5-7 8-9 N=15	17		3.30 BSh
14B				18		
14C				15		
	24/24 100%	ss	1-5 6-9 N=11			
15A				19		4.07 Sh
	24/24 100%	ss	3-6 5-8 N=11			
16A				12		4.27 Sh
	24/24 100%	ss	6-8 9-9 N=17			
17A				16		4.27 BSh
18A	24/24 100%	ss	4-8 5-6 N=13	17		4.27 Sh
18B				15		
	21/24 88%	ss	4-4 6-5 N=10			
19A				37		0.81 B
	22/24 92%	ss	3-6 8-9 N=14			
20A				12		2.33 BSh
20B				13		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Brown (10YR5/3) with 30% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand and gravel *[Continued from previous page]*	596
22		
	Olive yellow (2.5Y6/6) with 50% green gray (5GY6/1) mottles, wet, silty CLAY, trace sand and gravel	594
24		
	Olive (5Y5/3) with 50% green gray (5GY6/1) mottles, wet, very silty CLAY, trace sand and gravel	592
26		
	Brown yellow (10YR5/4), wet, fine to coarse SAND, little gravel	590
	Green gray (5GY6/1), moist, very silty CLAY, trace sand	
28		588
30	Very dark gray (N3/1), moist, silty CLAY, trace sand and gravel	586
32		584
34		582
36	Dark gray (10YR4/1) with 20% gray (10YR5/1) mottles, moist, clayey SILT, trace sand	580
38	Dark gray (10YR4/1) silty CLAY, moist, trace sand and gravel	578
	Dark gray (10YR4/1), wet, fine to coarse SAND, trace	
40		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
CONTRACTOR: Testing Service Corporation
Site: Duck Creek Gypsum Managment Facility
Rig mfg/model: CME-650 Track Rig
Location: Canton, Fulton Co., Illinois
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
Project: 03S5010
DATES: Start: 1/23/2008
Finish: 1/23/2008
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager
WEATHER: Overcast, windy, cold

BOREHOLE ID: BG51
Well ID: hole abandoned
Surface Elev: 616.8 ft. MSL
Completion: 46.0 ft. BGS
Station: 15,400.00N
-75.00E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 9.30 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
20C				12		4.07 B		gravel			
	24/24 100%	ss	3-7 9-14 N=16							576	
21A				12		4.65 B	42				
	24/24 100%	ss	12-25 38-37 N=63					Dark gray (10YR4/1) silty CLAY, moist, trace sand and gravel *[Continued from previous page]*		574	
22A				10		7.18 Sh	44				
	24/24 100%	ss	11-19 21-26 N=40							572	
23A				11		5.43 Sh	46				

End of Boring = 46.0 ft. BGS

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/28/2008
Finish: 1/28/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 4¼" hollow stem auger - blind drilled within 5 ft of BG51
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~BG51a~~
Well ID: G51S
Surface Elev: 616.8 ft. MSL
Completion: 29.2 ft. BGS
Station: 15,405.35N
-75.27E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 9.30 - during drilling
▼ = 10.41 - 1/30/2008
▽ =

SAMPLE			TESTING							
Number	Recov / Total (in) % Recovery	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
								Dark gray (10YR4/2) silty CLAY, moist, trace sand	616	
							2	Light brown gray (10YR6/2) with 25% brown yellow (10YR6/6) mottles, moist, silty CLAY, trace sand		
								Brown yellow (10YR6/6) with 50% light yellow brown (10YR6/4) mottles, moist, clayey SILT, trace sand	614	
							4			
									612	
							6			
									610	
							8	Gray (10YR6/1) with 20% brown yellow (10YR6/6) mottles, moist, clayey SILT, trace sand		
									608	
							10			
									606	
							12			
									604	
							14	Brown yellow (10YR5/4) with 30% yellow brown (10YR5/8) mottles, moist, clayey SILT, trace sand		
									602	
							16			
									600	
							18	Brown (10YR5/3) with 30% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand and gravel		
									598	
							20			

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/28/2008
Finish: 1/28/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 4¼" hollow stem auger - blind drilled within 5 ft of BG51
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG51a
Well ID: G51S
Surface Elev: 616.8 ft. MSL
Completion: 29.2 ft. BGS
Station: 15,405.35N
-75.27E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 9.30 - during drilling
▼ = 10.41 - 1/30/2008
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Elevation ft. MSL
							22	Brown (10YR5/3) with 30% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand and gravel *[Continued from previous page]*	596
								Olive yellow (2.5Y6/6) with 50% green gray (5GY6/1) mottles, wet, silty CLAY, trace sand and gravel	594
							24	Olive (5Y5/3) with 50% green gray (5GY6/1) mottles, wet, very silty CLAY, trace sand and gravel	592
							26	Brown yellow (10YR5/4), wet, fine to coarse SAND, little gravel	590
								Green gray (5GY6/1), moist, very silty CLAY, trace sand	
							28	Very dark gray (N3/1), moist, silty CLAY, trace sand and gravel	588

End of Boring = 29.16 ft. BGS

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/23/2008
Finish: 1/23/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG51
Well ID: hole abandoned
Surface Elev: 616.8 ft. MSL
Completion: 46.0 ft. BGS
Station: 15,400.00N
-75.00E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 9.30 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
1A	24/24 100%	ss	4-5 5-6 N=10	21		1.05 Sh
1B				31		0.81 Sh
	23/24 96%	ss	2-3 3-5 N=6			
2A				23		1.24 Sh
	21/24 88%	ss	1-3 2-3 N=5			
3A				27		0.74 BSh
	24/24 100%	ss	2-3 1-3 N=4			
4A				29		0.74 BSh
	22/24 92%	ss	1-2 3-3 N=5			
5A				30		0.78 B
	24/24 100%	ss	0-2 1-2 N=3			
6A				28		0.62 Sh
7A				28		0.81 BSh
	24/24 100%	ss	0-2 2-3 N=4			
	24/24 100%	ss	0-1 2-2 N=3			
8A				27		0.81 BSh
	23/24 96%	ss	1-2 3-4 N=5			
9A				26		1.09 BSh
	24/24 100%	ss	2-2 4-4 N=6			
10A				25		1.09

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark gray (10YR4/2) silty CLAY, moist, trace sand	616
	Light brown gray (10YR6/2) with 25% brown yellow (10YR6/6) mottles, moist, silty CLAY, trace sand	
2	Brown yellow (10YR6/6) with 50% light yellow brown (10YR6/4) mottles, moist, clayey SILT, trace sand	614
4		612
6		610
8	Gray (10YR6/1) with 20% brown yellow (10YR6/6) mottles, moist, clayey SILT, trace sand	608
10		606
12		604
14	Brown yellow (10YR5/4) with 30% yellow brown (10YR5/8) mottles, moist, clayey SILT, trace sand	602
16		600
18	Brown (10YR5/3) with 30% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand and gravel	598
20		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/23/2008
Finish: 1/23/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG51
Well ID: hole abandoned
Surface Elev: 616.8 ft. MSL
Completion: 46.0 ft. BGS
Station: 15,400.00N
-75.00E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 9.30 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
						BSh
	24/24 100%	ss	1-2 2-3 N=4			
11A				22		
12A	24/24 100%	ss	3-4 3-4 N=7	26		0.39 B
12B				21		0.50 B
	24/24 100%	ss	0-2 3-3 N=5			
13A				20		1.75 B
14A	24/24 100%	ss	5-7 8-9 N=15	17		3.30 BSh
14B				18		
14C				15		
	24/24 100%	ss	1-5 6-9 N=11			
15A				19		4.07 Sh
	24/24 100%	ss	3-6 5-8 N=11			
16A				12		4.27 Sh
	24/24 100%	ss	6-8 9-9 N=17			
17A				16		4.27 BSh
18A	24/24 100%	ss	4-8 5-6 N=13	17		4.27 Sh
18B				15		
	21/24 88%	ss	4-4 6-5 N=10			
19A				37		0.81 B
	22/24 92%	ss	3-6 8-9 N=14			
20A				12		2.33 BSh
20B				13		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Brown (10YR5/3) with 30% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand and gravel *[Continued from previous page]*	596
22		
	Olive yellow (2.5Y6/6) with 50% green gray (5GY6/1) mottles, wet, silty CLAY, trace sand and gravel	594
24		
	Olive (5Y5/3) with 50% green gray (5GY6/1) mottles, wet, very silty CLAY, trace sand and gravel	592
26		
	Brown yellow (10YR5/4), wet, fine to coarse SAND, little gravel	590
	Green gray (5GY6/1), moist, very silty CLAY, trace sand	
28		588
30	Very dark gray (N3/1), moist, silty CLAY, trace sand and gravel	586
32		584
34		582
36	Dark gray (10YR4/1) with 20% gray (10YR5/1) mottles, moist, clayey SILT, trace sand	580
38	Dark gray (10YR4/1) silty CLAY, moist, trace sand and gravel	578
	Dark gray (10YR4/1), wet, fine to coarse SAND, trace	
40		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
CONTRACTOR: Testing Service Corporation
Site: Duck Creek Gypsum Managment Facility
Rig mfg/model: CME-650 Track Rig
Location: Canton, Fulton Co., Illinois
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
Project: 03S5010
DATES: Start: 1/23/2008
Finish: 1/23/2008
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager
WEATHER: Overcast, windy, cold

BOREHOLE ID: BG51
Well ID: hole abandoned
Surface Elev: 616.8 ft. MSL
Completion: 46.0 ft. BGS
Station: 15,400.00N
-75.00E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 9.30 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
20C				12		4.07 B		gravel			
	24/24 100%	ss	3-7 9-14 N=16							576	
21A				12		4.65 B	42				
	24/24 100%	ss	12-25 38-37 N=63					Dark gray (10YR4/1) silty CLAY, moist, trace sand and gravel *[Continued from previous page]*		574	
22A				10		7.18 Sh	44				
	24/24 100%	ss	11-19 21-26 N=40							572	
23A				11		5.43 Sh	46				

End of Boring = 46.0 ft. BGS

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/22/2008
Finish: 1/22/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 4¼" hollow stem auger - blind drilled within 5 ft of BG52
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~BG52b~~
Well ID: BG52L
Surface Elev: 616.7 ft. MSL
Completion: 34.2 ft. BGS
Station: 14,660.08N
-76.47E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 32.80 - during drilling
▼ = 28.78 - 1/30/2008
▽ =

SAMPLE			TESTING				Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Failure Type*					
							2	FILL - Gray (10YR6/1) with 25% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand		616	
							4			614	
							6			612	
							8	FILL - Yellow brown (10YR5/4) with 25% very pale brown (10YR7/4) and 10% very dark green gray (10Y3/1) mottles, moist, silty CLAY, trace sand		610	
							10	FILL - Very dark green gray (10Y3/1) with 25% yellow brown (10YR5/4), mottles, moist, silty CLAY, trace sand and gravel		608	
							12	FILL - Yellow brown (10YR5/4) with 20% very pale brown (10YR7/4) and 15% very dark green gray (10Y3/1) mottles, moist, silty CLAY, trace sand and gravel		606	
							14			604	
							16	FILL - Dark gray (5Y4/1), moist, very silty CLAY, trace sand		602	
							18	FILL - Olive gray (5Y5/2), moist, very silty CLAY, trace sand		600	
							20			598	

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/22/2008
Finish: 1/22/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 4¼" hollow stem auger - blind drilled within 5 ft of BG52
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

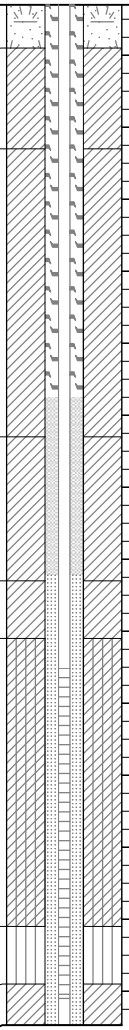
BOREHOLE ID: BG52b
Well ID: G52L
Surface Elev: 616.7 ft. MSL
Completion: 34.2 ft. BGS
Station: 14,660.08N
-76.47E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 32.80 - during drilling
▼ = 28.78 - 1/30/2008
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Elevation ft. MSL
								Very dark gray (10YR3/1), moist, clayey SILT, slight trace sand	596
								Dark gray brown (10YR4/2) with 20% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand	
							22		594
							24	Gray (10YR5/1) with 30% yellow brown (10YR5/4) mottles, moist, silty CLAY, trace sand	592
							26		590
								Gray (10YR5/1) with 30% green gray (5GY5/1) mottle, moist, silty CLAY, trace sand and gravel	
							28	Brown yellow (10YR6/8) with 20% green gray (5GY5/1) mottles, very moist, silty CLAY, trace sand and gravel	588
							30	Brown yellow (10YR6/8) with 25% light gray (10YR7/2) mottle, very moist, very silty CLAY, little sand, trace gravel	586
							32		584
								Dark gray brown (10YR4/2) with 25% dark yellow brown (10YR4/6) mottles, wet, clayey SILT, little sand, trace gravel	
							34	Dark gray (10YR4/1), very moist, silty CLAY, trace sand and gravel	

Borehole Detail



End of Boring = 34.17 ft. BGS

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/21/2008
Finish: 1/22/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~BG52~~
Well ID: G52S
Surface Elev: 616.5 ft. MSL
Completion: 46.0 ft. BGS
Station: 14,655.26N -76.07E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 32.80 - during drilling
▼ = 32.45 - 1/30/2008
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
	20/24 83%	ss	3-3 2-4 N=5			
1A				23		1.28 BSh
	24/24 100%	ss	3-3 4-4 N=7			
2A				16		2.13 Sh
	21/24 88%	ss	6-6 9-13 N=15			
3A				19		
	21/24 88%	ss	6-5 8-8 N=13			
4A				14		
	23/24 96%	ss	5-7 9-10 N=16			
5A				13		
	24/24 100%	ss	6-6 7-4 N=13			
6A				15		
	22/24 92%	ss	4-4 8-7 N=12			
7A				19		
	23/24 96%	ss	2-5 6-8 N=11			
8A				17		2.91 Sh
	21/24 88%	ss	2-3 3-4 N=6			
9A				25		
	24/24 100%	ss	2-5 5-5 N=10			
10A				28		1.59

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
2	FILL - Gray (10YR6/1) with 25% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand	616, 614, 612
6	FILL - Yellow brown (10YR5/4) with 25% very pale brown (10YR7/4) and 10% very dark green gray (10Y3/1) mottles, moist, silty CLAY, trace sand	610
8	FILL - Very dark green gray (10Y3/1) with 25% yellow brown (10YR5/4), mottles, moist, silty CLAY, trace sand and gravel	608
10	FILL - Yellow brown (10YR5/4) with 20% very pale brown (10YR7/4) and 15% very dark green gray (10Y3/1) mottles, moist, silty CLAY, trace sand and gravel	606, 604, 602
16	FILL - Dark gray (5Y4/1), moist, very silty CLAY, trace sand	600
18	FILL - Olive gray (5Y5/2), moist, very silty CLAY, trace sand	598
20		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/21/2008
Finish: 1/22/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG52
Well ID: G52S
Surface Elev: 616.5 ft. MSL
Completion: 46.0 ft. BGS
Station: 14,655.26N -76.07E

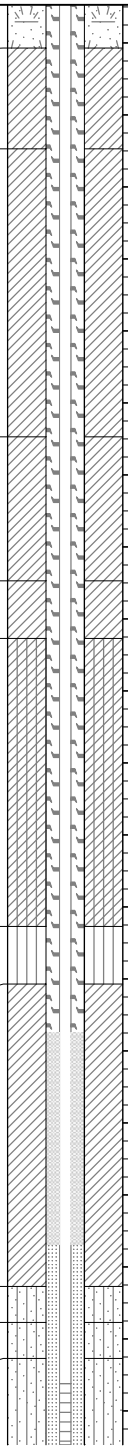
TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 32.80 - during drilling
▼ = 32.45 - 1/30/2008
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
11A	24/24 100%	ss	2-3 8-7 N=11	29		Sh
11B	24/24 100%	ss	5-5 7-9 N=12	23		3.30 BSh
12A	23/24 96%	ss	1-2 3-5 N=5	25		2.91 B
13A	24/24 100%	ss	5-6 7-6 N=13	25		2.13 B
14A				19		2.33 B
15A	24/24 100%	ss	1-2 2-3 N=4	27		0.78 B
15B	24/24 100%	ss	1-1 2-3 N=3	19		2.52 BSh
16A				22		1.24 B
17A	24/24 100%	ss	3-3 4-7 N=7	26		2.72 B
17B				26		
17C	24/24 100%	ss	2-5 6-8 N=11	17		
18A	24/24 100%	ss	9-10 10-11 N=20	16		5.24 Sh
19A				17		4.46 Sh
19B				25		
20A	24/24 100%	ss	5-7 5-6 N=12	25		
20B				30		3.69

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Very dark gray (10YR3/1), moist, clayey SILT, slight trace sand	596
	Dark gray brown (10YR4/2) with 20% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand	
22		594
24	Gray (10YR5/1) with 30% yellow brown (10YR5/4) mottles, moist, silty CLAY, trace sand	592
26		590
	Gray (10YR5/1) with 30% green gray (5GY5/1) mottle, moist, silty CLAY, trace sand and gravel	
28	Brown yellow (10YR6/8) with 20% green gray (5GY5/1) mottles, very moist, silty CLAY, trace sand and gravel	588
30	Brown yellow (10YR6/8) with 25% light gray (10YR7/2) mottle, very moist, very silty CLAY, little sand, trace gravel	586
32		584
	Dark gray brown (10YR4/2) with 25% dark yellow brown (10YR4/6) mottles, wet, clayey SILT, little sand, trace gravel	
34		582
36	Dark gray (10YR4/1), very moist, silty CLAY, trace sand and gravel	580
38	Dark gray (10YR4/1), wet, sandy SILT	
	Gray (N6/1) with 30% gray (5Y5/1) mottles, wet, sandy SILT	578
40	Gray (10YR5/1), wet, sandy SILT	

Borehole Detail



Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/21/2008
Finish: 1/22/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG52
Well ID: G52S
Surface Elev: 616.5 ft. MSL
Completion: 46.0 ft. BGS
Station: 14,655.26N
-76.07E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 32.80 - during drilling
▼ = 32.45 - 1/30/2008
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
						Sh				
	22/24 92%	ss	2-3 5-12 N=8					Gray (10YR5/1), wet, sandy SILT *[Continued from previous page]*	576	
21A				35		1.32 Sh				
21B				12		1.40 Sh	42			
	24/24 100%	ss	12-18 18-8 N=36					Dark gray (10YR4/1), wet, SAND and GRAVEL	574	
22A				13						
22B				13			44			
	24/24 100%	ss	3-5 8-11 N=13					Dark greenish gray (10Y4/1), moist, silty CLAY, trace sand and gravel	572	
23A				14		4.46 B	46			

End of Boring = 46.0 ft. BGS

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/21/2008
Finish: 1/22/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~BG52~~
Well ID: G52S
Surface Elev: 616.5 ft. MSL
Completion: 46.0 ft. BGS
Station: 14,655.26N -76.07E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 32.80 - during drilling
▼ = 32.45 - 1/30/2008
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
	20/24 83%	ss	3-3 2-4 N=5			
1A				23		1.28 BSh
	24/24 100%	ss	3-3 4-4 N=7			
2A				16		2.13 Sh
	21/24 88%	ss	6-6 9-13 N=15			
3A				19		
	21/24 88%	ss	6-5 8-8 N=13			
4A				14		
	23/24 96%	ss	5-7 9-10 N=16			
5A				13		
	24/24 100%	ss	6-6 7-4 N=13			
6A				15		
	22/24 92%	ss	4-4 8-7 N=12			
7A				19		
	23/24 96%	ss	2-5 6-8 N=11			
8A				17		2.91 Sh
	21/24 88%	ss	2-3 3-4 N=6			
9A				25		
	24/24 100%	ss	2-5 5-5 N=10			
10A				28		1.59

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
2	FILL - Gray (10YR6/1) with 25% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand	616, 614, 612
6	FILL - Yellow brown (10YR5/4) with 25% very pale brown (10YR7/4) and 10% very dark green gray (10Y3/1) mottles, moist, silty CLAY, trace sand	610
8	FILL - Very dark green gray (10Y3/1) with 25% yellow brown (10YR5/4), mottles, moist, silty CLAY, trace sand and gravel	608
10	FILL - Yellow brown (10YR5/4) with 20% very pale brown (10YR7/4) and 15% very dark green gray (10Y3/1) mottles, moist, silty CLAY, trace sand and gravel	606, 604, 602
16	FILL - Dark gray (5Y4/1), moist, very silty CLAY, trace sand	600
18	FILL - Olive gray (5Y5/2), moist, very silty CLAY, trace sand	598
20		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/21/2008
Finish: 1/22/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG52
Well ID: G52S
Surface Elev: 616.5 ft. MSL
Completion: 46.0 ft. BGS
Station: 14,655.26N -76.07E

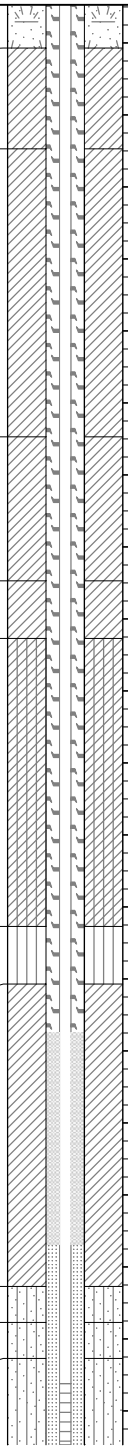
TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 32.80 - during drilling
▼ = 32.45 - 1/30/2008
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
11A	24/24 100%	ss	2-3 8-7 N=11	29		Sh
11B	24/24 100%	ss	5-5 7-9 N=12	23		3.30 BSh
12A	23/24 96%	ss	1-2 3-5 N=5	25		2.91 B
13A	24/24 100%	ss	5-6 7-6 N=13	25		2.13 B
14A				19		2.33 B
15A	24/24 100%	ss	1-2 2-3 N=4	27		0.78 B
15B	24/24 100%	ss	1-1 2-3 N=3	19		2.52 BSh
16A				22		1.24 B
17A	24/24 100%	ss	3-3 4-7 N=7	26		2.72 B
17B				26		
17C	24/24 100%	ss	2-5 6-8 N=11	17		
18A	24/24 100%	ss	9-10 10-11 N=20	16		5.24 Sh
19A				17		4.46 Sh
19B				25		
20A	24/24 100%	ss	5-7 5-6 N=12	25		
20B				30		3.69

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Very dark gray (10YR3/1), moist, clayey SILT, slight trace sand	596
	Dark gray brown (10YR4/2) with 20% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand	
22		594
24	Gray (10YR5/1) with 30% yellow brown (10YR5/4) mottles, moist, silty CLAY, trace sand	592
26		590
	Gray (10YR5/1) with 30% green gray (5GY5/1) mottle, moist, silty CLAY, trace sand and gravel	
28	Brown yellow (10YR6/8) with 20% green gray (5GY5/1) mottles, very moist, silty CLAY, trace sand and gravel	588
30	Brown yellow (10YR6/8) with 25% light gray (10YR7/2) mottle, very moist, very silty CLAY, little sand, trace gravel	586
32		584
	Dark gray brown (10YR4/2) with 25% dark yellow brown (10YR4/6) mottles, wet, clayey SILT, little sand, trace gravel	
34		582
36	Dark gray (10YR4/1), very moist, silty CLAY, trace sand and gravel	580
38	Dark gray (10YR4/1), wet, sandy SILT	
	Gray (N6/1) with 30% gray (5Y5/1) mottles, wet, sandy SILT	578
40	Gray (10YR5/1), wet, sandy SILT	

Borehole Detail



Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/21/2008
Finish: 1/22/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG52
Well ID: G52S
Surface Elev: 616.5 ft. MSL
Completion: 46.0 ft. BGS
Station: 14,655.26N
-76.07E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 32.80 - during drilling
▼ = 32.45 - 1/30/2008
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
						Sh				
	22/24 92%	ss	2-3 5-12 N=8					Gray (10YR5/1), wet, sandy SILT *[Continued from previous page]*	576	
21A				35		1.32 Sh				
21B				12		1.40 Sh	42			
	24/24 100%	ss	12-18 18-8 N=36					Dark gray (10YR4/1), wet, SAND and GRAVEL	574	
22A				13						
22B				13			44			
	24/24 100%	ss	3-5 8-11 N=13					Dark greenish gray (10Y4/1), moist, silty CLAY, trace sand and gravel	572	
23A				14		4.46 B	46			

End of Boring = 46.0 ft. BGS

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/5/2009
Finish: 2/5/2009
WEATHER: cold, sunny, windy, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

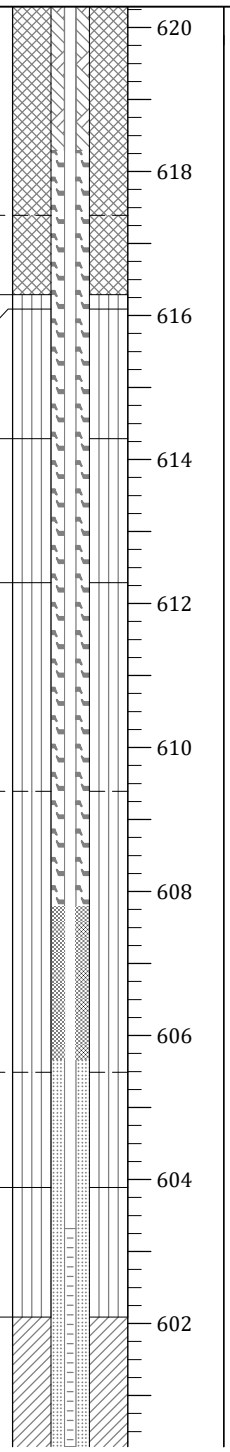
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~G53a~~
Well ID: G53L
Surface Elev: 620.29 ft. MSL
Completion: 26.79 ft. BGS
Station: 16,199.98N
506.32E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.00 - 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
								FILL - Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 10% gray (10YR6/1) mottles, moist, firm, clayey SILT.
							2	
								FILL - Dark yellowish brown (10YR4/4) with 5% gray (10YR5/1) mottles, moist, firm, clayey SILT with slight trace sand.
							4	Dark gray (10YR4/1), moist, friable, clayey SILT with slight trace sand and gravel, trace roots.
								Dark yellowish brown (10YR4/6) with 10% gray (10YR6/1) mottles, moist, firm, clayey SILT with slight trace sand.
							6	
								Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT.
							8	
								Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.
							10	
							12	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.
							14	
							16	Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.
								Dark gray (10YR4/1), moist, soft, clayey SILT.
							18	
							20	Dark gray (10YR4/1) with 5% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand.



Depth ft. BGS	Elevation ft. MSL
	620
2	618
4	616
6	614
8	612
10	610
12	608
14	606
16	604
18	602
20	

NOTE(S): See G53S Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/5/2009
Finish: 2/5/2009
WEATHER: cold, sunny, windy, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G53a
Well ID: G53L
Surface Elev: 620.29 ft. MSL
Completion: 26.79 ft. BGS
Station: 16,199.98N
506.32E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.00 - 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	Elevation ft. MSL
								Dark gray (10YR4/1) with 5% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand. *[Continued from previous page]*	600
							22		598
								Greenish gray (5GY5/1), moist, very soft, silty CLAY with trace sand and slight trace gravel.	
							24		596
								Greenish gray (5GY5/1), very moist, very soft, silty CLAY with sand and slight trace gravel.	
							▼ 26		594
								Greenish gray (5GY6/1), moist, soft, silty CLAY with trace sand and slight trace gravel.	

End of Boring = 26.79 ft bgs

Borehole Detail

Remarks

NOTE(S): See G53S Boring log for sample and testing data.

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/5/2009
Finish: 2/5/2009
WEATHER: cold, sunny, windy, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G53~~
Well ID: G53S
Surface Elev: 620.29 ft. MSL
Completion: 36.04 ft. BGS
Station: 16,199.56N
510.45E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.00 - during drilling
▼ = 31.20 - 02/05/09
▽ =

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	20/24 83%	ss	12-3 4-3 N=7	21		
2A	22/24 92%	ss	5-3 3-6 N=6	22		
3A	18/24 75%	ss	2-3 6-7 N=9	27		
4A	24/24 100%	ss	5-4 7-11 N=11	26		
5A	12/24 50%	ss	1-2 4-3 N=6	24		
6A	17/24 71%	ss	1-2 4-4 N=6	23		
7A	19/24 79%	ss	6-5 4-4 N=9	25		
8A	19/24 79%	ss	1-2 2-3 N=4	26		
9A	24/24 100%	ss	3-6 5-5 N=11	25		
10A	19/24 79%	ss	1-1 3-4 N=4	24		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	FILL - Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 10% gray (10YR6/1) mottles, moist, firm, clayey SILT.	620
2	FILL - Dark yellowish brown (10YR4/4) with 5% gray (10YR5/1) mottles, moist, firm, clayey SILT with slight trace sand.	618
4	Dark gray (10YR4/1), moist, friable, clayey SILT with slight trace sand and gravel, trace roots.	616
	Dark yellowish brown (10YR4/6) with 10% gray (10YR6/1) mottles, moist, firm, clayey SILT with slight trace sand.	
6	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT.	614
8	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	612
10		610
12	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	608
14		606
16	Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	604
	Dark gray (10YR4/1), moist, soft, clayey SILT.	
18	Dark gray (10YR4/1) with 5% dak yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand.	602
20		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/5/2009
Finish: 2/5/2009
WEATHER: cold, sunny, windy, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G53
Well ID: G53S
Surface Elev: 620.29 ft. MSL
Completion: 36.04 ft. BGS
Station: 16,199.56N
510.45E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.00 - during drilling
▼ = 31.20 - 02/05/09
▽ =

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
11A	19/24 79%	ss	woh-1 2-2 N=3	25		
12A	24/24 100%	ss	3-3 3-3 N=6	25		
12B				21		
13A	19/24 79%	ss	woh-1 1-1 N=2	23		
14A	23/24 96%	ss	woh-woh 3-4	20		
15A	22/24 92%	ss	1-3 6-8 N=9	16		
16A	18/24 75%	ss	woh-7 12-16 N=19	13		
16B				19		
17A	20/24 83%	ss	4-4 6-8 N=10	17		
17B				32		
18A	22/24 92%	ss	woh-3 3-9 N=6	30		
18B				20		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark gray (10YR4/1) with 5% dak yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand. *[Continued from previous page]*	600
22		598
	Greenish gray (5GY5/1), moist, very soft, silty CLAY with trace sand and slight trace gravel.	
24		596
	Greenish gray (5GY5/1), very moist, very soft, silty CLAY with sand and slight trace gravel.	
▼ 26		594
	Greenish gray (5GY6/1), moist, soft, silty CLAY with trace sand and slight trace gravel.	
28		592
	Dark gray (N4/1), moist, firm, clayey SILT with slight trace sand and gravel.	
30		590
▼	Brown (10YR5/3), wet, dense, silty very fine- to coarse-grained SAND.	
32		588
	Gray (10YR5/1), very moist, soft, clayey SILT.	
34		586
	Dark gray (N4/1), moist, firm, clayey SILT with slight trace sand and gravel. **End of Boring = 36.04 ft bgs**	
36		

Borehole Detail

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/5/2009
Finish: 2/5/2009
WEATHER: cold, sunny, windy, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G53~~
Well ID: G53S
Surface Elev: 620.29 ft. MSL
Completion: 36.04 ft. BGS
Station: 16,199.56N
510.45E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.00 - during drilling
▼ = 31.20 - 02/05/09
▽ =

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	20/24 83%	ss	12-3 4-3 N=7	21		
2A	22/24 92%	ss	5-3 3-6 N=6	22		
3A	18/24 75%	ss	2-3 6-7 N=9	27		
4A	24/24 100%	ss	5-4 7-11 N=11	26		
5A	12/24 50%	ss	1-2 4-3 N=6	24		
6A	17/24 71%	ss	1-2 4-4 N=6	23		
7A	19/24 79%	ss	6-5 4-4 N=9	25		
8A	19/24 79%	ss	1-2 2-3 N=4	26		
9A	24/24 100%	ss	3-6 5-5 N=11	25		
10A	19/24 79%	ss	1-1 3-4 N=4	24		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	FILL - Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 10% gray (10YR6/1) mottles, moist, firm, clayey SILT.	620
2	FILL - Dark yellowish brown (10YR4/4) with 5% gray (10YR5/1) mottles, moist, firm, clayey SILT with slight trace sand.	618
4	Dark gray (10YR4/1), moist, friable, clayey SILT with slight trace sand and gravel, trace roots.	616
	Dark yellowish brown (10YR4/6) with 10% gray (10YR6/1) mottles, moist, firm, clayey SILT with slight trace sand.	
6	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT.	614
8	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	612
10		610
12	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	608
14		606
16	Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	604
	Dark gray (10YR4/1), moist, soft, clayey SILT.	
18	Dark gray (10YR4/1) with 5% dak yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand.	602
20		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/5/2009
Finish: 2/5/2009
WEATHER: cold, sunny, windy, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G53
Well ID: G53S
Surface Elev: 620.29 ft. MSL
Completion: 36.04 ft. BGS
Station: 16,199.56N
510.45E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.00 - during drilling
▼ = 31.20 - 02/05/09
▽ =

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
11A	19/24 79%	ss	woh-1 2-2 N=3	25		
12A	24/24 100%	ss	3-3 3-3 N=6	25		
12B				21		
13A	19/24 79%	ss	woh-1 1-1 N=2	23		
14A	23/24 96%	ss	woh-woh 3-4	20		
15A	22/24 92%	ss	1-3 6-8 N=9	16		
16A	18/24 75%	ss	woh-7 12-16 N=19	13		
16B				19		
17A	20/24 83%	ss	4-4 6-8 N=10	17		
17B				32		
18A	22/24 92%	ss	woh-3 3-9 N=6	30		
18B				20		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark gray (10YR4/1) with 5% dak yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand. *[Continued from previous page]*	600
22		598
	Greenish gray (5GY5/1), moist, very soft, silty CLAY with trace sand and slight trace gravel.	
24		596
	Greenish gray (5GY5/1), very moist, very soft, silty CLAY with sand and slight trace gravel.	
▼ 26		594
	Greenish gray (5GY6/1), moist, soft, silty CLAY with trace sand and slight trace gravel.	
28		592
	Dark gray (N4/1), moist, firm, clayey SILT with slight trace sand and gravel.	
30		590
▼	Brown (10YR5/3), wet, dense, silty very fine- to coarse-grained SAND.	
32		588
	Gray (10YR5/1), very moist, soft, clayey SILT.	
34		586
	Dark gray (N4/1), moist, firm, clayey SILT with slight trace sand and gravel. **End of Boring = 36.04 ft bgs**	
36		

Borehole Detail

NOTE(S):

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/3/2021
Finish: 2/5/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: G54C
Well ID: G54C
Surface Elev: 619.59 ft. MSL
Completion: 102.00 ft. BGS
Station: 1,384,885.21N
2,348,250.14E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL
S1	18/24 75%	SS	2-2 4-5 N=6			1.5		Fill - Yellowish brown (10YR5/4) with 15% gray (10YR6/1) and 5% yellowish brown (10YR4/6) mottles, moist SILT with little clay, trace roots, and trace sand.	618
S2	21/24 88%	SS	2-5 6-7 N=11			2.0	2	Fill - Yellowish brown (10YR5/6) with 30% light brownish gray (10YR6/2) mottles, moist, soft SILT with little clay, trace sand, and trace gravel.	616
S3	22/24 92%	SS	2-7 10-12 N=17			2.5	4	Fill - Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) mottles, moist, firm SILT with little clay and trace sand.	614
S4	19/24 79%	SS	3-7 9-11 N=16			4.5	6	Fill - Yellowish brown (10YR5/4) firm SILT with little clay, trace sand, and trace gravel.	612
S5	20/24 83%	SS	3-7 9-10 N=16			4.5	8	Grayish brown (10YR5/2) firm SILT with little clay, trace sand, and trace gravel.	610
S6	21/24 88%	SS	3-4 7-10 N=11			4.5	10	Grayish brown (10YR5/2) with 30% yellowish brown (10YR5/6) mottles, firm SILT with little clay, trace sand, and trace gravel.	608
S7	21/24 88%	SS	3-7 12-15 N=19			4.5	12	Yellowish brown (10YR5/4) firm SILT with little clay, trace sand, and trace gravel.	606
ST8	20/24 83%	SH				4.0	14		604
S9	18/24 75%	SS	1-4 4-5 N=8			0.5	16	Yellowish brown (10YR5/6) with 10% gray (10YR6/1) mottles, moist, soft SILT with little clay.	602
S10	19/24 79%	SS	1-3 4-4 N=7			1.0	18		600
							20		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/3/2021
Finish: 2/5/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: G54C
Well ID: G54C
Surface Elev: 619.59 ft. MSL
Completion: 102.00 ft. BGS
Station: 1,384,885.21N
2,348,250.14E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type
S11	18/24 75%	SS	1-2 4-5 N=6			1.0
S12	20/24 83%	SS	1-3 4-7 N=7			1.0
S13	19/24 79%	SS	1-3 3-4 N=6			1.5
S14	22/24 92%	SS	woh-1 3-3 N=4			1.5
S15	21/24 88%	SS	1-2 3-4 N=5			1.0
S16	22/24 92%	SS	1-3 5-5 N=8			2.0
ST17	24/24 100%	SH				0.5
S18	21/24 88%	SS	2-3 4-3 N=7			1.0
S19	21/24 88%	SS	1-4 5-8 N=9			1.5
S20	20/24 83%	SS	woh-1 3-4 N=4			1.0

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
22	Gray (10YR6/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft SILT with little clay.	598	
24	Gray (10YR5/1) with 30% dark gray (10YR4/1) mottles, moist, soft SILT with little clay.	596	
	Grayish brown (10YR5/2) moist, soft, CLAY with little silt.	594	
26	Gray (10YR5/1) moist, soft, CLAY with little silt.	592	
28	Gray (10YR5/1) with 30% yellowish brown (10YR5/8) soft CLAY with little silt.	590	
30		588	
32		586	
34	Gray (10YR6/1) wet, soft CLAY with little silt and trace sand.	584	
36		582	
38	Dark gray (10YR4/1) wet, fine SAND with trace silt.		
	Dark gray (10YR4/1) very moist, soft SILT with little clay and trace sand.	580	
40			

NOTE(S):

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/3/2021
Finish: 2/5/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: G54C
Well ID: G54C
Surface Elev: 619.59 ft. MSL
Completion: 102.00 ft. BGS
Station: 1,384,885.21N
2,348,250.14E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type
S21	4/24 17%	SS	1-2 5-10 N=7			
S22	23/24 96%	SS	2-6 12-11 N=18			3.0
ST23	23/24 96%	SH				4.5
S24	24/24 100%	SS	3-6 8-14 N=14			4.5
S25	24/24 100%	SS	3-8 13-20 N=21			4.5
S26	24/24 100%	SS	3-10 14-19 N=24			4.5
S27	24/24 100%	SS	6-9 15-16 N=24			4.5
S28	24/24 100%	SS	4-10 28-50/3" N=38			4.5
S29	24/24 100%	SS	10-47 50/3.25-50/1.25			2.5
S30	24/24 100%	SS	19-29 44-72 N=73			4.5

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark gray (10YR4/1) very moist, soft SILT with little clay and trace sand. *[Continued from previous page]*	578
42		
44	Dark grayish brown (10YR4/2) moist, firm SILT with little clay, trace sand, and trace gravel.	576
		574
46		
48		572
50	Dark gray (10YR4/1) moist, firm SILT with little clay, trace sand, and trace gravel.	570
52		568
54		566
	Dark gray (10YR4/1) moist, firm SILT with little clay, trace sand, and trace gravel.	564
56	Dark gray (10YR4/1) wet, soft SAND with little clay and trace silt.	
58	Dark gray (10YR4/1) moist, firm SILT with little clay, trace sand, and trace gravel.	562
60		560

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/3/2021
Finish: 2/5/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: G54C
Well ID: G54C
Surface Elev: 619.59 ft. MSL
Completion: 102.00 ft. BGS
Station: 1,384,885.21N
2,348,250.14E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type
S31	24/24 100%	SS	14-29 42-54 N=71			4.5
S32	23/24 96%	SS	12-14 30-48 N=44			4.5
S33	23/24 96%	SS	10-22 25-34 N=47			4.5
S34	24/24 100%	SS	10-19 26-34 N=45			4.5
S35	24/24 100%	SS	11-19 24-33 N=43			4.5
S36	23/24 96%	SS	11-22 22-34 N=44			4.5
S37	24/24 100%	SS	9-13 20-22 N=33			4.5
S38	24/24 100%	SS	6-8 12-15 N=20			4.5
ST39	11/24 46%	SH				4.5
S40	14/24 58%	SS	7-10 17-20 N=27			4.5

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
62	Dark gray (10YR4/1) moist, firm SILT with little clay, trace sand, and trace gravel. *[Continued from previous page]*	558
64		556
66	Dark gray (10YR4/1) firm SILT with little clay, trace sand, and trace gravel.	554
68		552
70		550
72		548
74		546
76	Dark grayish olive (10Y4/2) firm, slick CLAY with trace silt.	544
78		542
80	Dark grayish olive (10Y4/2) firm, slick CLAY with trace silt and gravel.	540

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/3/2021
Finish: 2/5/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: G54C
Well ID: G54C
Surface Elev: 619.59 ft. MSL
Completion: 102.00 ft. BGS
Station: 1,384,885.21N
2,348,250.14E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type
S41	24/24 100%	SS	6-8 11-15 N=19			4.5
S42	24/24 100%	SS	3-7 9-10 N=16			4.5
S43	24/24 100%	SS	4-8 12-15 N=20			4.5
S44	24/24 100%	SS	5-7 11-14 N=18			4.0
S45	24/24 100%	SS	5-8 11-14 N=19			4.5
S46	24/24 100%	SS	5-9 13-15 N=22			4.5
S47	24/24 100%	SS	4-7 10-13 N=17			4.5
S48	24/24 100%	SS	3-6 8-11 N=14			4.0
S49	24/24 100%	SS	4-8 11-13 N=19			3.0
S50	21/24 88%	SS	5-7 10-12 N=17			3.0

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	Dark grayish olive (10Y4/2) firm, slick CLAY with trace silt and gravel. *[Continued from previous page]*		
82	Dark gray (10YR4/1) firm CLAY with trace silt and gravel.	538	
84	Dark gray (10YR4/1) with 5% gray (10YR5/1) mottles, firm, CLAY with little silt, trace sand, and trace gravel.	536	
86	Dark gray (10YR4/1) CLAY with little silt, trace sand, and trace gravel.	534	
88		532	
90	Grayish green (5GY5/2) with 30% dark grayish green (5GY4/2) mottles, firm, CLAY with trace silt and gravel. (WEATHERED SHALE)	530	
92		528	
94	Very dark grayish green (5GY3/2) firm, CLAY with trace silt. (WEATHERED SHALE)	526	
96		524	
98	Very dark grayish green (5GY3/2) firm, CLAY with trace silt and gravel. (WEATHERED SHALE)	522	
100		520	

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/3/2021
Finish: 2/5/2021
WEATHER: Overcast, cold (lo-20's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Al
Eng/Geo: T. Gass

BOREHOLE ID: G54C
Well ID: G54C
Surface Elev: 619.59 ft. MSL
Completion: 102.00 ft. BGS
Station: 1,384,885.21N
2,348,250.14E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

SAMPLE			TESTING							
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Water Content (%)	Dry Density (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
S51	24/24 *100%*	SS	*3-7* *9-11* N=16			*2.5*		Very dark grayish green (5GY3/2) firm, CLAY with trace silt and gravel. (WEATHERED SHALE) *[Continued from previous page]*		518	
							102	**End of boring = 102 feet**			

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/12/2009
Finish: 2/12/2009
WEATHER: cold, sunny, windy, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

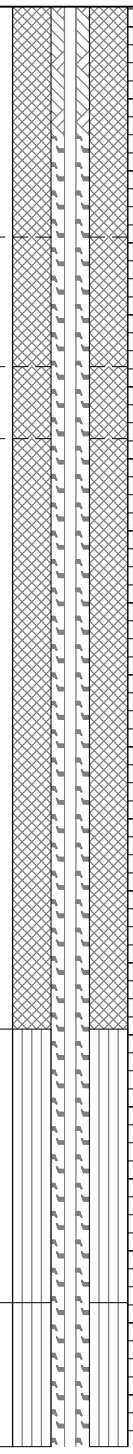
BOREHOLE ID: ~~G54a~~
Well ID: G54L
Surface Elev: 620.28 ft. MSL
Completion: 37.22 ft. BGS
Station: 14,664.37N
463.80E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
								FILL - Yellowish brown (10YR5/4) with 20% gray (10YR6/1) and 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand, trace roots.	620
							2		618
							4	FILL - Yellowish brown (10YR5/4) with 5% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand.	616
								FILL - Yellowish brown (10YR5/4) with 5% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT with slight trace sand.	
							6		614
							8		612
							10	FILL - Yellowish brown (10YR5/4), moist, firm, clayey SILT with trace sand and slight trace gravel.	610
							12		608
							14		606
							16	Dark yellowish brown (10YR4/4) with 20% gray (10YR6/1) mottles, moist, firm, clayey SILT with slight trace sand, trace roots.	604
							18		602
								Yellowish brown (10YR5/6) with 10% gray (10YR6/1) mottles, moist, friable, clayey SILT.	
							20		

Borehole Detail



Remarks

NOTE(S): See G54S Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/12/2009
Finish: 2/12/2009
WEATHER: cold, sunny, windy, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

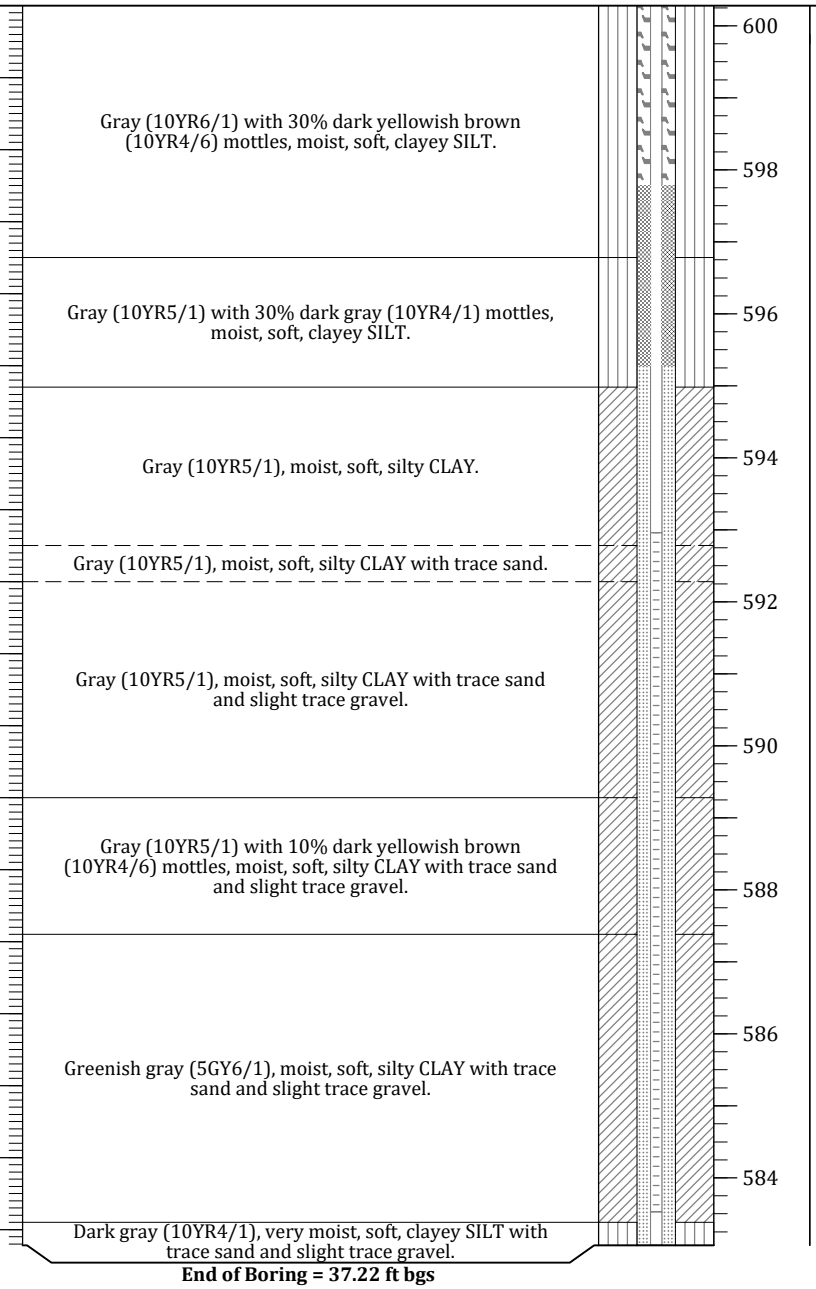
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G54a
Well ID: G54L
Surface Elev: 620.28 ft. MSL
Completion: 37.22 ft. BGS
Station: 14,664.37N
463.80E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL



End of Boring = 37.22 ft bgs

Borehole Detail | Remarks

NOTE(S): See G54S Boring log for sample and testing data.

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/12/2009
Finish: 2/12/2009
WEATHER: cold, sunny, windy, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G54~~
Well ID: G54S
Surface Elev: 620.28 ft. MSL
Completion: 48.41 ft. BGS
Station: 14,664.84N
460.47E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 44.20 - 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	22/24 92%	ss	3-2 2-2 N=4	25		
2A	18/24 75%	ss	1-2 3-3 N=5	23		
3A	20/24 83%	ss	1-5 8-10 N=13	17		
4A	24/24 100%	ss	8-13 13-15 N=26	18		
5A	24/24 100%	ss	4-7 10-9 N=17	16		
6A	19/24 79%	ss	2-3 6-8 N=9	18		
7A	24/24 100%	ss	8-17 15-16 N=32	16		
8A	20/24 83%	ss	2-4 4-6 N=8	22		
9A	22/24 92%	ss	5-5 9-10 N=14	22		
10A	18/24 75%	ss	1-3 3-4 N=6	23		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
0–3.5	FILL - Yellowish brown (10YR5/4) with 20% gray (10YR6/1) and 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand, trace roots.	620 – 618
3.5–5.5	FILL - Yellowish brown (10YR5/4) with 5% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand.	618 – 616
5.5–6	FILL - Yellowish brown (10YR5/4) with 5% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT with slight trace sand.	616 – 614
6–14	FILL - Yellowish brown (10YR5/4), moist, firm, clayey SILT with trace sand and slight trace gravel.	614 – 606
14–18	Dark yellowish brown (10YR4/4) with 20% gray (10YR6/1) mottles, moist, firm, clayey SILT with slight trace sand, trace roots.	606 – 602
18–20	Yellowish brown (10YR5/6) with 10% gray (10YR6/1) mottles, moist, friable, clayey SILT.	602

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/12/2009
Finish: 2/12/2009
WEATHER: cold, sunny, windy, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G54
Well ID: G54S
Surface Elev: 620.28 ft. MSL
Completion: 48.41 ft. BGS
Station: 14,664.84N
460.47E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 44.20 - 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
11A	19/24 79%	ss	1-2 1-3 N=3	28		
12A	20/24 83%	ss	4-5 5-4 N=10	25		
13A	19/24 79%	ss	2-2 3-4 N=5	23		
13B				24		
14A	20/24 83%	ss	4-4 4-5 N=8	27		
15A	14/24 58%	ss	woh-2 4-4 N=6	20		
16A	22/24 92%	ss	1-2 4-8 N=6	24		
17A	20/24 83%	ss	4-4 7-8 N=11	21		
18A	16/24 67%	ss	woh-1 2-3 N=3	14		
19A	14/24 58%	ss	woh-3 3-6 N=6	15		
20A	23/24 96%	ss	woh-3 4-5 N=7	13		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	600	
22		598	
24	Gray (10YR5/1) with 30% dark gray (10YR4/1) mottles, moist, soft, clayey SILT.	596	
26	Gray (10YR5/1), moist, soft, silty CLAY.	594	
28	Gray (10YR5/1), moist, soft, silty CLAY with trace sand.	592	
30	Gray (10YR5/1), moist, soft, silty CLAY with trace sand and slight trace gravel.	590	
32	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	588	
34	Greenish gray (5GY6/1), moist, soft, silty CLAY with trace sand and slight trace gravel.	586	
36		584	
38	Dark gray (10YR4/1), very moist, soft, clayey SILT with trace sand and slight trace gravel.	582	
40	Dark gray (10YR4/1), moist, soft, clayey SILT with trace sand and slight trace gravel.		

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/12/2009
Finish: 2/12/2009
WEATHER: cold, sunny, windy, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G54
Well ID: G54S
Surface Elev: 620.28 ft. MSL
Completion: 48.41 ft. BGS
Station: 14,664.84N
460.47E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 44.20 - 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
21A	20/24 83%	SS	1-3 5-7 N=8	14		
21B				32		
22A	20/24 83%	SS	5-7 7-9 N=14	28		
23A	20/24 83%	SS	2-4 8-7 N=12	16		
23B				12		
24A	22/24 92%	SS	7-10 13-17 N=23	19		
24B				13		
	0/5 0%	BD				

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	Dark gray (10YR4/1), moist, soft, clayey SILT with trace sand and slight trace gravel. *[Continued from previous page]*	580	
42	Dark gray (10YR4/1) with 20% gray (10YR5/1) mottles, very moist, soft, clayey SILT.	578	
	Dark gray (10YR4/1) with 20% gray (10YR5/1) mottles, moist, soft, clayey SILT.		
▼ 44	Dark gray (N4/1), wet, medium dense, silty fine- to coarse-grained SAND.	576	
	Dark gray (10YR4/1), moist, firm, clayey SILT with trace sand and slight trace gravel.		
46	Dark gray (N4/1), wet, medium dense, silty fine- to coarse-grained SAND.	574	
48	Dark gray (10YR4/1), moist, firm, clayey SILT with trace sand and slight trace gravel.	572	

End of Boring = 48.41 ft bgs

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/12/2009
Finish: 2/12/2009
WEATHER: cold, sunny, windy, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G54~~
Well ID: G54S
Surface Elev: 620.28 ft. MSL
Completion: 48.41 ft. BGS
Station: 14,664.84N
460.47E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 44.20 - 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	22/24 92%	ss	3-2 2-2 N=4	25		
2A	18/24 75%	ss	1-2 3-3 N=5	23		
3A	20/24 83%	ss	1-5 8-10 N=13	17		
4A	24/24 100%	ss	8-13 13-15 N=26	18		
5A	24/24 100%	ss	4-7 10-9 N=17	16		
6A	19/24 79%	ss	2-3 6-8 N=9	18		
7A	24/24 100%	ss	8-17 15-16 N=32	16		
8A	20/24 83%	ss	2-4 4-6 N=8	22		
9A	22/24 92%	ss	5-5 9-10 N=14	22		
10A	18/24 75%	ss	1-3 3-4 N=6	23		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
0–3.5	FILL - Yellowish brown (10YR5/4) with 20% gray (10YR6/1) and 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand, trace roots.	620 – 618
3.5–5.5	FILL - Yellowish brown (10YR5/4) with 5% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand.	618 – 616
5.5–6	FILL - Yellowish brown (10YR5/4) with 5% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT with slight trace sand.	616 – 614
6–14	FILL - Yellowish brown (10YR5/4), moist, firm, clayey SILT with trace sand and slight trace gravel.	614 – 606
14–18	Dark yellowish brown (10YR4/4) with 20% gray (10YR6/1) mottles, moist, firm, clayey SILT with slight trace sand, trace roots.	606 – 602
18–20	Yellowish brown (10YR5/6) with 10% gray (10YR6/1) mottles, moist, friable, clayey SILT.	602

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/12/2009
Finish: 2/12/2009
WEATHER: cold, sunny, windy, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G54
Well ID: G54S
Surface Elev: 620.28 ft. MSL
Completion: 48.41 ft. BGS
Station: 14,664.84N
460.47E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 44.20 - 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
11A	19/24 79%	ss	1-2 1-3 N=3	28		
12A	20/24 83%	ss	4-5 5-4 N=10	25		
13A	19/24 79%	ss	2-2 3-4 N=5	23		
13B				24		
14A	20/24 83%	ss	4-4 4-5 N=8	27		
15A	14/24 58%	ss	woh-2 4-4 N=6	20		
16A	22/24 92%	ss	1-2 4-8 N=6	24		
17A	20/24 83%	ss	4-4 7-8 N=11	21		
18A	16/24 67%	ss	woh-1 2-3 N=3	14		
19A	14/24 58%	ss	woh-3 3-6 N=6	15		
20A	23/24 96%	ss	woh-3 4-5 N=7	13		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	600	
22		598	
24	Gray (10YR5/1) with 30% dark gray (10YR4/1) mottles, moist, soft, clayey SILT.	596	
26	Gray (10YR5/1), moist, soft, silty CLAY.	594	
28	Gray (10YR5/1), moist, soft, silty CLAY with trace sand.	592	
30	Gray (10YR5/1), moist, soft, silty CLAY with trace sand and slight trace gravel.	590	
32	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	588	
34	Greenish gray (5GY6/1), moist, soft, silty CLAY with trace sand and slight trace gravel.	586	
36		584	
38	Dark gray (10YR4/1), very moist, soft, clayey SILT with trace sand and slight trace gravel.	582	
40	Dark gray (10YR4/1), moist, soft, clayey SILT with trace sand and slight trace gravel.		

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/12/2009
Finish: 2/12/2009
WEATHER: cold, sunny, windy, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G54
Well ID: G54S
Surface Elev: 620.28 ft. MSL
Completion: 48.41 ft. BGS
Station: 14,664.84N
460.47E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 44.20 - 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
21A	20/24 83%	SS	1-3 5-7 N=8	14		
21B				32		
22A	20/24 83%	SS	5-7 7-9 N=14	28		
23A	20/24 83%	SS	2-4 8-7 N=12	16		
23B				12		
24A	22/24 92%	SS	7-10 13-17 N=23	19		
24B				13		
	0/5 0%	BD				

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	Dark gray (10YR4/1), moist, soft, clayey SILT with trace sand and slight trace gravel. *[Continued from previous page]*	580	
42	Dark gray (10YR4/1) with 20% gray (10YR5/1) mottles, very moist, soft, clayey SILT.	578	
	Dark gray (10YR4/1) with 20% gray (10YR5/1) mottles, moist, soft, clayey SILT.		
▼ 44	Dark gray (N4/1), wet, medium dense, silty fine- to coarse-grained SAND.	576	
	Dark gray (10YR4/1), moist, firm, clayey SILT with trace sand and slight trace gravel.		
46	Dark gray (N4/1), wet, medium dense, silty fine- to coarse-grained SAND.	574	
48	Dark gray (10YR4/1), moist, firm, clayey SILT with trace sand and slight trace gravel.	572	

End of Boring = 48.41 ft bgs

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/19/2009
Finish: 2/19/2009
WEATHER: cold, sunny, windy, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~G55a~~
Well ID: G55L
Surface Elev: 619.78 ft. MSL
Completion: 36.60 ft. BGS
Station: 14,667.70N
705.07E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
							0	FILL - Yellowish brown (10YR5/4) with 15% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, moist, soft, clayey SILT with slight trace sand.	618
							2	FILL - Yellowish brown (10YR5/4) with 5% gray (10YR5/1) mottles, moist, soft, silty CLAY with slight trace sand and gravel.	616
							4		614
							6	FILL - Yellowish brown (10YR5/4) with 15% dark yellowish brown (10YR4/6) and 10% gray (10YR6/1) mottles, moist, firm, clayey SILT.	612
							8	FILL - Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	610
							10	FILL - Yellowish brown (10YR5/4) with 30% gray (10YR5/1) mottles, slightly moist, firm, clayey SILT with slight trace sand.	608
							12	FILL - Yellowish brown (10YR5/4) with 30% gray (10YR5/1) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel.	606
							14	Very dark grayish brown (10YR3/2), slightly moist, hard, clayey SILT with slight trace sand and trace roots.	604
							16	Yellowish brown (10YR5/6) with 10% gray (10YR5/1) mottles, moist, firm, silty CLAY.	602
							18	Light brownish gray (10YR6/2) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	600
							20	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	

Borehole Detail

Remarks

NOTE(S): See G55S Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/19/2009
Finish: 2/19/2009
WEATHER: cold, sunny, windy, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G55a
Well ID: G55L
Surface Elev: 619.78 ft. MSL
Completion: 36.60 ft. BGS
Station: 14,667.70N
705.07E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL	Remarks
							22	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	598	
							24	Gray (10YR5/1) with 10% dark gray (10YR4/1) mottles, moist, soft, clayey SILT.	596	
							26		594	
							28	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand and gravel.	592	
							30		590	
							32	Greenish gray (5GY5/1), moist, soft, silty CLAY with trace sand and slight trace gravel.	588	
								Greenish gray (5GY6/1), moist, soft, sandy CLAY with slight trace gravel.		
								Medium light gray (N6/1), moist, soft, sandy CLAY with slight trace gravel.	586	
							34	Medium light gray (N6/1), wet, soft, silty, very fine- to medium-grained SAND.		
								Greenish gray (10Y6/1), very moist, soft, clayey SILT with slight trace sand and gravel.	584	
							36	Gray (N6/1), very moist, soft, sandy CLAY with slight trace gravel.		

End of Boring = 36.6 ft bgs

NOTE(S): See G55S Boring log for sample and testing data.

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/19/2009
Finish: 2/19/2009
WEATHER: cold, sunny, windy, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G55~~
Well ID: G55S
Surface Elev: 619.78 ft. MSL
Completion: 45.96 ft. BGS
Station: 14,663.87N
705.03E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 41.80 - during drilling
▼ = 39.43 - 02/19/09
▽ =

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
1A	24/24 100%	ss	2-3 4-3 N=7	19			2	FILL - Yellowish brown (10YR5/4) with 15% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, moist, soft, clayey SILT with slight trace sand.	618	
2A	17/24 71%	ss	2-3 2-2 N=5	20			4	FILL - Yellowish brown (10YR5/4) with 5% gray (10YR5/1) mottles, moist, soft, silty CLAY with slight trace sand and gravel.	616	
3A	12/24 50%	ss	woh-2 3-4 N=5	15			6		614	
4A	24/24 100%	ss	6-8 12-11 N=20	15			8	FILL - Yellowish brown (10YR5/4) with 15% dark yellowish brown (10YR4/6) and 10% gray (10YR6/1) mottles, moist, firm, clayey SILT.	612	
5A	24/24 100%	ss	4-3 3-5 N=6	18				FILL - Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.		
5B				17			10	FILL - Yellowish brown (10YR5/4) with 30% gray (10YR5/1) mottles, slightly moist, firm, clayey SILT with slight trace sand.	610	
6A	22/24 92%	ss	1-2 6-8 N=8	19			12	FILL - Yellowish brown (10YR5/4) with 30% gray (10YR5/1) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel.	608	
7A	24/24 100%	ss	6-8 18-19 N=26	17			14	Very dark grayish brown (10YR3/2), slightly moist, hard, clayey SILT with slight trace sand and trace roots.	606	
8A	20/24 83%	ss	2-5 5-7 N=10	24			16	Yellowish brown (10YR5/6) with 10% gray (10YR5/1) mottles, moist, firm, silty CLAY.	604	
9A	22/24 92%	ss	10-9 11-11 N=20	24						
9B				23			18	Light brownish gray (10YR6/2) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	602	
10A	18/24 75%	ss	2-4 4-5 N=8	22			20	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	600	

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/19/2009
Finish: 2/19/2009
WEATHER: cold, sunny, windy, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G55
Well ID: G55S
Surface Elev: 619.78 ft. MSL
Completion: 45.96 ft. BGS
Station: 14,663.87N
705.03E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 41.80 - during drilling
▼ = 39.43 - 02/19/09
▽ =

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
11A	18/24 75%	ss	1-2 2-4 N=4	25		
12A	23/24 96%	ss	4-4 5-5 N=9	26		
13A	17/24 71%	ss	woh-2 3-3 N=5	21		
14A	22/24 92%	ss	3-3 4-5 N=7	25		
15A	24/24 100%	ss	woh-2 2-3 N=4	30		
16A	20/24 83%	ss	woh-1 3-4 N=4	25		
16B				22		
17A				24		
17B	12/24 50%	ss	2-3 4-4 N=7	16		
18A	11/24 46%	ss	1-3 5-4 N=8	16		
19A	17/24 71%	ss	2-5 6-7 N=11	14		
20A	19/24 79%	ss	3-8 11-7 N=19	11		
20B				19		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
22	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	598
24	Gray (10YR5/1) with 10% dark gray (10YR4/1) mottles, moist, soft, clayey SILT.	596
26		594
28	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand and gravel.	592
30		590
32	Greenish gray (5GY5/1), moist, soft, silty CLAY with trace sand and slight trace gravel.	588
	Greenish gray (5GY6/1), moist, soft, sandy CLAY with slight trace gravel.	
	Medium light gray (N6/1), moist, soft, sandy CLAY with slight trace gravel.	586
34	Medium light gray (N6/1), wet, soft, silty, very fine- to medium-grained SAND.	
	Greenish gray (10Y6/1), very moist, soft, clayey SILT with slight trace sand and gravel.	584
36	Gray (N6/1), very moist, soft, sandy CLAY with slight trace gravel.	582
38	Gray (N5/1), slightly moist, firm, clayey SILT with slight trace sand and gravel.	
▼	Gray (N5/1), moist, firm, SILT.	580
40		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/19/2009
Finish: 2/19/2009
WEATHER: cold, sunny, windy, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G55
Well ID: G55S
Surface Elev: 619.78 ft. MSL
Completion: 45.96 ft. BGS
Station: 14,663.87N
705.03E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 41.80 - during drilling
▼ = 39.43 - 02/19/09
▽ =

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
21A	18/24 *75%*	ss	*5-8* *10-19* N=18	36				Gray (N5/1), moist, firm, SILT. *[Continued from previous page]*		
21B				16						
							42	Gray (N5/1), wet, dense, silty very fine- to medium-grained SAND.	578	
22A	18/24 *75%*	ss	*6-13* *21-15* N=34	11						
22B				10						
							44	Gray (N5/1), slightly moist, hard, clayey SILT with slight trace sand and gravel.	576	
23A	20/24 *83%*	ss	*6-9* *13-12* N=22	12						
									574	

End of Boring = 45.96 ft bgs

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/19/2009
Finish: 2/19/2009
WEATHER: cold, sunny, windy, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G55~~
Well ID: G55S
Surface Elev: 619.78 ft. MSL
Completion: 45.96 ft. BGS
Station: 14,663.87N
705.03E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 41.80 - during drilling
▼ = 39.43 - 02/19/09
▽ =

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
1A	24/24 100%	ss	2-3 4-3 N=7	19			2	FILL - Yellowish brown (10YR5/4) with 15% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, moist, soft, clayey SILT with slight trace sand.	618	
2A	17/24 71%	ss	2-3 2-2 N=5	20			4	FILL - Yellowish brown (10YR5/4) with 5% gray (10YR5/1) mottles, moist, soft, silty CLAY with slight trace sand and gravel.	616	
3A	12/24 50%	ss	woh-2 3-4 N=5	15			6		614	
4A	24/24 100%	ss	6-8 12-11 N=20	15			8	FILL - Yellowish brown (10YR5/4) with 15% dark yellowish brown (10YR4/6) and 10% gray (10YR6/1) mottles, moist, firm, clayey SILT.	612	
5A	24/24 100%	ss	4-3 3-5 N=6	18				FILL - Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.		
5B				17			10	FILL - Yellowish brown (10YR5/4) with 30% gray (10YR5/1) mottles, slightly moist, firm, clayey SILT with slight trace sand.	610	
6A	22/24 92%	ss	1-2 6-8 N=8	19			12	FILL - Yellowish brown (10YR5/4) with 30% gray (10YR5/1) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel.	608	
7A	24/24 100%	ss	6-8 18-19 N=26	17			14	Very dark grayish brown (10YR3/2), slightly moist, hard, clayey SILT with slight trace sand and trace roots.	606	
8A	20/24 83%	ss	2-5 5-7 N=10	24			16	Yellowish brown (10YR5/6) with 10% gray (10YR5/1) mottles, moist, firm, silty CLAY.	604	
9A	22/24 92%	ss	10-9 11-11 N=20	24						
9B				23			18	Light brownish gray (10YR6/2) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	602	
10A	18/24 75%	ss	2-4 4-5 N=8	22			20	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	600	

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/19/2009
Finish: 2/19/2009
WEATHER: cold, sunny, windy, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G55
Well ID: G55S
Surface Elev: 619.78 ft. MSL
Completion: 45.96 ft. BGS
Station: 14,663.87N
705.03E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 41.80 - during drilling
▼ = 39.43 - 02/19/09
▽ =

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
11A	18/24 75%	ss	1-2 2-4 N=4	25		
12A	23/24 96%	ss	4-4 5-5 N=9	26		
13A	17/24 71%	ss	woh-2 3-3 N=5	21		
14A	22/24 92%	ss	3-3 4-5 N=7	25		
15A	24/24 100%	ss	woh-2 2-3 N=4	30		
16A	20/24 83%	ss	woh-1 3-4 N=4	25		
16B				22		
17A				24		
17B	12/24 50%	ss	2-3 4-4 N=7	16		
18A	11/24 46%	ss	1-3 5-4 N=8	16		
19A	17/24 71%	ss	2-5 6-7 N=11	14		
20A	19/24 79%	ss	3-8 11-7 N=19	11		
20B				19		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
22	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	598
24	Gray (10YR5/1) with 10% dark gray (10YR4/1) mottles, moist, soft, clayey SILT.	596
26		594
28	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand and gravel.	592
30		590
32	Greenish gray (5GY5/1), moist, soft, silty CLAY with trace sand and slight trace gravel.	588
	Greenish gray (5GY6/1), moist, soft, sandy CLAY with slight trace gravel.	
	Medium light gray (N6/1), moist, soft, sandy CLAY with slight trace gravel.	586
34	Medium light gray (N6/1), wet, soft, silty, very fine- to medium-grained SAND.	
	Greenish gray (10Y6/1), very moist, soft, clayey SILT with slight trace sand and gravel.	584
36	Gray (N6/1), very moist, soft, sandy CLAY with slight trace gravel.	582
38	Gray (N5/1), slightly moist, firm, clayey SILT with slight trace sand and gravel.	
▼	Gray (N5/1), moist, firm, SILT.	580
40		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/19/2009
Finish: 2/19/2009
WEATHER: cold, sunny, windy, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G55
Well ID: G55S
Surface Elev: 619.78 ft. MSL
Completion: 45.96 ft. BGS
Station: 14,663.87N
705.03E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 41.80 - during drilling
▼ = 39.43 - 02/19/09
▽ =

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
21A	18/24 *75%*	ss	*5-8* *10-19* N=18	36				Gray (N5/1), moist, firm, SILT. *[Continued from previous page]*		
21B				16						
							42	Gray (N5/1), wet, dense, silty very fine- to medium-grained SAND.	578	
22A	18/24 *75%*	ss	*6-13* *21-15* N=34	11						
22B				10						
							44	Gray (N5/1), slightly moist, hard, clayey SILT with slight trace sand and gravel.	576	
23A	20/24 *83%*	ss	*6-9* *13-12* N=22	12						
									574	

End of Boring = 45.96 ft bgs

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/16/2009
Finish: 2/16/2009
WEATHER: cool, sunny, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~G56a~~
Well ID: G56L
Surface Elev: 619.91 ft. MSL
Completion: 22.89 ft. BGS
Station: 14,708.56N
979.20E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL	Remarks
							2	FILL - Yellowish brown (10YR5/4) with 15% gray (10YR6/1) and 5% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand and gravel.	618	
							4		616	
							6		614	
							8	FILL - Yellowish brown (10YR5/4) with 15% gray (10YR6/1) and 5% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT with slight trace sand and gravel.	612	
							10		610	
							12	Grayish brown (10YR5/2) with 20% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT.	608	
							14	Light brownish gray (10YR6/2) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	606	
							16	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	604	
							18	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	602	
							20	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	600	

NOTE(S): See G56S Boring log for sample and testing data.

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/16/2009
Finish: 2/16/2009
WEATHER: cool, sunny, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G56a
Well ID: G56L
Surface Elev: 619.91 ft. MSL
Completion: 22.89 ft. BGS
Station: 14,708.56N
979.20E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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
								Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.			
							22	Dark grayish brown (10YR4/2), moist, soft, clayey SILT.		598	

End of Boring = 22.89 ft bgs

NOTE(S): See G56S Boring log for sample and testing data.

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/16/2009
Finish: 2/16/2009
WEATHER: cool, sunny, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G56~~
Well ID: G56S
Surface Elev: 619.91 ft. MSL
Completion: 40.00 ft. BGS
Station: 14,704.98N
978.76E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 33.20 - 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	22/24 92%	ss	3-3 4-6 N=7	20		
2A	24/24 100%	ss	6-6 6-7 N=12	16		
3A	20/24 83%	ss	1-4 7-7 N=11	15		
4A	22/24 92%	ss	9-10 11-13 N=21	19		
5A	20/24 83%	ss	1-4 6-8 N=10	19		
6A	22/24 92%	ss	2-4 8-8 N=12	27		
7A	24/24 100%	ss	9-15 13-13 N=28	26		
8A	16/24 67%	ss	1-1 2-3 N=3	30		
9A	22/24 92%	ss	3-3 5-6 N=8	23		
10A	19/24 79%	ss	1-3 3-2 N=6	24		
	22/24		1-3			

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
2	FILL - Yellowish brown (10YR5/4) with 15% gray (10YR6/1) and 5% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand and gravel.	618
4		616
6		614
8	FILL - Yellowish brown (10YR5/4) with 15% gray (10YR6/1) and 5% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT with slight trace sand and gravel.	612
10		610
12	Grayish brown (10YR5/2) with 20% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT.	608
14	Light brownish gray (10YR6/2) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	606
16	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	604
18	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	602
	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	
20	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	600

Borehole Detail

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/16/2009
Finish: 2/16/2009
WEATHER: cool, sunny, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G56
Well ID: G56S
Surface Elev: 619.91 ft. MSL
Completion: 40.00 ft. BGS
Station: 14,704.98N
978.76E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 33.20 - 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
11A	92%	ss	5-6 N=8	24		
12A	16/24 67%	ss	4-4 5-5 N=9	24		
13A	20/24 83%	ss	woh-2 2-3 N=4	23		
14A	18/24 75%	ss	woh-2 3-4 N=5	23		
15A	19/24 79%	ss	woh-1 2-3 N=3	20		
16A	18/24 75%	ss	woh-1 2-2 N=3	15		
17A	16/24 67%	ss	4-4 6-8 N=10	15		
18A	13/24 54%	ss	0-3 5-6 N=8	17		
19A	20/24 83%	ss	2-4 7-5 N=11	24		
20A	19/24 79%	ss	woh-4 7-7 N=11	11		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT. *[Continued from previous page]*	
22		598
	Dark grayish brown (10YR4/2), moist, soft, clayey SILT.	
24		596
	Grayish brown (10YR5/2) with 5% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand.	
26		594
28		592
	Dark greenish gray (5GY4/1), moist, soft, sandy CLAY with slight trace gravel.	
30		590
	Greenish gray (5GY5/1), moist, soft, sandy CLAY with slight trace gravel.	
32		588
▼	Gray (10YR5/1), wet, medium dense, silty fine- to coarse-grained SAND with slight trace gravel.	
34		586
	Greenish gray (10Y6/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.	
36		584
	Greenish gray (10Y6/1), wet, medium dense, SILT with trace clay.	
38	Greenish gray (10Y6/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.	582
	Gray (10YR5/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.	
40		580

End of Boring = 40.0 ft bgs

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/16/2009
Finish: 2/16/2009
WEATHER: cool, sunny, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G56~~
Well ID: G56S
Surface Elev: 619.91 ft. MSL
Completion: 40.00 ft. BGS
Station: 14,704.98N
978.76E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 33.20 - 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	22/24 92%	ss	3-3 4-6 N=7	20		
2A	24/24 100%	ss	6-6 6-7 N=12	16		
3A	20/24 83%	ss	1-4 7-7 N=11	15		
4A	22/24 92%	ss	9-10 11-13 N=21	19		
5A	20/24 83%	ss	1-4 6-8 N=10	19		
6A	22/24 92%	ss	2-4 8-8 N=12	27		
7A	24/24 100%	ss	9-15 13-13 N=28	26		
8A	16/24 67%	ss	1-1 2-3 N=3	30		
9A	22/24 92%	ss	3-3 5-6 N=8	23		
10A	19/24 79%	ss	1-3 3-2 N=6	24		
	22/24		1-3			

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
2	FILL - Yellowish brown (10YR5/4) with 15% gray (10YR6/1) and 5% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand and gravel.	618
4		616
6		614
8	FILL - Yellowish brown (10YR5/4) with 15% gray (10YR6/1) and 5% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT with slight trace sand and gravel.	612
10		610
12	Grayish brown (10YR5/2) with 20% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT.	608
14	Light brownish gray (10YR6/2) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	606
16	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	604
18	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	602
	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	
20	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	600

Borehole Detail

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/16/2009
Finish: 2/16/2009
WEATHER: cool, sunny, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G56
Well ID: G56S
Surface Elev: 619.91 ft. MSL
Completion: 40.00 ft. BGS
Station: 14,704.98N
978.76E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 33.20 - 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
11A	92%	ss	5-6 N=8	24		
12A	16/24 67%	ss	4-4 5-5 N=9	24		
13A	20/24 83%	ss	woh-2 2-3 N=4	23		
14A	18/24 75%	ss	woh-2 3-4 N=5	23		
15A	19/24 79%	ss	woh-1 2-3 N=3	20		
16A	18/24 75%	ss	woh-1 2-2 N=3	15		
17A	16/24 67%	ss	4-4 6-8 N=10	15		
18A	13/24 54%	ss	0-3 5-6 N=8	17		
19A	20/24 83%	ss	2-4 7-5 N=11	24		
20A	19/24 79%	ss	woh-4 7-7 N=11	11		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT. *[Continued from previous page]*	
22		598
	Dark grayish brown (10YR4/2), moist, soft, clayey SILT.	
24		596
	Grayish brown (10YR5/2) with 5% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand.	
26		594
28		592
	Dark greenish gray (5GY4/1), moist, soft, sandy CLAY with slight trace gravel.	
30		590
	Greenish gray (5GY5/1), moist, soft, sandy CLAY with slight trace gravel.	
32		588
▼	Gray (10YR5/1), wet, medium dense, silty fine- to coarse-grained SAND with slight trace gravel.	
34		586
	Greenish gray (10Y6/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.	
36		584
	Greenish gray (10Y6/1), wet, medium dense, SILT with trace clay.	
38	Greenish gray (10Y6/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.	582
	Gray (10YR5/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.	
40		580

End of Boring = 40.0 ft bgs

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/30/2009
Finish: 1/30/2009
WEATHER: cold, sunny, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G57a~~
Well ID: G57L
Surface Elev: 619.98 ft. MSL
Completion: 26.00 ft. BGS
Station: 15,064.65N
987.47E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
							2	FILL - Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 5% very dark brown (10YR2/2) mottles, slightly moist, firm, clayey SILT.	618
							4		616
							6	FILL - Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 5% very dark brown (10YR2/2) mottles, moist, firm, clayey SILT with slight trace gravel, slight trace iron staining (10YR5/6) visible.	614
							8		612
							10	FILL - Dark yellowish brown (10YR4/6), moist, firm, silty CLAY.	610
							12	Dark gray (10YR4/1), moist, firm, silty CLAY with trace gravel.	608
							14	Dark grayish brown (10YR4/2) with gray (10YR5/1) mottles, moist, firm, clayey SILT with trace gravel.	606
							16	Dark yellowish brown (10YR3/6), moist, firm, silty CLAY.	604
							18	Light yellowish brown (10YR6/4), slightly moist, firm, clayey SILT, with trace iron staining (10YR4/6) visible.	602
							20	Dark grayish brown (10YR4/2), moist, firm, clayey SILT.	600

Borehole Detail

Remarks

NOTE(S): See G57S Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/30/2009
Finish: 1/30/2009
WEATHER: cold, sunny, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G57a
Well ID: G57L
Surface Elev: 619.98 ft. MSL
Completion: 26.00 ft. BGS
Station: 15,064.65N
987.47E

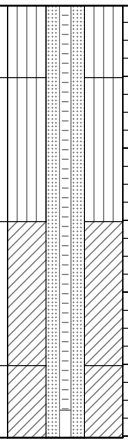
TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
								Dark grayish brown (10YR4/2), moist, firm, clayey SILT. *[Continued from previous page]*	
							22	Grayish brown (10YR5/2), moist, firm, clayey SILT, with trace iron staining (10YR5/6) visible.	598
							24	Dark brown (10YR3/3), moist, firm, silty CLAY.	596
							26	Dark yellowish brown (10YR3/6) with 40% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY.	594

End of Boring = 26.00 ft bgs

Borehole Detail



Remarks

NOTE(S): See G57S Boring log for sample and testing data.

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/30/2009
Finish: 1/30/2009
WEATHER: cold, sunny, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G57~~
Well ID: G57S
Surface Elev: 619.98 ft. MSL
Completion: 38.00 ft. BGS
Station: 15,060.26N
987.45E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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
1A	24/24 100%	ss	13-8 5-3 N=13	25		
2A	20/24 83%	ss	3-3 5-4 N=8	19		
3A	24/24 100%	ss	3-3 4-5 N=7	17		
4A	24/24 100%	ss	8-5 5-8 N=10	20		
5A	22/24 92%	ss	1-3 3-3 N=6	22		
6A	16/24 67%	ss	3-3 7-6 N=10	17		
7A	24/24 100%	ss	5-6 7-6 N=13	22		
7B				20		
8A	22/24 92%	ss	5-5 7-5 N=12	22		
9A	24/24 100%	ss	9-10 8-6 N=18	24		
10A	24/24 100%	ss	1-2 4-4 N=6	27		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
2	FILL - Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 5% very dark brown (10YR2/2) mottles, slightly moist, firm, clayey SILT.	618
4		616
6	FILL - Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 5% very dark brown (10YR2/2) mottles, moist, firm, clayey SILT with slight trace gravel, slight trace iron staining (10YR5/6) visible.	614
8		612
10	FILL - Dark yellowish brown (10YR4/6), moist, firm, silty CLAY.	610
12	Dark gray (10YR4/1), moist, firm, silty CLAY with trace gravel.	608
14	Dark grayish brown (10YR4/2) with gray (10YR5/1) mottles, moist, firm, clayey SILT with trace gravel.	606
16	Dark yellowish brown (10YR3/6), moist, firm, silty CLAY.	604
18	Light yellowish brown (10YR6/4), slightly moist, firm, clayey SILT, with trace iron staining (10YR4/6) visible.	602
20	Dark grayish brown (10YR4/2), moist, firm, clayey SILT.	600

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/30/2009
Finish: 1/30/2009
WEATHER: cold, sunny, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G57
Well ID: G57S
Surface Elev: 619.98 ft. MSL
Completion: 38.00 ft. BGS
Station: 15,060.26N
987.45E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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
11A	24/24 100%	ss	1-3 5-3 N=8	25		
12A	24/24 100%	ss	1-3 5-4 N=8	25		
13A	23/24 96%	ss	0-2 2-3 N=4	26		
14A	24/24 100%	ss	2-3 3-6 N=6	26		
15A	24/24 100%	ss	1-2 3-5 N=5	23		
16A	24/24 100%	ss	1-2 5-3 N=7	14		
16B				18		
17A	23/24 96%	ss	6-8 10-4 N=18	16		
17B				14		
18A	22/24 92%	ss	1-3 5-8 N=8	11		
19A	18/24 75%	ss	5-13 17-15 N=30	11		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark grayish brown (10YR4/2), moist, firm, clayey SILT. *[Continued from previous page]*	
22	Grayish brown (10YR5/2), moist, firm, clayey SILT, with trace iron staining (10YR5/6) visible.	598
24	Dark brown (10YR3/3), moist, firm, silty CLAY.	596
26	Dark yellowish brown (10YR3/6) with 40% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY.	594
28	Dark yellowish brown (10YR4/4) with 20% dark yellowish brown (10YR4/2) mottles, moist, firm, silty CLAY with slight trace sand and gravel.	592
30	Greenish gray (5G6/1), moist, soft, clayey SILT with trace sand and slight trace gravel.	590
	Greenish brown (10YR5/2), wet, soft, sandy CLAY.	
32	Yellowish brown (10YR5/4), wet, medium dense, silty, fine- to coarse-grained SAND with trace gravel.	588
	Gray (10YR5/1), wet, medium dense, silty, fine- to coarse-grained SAND with trace gravel.	
34	Gray (N5/1), wet, firm, clayey SILT with slight trace sand and gravel.	586
36		584
38		582

End of Boring = 38.00 ft bgs

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/30/2009
Finish: 1/30/2009
WEATHER: cold, sunny, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G57~~
Well ID: G57S
Surface Elev: 619.98 ft. MSL
Completion: 38.00 ft. BGS
Station: 15,060.26N
987.45E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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
1A	24/24 100%	ss	13-8 5-3 N=13	25		
2A	20/24 83%	ss	3-3 5-4 N=8	19		
3A	24/24 100%	ss	3-3 4-5 N=7	17		
4A	24/24 100%	ss	8-5 5-8 N=10	20		
5A	22/24 92%	ss	1-3 3-3 N=6	22		
6A	16/24 67%	ss	3-3 7-6 N=10	17		
7A	24/24 100%	ss	5-6 7-6 N=13	22		
7B				20		
8A	22/24 92%	ss	5-5 7-5 N=12	22		
9A	24/24 100%	ss	9-10 8-6 N=18	24		
10A	24/24 100%	ss	1-2 4-4 N=6	27		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
2	FILL - Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 5% very dark brown (10YR2/2) mottles, slightly moist, firm, clayey SILT.	618
4		616
6	FILL - Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 5% very dark brown (10YR2/2) mottles, moist, firm, clayey SILT with slight trace gravel, slight trace iron staining (10YR5/6) visible.	614
8		612
10	FILL - Dark yellowish brown (10YR4/6), moist, firm, silty CLAY.	610
12	Dark gray (10YR4/1), moist, firm, silty CLAY with trace gravel.	608
14	Dark grayish brown (10YR4/2) with gray (10YR5/1) mottles, moist, firm, clayey SILT with trace gravel.	606
16	Dark yellowish brown (10YR3/6), moist, firm, silty CLAY.	604
18	Light yellowish brown (10YR6/4), slightly moist, firm, clayey SILT, with trace iron staining (10YR4/6) visible.	602
20	Dark grayish brown (10YR4/2), moist, firm, clayey SILT.	600

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/30/2009
Finish: 1/30/2009
WEATHER: cold, sunny, lo-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G57
Well ID: G57S
Surface Elev: 619.98 ft. MSL
Completion: 38.00 ft. BGS
Station: 15,060.26N
987.45E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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
11A	24/24 100%	ss	1-3 5-3 N=8	25		
12A	24/24 100%	ss	1-3 5-4 N=8	25		
13A	23/24 96%	ss	0-2 2-3 N=4	26		
14A	24/24 100%	ss	2-3 3-6 N=6	26		
15A	24/24 100%	ss	1-2 3-5 N=5	23		
16A	24/24 100%	ss	1-2 5-3 N=7	14		
16B				18		
17A	23/24 96%	ss	6-8 10-4 N=18	16		
17B				14		
18A	22/24 92%	ss	1-3 5-8 N=8	11		
19A	18/24 75%	ss	5-13 17-15 N=30	11		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark grayish brown (10YR4/2), moist, firm, clayey SILT. *[Continued from previous page]*	
22	Grayish brown (10YR5/2), moist, firm, clayey SILT, with trace iron staining (10YR5/6) visible.	598
24	Dark brown (10YR3/3), moist, firm, silty CLAY.	596
26	Dark yellowish brown (10YR3/6) with 40% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY.	594
28	Dark yellowish brown (10YR4/4) with 20% dark yellowish brown (10YR4/2) mottles, moist, firm, silty CLAY with slight trace sand and gravel.	592
30	Greenish gray (5G6/1), moist, soft, clayey SILT with trace sand and slight trace gravel.	590
	Greenish brown (10YR5/2), wet, soft, sandy CLAY.	
32	Yellowish brown (10YR5/4), wet, medium dense, silty, fine- to coarse-grained SAND with trace gravel.	588
	Gray (10YR5/1), wet, medium dense, silty, fine- to coarse-grained SAND with trace gravel.	
34	Gray (N5/1), wet, firm, clayey SILT with slight trace sand and gravel.	586
36		584
38		582

End of Boring = 38.00 ft bgs

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/26/2009
Finish: 1/26/2009
WEATHER: cold, overcast, mid-teen's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~G58a~~
Well ID: G58L
Surface Elev: 620.04 ft. MSL
Completion: 30.56 ft. BGS
Station: 15,204.30N
989.01E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
							2	FILL - Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT.	618
							4		616
							6	FILL - Yellowish brown (10YR5/4) with 30% gray (10YR5/1) mottles, moist, soft, clayey SILT with slight trace sand.	614
							8	FILL - Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) and 10% gray (10YR6/1) mottles, moist, firm, clayey SILT with slight trace sand.	612
							10	FILL - Gray (10YR5/1) with 40% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand.	610
							12	Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 10% gray (10YR6/1) mottles, moist, soft, clayey SILT.	608
							14		606
							16	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	604
							18		602
							20		

Borehole Detail

Remarks

NOTE(S): See G58S Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/26/2009
Finish: 1/26/2009
WEATHER: cold, overcast, mid-teen's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G58a
Well ID: G58L
Surface Elev: 620.04 ft. MSL
Completion: 30.56 ft. BGS
Station: 15,204.30N
989.01E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
								Gray (10YR6/1) with 35% dark gray (10YR4/1) and 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	
							22		598
								Dark gray (10YR5/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	
							24		596
							26	Dark gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	594
							28		592
								Gray (10YR6/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	
							30		590
								Greenish gray (5GY5/1) with 5% yellowish brown (10YR5/6) mottles, moist, soft, sandy CLAY with trace gravel.	

End of Boring = 30.56 ft bgs

Remarks

NOTE(S): See G58S Boring log for sample and testing data.

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/26/2009
Finish: 1/26/2009
WEATHER: cold, overcast, mid-teen's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G58~~
Well ID: G58S
Surface Elev: 620.04 ft. MSL
Completion: 36.43 ft. BGS
Station: 15,200.16N
989.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 34.20 - 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	24/24 100%	ss	13-11 7-5 N=18	23		
2A	24/24 100%	ss	7-8 10-12 N=18	23		
3A	24/24 100%	ss	4-4 6-9 N=10	20		
4A	23/24 96%	ss	8-12 14-19 N=26	19		
5A	24/24 100%	ss	2-3 7-7 N=10	20		
6A	20/24 83%	ss	2-3 5-8 N=8	22		
7A	24/24 100%	ss	7-7 7-6 N=14	25		
8A	17/24 71%	ss	1-3 5-7 N=8	23		
9A	19/24 79%	ss	3-3 5-5 N=8	24		
10A	22/24 92%	ss	1-3 3-4 N=6	33		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
2	FILL - Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT.	618
4		616
6	FILL - Yellowish brown (10YR5/4) with 30% gray (10YR5/1) mottles, moist, soft, clayey SILT with slight trace sand.	614
8	FILL - Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) and 10% gray (10YR6/1) mottles, moist, firm, clayey SILT with slight trace sand.	612
10	FILL - Gray (10YR5/1) with 40% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand.	610
12	Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 10% gray (10YR6/1) mottles, moist, soft, clayey SILT.	608
14		606
16	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	604
18		602
20		

Borehole Detail

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/26/2009
Finish: 1/26/2009
WEATHER: cold, overcast, mid-teen's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G58
Well ID: G58S
Surface Elev: 620.04 ft. MSL
Completion: 36.43 ft. BGS
Station: 15,200.16N
989.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 34.20 - 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
11A	17/24 71%	ss	2-2 5-5 N=7	24		
12A	24/24 100%	ss	5-5 6-8 N=11	22		
13A	24/24 100%	ss	2-3 5-5 N=8	20		
13B				26		
14A	24/24 100%	ss	5-9 6-7 N=15	30		
15A	23/24 96%	ss	woh-2 3-4 N=5	21		
16A	24/24 100%	ss	6-8 11-7 N=19	18		
16B				16		
16C				20		
17A	20/24 83%	ss	3-6 10-3 N=16	13		
18A	23/24 96%	ss	3-6 8-12 N=14	17		
18B				14		
18C				14		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Gray (10YR6/1) with 35% dark gray (10YR4/1) and 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	
22		598
	Dark gray (10YR5/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	
24		596
	Dark gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	
26		594
28		592
	Gray (10YR6/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	
30		590
	Greenish gray (5GY5/1) with 5% yellowish brown (10YR5/6) mottles, moist, soft, sandy CLAY with trace gravel.	
	Greenish gray (5GY5/1), very moist, dense, silty, fine-to coarse-grained SAND with trace gravel.	
32	Gray (10YR6/1), wet, firm, SILT.	588
	Greenish gray (5GY5/1), moist, firm, clayey SILT with sand and trace gravel.	
	Gray (N5/1), wet, medium dense, silty very fine- to coarse-grained SAND with trace gravel.	
	Greenish gray (5GY5/1), moist, firm, sandy CLAY with trace gravel.	
▼ 34		586
	Gray (N5/1), wet, medium dense, silty fine- to coarse-grained SAND with trace gravel.	
	Greenish gray (5GY5/1), very moist, firm, sandy CLAY with trace gravel.	
36	Dark gray (N4/1), slightly moist, hard, clayey SILT with sand and slight trace gravel.	584

End of Boring = 36.43 ft bgs

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/26/2009
Finish: 1/26/2009
WEATHER: cold, overcast, mid-teen's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G58~~
Well ID: G58S
Surface Elev: 620.04 ft. MSL
Completion: 36.43 ft. BGS
Station: 15,200.16N
989.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 34.20 - 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	24/24 100%	ss	13-11 7-5 N=18	23		
2A	24/24 100%	ss	7-8 10-12 N=18	23		
3A	24/24 100%	ss	4-4 6-9 N=10	20		
4A	23/24 96%	ss	8-12 14-19 N=26	19		
5A	24/24 100%	ss	2-3 7-7 N=10	20		
6A	20/24 83%	ss	2-3 5-8 N=8	22		
7A	24/24 100%	ss	7-7 7-6 N=14	25		
8A	17/24 71%	ss	1-3 5-7 N=8	23		
9A	19/24 79%	ss	3-3 5-5 N=8	24		
10A	22/24 92%	ss	1-3 3-4 N=6	33		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
2	FILL - Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT.	618
4		616
6	FILL - Yellowish brown (10YR5/4) with 30% gray (10YR5/1) mottles, moist, soft, clayey SILT with slight trace sand.	614
8	FILL - Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) and 10% gray (10YR6/1) mottles, moist, firm, clayey SILT with slight trace sand.	612
10	FILL - Gray (10YR5/1) with 40% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand.	610
12	Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 10% gray (10YR6/1) mottles, moist, soft, clayey SILT.	608
14		606
16	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	604
18		602
20		

Borehole Detail

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/26/2009
Finish: 1/26/2009
WEATHER: cold, overcast, mid-teen's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G58
Well ID: G58S
Surface Elev: 620.04 ft. MSL
Completion: 36.43 ft. BGS
Station: 15,200.16N
989.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 34.20 - 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
11A	17/24 71%	ss	2-2 5-5 N=7	24		
12A	24/24 100%	ss	5-5 6-8 N=11	22		
13A	24/24 100%	ss	2-3 5-5 N=8	20		
13B				26		
14A	24/24 100%	ss	5-9 6-7 N=15	30		
15A	23/24 96%	ss	woh-2 3-4 N=5	21		
16A	24/24 100%	ss	6-8 11-7 N=19	18		
16B				16		
16C				20		
17A	20/24 83%	ss	3-6 10-3 N=16	13		
18A	23/24 96%	ss	3-6 8-12 N=14	17		
18B				14		
18C				14		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Gray (10YR6/1) with 35% dark gray (10YR4/1) and 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	
22		598
	Dark gray (10YR5/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	
24		596
	Dark gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	
26		594
28		592
	Gray (10YR6/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	
30		590
	Greenish gray (5GY5/1) with 5% yellowish brown (10YR5/6) mottles, moist, soft, sandy CLAY with trace gravel.	
	Greenish gray (5GY5/1), very moist, dense, silty, fine-to coarse-grained SAND with trace gravel.	
32	Gray (10YR6/1), wet, firm, SILT.	588
	Greenish gray (5GY5/1), moist, firm, clayey SILT with sand and trace gravel.	
	Gray (N5/1), wet, medium dense, silty very fine- to coarse-grained SAND with trace gravel.	
	Greenish gray (5GY5/1), moist, firm, sandy CLAY with trace gravel.	
▼ 34		586
	Gray (N5/1), wet, medium dense, silty fine- to coarse-grained SAND with trace gravel.	
	Greenish gray (5GY5/1), very moist, firm, sandy CLAY with trace gravel.	
36	Dark gray (N4/1), slightly moist, hard, clayey SILT with sand and slight trace gravel.	584

End of Boring = 36.43 ft bgs

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/23/2009
Finish: 1/23/2009
WEATHER: cold, overcast, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~G59a~~
Well ID: G59L
Surface Elev: 620.15 ft. MSL
Completion: 33.03 ft. BGS
Station: 15,343.87N
992.61E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
							0	FILL - Dark yellowish brown (10YR4/6) with 30% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel.	620
							2		618
							4	FILL - Yellowish brown (10YR5/4) with 5% gray (10YR6/1) mottles, slightly moist, hard, clayey SILT with slight trace sand and gravel	616
							6		614
							8	FILL - Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, moist, soft, silty CLAY, trace roots.	612
							10		610
							12	FILL - Dark grayish brown (10YR4/2), slightly moist, firm, clayey SILT with slight trace sand.	608
							14	Very dark grayish brown (10YR3/2), slightly moist, firm, clayey SILT, trace roots.	606
							16	Dark grayish brown (10YR4/2), moist, firm, silty CLAY, slight trace roots.	604
							18	Dark grayish brown (10YR4/2) with 15% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY, slight trace roots.	602
							20	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	

Borehole Detail

Remarks

NOTE(S): See G59S Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/23/2009
Finish: 1/23/2009
WEATHER: cold, overcast, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G59a
Well ID: G59L
Surface Elev: 620.15 ft. MSL
Completion: 33.03 ft. BGS
Station: 15,343.87N
992.61E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
								Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT. *[Continued from previous page]*	600
							22	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) and 10% dark gray (10YR4/1) mottles, moist, soft, clayey SILT.	598
							24	Gray (10YR5/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand and gravel.	596
							26	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	594
							28	Greenish gray (10GY6/1), moist, very soft, sandy CLAY with silt and trace gravel.	592
							30		590
							32		588

Borehole Detail

End of Boring = 33.03 ft bgs

Remarks

NOTE(S): See G59S Boring log for sample and testing data.

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/23/2009
Finish: 1/23/2009
WEATHER: cold, overcast, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G59~~
Well ID: G59S
Surface Elev: 620.15 ft. MSL
Completion: 42.49 ft. BGS
Station: 15,339.79N
992.55E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 39.30 - 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	24/24 100%	ss	13-15 20-19 N=35	17		
2A	24/24 100%	ss	26-10 15-17 N=25	19		
3A	24/24 100%	ss	6-6 10-6 N=16	19		
4A	24/24 100%	ss	10-10 9-7 N=19	23		
5A	23/24 96%	ss	3-5 5-5 N=10	20		
6A	20/24 83%	ss	2-3 5-8 N=8	20		
7A	24/24 100%	ss	10-14 12-11 N=26	17		
7B				30		
8A	20/24 83%	ss	3-4 8-9 N=12	22		
9A	24/24 100%	ss	8-11 11-11 N=22	25		
10A	20/24 83%	ss	1-2 4-5 N=6	25		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
2	FILL - Dark yellowish brown (10YR4/6) with 30% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel.	618
4		616
6	FILL - Yellowish brown (10YR5/4) with 5% gray (10YR6/1) mottles, slightly moist, hard, clayey SILT with slight trace sand and gravel	614
8		612
10	FILL - Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, moist, soft, silty CLAY, trace roots.	610
12	FILL - Dark grayish brown (10YR4/2), slightly moist, firm, clayey SILT with slight trace sand.	608
14	Very dark grayish brown (10YR3/2), slightly moist, firm, clayey SILT, trace roots.	606
	Dark grayish brown (10YR4/2), moist, firm, silty CLAY, slight trace roots.	
16		604
18	Dark grayish brown (10YR4/2) with 15% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY, slight trace roots.	602
20	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/23/2009
Finish: 1/23/2009
WEATHER: cold, overcast, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G59
Well ID: G59S
Surface Elev: 620.15 ft. MSL
Completion: 42.49 ft. BGS
Station: 15,339.79N
992.55E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 39.30 - 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
11A	18/24 75%	ss	woh-2 2-4 N=4	29		
12A	16/24 67%	ss	4-7 5-6 N=12	31		
13A	22/24 92%	ss	1-2 3-4 N=5	24		
14A	17/24 71%	ss	4-7 7-6 N=14	23		
15A	16/24 67%	ss	1-2 4-6 N=6	21		
16A	16/24 67%	ss	woh-2 2-2 N=4	17		
17A	16/24 67%	ss	2-3 2-3 N=5	20		
18A	21/24 88%	ss	1-3 4-6 N=7	15		
19A	24/24 100%	ss	6-9 11-9 N=20	15		
20A	24/24 100%	ss	15-22 24-17 N=46	12		
20B				16		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT. *[Continued from previous page]*	600	
22	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) and 10% dark gray (10YR4/1) mottles, moist, soft, clayey SILT.	598	
24	Gray (10YR5/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand and gravel.	596	
26	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	594	
28		592	
30	Greenish gray (10GY6/1), moist, very soft, sandy CLAY with silt and trace gravel.	590	
32		588	
34	Gray (N5/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	586	
36		584	
38		582	
▼	Gray (N5/1), wet, dense, silty, very fine- to coarse-grained SAND.		
40			

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/23/2009
Finish: 1/23/2009
WEATHER: cold, overcast, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G59
Well ID: G59S
Surface Elev: 620.15 ft. MSL
Completion: 42.49 ft. BGS
Station: 15,339.79N
992.55E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 39.30 - 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
21A	24/24 100%	ss	2-2 4-5 N=6	16				Gray (10YR5/1) with 5% dark gray (10YR4/1), moist, soft, clayey SILT.		580	
21B				30			42			578	

End of Boring = 42.49 ft bgs

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/23/2009
Finish: 1/23/2009
WEATHER: cold, overcast, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G59~~
Well ID: G59S
Surface Elev: 620.15 ft. MSL
Completion: 42.49 ft. BGS
Station: 15,339.79N
992.55E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 39.30 - 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	24/24 100%	ss	13-15 20-19 N=35	17		
2A	24/24 100%	ss	26-10 15-17 N=25	19		
3A	24/24 100%	ss	6-6 10-6 N=16	19		
4A	24/24 100%	ss	10-10 9-7 N=19	23		
5A	23/24 96%	ss	3-5 5-5 N=10	20		
6A	20/24 83%	ss	2-3 5-8 N=8	20		
7A	24/24 100%	ss	10-14 12-11 N=26	17		
7B				30		
8A	20/24 83%	ss	3-4 8-9 N=12	22		
9A	24/24 100%	ss	8-11 11-11 N=22	25		
10A	20/24 83%	ss	1-2 4-5 N=6	25		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
2	FILL - Dark yellowish brown (10YR4/6) with 30% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel.	618
4		616
6	FILL - Yellowish brown (10YR5/4) with 5% gray (10YR6/1) mottles, slightly moist, hard, clayey SILT with slight trace sand and gravel	614
8		612
10	FILL - Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, moist, soft, silty CLAY, trace roots.	610
12	FILL - Dark grayish brown (10YR4/2), slightly moist, firm, clayey SILT with slight trace sand.	608
14	Very dark grayish brown (10YR3/2), slightly moist, firm, clayey SILT, trace roots.	606
	Dark grayish brown (10YR4/2), moist, firm, silty CLAY, slight trace roots.	
16		604
18	Dark grayish brown (10YR4/2) with 15% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY, slight trace roots.	602
20	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/23/2009
Finish: 1/23/2009
WEATHER: cold, overcast, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G59
Well ID: G59S
Surface Elev: 620.15 ft. MSL
Completion: 42.49 ft. BGS
Station: 15,339.79N
992.55E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 39.30 - 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
11A	18/24 75%	ss	woh-2 2-4 N=4	29		
12A	16/24 67%	ss	4-7 5-6 N=12	31		
13A	22/24 92%	ss	1-2 3-4 N=5	24		
14A	17/24 71%	ss	4-7 7-6 N=14	23		
15A	16/24 67%	ss	1-2 4-6 N=6	21		
16A	16/24 67%	ss	woh-2 2-2 N=4	17		
17A	16/24 67%	ss	2-3 2-3 N=5	20		
18A	21/24 88%	ss	1-3 4-6 N=7	15		
19A	24/24 100%	ss	6-9 11-9 N=20	15		
20A	24/24 100%	ss	15-22 24-17 N=46	12		
20B				16		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT. *[Continued from previous page]*	600	
22	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) and 10% dark gray (10YR4/1) mottles, moist, soft, clayey SILT.	598	
24	Gray (10YR5/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand and gravel.	596	
26	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	594	
28		592	
30	Greenish gray (10GY6/1), moist, very soft, sandy CLAY with silt and trace gravel.	590	
32		588	
34	Gray (N5/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	586	
36		584	
38		582	
▼	Gray (N5/1), wet, dense, silty, very fine- to coarse-grained SAND.		
40			

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/23/2009
Finish: 1/23/2009
WEATHER: cold, overcast, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G59
Well ID: G59S
Surface Elev: 620.15 ft. MSL
Completion: 42.49 ft. BGS
Station: 15,339.79N
992.55E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 39.30 - 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
21A	24/24 100%	ss	2-2 4-5 N=6	16				Gray (10YR5/1) with 5% dark gray (10YR4/1), moist, soft, clayey SILT.		580	
21B				30			42			578	

End of Boring = 42.49 ft bgs

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/17/2008
Finish: 1/17/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 4¼" hollow stem auger - blind drilled within 5 ft of BG60
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~BG60b~~
Well ID: G60L
Surface Elev: 612.5 ft. MSL
Completion: 25.3 ft. BGS
Station: 15,474.74N
1,049.75E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 30.60 - during drilling
▼ = 21.02 - 1/30/2008
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) % Recovery	Type	Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL
								Dark yellow brown (10YR3/4), slightly moist, silty CLAY, trace sand	612
								Light gray (10YR7/2) with 40% brown yellow (10YR6/8) mottles, moist, silty CLAY, trace sand	
							2	Brown yellow (10YR6/8) with 40% light gray (10YR7/2) mottles, moist, clayey SILT, trace sand	610
							4	Yellow brown (10YR5/8), moist, clayey SILT, trace sand	608
							6	Light yellow brown (10YR6/4) with 30% brown yellow (10YR6/8) mottles, moist, clayey SILT, trace sand	606
							8	Yellow brown (10YR5/8) with 20% light yellow brown (10YR6/4) mottles, moist, clayey SILT, trace sand	604
							10	Light brown gray (10YR6/2) with 10% brown yellow (10YR6/8) mottles, very moist, clayey SILT, trace sand	602
							12	Gray brown (10YR5/2) with 30% very dark gray brown (10YR3/2) mottles, moist, clayey SILT, trace sand	600
							14	Dark gray (10YR4/1), moist, clayey SILT, trace sand	598
								Dark gray (10YR4/1) with 10% very dark gray (10YR3/1) mottles, moist, clayey SILT, trace sand	
							16	Black (10YR2/1), moist, very silty CLAY, trace sand	596
							18	Dark gray (10YR4/1), moist, silty CLAY, trace sand	
								Dark green gray (10Y4/1) with 5% very dark gray (10YR3/1) mottles, moist, silty CLAY, trace sand, trace organics	594
							20	Dark green gray (10Y4/1) moist, silty CLAY, trace sand and gravel	

Borehole Detail

NOTE(S):

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/17/2008
Finish: 1/17/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 4¼" hollow stem auger - blind drilled within 5 ft of BG60
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG60b
Well ID: G60L
Surface Elev: 612.5 ft. MSL
Completion: 25.3 ft. BGS
Station: 15,474.74N
1,049.75E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 30.60 - during drilling
▼ = 21.02 - 1/30/2008
▽ =

SAMPLE			TESTING							
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
								Dark green gray (10Y4/1) moist, silty CLAY, trace sand and gravel *[Continued from previous page]*		592	
							22	Green gray (5GY5/1), very moist, silty CLAY, trace sand and gravel		590	
							24	Green gray (5GY5/1) with 5% yellow brown (10YR5/4) mottles, wet, very silty CLAY, trace sand and gravel		588	

End of Boring = 25.28 ft. BGS

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/16/2008
Finish: 1/16/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~BG60~~
Well ID: G60S
Surface Elev: 612.2 ft. MSL
Completion: 38.0 ft. BGS
Station: 15,469.50N
1,050.18E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 30.60 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
1A	19/24 79%	ss	4-6 6-7 N=12	24		
1B				19		4.27 Sh
	21/24 88%	ss	4-4 5-6 N=9			
2A				23		0.92 Sh
3A				23		
	24/24 100%	ss	2-3 4-4 N=7			
3B				25		1.40 Sh
	21/24 88%	ss	3-4 6-5 N=10			
4A				24		
	22/24 92%	ss	2-2 3-4 N=5			
5A				27		0.78 Sh
	19/24 79%	ss	2-2 3-3 N=5			
6A				23		2.13 Sh
	21/24 88%	ss	2-2 2-3 N=4			
7A				27		2.33 Sh
8A	23/24 96%	ss	2-2 3-4 N=5	29		1.71 B
8B				33		1.82
9A				25		1.63 B
	24/24 100%	ss	2-3 3-5 N=6			
9B				23		1.67
9C				22		1.67
10A				27		0.97 B
	23/24 96%	ss	1-3 3-4 N=6			
10B				23		0.74

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark yellow brown (10YR3/4), slightly moist, silty CLAY, trace sand	612
	Light gray (10YR7/2) with 40% brown yellow (10YR6/8) mottles, moist, silty CLAY, trace sand	
2	Brown yellow (10YR6/8) with 40% light gray (10YR7/2) mottles, moist, clayey SILT, trace sand	610
4	Yellow brown (10YR5/8), moist, clayey SILT, trace sand	608
6	Light yellow brown (10YR6/4) with 30% brown yellow (10YR6/8) mottles, moist, clayey SILT, trace sand	606
8	Yellow brown (10YR5/8) with 20% light yellow brown (10YR6/4) mottles, moist, clayey SILT, trace sand	604
10	Light brown gray (10YR6/2) with 10% brown yellow (10YR6/8) mottles, very moist, clayey SILT, trace sand	602
12	Gray brown (10YR5/2) with 30% very dark gray brown (10YR3/2) mottles, moist, clayey SILT, trace sand	600
14	Dark gray (10YR4/1), moist, clayey SILT, trace sand	598
16	Dark gray (10YR4/1) with 10% very dark gray (10YR3/1) mottles, moist, clayey SILT, trace sand	596
	Black (10YR2/1), moist, very silty CLAY, trace sand	
18	Dark gray (10YR4/1), moist, silty CLAY, trace sand	594
	Dark green gray (10Y4/1) with 5% very dark gray (10YR3/1) mottles, moist, silty CLAY, trace sand, trace organics	
20	Dark green gray (10Y4/1) moist, silty CLAY, trace sand and gravel	

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/16/2008
Finish: 1/16/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG60
Well ID: G60S
Surface Elev: 612.2 ft. MSL
Completion: 38.0 ft. BGS
Station: 15,469.50N
1,050.18E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 30.60 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	24/24 100%	ss	1-2 4-5 N=6					Dark green gray (10Y4/1) moist, silty CLAY, trace sand and gravel *[Continued from previous page]*	592	
11A				18		1.32	22			
12A				18		0.47 B		Green gray (5GY5/1), very moist, silty CLAY, trace sand and gravel	590	
	24/24 100%	ss	4-4 4-4 N=8							
12B				20		0.04 B	24	Green gray (5GY5/1) with 5% yellow brown (10YR5/4) mottles, wet, very silty CLAY, trace sand and gravel	588	
13A				19		0.93 B				
	23/24 96%	ss	2-2 2-4 N=4							
13B				18		1.44 BSh	26	Green gray (5GY6/1), very moist, clayey SILT, trace sand	586	
14A			3-1 7-8 N=8	17		0.50 B		Green gray (5GY6/1), moist, very silty CLAY, trace sand and gravel		
14B	24/24 100%	ss		16		5.43 Sh	28	Dark gray (10YR4/1), moist, silty CLAY, trace sand and gravel	584	
	24/24 100%	ss	3-6 8-12 N=14							
15A				12		4.46 Sh	30		582	
16A				17			▼	Dark gray (N4/1), very moist, sandy SILT		
	24/24 100%	ss	5-6 6-7 N=12					Dark gray (N4/1), wet, fine to coarse SAND, trace gravel		
16B				16						
16C				20			32	Dark gray (N4/1), wet, fine to medium SAND	580	
	24/24 100%	ss	3-3 6-9 N=9					Gray (10YR5/1), very moist, clayey SILT, trace sand		
17A				35		1.44 Sh	34		578	
	22/24 92%	ss	3-6 14-17 N=20					Dark gray (N4/1), moist, clayey SILT, trace sand and gravel		
18A				16		3.93 Sh	36		576	
19A	24/24 100%	ss	11-13 14-13 N=27	12		4.46 Sh		Very dark green gray (10Y3/1), moist, silty CLAY, trace sand and gravel		
19B				18		6.21 Sh	38			

End of Boring = 38.0 ft. BGS

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/16/2008
Finish: 1/16/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~BG60~~
Well ID: G60S
Surface Elev: 612.2 ft. MSL
Completion: 38.0 ft. BGS
Station: 15,469.50N
1,050.18E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 30.60 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
1A	19/24 79%	ss	4-6 6-7 N=12	24		
1B				19		4.27 Sh
	21/24 88%	ss	4-4 5-6 N=9			
2A				23		0.92 Sh
3A				23		
	24/24 100%	ss	2-3 4-4 N=7			
3B				25		1.40 Sh
	21/24 88%	ss	3-4 6-5 N=10			
4A				24		
	22/24 92%	ss	2-2 3-4 N=5			
5A				27		0.78 Sh
	19/24 79%	ss	2-2 3-3 N=5			
6A				23		2.13 Sh
	21/24 88%	ss	2-2 2-3 N=4			
7A				27		2.33 Sh
8A	23/24 96%	ss	2-2 3-4 N=5	29		1.71 B
8B				33		1.82
9A				25		1.63 B
	24/24 100%	ss	2-3 3-5 N=6			
9B				23		1.67
9C				22		1.67
10A				27		0.97 B
	23/24 96%	ss	1-3 3-4 N=6			
10B				23		0.74

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark yellow brown (10YR3/4), slightly moist, silty CLAY, trace sand	612
	Light gray (10YR7/2) with 40% brown yellow (10YR6/8) mottles, moist, silty CLAY, trace sand	
2	Brown yellow (10YR6/8) with 40% light gray (10YR7/2) mottles, moist, clayey SILT, trace sand	610
4	Yellow brown (10YR5/8), moist, clayey SILT, trace sand	608
6	Light yellow brown (10YR6/4) with 30% brown yellow (10YR6/8) mottles, moist, clayey SILT, trace sand	606
8	Yellow brown (10YR5/8) with 20% light yellow brown (10YR6/4) mottles, moist, clayey SILT, trace sand	604
10	Light brown gray (10YR6/2) with 10% brown yellow (10YR6/8) mottles, very moist, clayey SILT, trace sand	602
12	Gray brown (10YR5/2) with 30% very dark gray brown (10YR3/2) mottles, moist, clayey SILT, trace sand	600
14	Dark gray (10YR4/1), moist, clayey SILT, trace sand	598
16	Dark gray (10YR4/1) with 10% very dark gray (10YR3/1) mottles, moist, clayey SILT, trace sand	596
	Black (10YR2/1), moist, very silty CLAY, trace sand	
18	Dark gray (10YR4/1), moist, silty CLAY, trace sand	594
	Dark green gray (10Y4/1) with 5% very dark gray (10YR3/1) mottles, moist, silty CLAY, trace sand, trace organics	
20	Dark green gray (10Y4/1) moist, silty CLAY, trace sand and gravel	

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/16/2008
Finish: 1/16/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG60
Well ID: G60S
Surface Elev: 612.2 ft. MSL
Completion: 38.0 ft. BGS
Station: 15,469.50N
1,050.18E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 30.60 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	24/24 100%	ss	1-2 4-5 N=6					Dark green gray (10Y4/1) moist, silty CLAY, trace sand and gravel *[Continued from previous page]*	592	
11A				18		1.32	22			
12A				18		0.47 B		Green gray (5GY5/1), very moist, silty CLAY, trace sand and gravel	590	
	24/24 100%	ss	4-4 4-4 N=8							
12B				20		0.04 B	24	Green gray (5GY5/1) with 5% yellow brown (10YR5/4) mottles, wet, very silty CLAY, trace sand and gravel	588	
13A				19		0.93 B				
	23/24 96%	ss	2-2 2-4 N=4							
13B				18		1.44 BSh	26	Green gray (5GY6/1), very moist, clayey SILT, trace sand	586	
14A			3-1 7-8 N=8	17		0.50 B		Green gray (5GY6/1), moist, very silty CLAY, trace sand and gravel		
14B	24/24 100%	ss		16		5.43 Sh	28	Dark gray (10YR4/1), moist, silty CLAY, trace sand and gravel	584	
	24/24 100%	ss	3-6 8-12 N=14							
15A				12		4.46 Sh	30		582	
16A				17			▼	Dark gray (N4/1), very moist, sandy SILT		
	24/24 100%	ss	5-6 6-7 N=12					Dark gray (N4/1), wet, fine to coarse SAND, trace gravel		
16B				16						
16C				20			32	Dark gray (N4/1), wet, fine to medium SAND	580	
	24/24 100%	ss	3-3 6-9 N=9					Gray (10YR5/1), very moist, clayey SILT, trace sand		
17A				35		1.44 Sh	34		578	
	22/24 92%	ss	3-6 14-17 N=20					Dark gray (N4/1), moist, clayey SILT, trace sand and gravel		
18A				16		3.93 Sh	36		576	
19A	24/24 100%	ss	11-13 14-13 N=27	12		4.46 Sh		Very dark green gray (10Y3/1), moist, silty CLAY, trace sand and gravel		
19B				18		6.21 Sh	38			

End of Boring = 38.0 ft. BGS

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/21/2009
Finish: 1/21/2009
WEATHER: cold, sunny, windy, mid-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~G61a~~
Well ID: G61L
Surface Elev: 620.00 ft. MSL
Completion: 19.90 ft. BGS
Station: 15,640.94N
994.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ = 19.50 - 01/21/09
▽ =

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	Elevation ft. MSL
							2	FILL - Yellowish brown (10YR5/4) with 15% yellowish brown (10YR5/6) mottles, slightly moist, firm, clayey SILT.	618
							4		616
							6	FILL - Yellowish brown (10YR5/4) with 15% yellowish brown (10YR5/6) and 15% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT.	614
							8	Grayish brown (10YR5/2), slightly moist, hard, clayey SILT.	612
								Light brownish gray (10YR6/2) with 35% dark yellowish brown (10YR4/6) mottles, slightly moist, hard, clayey SILT.	
							10		610
							12	Gray (10YR6/1) with 40% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	608
							14		606
							16	Gray (10YR6/1) with 40% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	604
								Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	
							18		602
								Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	
							▼	Very dark gray (10YR3/1), slightly moist, friable, micaceous, clayey SILT.	

End of Boring = 19.9 ft bgs

NOTE(S): See G61S Boring log for sample and testing data.

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/20/2009
Finish: 1/21/2009
WEATHER: cold, sunny, windy, mid-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G61~~
Well ID: G61S
Surface Elev: 620.00 ft. MSL
Completion: 38.00 ft. BGS
Station: 15,644.94N
994.79E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ = 19.50 - 01/21/09
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	24/24 100%	ss	18-12 9-8 N=21					FILL - Yellowish brown (10YR5/4) with 15% yellowish brown (10YR5/6) mottles, slightly moist, firm, clayey SILT.		
2A	24/24 100%	ss	8-5 7-8 N=12	18			2		618	
							4		616	
3A	20/24 83%	ss	2-4 4-6 N=8	21				FILL - Yellowish brown (10YR5/4) with 15% yellowish brown (10YR5/6) and 15% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT.		
4A	24/24 100%	ss	7-9 10-11 N=19	20			6		614	
4B				21				Grayish brown (10YR5/2), slightly moist, hard, clayey SILT.		
							8		612	
5A	19/24 79%	ss	2-3 6-7 N=9	26				Light brownish gray (10YR6/2) with 35% dark yellowish brown (10YR4/6) mottles, slightly moist, hard, clayey SILT.		
							10		610	
6A	20/24 83%	ss	2-3 4-4 N=7	24						
							12		608	
7A	24/24 100%	ss	4-4 5-6 N=9	24				Gray (10YR6/1) with 40% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.		
							14		606	
8A	22/24 92%	ss	3-4 5-5 N=9	25						
							16	Gray (10YR6/1) with 40% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	604	
9A	24/24 100%	ss	3-3 4-6 N=7	24				Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.		
							18		602	
10A	22/24 92%	ss	2-3 3-4 N=6	25				Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.		
10B				28			▼ 20	Very dark gray (10YR3/1), slightly moist, friable,	600	

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/20/2009
Finish: 1/21/2009
WEATHER: cold, sunny, windy, mid-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G61
Well ID: G61S
Surface Elev: 620.00 ft. MSL
Completion: 38.00 ft. BGS
Station: 15,644.94N
994.79E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ = 19.50 - 01/21/09
▽ =

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
11A	19/24 79%	ss	3-4 5-6 N=9	36		
11B				26		
12A	24/24 100%	ss	4-3 6-9 N=9	25		
13A	20/24 83%	ss	woh-3 4-6 N=7	24		
14A	24/24 100%	ss	3-3 5-6 N=8	22		
15A	22/24 92%	ss	woh-3 3-4 N=6	22		
16A	19/24 79%	ss	woh-1 3-3 N=4	17		
17A	24/24 100%	ss	3-4 5-5 N=9	19		
17B				14		
18A	19/24 79%	ss	1-7 7-7 N=14	21		
19A	24/24 100%	ss	7-11 19-32 N=30	12		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	micaceous, clayey SILT.	
22	Dark gray (10YR4/1), moist, soft, clayey SILT.	598
24		596
26	Greenish gray (5GY5/1), moist, soft, silty CLAY with slight trace sand.	594
28		592
30	Greenish gray (5GY5/1), very moist, very soft, sandy CLAY with slight trace gravel.	590
32		588
	Greenish gray (10Y5/1), slightly moist, soft, clayey SILT with trace sand and slight trace gravel.	
34		586
	Medium light gray (N6/1), wet, firm, SILT with slight trace sand and gravel.	
36		584
	Greenish gray (10Y5/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.	
38		582

End of Boring = 38.0 ft bgs

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/20/2009
Finish: 1/21/2009
WEATHER: cold, sunny, windy, mid-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G61~~
Well ID: G61S
Surface Elev: 620.00 ft. MSL
Completion: 38.00 ft. BGS
Station: 15,644.94N
994.79E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ = 19.50 - 01/21/09
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	24/24 100%	ss	18-12 9-8 N=21					FILL - Yellowish brown (10YR5/4) with 15% yellowish brown (10YR5/6) mottles, slightly moist, firm, clayey SILT.		
2A	24/24 100%	ss	8-5 7-8 N=12	18			2		618	
							4		616	
3A	20/24 83%	ss	2-4 4-6 N=8	21				FILL - Yellowish brown (10YR5/4) with 15% yellowish brown (10YR5/6) and 15% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT.		
4A	24/24 100%	ss	7-9 10-11 N=19	20			6		614	
4B				21				Grayish brown (10YR5/2), slightly moist, hard, clayey SILT.		
							8		612	
5A	19/24 79%	ss	2-3 6-7 N=9	26				Light brownish gray (10YR6/2) with 35% dark yellowish brown (10YR4/6) mottles, slightly moist, hard, clayey SILT.		
							10		610	
6A	20/24 83%	ss	2-3 4-4 N=7	24						
							12		608	
7A	24/24 100%	ss	4-4 5-6 N=9	24				Gray (10YR6/1) with 40% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.		
							14		606	
8A	22/24 92%	ss	3-4 5-5 N=9	25						
							16	Gray (10YR6/1) with 40% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	604	
9A	24/24 100%	ss	3-3 4-6 N=7	24				Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.		
							18		602	
10A	22/24 92%	ss	2-3 3-4 N=6	25				Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.		
10B				28			▼ 20	Very dark gray (10YR3/1), slightly moist, friable,	600	

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/20/2009
Finish: 1/21/2009
WEATHER: cold, sunny, windy, mid-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G61
Well ID: G61S
Surface Elev: 620.00 ft. MSL
Completion: 38.00 ft. BGS
Station: 15,644.94N
994.79E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ = 19.50 - 01/21/09
▽ =

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
11A	19/24 79%	ss	3-4 5-6 N=9	36		
11B				26		
12A	24/24 100%	ss	4-3 6-9 N=9	25		
13A	20/24 83%	ss	woh-3 4-6 N=7	24		
14A	24/24 100%	ss	3-3 5-6 N=8	22		
15A	22/24 92%	ss	woh-3 3-4 N=6	22		
16A	19/24 79%	ss	woh-1 3-3 N=4	17		
17A	24/24 100%	ss	3-4 5-5 N=9	19		
17B				14		
18A	19/24 79%	ss	1-7 7-7 N=14	21		
19A	24/24 100%	ss	7-11 19-32 N=30	12		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	micaceous, clayey SILT.	
22	Dark gray (10YR4/1), moist, soft, clayey SILT.	598
24		596
26	Greenish gray (5GY5/1), moist, soft, silty CLAY with slight trace sand.	594
28		592
30	Greenish gray (5GY5/1), very moist, very soft, sandy CLAY with slight trace gravel.	590
32		588
	Greenish gray (10Y5/1), slightly moist, soft, clayey SILT with trace sand and slight trace gravel.	
34		586
	Medium light gray (N6/1), wet, firm, SILT with slight trace sand and gravel.	
36		584
	Greenish gray (10Y5/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.	
38		582

End of Boring = 38.0 ft bgs

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/21/2009
Finish: 1/22/2009
WEATHER: cold, sunny, windy, mid-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~G62~~
Well ID: G62L
Surface Elev: 620.02 ft. MSL
Completion: 38.00 ft. BGS
Station: 15,785.21N
994.71E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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
1A	24/24 100%	SS	13-9 5-5 N=14	25.8		
2A	24/24 100%	SS	6-8 8-10 N=16	17.4		
3A	22/24 92%	SS	3-7 7-7 N=14	17.8		
4A	24/24 100%	SS	11-14 13-11 N=27	17.1		
5A	24/24 100%	SS	3-4 6-9 N=10	15.8		
6A	24/24 100%	SS	3-6 8-11 N=14	15.9		
7A	24/24 100%	SS	11-18 22-20 N=40	16.2		
8A	24/24 100%	SS	2-8 19-12 N=27	14.8		
9A	24/24 100%	SS	12-13 18-15 N=31	23.1		
10A	22/24 92%	SS	2-2 4-4 N=6	23.5		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	FILL - Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT.	
2		618
	FILL - Yellowish brown (10YR5/4), slightly moist, firm, clayey SILT with slight trace sand and gravel.	
4		616
6		614
	FILL - Yellowish brown (10YR5/4) with 5% medium dark gray (N4/1) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel.	
8		612
10		610
	FILL - Yellowish brown (10YR5/4) with 5% medium dark gray (N4/1) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel and slight trace roots.	
12		608
	FILL - Yellowish brown (10YR5/4) with 5% medium dark gray (N4/1) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel.	
14		606
	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, slightly moist, hard, clayey SILT.	
16		604
18		602
	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	
20		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/21/2009
Finish: 1/22/2009
WEATHER: cold, sunny, windy, mid-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G62
Well ID: G62L
Surface Elev: 620.02 ft. MSL
Completion: 38.00 ft. BGS
Station: 15,785.21N
994.71E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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
11A	22/24 92%	SS	1-2 4-4 N=6	20.6		
12A	24/24 100%	SS	2-3 3-4 N=6	23.5		
12B				21.8		
13A	22/24 92%	SS	woh-2 3-3 N=5	20.9		
14A	24/24 100%	SS	4-5 5-8 N=10	20.3		
14B				22.0		
15A	24/24 100%	SS	1-2 3-3 N=5	18.7		
16A	24/24 100%	SS	woh-1 2-4 N=3	18.2		
17A	17/24 71%	SS	4-3 5-7 N=8	19.4		
18A	22/24 92%	SS	1-4 4-6 N=8	14.7		
19A	24/24 100%	SS	6-13 13-13 N=26	13.2		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
22	Gray (10YR5/1) with 10% dark gray (10YR4/1) mottles, moist, soft, clayey SILT.	598
24	Dark reddish gray (5YR4/2) with 5% dark reddish brown (5YR3/4) mottles, moist, soft, silty CLAY.	596
26	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	594
28	Strong brown (7.5YR5/6), moist, hard, silty CLAY with trace sand and slight trace gravel.	592
30	Greenish gray (5GY5/1) with 10% dark yellowish brown (10YR4/6) and 5% olive gray (5Y4/2) mottles, moist, soft, silty CLAY with sand and trace gravel.	590
32	Greenish gray (5GY5/1) with 5% olive gray (5Y4/2) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	588
34		586
36	Dark gray (N4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	584
38		

Borehole Detail

Remarks

End of Boring = 38.0 ft bgs

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/2/2009
Finish: 2/2/2009
WEATHER: cold, sunny, windy, hi-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~G63a~~
Well ID: G63L
Surface Elev: 620.12 ft. MSL
Completion: 28.36 ft. BGS
Station: 15,928.37N
998.01E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
							0	FILL - Yellowish brown (10YR5/4) with 15% yellowish brown (10YR4/6) and 10% gray (10YR6/1) mottles, slightly moist, soft, clayey SILT with slight trace sand and gravel.	620
							2		618
							4		616
							6		614
							7	FILL - Brown (10YR4/3) with 15% gray (10YR5/1) mottles, moist, firm, clayey SILT with trace sand and slight trace gravel.	
							8		612
							9	FILL - Brown (10YR4/3) with 15% gray (10YR5/1) mottles, moist, soft, friable, clayey SILT with trace sand and slight trace gravel.	
							10		610
							11	Yellowish brown (10YR5/4), slightly moist, firm, clayey SILT with slight trace sand and gravel, trace roots.	
							12		608
							14	Gray (10YR5/1) with 10% yellowish brown (10YR5/4) mottles, moist, soft, clayey SILT with trace sand and slight trace gravel.	606
							15	Yellowish brown (10YR5/4) with 5% gray (10YR6/1) mottles, moist, soft, clayey SILT with trace sand and slight trace gravel.	
							16		604
							17	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT.	
							18		602
							19	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	
							20		

Borehole Detail

NOTE(S): See G63S Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/2/2009
Finish: 2/2/2009
WEATHER: cold, sunny, windy, hi-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G63a
Well ID: G63L
Surface Elev: 620.12 ft. MSL
Completion: 28.36 ft. BGS
Station: 15,928.37N
998.01E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
								Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand.	600
							22		598
							24	Gray (10YR5/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.	596
							26		594
							28		592

End of Boring = 28.36 ft bgs

NOTE(S): See G63S Boring log for sample and testing data.

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/2/2009
Finish: 2/2/2009
WEATHER: cold, sunny, windy, hi-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G63~~
Well ID: G63S
Surface Elev: 620.12 ft. MSL
Completion: 40.00 ft. BGS
Station: 15,924.41N
998.26E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 36.60 - 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	24/24 100%	ss	3-3 3-6 N=6	21		
2A	24/24 100%	ss	2-3 4-5 N=7	22		
3A	22/24 92%	ss	3-3 4-6 N=7	18		
4A	24/24 100%	ss	9-9 10-11 N=19	17		
5A	24/24 100%	ss	1-3 4-5 N=7	13		
6A	23/24 96%	ss	1-3 3-6 N=6	15		
7A	24/24 100%	ss	8-9 12-12 N=21	15		
8A	23/24 96%	ss	1-2 5-6 N=7	13		
8B				18		
9A	24/24 100%	ss	7-10 14-13 N=24	19		
9B				19		
10A	20/24 83%	ss	1-3 3-3 N=6	26		
11A	22/24		1-4	21		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
0–8	FILL - Yellowish brown (10YR5/4) with 15% yellowish brown (10YR4/6) and 10% gray (10YR6/1) mottles, slightly moist, soft, clayey SILT with slight trace sand and gravel.	620 – 612
8	FILL - Brown (10YR4/3) with 15% gray (10YR5/1) mottles, moist, firm, clayey SILT with trace sand and slight trace gravel.	612
8–12	FILL - Brown (10YR4/3) with 15% gray (10YR5/1) mottles, moist, soft, friable, clayey SILT with trace sand and slight trace gravel.	612 – 608
12–14	Yellowish brown (10YR5/4), slightly moist, firm, clayey SILT with slight trace sand and gravel, trace roots.	608 – 606
14	Gray (10YR5/1) with 10% yellowish brown (10YR5/4) mottles, moist, soft, clayey SILT with trace sand and slight trace gravel.	606
14–18	Yellowish brown (10YR5/4) with 5% gray (10YR6/1) mottles, moist, soft, clayey SILT with trace sand and slight trace gravel.	606 – 602
18	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT.	602
18–20	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	602 – 600
20	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand.	600

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/2/2009
Finish: 2/2/2009
WEATHER: cold, sunny, windy, hi-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G63
Well ID: G63S
Surface Elev: 620.12 ft. MSL
Completion: 40.00 ft. BGS
Station: 15,924.41N
998.26E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 36.60 - 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
	92%	ss	4-3 N=8			
12A	24/24 100%	ss	4-5 5-6 N=10	22		
13A	19/24 79%	ss	1-2 4-5 N=6	21		
14A	24/24 100%	ss	5-7 7-7 N=14	20		
15A	24/24 100%	ss	1-2 3-4 N=5	20		
16A	20/24 83%	ss	woh-1 2-3 N=3	22		
17A 17B	20/24 83%	ss	3-4 6-6 N=10	17 16		
18A	23/24 96%	ss	3-8 17-15 N=25	11		
19A 19B	23/24 96%	ss	10-18 25-9 N=43	11 26		
20A	16/24 67%	ss	9-10 13-15 N=23	19		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand. *[Continued from previous page]*	
22		598
24		596
26	Gray (10YR5/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.	594
28		592
30		590
32	Yellowish brown (10YR5/4) with 15% gray (10YR5/1) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	588
	Greenish gray (5GY5/1), moist, firm, silty CLAY with trace sand and slight trace gravel.	
34	Dark gray (N4/1), slightly moist, hard, clayey SILT with trace sand and gravel.	586
36		584
	Dark gray (N4/1), wet, medium dense, silty, fine- to coarse-grained SAND with slight trace gravel.	
38	Dark gray (N4/1), very moist, firm, SILT, trace organic material.	582
	Dark gray (N4/1), slightly moist, hard, clayey SILT with slight trace sand and gravel.	
40		

End of Boring = 40.0 ft bgs

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/2/2009
Finish: 2/2/2009
WEATHER: cold, sunny, windy, hi-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G63~~
Well ID: G63S
Surface Elev: 620.12 ft. MSL
Completion: 40.00 ft. BGS
Station: 15,924.41N
998.26E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 36.60 - 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	24/24 100%	ss	3-3 3-6 N=6	21		
2A	24/24 100%	ss	2-3 4-5 N=7	22		
3A	22/24 92%	ss	3-3 4-6 N=7	18		
4A	24/24 100%	ss	9-9 10-11 N=19	17		
5A	24/24 100%	ss	1-3 4-5 N=7	13		
6A	23/24 96%	ss	1-3 3-6 N=6	15		
7A	24/24 100%	ss	8-9 12-12 N=21	15		
8A	23/24 96%	ss	1-2 5-6 N=7	13		
8B				18		
9A	24/24 100%	ss	7-10 14-13 N=24	19		
9B				19		
10A	20/24 83%	ss	1-3 3-3 N=6	26		
11A	22/24		1-4	21		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
0–8	FILL - Yellowish brown (10YR5/4) with 15% yellowish brown (10YR4/6) and 10% gray (10YR6/1) mottles, slightly moist, soft, clayey SILT with slight trace sand and gravel.	620 – 612
8	FILL - Brown (10YR4/3) with 15% gray (10YR5/1) mottles, moist, firm, clayey SILT with trace sand and slight trace gravel.	612
8–12	FILL - Brown (10YR4/3) with 15% gray (10YR5/1) mottles, moist, soft, friable, clayey SILT with trace sand and slight trace gravel.	612 – 608
12–14	Yellowish brown (10YR5/4), slightly moist, firm, clayey SILT with slight trace sand and gravel, trace roots.	608 – 606
14	Gray (10YR5/1) with 10% yellowish brown (10YR5/4) mottles, moist, soft, clayey SILT with trace sand and slight trace gravel.	606
14–18	Yellowish brown (10YR5/4) with 5% gray (10YR6/1) mottles, moist, soft, clayey SILT with trace sand and slight trace gravel.	606 – 602
18	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT.	602
18–20	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	602 – 600
20	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand.	600

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/2/2009
Finish: 2/2/2009
WEATHER: cold, sunny, windy, hi-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G63
Well ID: G63S
Surface Elev: 620.12 ft. MSL
Completion: 40.00 ft. BGS
Station: 15,924.41N
998.26E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 36.60 - 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
	92%	ss	4-3 N=8			
12A	24/24 100%	ss	4-5 5-6 N=10	22		
13A	19/24 79%	ss	1-2 4-5 N=6	21		
14A	24/24 100%	ss	5-7 7-7 N=14	20		
15A	24/24 100%	ss	1-2 3-4 N=5	20		
16A	20/24 83%	ss	woh-1 2-3 N=3	22		
17A 17B	20/24 83%	ss	3-4 6-6 N=10	17 16		
18A	23/24 96%	ss	3-8 17-15 N=25	11		
19A 19B	23/24 96%	ss	10-18 25-9 N=43	11 26		
20A	16/24 67%	ss	9-10 13-15 N=23	19		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand. *[Continued from previous page]*	
22		598
24		596
26	Gray (10YR5/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.	594
28		592
30		590
32	Yellowish brown (10YR5/4) with 15% gray (10YR5/1) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	588
	Greenish gray (5GY5/1), moist, firm, silty CLAY with trace sand and slight trace gravel.	
34	Dark gray (N4/1), slightly moist, hard, clayey SILT with trace sand and gravel.	586
36		584
	Dark gray (N4/1), wet, medium dense, silty, fine- to coarse-grained SAND with slight trace gravel.	
38	Dark gray (N4/1), very moist, firm, SILT, trace organic material.	582
	Dark gray (N4/1), slightly moist, hard, clayey SILT with slight trace sand and gravel.	
40		

End of Boring = 40.0 ft bgs

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/22/2009
Finish: 1/22/2009
WEATHER: cold, sunny, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~G64a~~
Well ID: G64L
Surface Elev: 620.02 ft. MSL
Completion: 27.95 ft. BGS
Station: 16,069.29N
995.70E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
							2	FILL - Yellowish brown (10YR5/4), slightly moist, firm, clayey SILT with slight trace sand and gravel.	618
							4		616
							6		614
							8	Gray (10YR5/1) mottles, moist, firm, clayey SILT with trace sand and slight trace gravel.	612
							10	Yellowish brown (10YR5/4) with 10% gray (10YR6/1), moist, firm, clayey SILT with trace sand and slight trace gravel.	610
							12	Yellowish brown (10YR5/4) with 10% gray (10YR6/1) and 5% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with trace sand and slight trace gravel.	608
							14	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	606
							16		604
							18	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	602
							20	Dark gray (10YR4/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	

Borehole Detail

NOTE(S): See G64S Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/22/2009
Finish: 1/22/2009
WEATHER: cold, sunny, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G64a
Well ID: G64L
Surface Elev: 620.02 ft. MSL
Completion: 27.95 ft. BGS
Station: 16,069.29N
995.70E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
								Dark gray (10YR4/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT. *[Continued from previous page]*	
							22	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY.	598
							24	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.	596
							26	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, silty CLAY with sand and slight trace gravel.	594

End of Boring = 27.95 ft bgs

Borehole Detail

Remarks

NOTE(S): See G64S Boring log for sample and testing data.

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/22/2009
Finish: 1/22/2009
WEATHER: cold, sunny, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G64~~
Well ID: G64S
Surface Elev: 620.02 ft. MSL
Completion: 40.00 ft. BGS
Station: 16,064.64N
994.93E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 36.60 - 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	24/24 100%	ss	24-14 10-6 N=24	24		
2A	24/24 100%	ss	4-6 8-9 N=14	17		
3A	23/24 96%	ss	5-7 5-7 N=12	15		
4A	22/24 92%	ss	7-8 10-13 N=18	13		
5A	24/24 100%	ss	3-5 7-7 N=12	19		
6A	22/24 92%	ss	3-3 5-8 N=8	24		
7A 7B	22/24 92%	ss	8-8 6-7 N=14	25 25		
8A	22/24 92%	ss	1-5 4-5 N=9	22		
9A	24/24 100%	ss	8-5 4-5 N=9	25		
10A	20/24 83%	ss	1-1 3-4 N=4	24		
11A	22/24		0-2	24		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
2	FILL - Yellowish brown (10YR5/4), slightly moist, firm, clayey SILT with slight trace sand and gravel.	618
4		616
6		614
8	Gray (10YR5/1) mottles, moist, firm, clayey SILT with trace sand and slight trace gravel.	612
10	Yellowish brown (10YR5/4) with 10% gray (10YR6/1), moist, firm, clayey SILT with trace sand and slight trace gravel.	610
12	Yellowish brown (10YR5/4) with 10% gray (10YR6/1) and 5% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with trace sand and slight trace gravel.	608
14	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	606
16		604
18	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	602
20	Dark gray (10YR4/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	600

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/22/2009
Finish: 1/22/2009
WEATHER: cold, sunny, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G64
Well ID: G64S
Surface Elev: 620.02 ft. MSL
Completion: 40.00 ft. BGS
Station: 16,064.64N
994.93E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 36.60 - 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
11B	92%	ss	4-4 N=6	25		
12A	24/24 100%	ss	5-6 6-6 N=12	21		
13A	22/24 92%	ss	1-1 4-7 N=5	23		
14A	24/24 100%	ss	5-7 8-6 N=15	20		
15A	24/24 100%	ss	1-2 2-3 N=4	18		
16A	17/24 71%	ss	woh-2 4-6 N=6	17		
17A	24/24 100%	ss	6-8 12-13 N=20	17		
17B				13		
18A	19/24 79%	ss	7-8 9-13 N=17	14		
19A	24/24 100%	ss	7-10 12-13 N=22	13		
19B				22		
19C				33		
20A	20/24 83%	ss	3-6 10-14 N=16	14		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
22	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY.	598
24	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.	596
26	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, silty CLAY with sand and slight trace gravel.	594
28	Greenish gray (10GY6/1) with 10% olive (5Y5/3) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	592
30	Greenish gray (10Y5/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	590
32	Gray (N5/1), wet, medium dense, silty, very fine- to fine-grained SAND.	588
34	Gray (N5/1), very moist, firm, clayey SILT.	586
36	Gray (N5/1), wet, dense, silty, fine- to coarse-grained SAND with slight trace gravel.	584
38	Greenish gray (10Y5/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	582
40		

End of Boring = 40.0 ft bgs

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/22/2009
Finish: 1/22/2009
WEATHER: cold, sunny, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G64~~
Well ID: G64S
Surface Elev: 620.02 ft. MSL
Completion: 40.00 ft. BGS
Station: 16,064.64N
994.93E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 36.60 - 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	24/24 100%	ss	24-14 10-6 N=24	24		
2A	24/24 100%	ss	4-6 8-9 N=14	17		
3A	23/24 96%	ss	5-7 5-7 N=12	15		
4A	22/24 92%	ss	7-8 10-13 N=18	13		
5A	24/24 100%	ss	3-5 7-7 N=12	19		
6A	22/24 92%	ss	3-3 5-8 N=8	24		
7A 7B	22/24 92%	ss	8-8 6-7 N=14	25 25		
8A	22/24 92%	ss	1-5 4-5 N=9	22		
9A	24/24 100%	ss	8-5 4-5 N=9	25		
10A	20/24 83%	ss	1-1 3-4 N=4	24		
11A	22/24		0-2	24		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
2	FILL - Yellowish brown (10YR5/4), slightly moist, firm, clayey SILT with slight trace sand and gravel.	618
4		616
6		614
8	Gray (10YR5/1) mottles, moist, firm, clayey SILT with trace sand and slight trace gravel.	612
10	Yellowish brown (10YR5/4) with 10% gray (10YR6/1), moist, firm, clayey SILT with trace sand and slight trace gravel.	610
12	Yellowish brown (10YR5/4) with 10% gray (10YR6/1) and 5% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with trace sand and slight trace gravel.	608
14	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	606
16		604
18	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	602
20	Dark gray (10YR4/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	600

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/22/2009
Finish: 1/22/2009
WEATHER: cold, sunny, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G64
Well ID: G64S
Surface Elev: 620.02 ft. MSL
Completion: 40.00 ft. BGS
Station: 16,064.64N
994.93E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 36.60 - 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
11B	92%	ss	4-4 N=6	25		
12A	24/24 100%	ss	5-6 6-6 N=12	21		
13A	22/24 92%	ss	1-1 4-7 N=5	23		
14A	24/24 100%	ss	5-7 8-6 N=15	20		
15A	24/24 100%	ss	1-2 2-3 N=4	18		
16A	17/24 71%	ss	woh-2 4-6 N=6	17		
17A	24/24 100%	ss	6-8 12-13 N=20	17		
17B				13		
18A	19/24 79%	ss	7-8 9-13 N=17	14		
19A	24/24 100%	ss	7-10 12-13 N=22	13		
19B				22		
19C				33		
20A	20/24 83%	ss	3-6 10-14 N=16	14		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
22	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY.	598
24	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.	596
26	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, silty CLAY with sand and slight trace gravel.	594
28	Greenish gray (10GY6/1) with 10% olive (5Y5/3) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	592
30	Greenish gray (10Y5/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	590
32	Gray (N5/1), wet, medium dense, silty, very fine- to fine-grained SAND.	588
34	Gray (N5/1), very moist, firm, clayey SILT.	586
36	Gray (N5/1), wet, dense, silty, fine- to coarse-grained SAND with slight trace gravel.	584
38	Greenish gray (10Y5/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	582
40		

End of Boring = 40.0 ft bgs

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/15/2008
Finish: 1/15/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger - blind drilled within 10 ft of BG65
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~BG65b~~
Well ID: G65L
Surface Elev: 610.1 ft. MSL
Completion: 22.5 ft. BGS
Station: 13,986.12N
919.86E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.80 - during drilling
▼ = 22.31 - 1/30/2008
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Elevation ft. MSL
								Dark yellow brown (10YR4/4), slightly moist, silty CLAY, trace sand	
								Dark yellow brown (10YR4/6), moist, silty CLAY, trace sand	
							2		608
								Yellow brown (10YR5/6) with 30% yellow brown (10YR5/4) mottles, moist, silty CLAY, trace sand	
							4		606
								Brown yellow (10YR6/6), moist, clayey SILT, trace sand	
							6		604
							8		602
								Light gray (10YR7/2) with 5% brown yellow (10YR6/8) mottles, moist, sandy SILT	
							10		600
							12		598
							14		596
								Brown (10YR5/3) with 40% brown yellow (10YR5/4) mottles, moist, clayey SILT, trace sand	
							16		594
								Yellow brown (10YR5/8) with 35% brown (10YR5/3) and 10% very dark brown (10YR2/1) mottles, moist, very silty CLAY, trace sand	
							18		592
								Black (10YR2/1) with 40% brown yellow (10YR6/6) and 5% gray brown (10YR5/2) mottles, moist, silty CLAY, trace sand and gravel	
								Dark yellow brown (10YR4/6) with 30% brown yellow (10YR6/6) and 5% black (10YR2/1) mottles, moist, sandy CLAY, trace gravel	
							20		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/15/2008
Finish: 1/15/2008
WEATHER: Overcast, windy, cold

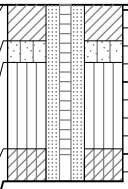
CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger - blind drilled within 10 ft of BG65
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG65b
Well ID: G65L
Surface Elev: 610.1 ft. MSL
Completion: 22.5 ft. BGS
Station: 13,986.12N
919.86E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.80 - during drilling
▼ = 22.31 - 1/30/2008
▽ =

SAMPLE			TESTING							
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
								Brown (10YR5/3) with 45% dark yellow brown (10YR4/6) mottles, moist, sandy CLAY, trace gravel			
								Gray brown (10YR5/2) with 30% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand and gravel			
								Dark yellow (10YR4/6) with 10% brown (10YR3/4) mottles, moist, silty fine to medium SAND			
							▼ 22	Yellow brown (10YR5/6) with30% light gray (10YR7/2) mottles, moist, clayey SILT, trace sand and gravel		588	
								Yellow brown (10YR5/8) with 20% gray (10YR6/1) and 15% dark brown (10YR3/3) mottles, very moist, very silty CLAY, trace sand and gravel			



End of Boring = 22.45 ft. BGS

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/14/2008
Finish: 1/14/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG65
Well ID: hole abandoned
Surface Elev: 609.7 ft. MSL
Completion: 44.0 ft. BGS
Station: 13,982.80N 909.90E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.80 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
1A	24/24 100%	ss	4-4 6-6 N=10	23		
1B				22		2.72 BSh
	24/24 100%	ss	6-6 8-10 N=14			
2A				19		4.15 Sh
	20/24 83%	ss	4-4 7-7 N=11			
3A				17		2.62 Sh
	22/24 92%	ss	4-8 6-8 N=14			
4A						
4B				11		
	17/24 71%	ss	3-5 6-8 N=11			
5A				9		
	24/24 100%	ss	3-5 7-6 N=12			
6A				11		
7A				13		
	24/24 100%	ss	6-9 9-10 N=18			
7B				17		
	17/24 71%	ss	2-3 5-6 N=8			
8A				18		
9A	21/24 88%	ss	5-8 10-10 N=18	17		
9B				17		
10A				20		
10B	19/24 79%	ss	1-3 4-7 N=7	18		
10C				22		1.44

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark yellow brown (10YR4/4), slightly moist, silty CLAY, trace sand	
	Dark yellow brown (10YR4/6), moist, silty CLAY, trace sand	608
2	Yellow brown (10YR5/6) with 30% yellow brown (10YR5/4) mottles, moist, silty CLAY, trace sand	606
4	Brown yellow (10YR6/6), moist, clayey SILT, trace sand	604
6	Light gray (10YR7/2) with 5% brown yellow (10YR6/8) mottles, moist, sandy SILT	602
8		600
10		598
12	Brown (10YR5/3) with 40% brown yellow (10YR5/4) mottles, moist, clayey SILT, trace sand	596
14		594
16	Yellow brown (10YR5/8) with 35% brown (10YR5/3) and 10% very dark brown (10YR2/1) mottles, moist, very silty CLAY, trace sand	592
18	Black (10YR2/1) with 40% brown yellow (10YR6/6) and 5% gray brown (10YR5/2) mottles, moist, silty CLAY, trace sand and gravel	
	Dark yellow brown (10YR4/6) with 30% brown yellow (10YR6/6) and 5% black (10YR2/1) mottles, moist, sandy CLAY, trace gravel	590
20		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/14/2008
Finish: 1/14/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG65
Well ID: hole abandoned
Surface Elev: 609.7 ft. MSL
Completion: 44.0 ft. BGS
Station: 13,982.80N 909.90E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.80 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
11A				21		Sh
						1.16
	20/24 83%	ss	4-4 3-3 N=7			BSh
11B						
11C				16		
12A	19/24 79%	ss	3-5 4-43 N=9	26		
12B				26		
	24/24 100%	ss	1-3 5-10 N=8			
13A				19		
14A	20/24 83%	ss	10-8 7-6 N=15	19		
14B				14		
14C				22		1.09
15A				25		B
15B	24/24 100%	ss	7-12 11-17 N=23	21		
15C				13		
15D				11		
16A				13		
	20/24 83%	ss	2-10 9-14 N=19			
16B				12		5.82
						BSh
	24/24 100%	ss	11-15 16-20 N=31			
17A				12		6.40
						Bh
	24/24 100%	ss	7-16 24-35 N=40			
18A				11		7.62
						Sh
	24/24 100%	ss	43-72 75-97 N=147			
19A				10		
19B				11		
	22/24 92%	ss	11-27 25-25 N=52			
20A				13		5.24

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Brown (10YR5/3) with 45% dark yellow brown (10YR4/6) mottles, moist, sandy CLAY, trace gravel	
	Gray brown (10YR5/2) with 30% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand and gravel	
	Dark yellow (10YR4/6) with 10% brown (10YR3/4) mottles, moist, silty fine to medium SAND	588
22	Yellow brown (10YR5/6) with30% light gray (10YR7/2) mottles, moist, clayey SILT, trace sand and gravel	
	Yellow brown (10YR5/8) with 20% gray (10YR6/1) and 15% dark brown (10YR3/3) mottles, very moist, very silty CLAY, trace sand and gravel	586
24	Yellow brown (10YR5/6) with 50% light brown gray (10YR6/2) mottles, moist, very silty CLAY, trace sand and gravel	
		584
26	Gray (10YR6/1) with 5% yellow brown (10YR5/4) mottles, moist, clayey SILT, trace sand and gravel	
▼	Gray (10YR6/1) with 25% yellow brown (10YR5/4) mottles, wet, sandy SILT, trace gravel	
	Gray brown (10YR5/2), very moist, clayey SILT, trace sand	582
28	Yellow brown (10YR5/8), very moist to wet, fine to coarse SAND, trace gravel	
	Dark yellow brown (10YR4/6) with 40% yellow brown (10YR5/6) mottles, wet, sandy SILT, trace gravel	
	Gray brown (10YR5/2) with 40% yellow brown (10YR5/6) mottles, moist, very silty CLAY, trace sand and gravel	580
30	Dark yellow brown (10YR4/6) with 15% pale brown (10YR6/3) mottles, moist, very silty CLAY, little sand, trace gravel	
	Green gray (10Y5/1), moist, silty CLAY, trace sand and gravel	578
32		
		576
34	Gray (N5/1) with 30% gray brown (10YR5/2) mottles, moist, silty CLAY, little sand and gravel	
		574
36		
		572
38	Gray (N5), wet, fine to medium SAND	
	Gray (N5) with 10% gray brown (10YR5/2) mottles, moist, silty CLAY, trace sand and gravel	
		570
40		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/14/2008
Finish: 1/14/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG65
Well ID: hole abandoned
Surface Elev: 609.7 ft. MSL
Completion: 44.0 ft. BGS
Station: 13,982.80N
909.90E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.80 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*
						Sh
	24/24 *100%*	ss	*4-14 17-24* N=31			
21A				10		10.86 *BSh*
21B				11		6.98 *Sh*
22A				24		2.33 *Sh*
22B	24/24 *100%*	ss	*27-41 77-109* N=118	18		
22C				14		
22D				11		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	Gray (N5) with 10% gray brown (10YR5/2) mottles, moist, silty CLAY, trace sand and gravel *[Continued from previous page]*		
42	Very dark green (10Y3/1) with 25% gray brown yellow (10YR6/8) mottles, moist, silty CLAY, trace sand and gravel	568	
	Green (5GY) with 10% gray brown (10YR4/3) mottles, moist, silty CLAY, trace sand and gravel		
	Dark green gray (10GY4/1), moist, silty CLAY, trace sand		
	Green (10Y5/1), wet, fine to medium SAND	566	
44	CHERT		

End of Boring = 44.0 ft. BGS

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/15/2008
Finish: 1/15/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger - blind drilled within 5 ft of BG65
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~BG65a~~
Well ID: G65S
Surface Elev: 609.9 ft. MSL
Completion: 32.7 ft. BGS
Station: 13,985.08N
914.07E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.80 - during drilling
▼ = 25.28 - 1/30/2008
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Elevation ft. MSL
								Dark yellow brown (10YR4/4), slightly moist, silty CLAY, trace sand	
								Dark yellow brown (10YR4/6), moist, silty CLAY, trace sand	
							2		608
								Yellow brown (10YR5/6) with 30% yellow brown (10YR5/4) mottles, moist, silty CLAY, trace sand	
							4		606
								Brown yellow (10YR6/6), moist, clayey SILT, trace sand	
							6		604
							8		602
								Light gray (10YR7/2) with 5% brown yellow (10YR6/8) mottles, moist, sandy SILT	
							10		600
							12		598
							14		596
								Brown (10YR5/3) with 40% brown yellow (10YR5/4) mottles, moist, clayey SILT, trace sand	
							16		594
								Yellow brown (10YR5/8) with 35% brown (10YR5/3) and 10% very dark brown (10YR2/1) mottles, moist, very silty CLAY, trace sand	
							18		592
								Black (10YR2/1) with 40% brown yellow (10YR6/6) and 5% gray brown (10YR5/2) mottles, moist, silty CLAY, trace sand and gravel	
								Dark yellow brown (10YR4/6) with 30% brown yellow (10YR6/6) and 5% black (10YR2/1) mottles, moist, sandy CLAY, trace gravel	
							20		590

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/15/2008
Finish: 1/15/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger - blind drilled within 5 ft of BG65
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG65a
Well ID: G65S
Surface Elev: 609.9 ft. MSL
Completion: 32.7 ft. BGS
Station: 13,985.08N
914.07E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.80 - during drilling
▼ = 25.28 - 1/30/2008
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Elevation ft. MSL
								Brown (10YR5/3) with 45% dark yellow brown (10YR4/6) mottles, moist, sandy CLAY, trace gravel	
								Gray brown (10YR5/2) with 30% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand and gravel	
								Dark yellow (10YR4/6) with 10% brown (10YR3/4) mottles, moist, silty fine to medium SAND	
							22	Yellow brown (10YR5/6) with30% light gray (10YR7/2) mottles, moist, clayey SILT, trace sand and gravel	588
								Yellow brown (10YR5/8) with 20% gray (10YR6/1) and 15% dark brown (10YR3/3) mottles, very moist, very silty CLAY, trace sand and gravel	
							24	Yellow brown (10YR5/6) with 50% light brown gray (10YR6/2) mottles, moist, very silty CLAY, trace sand and gravel	586
							26	Gray (10YR6/1) with 5% yellow brown (10YR5/4) mottles, moist, clayey SILT, trace sand and gravel	584
								Gray (10YR6/1) with 25% yellow brown (10YR5/4) mottles, wet, sandy SILT, trace gravel	
							28	Gray brown (10YR5/2), very moist, clayey SILT, trace sand	582
								Yellow brown (10YR5/8), very moist to wet, fine to coarse SAND, trace gravel	
								Dark yellow brown (10YR4/6) with 40% yellow brown (10YR5/6) mottles, wet, sandy SILT, trace gravel	
							30	Gray brown (10YR5/2) with 40% yellow brown (10YR5/6) mottles, moist, very silty CLAY, trace sand and gravel	580
								Dark yellow brown (10YR4/6) with 15% pale brown (10YR6/3) mottles, moist, very silty CLAY, little sand, trace gravel	
							32	Green gray (10Y5/1), moist, silty CLAY, trace sand and gravel	578
								Gray (N5/1) with 30% gray brown (10YR5/2) mottles, moist, silty CLAY, little sand and gravel	

End of Boring = 32.70 ft. BGS

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/14/2008
Finish: 1/14/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG65
Well ID: hole abandoned
Surface Elev: 609.7 ft. MSL
Completion: 44.0 ft. BGS
Station: 13,982.80N 909.90E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.80 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
1A	24/24 100%	ss	4-4 6-6 N=10	23		
1B				22		2.72 BSh
	24/24 100%	ss	6-6 8-10 N=14			
2A				19		4.15 Sh
	20/24 83%	ss	4-4 7-7 N=11			
3A				17		2.62 Sh
	22/24 92%	ss	4-8 6-8 N=14			
4A						
4B				11		
	17/24 71%	ss	3-5 6-8 N=11			
5A				9		
	24/24 100%	ss	3-5 7-6 N=12			
6A				11		
7A				13		
	24/24 100%	ss	6-9 9-10 N=18			
7B				17		
	17/24 71%	ss	2-3 5-6 N=8			
8A				18		
9A	21/24 88%	ss	5-8 10-10 N=18	17		
9B				17		
10A				20		
10B	19/24 79%	ss	1-3 4-7 N=7	18		
10C				22		1.44

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark yellow brown (10YR4/4), slightly moist, silty CLAY, trace sand	
	Dark yellow brown (10YR4/6), moist, silty CLAY, trace sand	608
2	Yellow brown (10YR5/6) with 30% yellow brown (10YR5/4) mottles, moist, silty CLAY, trace sand	606
4	Brown yellow (10YR6/6), moist, clayey SILT, trace sand	604
6	Light gray (10YR7/2) with 5% brown yellow (10YR6/8) mottles, moist, sandy SILT	602
8		600
10		598
12	Brown (10YR5/3) with 40% brown yellow (10YR5/4) mottles, moist, clayey SILT, trace sand	596
14		594
16	Yellow brown (10YR5/8) with 35% brown (10YR5/3) and 10% very dark brown (10YR2/1) mottles, moist, very silty CLAY, trace sand	592
18	Black (10YR2/1) with 40% brown yellow (10YR6/6) and 5% gray brown (10YR5/2) mottles, moist, silty CLAY, trace sand and gravel	
	Dark yellow brown (10YR4/6) with 30% brown yellow (10YR6/6) and 5% black (10YR2/1) mottles, moist, sandy CLAY, trace gravel	590
20		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/14/2008
Finish: 1/14/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG65
Well ID: hole abandoned
Surface Elev: 609.7 ft. MSL
Completion: 44.0 ft. BGS
Station: 13,982.80N 909.90E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.80 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
11A				21		Sh
						1.16
	20/24 83%	ss	4-4 3-3 N=7			BSh
11B						
11C				16		
12A	19/24 79%	ss	3-5 4-43 N=9	26		
12B				26		
	24/24 100%	ss	1-3 5-10 N=8			
13A				19		
14A	20/24 83%	ss	10-8 7-6 N=15	19		
14B				14		
14C				22		1.09
15A				25		B
15B	24/24 100%	ss	7-12 11-17 N=23	21		
15C				13		
15D				11		
16A				13		
	20/24 83%	ss	2-10 9-14 N=19			
16B				12		5.82
						BSh
	24/24 100%	ss	11-15 16-20 N=31			
17A				12		6.40
						Bh
	24/24 100%	ss	7-16 24-35 N=40			
18A				11		7.62
						Sh
	24/24 100%	ss	43-72 75-97 N=147			
19A				10		
19B				11		
	22/24 92%	ss	11-27 25-25 N=52			
20A				13		5.24

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Brown (10YR5/3) with 45% dark yellow brown (10YR4/6) mottles, moist, sandy CLAY, trace gravel	
	Gray brown (10YR5/2) with 30% yellow brown (10YR5/6) mottles, moist, silty CLAY, trace sand and gravel	
	Dark yellow (10YR4/6) with 10% brown (10YR3/4) mottles, moist, silty fine to medium SAND	588
22	Yellow brown (10YR5/6) with30% light gray (10YR7/2) mottles, moist, clayey SILT, trace sand and gravel	
	Yellow brown (10YR5/8) with 20% gray (10YR6/1) and 15% dark brown (10YR3/3) mottles, very moist, very silty CLAY, trace sand and gravel	586
24	Yellow brown (10YR5/6) with 50% light brown gray (10YR6/2) mottles, moist, very silty CLAY, trace sand and gravel	
		584
26	Gray (10YR6/1) with 5% yellow brown (10YR5/4) mottles, moist, clayey SILT, trace sand and gravel	
▼	Gray (10YR6/1) with 25% yellow brown (10YR5/4) mottles, wet, sandy SILT, trace gravel	
	Gray brown (10YR5/2), very moist, clayey SILT, trace sand	582
28	Yellow brown (10YR5/8), very moist to wet, fine to coarse SAND, trace gravel	
	Dark yellow brown (10YR4/6) with 40% yellow brown (10YR5/6) mottles, wet, sandy SILT, trace gravel	
	Gray brown (10YR5/2) with 40% yellow brown (10YR5/6) mottles, moist, very silty CLAY, trace sand and gravel	580
30	Dark yellow brown (10YR4/6) with 15% pale brown (10YR6/3) mottles, moist, very silty CLAY, little sand, trace gravel	
	Green gray (10Y5/1), moist, silty CLAY, trace sand and gravel	578
32		
		576
34	Gray (N5/1) with 30% gray brown (10YR5/2) mottles, moist, silty CLAY, little sand and gravel	
		574
36		
		572
38	Gray (N5), wet, fine to medium SAND	
	Gray (N5) with 10% gray brown (10YR5/2) mottles, moist, silty CLAY, trace sand and gravel	
		570
40		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Gypsum Managment Facility
Location: Canton, Fulton Co., Illinois
Project: 03S5010
DATES: Start: 1/14/2008
Finish: 1/14/2008
WEATHER: Overcast, windy, cold

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME-650 Track Rig
Drilling Method: 3¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: R. Keedy
Eng/Geo: R. Hasenyager

BOREHOLE ID: BG65
Well ID: hole abandoned
Surface Elev: 609.7 ft. MSL
Completion: 44.0 ft. BGS
Station: 13,982.80N
909.90E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.80 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*
						Sh
	24/24 *100%*	ss	*4-14 17-24* N=31			
21A				10		10.86 *BSh*
21B				11		6.98 *Sh*
22A				24		2.33 *Sh*
22B	24/24 *100%*	ss	*27-41 77-109* N=118	18		
22C				14		
22D				11		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	Gray (N5) with 10% gray brown (10YR5/2) mottles, moist, silty CLAY, trace sand and gravel *[Continued from previous page]*		
42	Very dark green (10Y3/1) with 25% gray brown yellow (10YR6/8) mottles, moist, silty CLAY, trace sand and gravel	568	
	Green (5GY) with 10% gray brown (10YR4/3) mottles, moist, silty CLAY, trace sand and gravel		
	Dark green gray (10GY4/1), moist, silty CLAY, trace sand		
	Green (10Y5/1), wet, fine to medium SAND	566	
44	CHERT		

End of Boring = 44.0 ft. BGS

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/4/2009
Finish: 2/4/2009
WEATHER: very cold, sunny, windy, lo-teen's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~G66a~~
Well ID: G66L
Surface Elev: 614.86 ft. MSL
Completion: 19.74 ft. BGS
Station: 14,240.49N
965.72E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL	Remarks
								FILL - Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) mottles, slightly moist, hard, clayey SILT.	614	
							2	FILL - Grayish brown (10YR5/2) with 10% dark yellowish brown (10YR4/6) and 10% yellowish brown (10YR5/4) mottles, slightly moist, hard, clayey SILT with slight trace sand.		
								FILL - Gray (10YR6/1) with 40% dark yellowish brown (10YR4/6) mottles, slightly moist, firm, clayey SILT, slight trace roots.	612	
							4			
								FILL - Yellowish brown (10YR5/4) with 20% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT.	610	
							6			
									608	
							8			
								Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, moist, firm, clayey SILT.	606	
							10			
								Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, moist, soft, clayey SILT.	604	
							12			
								Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY.	602	
							14			
									600	
							16	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.		
									598	
							18			
								Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY.	596	

End of Boring = 19.74 ft bgs

NOTE(S): See G66S Boring log for sample and testing data.

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/4/2009
Finish: 2/4/2009
WEATHER: very cold, sunny, windy, lo-teen's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~G66~~
Well ID: G66S
Surface Elev: 614.86 ft. MSL
Completion: 40.09 ft. BGS
Station: 14,236.19N
964.90E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 34.20 - 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	24/24 100%	ss	30-30 20-10 N=50	18.4		
2A	24/24 100%	ss	10-13 15-22 N=28	20.5		
2B				16.3		
3A	20/24 83%	ss	4-8 8-7 N=16	17.7		
4A	24/24 100%	ss	10-12 12-9 N=24	19.5		
5A	19/24 79%	ss	3-6 8-10 N=14	22.8		
6A	19/24 79%	ss	1-3 3-5 N=6	26.1		
7A	22/24 92%	ss	3-4 3-4 N=7	28.4		
8A	16/24 67%	ss	1-2 4-4 N=6	23.4		
9A	20/24 83%	ss	3-4 5-6 N=9	23.5		
10A	19/24 79%	ss	1-3 4-3 N=7	24.6		
11A	19/24		2-2	25.9		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	FILL - Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) mottles, slightly moist, hard, clayey SILT.	614
2	FILL - Grayish brown (10YR5/2) with 10% dark yellowish brown (10YR4/6) and 10% yellowish brown (10YR5/4) mottles, slightly moist, hard, clayey SILT with slight trace sand.	
	FILL - Gray (10YR6/1) with 40% dark yellowish brown (10YR4/6) mottles, slightly moist, firm, clayey SILT, slight trace roots.	612
4		
	FILL - Yellowish brown (10YR5/4) with 20% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT.	610
6		608
8		
	Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, moist, firm, clayey SILT.	606
10		
	Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, moist, soft, clayey SILT.	604
12		
	Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY.	602
14		
	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	600
16		598
18		
	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY.	596
20		594

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/4/2009
Finish: 2/4/2009
WEATHER: very cold, sunny, windy, lo-teen's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G66
Well ID: G66S
Surface Elev: 614.86 ft. MSL
Completion: 40.09 ft. BGS
Station: 14,236.19N
964.90E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 34.20 - 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
11B	79%	SS	3-4 N=5	23.9		
12A	23/24 96%	SS	3-3 4-5 N=7	25.2		
13A	22/24 92%	SS	woh-2 2-3 N=4	22.7		
14A	23/24 96%	SS	4-7 7-8 N=14	18.8		
15A	18/24 75%	SS	1-1 3-4 N=4	21.3		
16A	19/24 79%	SS	1-3 4-5 N=7	17.2		
17A	24/24 100%	SS	6-8 9-9 N=17	13.9		
17B				32.2		
18A	22/24 92%	SS	4-10 16-13 N=26	15.6		
19A	24/24 100%	SS	12-12 13-22 N=25	11.8		
20A	19/24 79%	SS	18-28 36-48 N=64	11.2		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
22	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand.	592	
24	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with trace sand and slight trace gravel.	590	
26	Greenish gray (5GY5/1), moist, firm, silty CLAY with trace sand and slight trace gravel.	588	
28	Greenish gray (5GY5/1), moist, soft, silty CLAY with trace sand.	586	
30	Greenish gray (5GY6/1), moist, soft, clayey SILT with slight trace sand and gravel.	584	
32	Dark gray (N4/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.	582	
▼ 34	Dark gray (N4/1), very moist, firm, clayey SILT with slight trace sand.		
	Dark gray (N4/1), moist, firm, clayey SILT with slight trace sand.	580	
36	Dark gray (N4/1), moist, firm, clayey SILT with sand and slight trace gravel.	578	
38	Dark gray (N4/1), slightly moist, hard, clayey SILT with slight trace sand and gravel.	576	Thin(<0.1'), wet, fine- to medium-grained sand seams near 36.0', 38.0', and 39.5'.
40			

End of Boring = 40.09 ft bgs

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/4/2009
Finish: 2/4/2009
WEATHER: very cold, sunny, windy, lo-teen's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~G66~~
Well ID: G66S
Surface Elev: 614.86 ft. MSL
Completion: 40.09 ft. BGS
Station: 14,236.19N
964.90E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 34.20 - 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	24/24 100%	ss	30-30 20-10 N=50	18.4		
2A	24/24 100%	ss	10-13 15-22 N=28	20.5		
2B				16.3		
3A	20/24 83%	ss	4-8 8-7 N=16	17.7		
4A	24/24 100%	ss	10-12 12-9 N=24	19.5		
5A	19/24 79%	ss	3-6 8-10 N=14	22.8		
6A	19/24 79%	ss	1-3 3-5 N=6	26.1		
7A	22/24 92%	ss	3-4 3-4 N=7	28.4		
8A	16/24 67%	ss	1-2 4-4 N=6	23.4		
9A	20/24 83%	ss	3-4 5-6 N=9	23.5		
10A	19/24 79%	ss	1-3 4-3 N=7	24.6		
11A	19/24		2-2	25.9		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	FILL - Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) mottles, slightly moist, hard, clayey SILT.	614
2	FILL - Grayish brown (10YR5/2) with 10% dark yellowish brown (10YR4/6) and 10% yellowish brown (10YR5/4) mottles, slightly moist, hard, clayey SILT with slight trace sand.	
	FILL - Gray (10YR6/1) with 40% dark yellowish brown (10YR4/6) mottles, slightly moist, firm, clayey SILT, slight trace roots.	612
4		
	FILL - Yellowish brown (10YR5/4) with 20% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT.	610
6		608
8		
	Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, moist, firm, clayey SILT.	606
10		
	Yellowish brown (10YR5/4) with 20% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, moist, soft, clayey SILT.	604
12		
	Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY.	602
14		
	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	600
16		598
18		
	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY.	596
20		594

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/4/2009
Finish: 2/4/2009
WEATHER: very cold, sunny, windy, lo-teen's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G66
Well ID: G66S
Surface Elev: 614.86 ft. MSL
Completion: 40.09 ft. BGS
Station: 14,236.19N
964.90E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 34.20 - 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
11B	79%	SS	3-4 N=5	23.9		
12A	23/24 96%	SS	3-3 4-5 N=7	25.2		
13A	22/24 92%	SS	woh-2 2-3 N=4	22.7		
14A	23/24 96%	SS	4-7 7-8 N=14	18.8		
15A	18/24 75%	SS	1-1 3-4 N=4	21.3		
16A	19/24 79%	SS	1-3 4-5 N=7	17.2		
17A	24/24 100%	SS	6-8 9-9 N=17	13.9		
17B				32.2		
18A	22/24 92%	SS	4-10 16-13 N=26	15.6		
19A	24/24 100%	SS	12-12 13-22 N=25	11.8		
20A	19/24 79%	SS	18-28 36-48 N=64	11.2		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
22	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand.	592	
24	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with trace sand and slight trace gravel.	590	
26	Greenish gray (5GY5/1), moist, firm, silty CLAY with trace sand and slight trace gravel.	588	
28	Greenish gray (5GY5/1), moist, soft, silty CLAY with trace sand.	586	
30	Greenish gray (5GY6/1), moist, soft, clayey SILT with slight trace sand and gravel.	584	
32	Dark gray (N4/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.	582	
▼ 34	Dark gray (N4/1), very moist, firm, clayey SILT with slight trace sand.		
	Dark gray (N4/1), moist, firm, clayey SILT with slight trace sand.	580	
36	Dark gray (N4/1), moist, firm, clayey SILT with sand and slight trace gravel.	578	
38	Dark gray (N4/1), slightly moist, hard, clayey SILT with slight trace sand and gravel.	576	Thin(<0.1'), wet, fine- to medium-grained sand seams near 36.0', 38.0', and 39.5'.
40			

End of Boring = 40.09 ft bgs

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/3/2009
Finish: 2/3/2009
WEATHER: very cold, partly cloudy, windy, lo-teen's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~G67a~~
Well ID: G67L
Surface Elev: 614.64 ft. MSL
Completion: 17.18 ft. BGS
Station: 14,527.50N
928.85E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
								FILL - Yellowish brown (10YR5/4) with 10% gray (10YR5/1) mottles, slightly moist, hard, clayey SILT with slight trace sand and gravel.	614
							2	FILL - Yellowish brown (10YR5/4) with 15% gray (10YR6/1) and 10% dark yellowish brown (10YR4/6) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel.	612
							4	FILL - Yellowish brown (10YR5/4) with 10% gray (10YR6/1) mottles, moist, firm, clayey SILT with slight trace sand and gravel, trace roots.	610
							6	Gray (10YR5/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, hard, clayey SILT.	608
							8	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	606
							10		604
							12	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	602
							14	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, wet, soft, clayey SILT.	600
							16	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	598

Borehole Detail

End of Boring = 17.18 ft bgs

NOTE(S): See G67S Boring log for sample and testing data.

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/3/2009
Finish: 2/3/2009
WEATHER: very cold, partly cloudy, windy, lo-teen's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~G67~~
Well ID: G67S
Surface Elev: 614.64 ft. MSL
Completion: 38.00 ft. BGS
Station: 14,530.27N
925.18E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 33.50 - during drilling
▼ = 31.71 - 02/03/09
▽ =

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	24/24 100%	SS	24-18 14-18 N=32	18.7		
2A	24/24 100%	SS	8-13 11-14 N=24	16.6		
3A	24/24 100%	SS	4-4 7-8 N=11	18.0		
4A	24/24 100%	SS	8-8 14-15 N=22	25.8		
5A	19/24 79%	SS	1-3 3-3 N=6	25.5		
6A	22/24 92%	SS	1-2 4-4 N=6	21.9		
7A	22/24 92%	SS	6-6 6-5 N=12	21.2		
8A	16/24 67%	SS	1-2 2-2 N=4	22.2		
9A	24/24 100%	SS	3-3 4-3 N=7	22.9		
9B				25.5		
10A	19/24 79%	SS	1-2 1-2 N=3	25.4		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	FILL - Yellowish brown (10YR5/4) with 10% gray (10YR5/1) mottles, slightly moist, hard, clayey SILT with slight trace sand and gravel.	614
2	FILL - Yellowish brown (10YR5/4) with 15% gray (10YR6/1) and 10% dark yellowish brown (10YR4/6) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel.	612
4	FILL - Yellowish brown (10YR5/4) with 10% gray (10YR6/1) mottles, moist, firm, clayey SILT with slight trace sand and gravel, trace roots.	610
6	Gray (10YR5/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, hard, clayey SILT.	608
8	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	606
10		604
12	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	602
14	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, wet, soft, clayey SILT.	600
16	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	598
18	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY.	596
20		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/3/2009
Finish: 2/3/2009
WEATHER: very cold, partly cloudy, windy, lo-teen's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G67
Well ID: G67S
Surface Elev: 614.64 ft. MSL
Completion: 38.00 ft. BGS
Station: 14,530.27N
925.18E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 33.50 - during drilling
▼ = 31.71 - 02/03/09
▽ =

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
11A	18/24 75%	SS	1-2 2-2 N=4	25.5		
12A	22/24 92%	SS	2-3 3-4 N=6	27.8		
13A	24/24 100%	SS	woh-1 2-2 N=3	23.5		
14A	16/24 67%	SS	2-2 3-3 N=5	19.2		
15A	17/24 71%	SS	woh-1 1-3 N=2	15.8		
16A	18/24 75%	SS	3-4 7-15 N=11	17.6		
16B				12.3		
17A	24/24 100%	SS	14-21 25-22 N=46	11.6		
17B				13.6		
18A	18/24 75%	SS	1-8 12-11 N=20	11.9		
19A	22/24 92%	SS	14-22 23-25 N=45	12.5		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY. *[Continued from previous page]*	594
22		592
	Gray (10YR5/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand.	
24		590
	Grayish brown (10YR5/2) with 15% dark yellowish brown (10YR4/6) mottles, moist, very soft, silty CLAY with trace sand.	
26		588
28	Greenish gray (5GY5/1), moist, very soft, silty CLAY with trace sand and slight trace gravel.	586
30		584
32	Gray (N5/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	582
	Yellowish brown (10YR5/4), wet, medium dense, silty, fine- to coarse-grained SAND with slight trace gravel.	
34	Gray (N5/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	580
	Yellowish brown (10YR5/4), wet, medium dense, silty, fine- to coarse-grained SAND with slight trace gravel.	
36	Gray (N5/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	578
38		

End of Boring = 38.0 ft bgs

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/3/2009
Finish: 2/3/2009
WEATHER: very cold, partly cloudy, windy, lo-teen's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~G67~~
Well ID: G67S
Surface Elev: 614.64 ft. MSL
Completion: 38.00 ft. BGS
Station: 14,530.27N
925.18E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 33.50 - during drilling
▼ = 31.71 - 02/03/09
▽ =

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	24/24 100%	SS	24-18 14-18 N=32	18.7		
2A	24/24 100%	SS	8-13 11-14 N=24	16.6		
3A	24/24 100%	SS	4-4 7-8 N=11	18.0		
4A	24/24 100%	SS	8-8 14-15 N=22	25.8		
5A	19/24 79%	SS	1-3 3-3 N=6	25.5		
6A	22/24 92%	SS	1-2 4-4 N=6	21.9		
7A	22/24 92%	SS	6-6 6-5 N=12	21.2		
8A	16/24 67%	SS	1-2 2-2 N=4	22.2		
9A	24/24 100%	SS	3-3 4-3 N=7	22.9		
9B				25.5		
10A	19/24 79%	SS	1-2 1-2 N=3	25.4		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	FILL - Yellowish brown (10YR5/4) with 10% gray (10YR5/1) mottles, slightly moist, hard, clayey SILT with slight trace sand and gravel.	614
2	FILL - Yellowish brown (10YR5/4) with 15% gray (10YR6/1) and 10% dark yellowish brown (10YR4/6) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel.	612
4	FILL - Yellowish brown (10YR5/4) with 10% gray (10YR6/1) mottles, moist, firm, clayey SILT with slight trace sand and gravel, trace roots.	610
6	Gray (10YR5/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, hard, clayey SILT.	608
8	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	606
10		604
12	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	602
14	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, wet, soft, clayey SILT.	600
16	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	598
18	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY.	596
20		

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/3/2009
Finish: 2/3/2009
WEATHER: very cold, partly cloudy, windy, lo-teen's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G67
Well ID: G67S
Surface Elev: 614.64 ft. MSL
Completion: 38.00 ft. BGS
Station: 14,530.27N
925.18E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 33.50 - during drilling
▼ = 31.71 - 02/03/09
▽ =

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
11A	18/24 75%	SS	1-2 2-2 N=4	25.5		
12A	22/24 92%	SS	2-3 3-4 N=6	27.8		
13A	24/24 100%	SS	woh-1 2-2 N=3	23.5		
14A	16/24 67%	SS	2-2 3-3 N=5	19.2		
15A	17/24 71%	SS	woh-1 1-3 N=2	15.8		
16A	18/24 75%	SS	3-4 7-15 N=11	17.6		
16B				12.3		
17A	24/24 100%	SS	14-21 25-22 N=46	11.6		
17B				13.6		
18A	18/24 75%	SS	1-8 12-11 N=20	11.9		
19A	22/24 92%	SS	14-22 23-25 N=45	12.5		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Gray (10YR5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY. *[Continued from previous page]*	594
22		592
	Gray (10YR5/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand.	
24		590
	Grayish brown (10YR5/2) with 15% dark yellowish brown (10YR4/6) mottles, moist, very soft, silty CLAY with trace sand.	
26		588
28	Greenish gray (5GY5/1), moist, very soft, silty CLAY with trace sand and slight trace gravel.	586
30		584
32	Gray (N5/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	582
	Yellowish brown (10YR5/4), wet, medium dense, silty, fine- to coarse-grained SAND with slight trace gravel.	
34	Gray (N5/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	580
	Yellowish brown (10YR5/4), wet, medium dense, silty, fine- to coarse-grained SAND with slight trace gravel.	
36	Gray (N5/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	578
38		

End of Boring = 38.0 ft bgs

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/18/2008
Finish: 11/18/2008
WEATHER: cold, sunny, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: ~~G70a~~
Well ID: G70L
Surface Elev: 614.97 ft. MSL
Completion: 30.00 ft. BGS
Station: 14,371.22N
156.88E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 27.00 - 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	Elevation ft. MSL
							2	FILL - Yellowish brown (10YR5/4), dry, firm, clayey SILT.	614, 612
							4	FILL - Brown (10YR5/3), dry, firm, silty CLAY.	610
							6	FILL - Dark grayish brown (10YR4/2), slightly moist, firm, silty CLAY.	608
							8	FILL - Brown (10YR5/3), slightly moist, firm, silty CLAY.	606
							10	FILL - Yellowish brown (10YR5/6), moist, hard, silty CLAY, trace roots.	604
							12	FILL - Yellowish brown (10YR5/6), very moist, hard, silty CLAY.	602
							14	FILL - Dark yellowish brown (10YR3/6), very moist, hard, silty CLAY.	600
							16	FILL - Yellowish brown (10YR5/6), very moist, hard, silty CLAY.	598
							18	Brown (7.5YR4/4) with 50% strong brown (7.5YR4/6) mottles, moist, hard, silty CLAY.	596
							20		

Borehole Detail

Remarks

NOTE(S): See G70S Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/18/2008
Finish: 11/18/2008
WEATHER: cold, sunny, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: .

BOREHOLE ID: G70a
Well ID: G70L
Surface Elev: 614.97 ft. MSL
Completion: 30.00 ft. BGS
Station: 14,371.22N
156.88E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 27.00 - 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	Elevation ft. MSL
								Brown (7.5YR4/4) with 50% strong brown (7.5YR4/6) mottles, moist, hard, silty CLAY. *[Continued from previous page]*	594
							22	Brown (7.5YR4/3), moist, hard, silty CLAY with trace sand.	592
							24	Brown (10YR5/3) with 50% dark yellowish brown (10YR4/6) mottles, moist, hard, silty CLAY with trace sand and slight trace gravel.	590
							26	Dark yellowish brown (10YR4/4) with 30% grayish brown (10YR5/2) very moist to wet, soft, clayey SILT with trace sand and slight trace gravel.	588
							28	Yellowish brown (10YR5/4) with 50% pale brown (10YR6/3) mottles, very moist to wet, soft, clayey SILT with slight trace sand and gravel. *Silt content increases with depth.*	586
							30	Yellowish brown (10YR5/4) with 20% light yellowish brown (10YR6/4) mottles, very moist, hard, clayey SILT with slight trace gravel.	

End of Boring = 30.00 ft bgs

Borehole Detail

Remarks

NOTE(S): See G70S Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/20/2008
Finish: 11/20/2008
WEATHER: cold, overcast, (30's)

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~G71a~~
Well ID: G71L
Surface Elev: 614.94 ft. MSL
Completion: 30.20 ft. BGS
Station: 14,106.39N
278.83E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
							2	FILL - Yellowish brown (10YR5/8), slightly moist, firm, clayey SILT with slight trace sand and gravel.	614
							4		612
							6	FILL - Yellowish brown (10YR5/8) with 20% gray (10YR6/1) mottles, moist, firm, silty CLAY with slight trace sand and gravel, trace roots.	610
							8		608
							10	Light yellowish brown (10YR6/4) with 30% brownish yellow (10YR6/8) mottles, moist, soft to friable, clayey SILT with slight trace sand.	606
							12		604
							14	Light gray (10YR7/1) with 20% yellowish brown (10YR5/8) mottles, slightly moist, friable, clayey SILT with slight trace sand.	602
							16	Dark yellowish brown (10YR4/6), moist, friable, clayey SILT with slight trace sand.	600
							18	Dark yellowish brown (10YR4/4) with 30% very dark grayish brown (10YR3/2) and 10% yellowish brown (10YR5/8) mottles, moist, friable, clayey SILT with slight trace sand.	598
							20		596

Borehole Detail

Remarks

NOTE(S): See G71S Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/20/2008
Finish: 11/20/2008
WEATHER: cold, overcast, (30's)

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: G71a
Well ID: G71L
Surface Elev: 614.94 ft. MSL
Completion: 30.20 ft. BGS
Station: 14,106.39N
278.83E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
								Dark yellowish brown (10YR4/4) with 30% very dark grayish brown (10YR3/2) and 10% yellowish brown (10YR5/8) mottles, moist, firm, clayey SILT with slight trace sand.	594
							22	Yellowish brown (10YR5/8) with 25% very dark grayish brown (10YR3/2) and 10% gray (10YR5/1) mottles, moist, firm, silty CLAY with sand and slight trace gravel.	592
							24	Brownish yellow (10YR6/6) with 20% gray (10YR6/1) mottles, moist, soft to friable, clayey SILT with trace sand and slight trace gravel.	590
							26	Gray (10YR5/1) with 50% brownish yellow (10YR6/6) mottles, moist, soft, silty CLAY with sand and trace gravel.	588
							28	Brownish yellow (10YR6/6) with 25% gray (10YR6/1) mottles, moist, soft to friable, clayey SILT with slight trace sand.	
								Brownish yellow (10YR6/6), slightly moist, loose, silty, very fine- to medium-grained SAND with slight trace gravel.	586
							30	Brownish yellow (10YR6/6) with 30% gray (10YR6/1) mottles, moist, friable, clayey SILT.	

End of Boring = 30.20 ft bgs

Borehole Detail

NOTE(S): See G71S Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/20/2008
Finish: 11/20/2008
WEATHER: cold, overcast, (30's)

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~G71~~
Well ID: G71S
Surface Elev: 614.94 ft. MSL
Completion: 40.00 ft. BGS
Station: 14,110.54N
277.06E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 35.30 - 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	24/24 100%	SS	6-9 9-5 N=18	15.5		
2A	24/24 100%	SS	4-6 9-11 N=15	18.2		
3A	24/24 100%	SS	3-6 9-12 N=15	18.9		
4A	24/24 100%	SS	10-15 17-13 N=32	18.4		
5A	24/24 100%	SS	2-4 6-7 N=10	17.0		
6A	20/24 83%	SS	1-4 5-6 N=9	9.0		
7A	24/24 100%	SS	7-10 12-12 N=22	8.0		
8A	24/24 100%	SS	3-5 6-7 N=11	10.3		
9A	24/24 100%	SS	6-8 10-9 N=18	15.4		
10A	24/24 100%	SS	2-4 6-6 N=10	15.8		
	24/24		3-4			

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
2	FILL - Yellowish brown (10YR5/8), slightly moist, firm, clayey SILT with slight trace sand and gravel.	614	
4		612	
6	FILL - Yellowish brown (10YR5/8) with 20% gray (10YR6/1) mottles, moist, firm, silty CLAY with slight trace sand and gravel, trace roots.	610	
8		608	
10	Light yellowish brown (10YR6/4) with 30% brownish yellow (10YR6/8) mottles, moist, soft to friable, clayey SILT with slight trace sand.	606	
12		604	
14	Light gray (10YR7/1) with 20% yellowish brown (10YR5/8) mottles, slightly moist, friable, clayey SILT with slight trace sand.	602	
16		600	
18	Dark yellowish brown (10YR4/6), moist, friable, clayey SILT with slight trace sand.	598	
20	Dark yellowish brown (10YR4/4) with 30% very dark grayish brown (10YR3/2) and 10% yellowish brown (10YR5/8) mottles, moist, friable, clayey SILT with slight trace sand.	596	
	Dark yellowish brown (10YR4/4) with 30% very dark grayish brown (10YR3/2) and 10% yellowish brown (10YR5/8) mottles, moist, firm, clayey SILT with slight	594	

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/20/2008
Finish: 11/20/2008
WEATHER: cold, overcast, (30's)

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: G71
Well ID: G71S
Surface Elev: 614.94 ft. MSL
Completion: 40.00 ft. BGS
Station: 14,110.54N
277.06E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 35.30 - 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
11A	100%	SS	6-9 N=10	18.0		
12A	24/24 100%	SS	6-13 15-14 N=28	20.6		
13A	24/24 100%	SS	woh-2 4-6 N=6	18.0		
14A	24/24 100%	SS	6-16 14-16 N=30	17.8		
14B				11.5		
15A	24/24 100%	SS	2-12 14-50/5" N=26	12.6		
16A	24/24 100%	SS	3-14 10-11 N=24	13.5		
16B				13.3		
17A	24/24 100%	SS	8-13 15-11 N=28	14.0		
18A	23/24 96%	SS	2-11 9-7 N=20	13.0		
18B				28.0		
19A	22/24 92%	SS	4-6 7-10 N=13	28.5		
20A	24/24 100%	SS	10-13 15-26 N=28	12.0		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	trace sand.	
22	Yellowish brown (10YR5/8) with 25% very dark grayish brown (10YR3/2) and 10% gray (10YR5/1) mottles, moist, firm, silty CLAY with sand and slight trace gravel.	592
24	Brownish yellow (10YR6/6) with 20% gray (10YR6/1) mottles, moist, soft to friable, clayey SILT with trace sand and slight trace gravel.	590
26	Gray (10YR5/1) with 50% brownish yellow (10YR6/6) mottles, moist, soft, silty CLAY with sand and trace gravel.	588
28	Brownish yellow (10YR6/6) with 25% gray (10YR6/1) mottles, moist, soft to friable, clayey SILT with slight trace sand.	
	Brownish yellow (10YR6/6), slightly moist, loose, silty, very fine- to medium-grained SAND with slight trace gravel.	586
30	Brownish yellow (10YR6/6) with 30% gray (10YR6/1) mottles, moist, friable, clayey SILT.	584
32	Dark gray (10YR4/1), moist, firm, silty CLAY with sand and trace gravel.	582
34		580
36	Dark gray (10YR4/1), wet, soft, clayey SILT, trace wood fragments.	578
38	Dark gray (10YR4/1), moist, firm, silty CLAY with sand and trace gravel.	576
40	**End of Boring = 40.00 ft bgs**	

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/20/2008
Finish: 11/20/2008
WEATHER: cold, overcast, (30's)

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~G71~~
Well ID: G71S
Surface Elev: 614.94 ft. MSL
Completion: 40.00 ft. BGS
Station: 14,110.54N
277.06E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 35.30 - 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	24/24 100%	SS	6-9 9-5 N=18	15.5		
2A	24/24 100%	SS	4-6 9-11 N=15	18.2		
3A	24/24 100%	SS	3-6 9-12 N=15	18.9		
4A	24/24 100%	SS	10-15 17-13 N=32	18.4		
5A	24/24 100%	SS	2-4 6-7 N=10	17.0		
6A	20/24 83%	SS	1-4 5-6 N=9	9.0		
7A	24/24 100%	SS	7-10 12-12 N=22	8.0		
8A	24/24 100%	SS	3-5 6-7 N=11	10.3		
9A	24/24 100%	SS	6-8 10-9 N=18	15.4		
10A	24/24 100%	SS	2-4 6-6 N=10	15.8		
	24/24		3-4			

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
2	FILL - Yellowish brown (10YR5/8), slightly moist, firm, clayey SILT with slight trace sand and gravel.	614	
4		612	
6	FILL - Yellowish brown (10YR5/8) with 20% gray (10YR6/1) mottles, moist, firm, silty CLAY with slight trace sand and gravel, trace roots.	610	
8		608	
10	Light yellowish brown (10YR6/4) with 30% brownish yellow (10YR6/8) mottles, moist, soft to friable, clayey SILT with slight trace sand.	606	
12		604	
14	Light gray (10YR7/1) with 20% yellowish brown (10YR5/8) mottles, slightly moist, friable, clayey SILT with slight trace sand.	602	
16		600	
18	Dark yellowish brown (10YR4/6), moist, friable, clayey SILT with slight trace sand.	598	
20	Dark yellowish brown (10YR4/4) with 30% very dark grayish brown (10YR3/2) and 10% yellowish brown (10YR5/8) mottles, moist, friable, clayey SILT with slight trace sand.	596	
	Dark yellowish brown (10YR4/4) with 30% very dark grayish brown (10YR3/2) and 10% yellowish brown (10YR5/8) mottles, moist, firm, clayey SILT with slight	594	

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/20/2008
Finish: 11/20/2008
WEATHER: cold, overcast, (30's)

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: G71
Well ID: G71S
Surface Elev: 614.94 ft. MSL
Completion: 40.00 ft. BGS
Station: 14,110.54N
277.06E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 35.30 - 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
11A	100%	SS	6-9 N=10	18.0		
12A	24/24 100%	SS	6-13 15-14 N=28	20.6		
13A	24/24 100%	SS	woh-2 4-6 N=6	18.0		
14A	24/24 100%	SS	6-16 14-16 N=30	17.8		
14B				11.5		
15A	24/24 100%	SS	2-12 14-50/5" N=26	12.6		
16A	24/24 100%	SS	3-14 10-11 N=24	13.5		
16B				13.3		
17A	24/24 100%	SS	8-13 15-11 N=28	14.0		
18A	23/24 96%	SS	2-11 9-7 N=20	13.0		
18B				28.0		
19A	22/24 92%	SS	4-6 7-10 N=13	28.5		
20A	24/24 100%	SS	10-13 15-26 N=28	12.0		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	trace sand.	
22	Yellowish brown (10YR5/8) with 25% very dark grayish brown (10YR3/2) and 10% gray (10YR5/1) mottles, moist, firm, silty CLAY with sand and slight trace gravel.	592
24	Brownish yellow (10YR6/6) with 20% gray (10YR6/1) mottles, moist, soft to friable, clayey SILT with trace sand and slight trace gravel.	590
26	Gray (10YR5/1) with 50% brownish yellow (10YR6/6) mottles, moist, soft, silty CLAY with sand and trace gravel.	588
28	Brownish yellow (10YR6/6) with 25% gray (10YR6/1) mottles, moist, soft to friable, clayey SILT with slight trace sand.	
	Brownish yellow (10YR6/6), slightly moist, loose, silty, very fine- to medium-grained SAND with slight trace gravel.	586
30	Brownish yellow (10YR6/6) with 30% gray (10YR6/1) mottles, moist, friable, clayey SILT.	584
32	Dark gray (10YR4/1), moist, firm, silty CLAY with sand and trace gravel.	582
34		580
36	Dark gray (10YR4/1), wet, soft, clayey SILT, trace wood fragments.	578
38	Dark gray (10YR4/1), moist, firm, silty CLAY with sand and trace gravel.	576
40	**End of Boring = 40.00 ft bgs**	

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/19/2008
Finish: 11/19/2008
WEATHER: sunny, cold, (40's)

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~G72a~~
Well ID: G72L
Surface Elev: 615.01 ft. MSL
Completion: 24.79 ft. BGS
Station: 13,904.84N
509.93E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
							2	FILL - Yellowish brown (10YR5/8), moist, firm, clayey SILT with slight trace sand and gravel.	614, 612, 610
							6	Yellowish brown (10YR5/8), moist, firm, silty CLAY with slight trace sand and gravel.	608
							8		606
							10	Yellowish brown (10YR5/8), moist, soft, silty CLAY with slight trace sand.	604
							12		602
							14	Light gray (10YR7/1) with 30% yellowish brown (10YR5/8) mottles, moist, friable, clayey SILT with slight trace sand.	600
							16	Light gray (10YR7/1) with 10% yellowish brown (10YR5/8) mottles, moist, friable, SILT with some clay and slight trace sand.	598
							18	Dark gray (10YR4/1) with 80% dark yellowish brown (10YR4/4) mottles, moist, friable, clayey SILT with slight trace sand.	596
							20		

Borehole Detail

NOTE(S): See G72S Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/19/2008
Finish: 11/19/2008
WEATHER: sunny, cold, (40's)

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: G72a
Well ID: G72L
Surface Elev: 615.01 ft. MSL
Completion: 24.79 ft. BGS
Station: 13,904.84N
509.93E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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
								Dark yellowish brown (10YR4/8), moist, friable, very clayey SILT with trace sand.		594	
							22	Dark yellowish brown (10YR4/6) with 40% yellowish brown (10YR5/8) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.		592	
							24	Grayish brown (10YR5/2) with 30% yellowish brown (10YR5/8) mottles, moist, soft, clayey SILT with trace sand.			

End of Boring = 24.79 ft bgs

NOTE(S): See G72S Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/19/2008
Finish: 11/19/2008
WEATHER: sunny, cold, (40's)

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~G72~~
Well ID: G72S
Surface Elev: 615.01 ft. MSL
Completion: 39.40 ft. BGS
Station: 13,905.05N
504.94E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 28.30 - 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	24/24 100%	SS	3-3 6-6 N=9	20.4		
2A	24/24 100%	SS	3-5 6-6 N=11	18.3		
3A	24/24 100%	SS	3-5 6-9 N=11	15.7		
4A	24/24 100%	SS	10-14 16-16 N=30	21.3		
5A	24/24 100%	SS	3-4 6-7 N=10	19.3		
6A	24/24 100%	SS	2-3 6-8 N=9	18.2		
7A	20/24 83%	SS	5-7 12-13 N=19	9.2		
8A	24/24 100%	SS	1-3 4-6 N=7	11.1		
9A	24/24 100%	SS	5-7 10-9 N=17	12.3		
10A	24/24 100%	SS	1-3 4-7 N=7	17.5		
	24/24		1-3			

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
2	FILL - Yellowish brown (10YR5/8), moist, firm, clayey SILT with slight trace sand and gravel.	614	
4		612	
6		610	
8	Yellowish brown (10YR5/8), moist, firm, silty CLAY with slight trace sand and gravel.	608	
10		606	
12	Yellowish brown (10YR5/8), moist, soft, silty CLAY with slight trace sand.	604	
14		602	
16	Light gray (10YR7/1) with 30% yellowish brown (10YR5/8) mottles, moist, friable, clayey SILT with slight trace sand.	600	
18		598	
20	Light gray (10YR7/1) with 10% yellowish brown (10YR5/8) mottles, moist, friable, SILT with some clay and slight trace sand.	596	
	Dark gray (10YR4/1) with 80% dark yellowish brown (10YR4/4) mottles, moist, friable, clayey SILT with slight trace sand. Dark yellowish brown (10YR4/8), moist, friable, very clayey SILT with trace sand.		

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/19/2008
Finish: 11/19/2008
WEATHER: sunny, cold, (40's)

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: G72
Well ID: G72S
Surface Elev: 615.01 ft. MSL
Completion: 39.40 ft. BGS
Station: 13,905.05N
504.94E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 28.30 - 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
11A	100%	SS	4-8 N=7	16.6		
12A	24/24 100%	SS	4-8 12-13 N=20	19.1		
13A	24/24 100%	SS	1-3 5-8 N=8	17.4		
14A	24/24 100%	SS	5-6 8-8 N=14	21.2		
15A	24/24 100%	SS	woh-1 2-3 N=3	26.5		
16A	24/24 100%	SS	1-3 6-10 N=9	19.3		
16B				15.9		
17A	20/24 83%	SS	5-10 13-11 N=23	24.9		
18A	24/24 100%	SS	2-6 7-9 N=13	27.8		
18B				11.1		
19A	24/24 100%	SS	7-9 12-14 N=21	11.1		
20A	17/17 100%	SS	26-45 50/5"	9.4		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark yellowish brown (10YR4/8), moist, friable, very clayey SILT with trace sand. *[Continued from previous page]*	
22		
	Dark yellowish brown (10YR4/6) with 40% yellowish brown (10YR5/8) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.	592
24		
	Grayish brown (10YR5/2) with 30% yellowish brown (10YR5/8) mottles, moist, soft, clayey SILT with trace sand.	590
26		
	Yellowish brown (10YR5/8) with 10% gray (10YR6/1) mottles, very moist, soft, silty CLAY with trace sand.	588
▼ 28		
	Gray (10YR6/1) with 20% yellowish brown (10YR5/8) mottles, very moist to wet, very soft, silty CLAY with trace sand and slight trace gravel.	586
30		
	Light gray (10YR7/1) with 30% yellowish brown (10YR5/8) mottles, wet, very soft, clayey SILT with some very fine-grained sand and slight trace gravel.	584
	Dark gray (10YR4/1), moist, firm, silty CLAY with trace sand and slight trace gravel.	
32		
	Brownish yellow (10YR6/6), wet, soft, clayey SILT with trace very fine-grained sand.	582
34	Dark gray (10YR4/1), moist, firm, very silty CLAY with slight trace sand.	
	Dark gray (10YR4/1), moist, loose, SILT and very fine-grained SAND.	580
36		
	Dark gray (10YR4/1), moist, firm, silty CLAY with trace sand and slight trace gravel.	578
38		
		576

End of Boring = 39.40 ft bgs

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/19/2008
Finish: 11/19/2008
WEATHER: sunny, cold, (40's)

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~G72~~
Well ID: G72S
Surface Elev: 615.01 ft. MSL
Completion: 39.40 ft. BGS
Station: 13,905.05N
504.94E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 28.30 - 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	24/24 100%	SS	3-3 6-6 N=9	20.4		
2A	24/24 100%	SS	3-5 6-6 N=11	18.3		
3A	24/24 100%	SS	3-5 6-9 N=11	15.7		
4A	24/24 100%	SS	10-14 16-16 N=30	21.3		
5A	24/24 100%	SS	3-4 6-7 N=10	19.3		
6A	24/24 100%	SS	2-3 6-8 N=9	18.2		
7A	20/24 83%	SS	5-7 12-13 N=19	9.2		
8A	24/24 100%	SS	1-3 4-6 N=7	11.1		
9A	24/24 100%	SS	5-7 10-9 N=17	12.3		
10A	24/24 100%	SS	1-3 4-7 N=7	17.5		
	24/24		1-3			

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
2	FILL - Yellowish brown (10YR5/8), moist, firm, clayey SILT with slight trace sand and gravel.	614	
4		612	
6		610	
8	Yellowish brown (10YR5/8), moist, firm, silty CLAY with slight trace sand and gravel.	608	
10		606	
12	Yellowish brown (10YR5/8), moist, soft, silty CLAY with slight trace sand.	604	
14		602	
16	Light gray (10YR7/1) with 30% yellowish brown (10YR5/8) mottles, moist, friable, clayey SILT with slight trace sand.	600	
18		598	
20	Light gray (10YR7/1) with 10% yellowish brown (10YR5/8) mottles, moist, friable, SILT with some clay and slight trace sand.	596	
	Dark gray (10YR4/1) with 80% dark yellowish brown (10YR4/4) mottles, moist, friable, clayey SILT with slight trace sand. Dark yellowish brown (10YR4/8), moist, friable, very clayey SILT with trace sand.		

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/19/2008
Finish: 11/19/2008
WEATHER: sunny, cold, (40's)

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: G72
Well ID: G72S
Surface Elev: 615.01 ft. MSL
Completion: 39.40 ft. BGS
Station: 13,905.05N
504.94E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 28.30 - 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
11A	100%	SS	4-8 N=7	16.6		
12A	24/24 100%	SS	4-8 12-13 N=20	19.1		
13A	24/24 100%	SS	1-3 5-8 N=8	17.4		
14A	24/24 100%	SS	5-6 8-8 N=14	21.2		
15A	24/24 100%	SS	woh-1 2-3 N=3	26.5		
16A	24/24 100%	SS	1-3 6-10 N=9	19.3		
16B				15.9		
17A	20/24 83%	SS	5-10 13-11 N=23	24.9		
18A	24/24 100%	SS	2-6 7-9 N=13	27.8		
18B				11.1		
19A	24/24 100%	SS	7-9 12-14 N=21	11.1		
20A	17/17 100%	SS	26-45 50/5"	9.4		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark yellowish brown (10YR4/8), moist, friable, very clayey SILT with trace sand. *[Continued from previous page]*	
22		
	Dark yellowish brown (10YR4/6) with 40% yellowish brown (10YR5/8) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.	592
24		
	Grayish brown (10YR5/2) with 30% yellowish brown (10YR5/8) mottles, moist, soft, clayey SILT with trace sand.	590
26		
	Yellowish brown (10YR5/8) with 10% gray (10YR6/1) mottles, very moist, soft, silty CLAY with trace sand.	588
▼ 28		
	Gray (10YR6/1) with 20% yellowish brown (10YR5/8) mottles, very moist to wet, very soft, silty CLAY with trace sand and slight trace gravel.	586
30		
	Light gray (10YR7/1) with 30% yellowish brown (10YR5/8) mottles, wet, very soft, clayey SILT with some very fine-grained sand and slight trace gravel.	584
	Dark gray (10YR4/1), moist, firm, silty CLAY with trace sand and slight trace gravel.	
32		
	Brownish yellow (10YR6/6), wet, soft, clayey SILT with trace very fine-grained sand.	582
34	Dark gray (10YR4/1), moist, firm, very silty CLAY with slight trace sand.	
	Dark gray (10YR4/1), moist, loose, SILT and very fine-grained SAND.	580
36		
	Dark gray (10YR4/1), moist, firm, silty CLAY with trace sand and slight trace gravel.	578
38		
		576

End of Boring = 39.40 ft bgs

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/6/2009
Finish: 2/6/2009
WEATHER: cool, sunny, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~G73a~~
Well ID: G73L
Surface Elev: 614.64 ft. MSL
Completion: 34.76 ft. BGS
Station: 13,924.52N
799.45E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
								FILL - Yellowish brown (10YR5/4) with 30% gray (10YR5/1) mottles, slightly moist, hard, clayey SILT with slight trace sand and gravel.	614
							2	FILL - Dark yellowish brown (10YR4/4), slightly moist, firm, clayey SILT with slight trace sand and gravel.	612
							4	FILL - Gray (10YR5/1) with 40% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT with slight trace sand and gravel.	610
							6	FILL - Dark yellowish brown (10YR4/4) with 10% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel.	608
							8	FILL - Dark yellowish brown (10YR4/4) with 10% gray (10YR6/1) mottles, slightly moist, soft, clayey SILT with slight trace sand and gravel.	606
							10	FILL - Dark yellowish brown (10YR4/4) with 5% gray (10YR6/1) mottles, moist, firm, clayey SILT with slight trace sand and gravel.	604
							12	FILL - Strong brown (7.5YR4/6), moist, firm, silty CLAY with slight trace sand, trace roots.	602
							14	Dark yellowish brown (10YR4/4) with 10% gray (10YR6/1) mottles, moist, soft to friable, clayey SILT with slight trace sand.	600
							16	Yellowish brown (10YR5/4) with 5% dark yellowish brown (10YR4/6) and 5% (10YR5/1) mottles, moist, firm, clayey SILT with slight trace sand, trace roots.	598
							18	Brown (10YR4/3) with 5% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, slightly moist, hard, clayey SILT with slight trace sand and gravel.	596
							20		

Borehole Detail

Remarks

NOTE(S): See G73S Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 2/6/2009
Finish: 2/6/2009
WEATHER: cool, sunny, lo-30's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G73a
Well ID: G73L
Surface Elev: 614.64 ft. MSL
Completion: 34.76 ft. BGS
Station: 13,924.52N
799.45E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

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	Elevation ft. MSL
							22	Brown (10YR4/3) with 5% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, slightly moist, hard, clayey SILT with slight trace sand and gravel. *[Continued from previous page]*	594, 592
							24		590
							26	Dark yellowish brown (10YR4/4) with 5% gray (10YR6/1) mottles, 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.	588
							28	Dark yellowish brown (10YR4/4) with 20% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel.	586
							30	Brown (10YR4/3) with 15% gray (10YR5/1) mottles, moist, firm, clayey SILT with slight trace sand and gravel.	584
							32	Dark yellowish brown (10YR4/4) with 10% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel.	582
								Dark yellowish brown (10YR4/4) with 30% gray (10YR6/1) mottles, very moist, soft, clayey SILT.	
							34	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	580
								Dark yellowish brown (10YR4/6) with 30% gray (10YR5/1) mottles, moist, soft, clayey SILT with slight trace sand and gravel.	

End of Boring = 34.76 ft bgs

NOTE(S): See G73S Boring log for sample and testing data.

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/10/2008
Finish: 11/10/2008
WEATHER: cool, sunny, lo-40's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

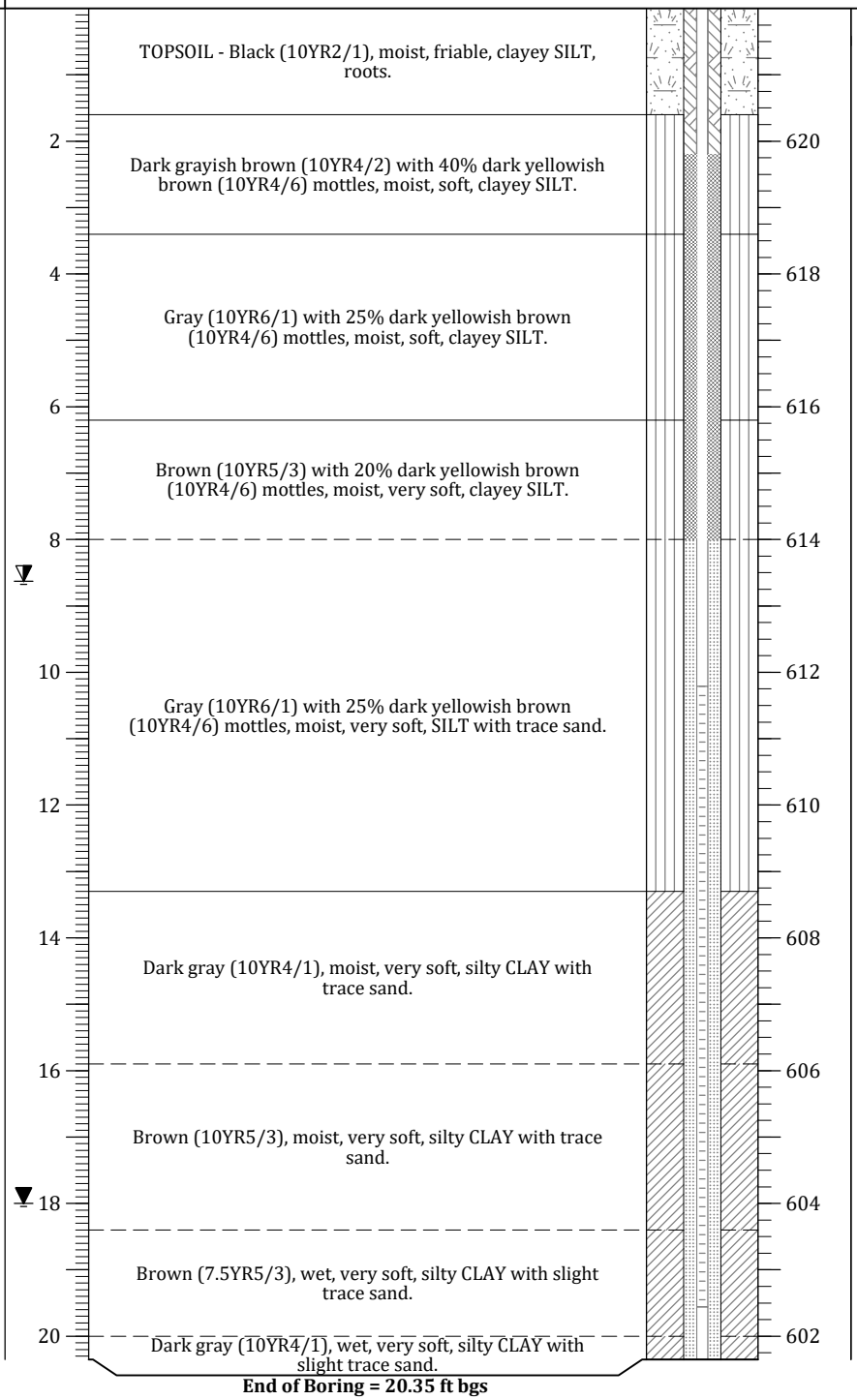
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~P01b~~
Well ID: P01L
Surface Elev: 622.00 ft. MSL
Completion: 20.35 ft. BGS
Station: 16,744.77N
-194.61E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 7, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 18.00 - during drilling
▼ = 8.63 - 01/08/09
▽ =

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



End of Boring = 20.35 ft bgs

NOTE(S): See P01I Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/10/2008
Finish: 11/10/2008
WEATHER: cool, sunny, lo-40's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~P01~~
Well ID: P01I
Surface Elev: 622.00 ft. MSL
Completion: 46.00 ft. BGS
Station: 16,749.97N
-194.61E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 7, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 18.00 - during drilling
▼ = 9.58 - 01/08/09
▽ =

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	24/24 100%	SS	4-4 5-10 N=9	17.2		
1B				30.5		
2A	24/24 100%	SS	2-2 3-4 N=5	30.3		
2B				24.9		
3A	23/24 96%	SS	2-2 3-4 N=5	24.9		
4A	24/24 100%	SS	2-3 4-4 N=7	22.9		
5A	20/24 83%	SS	2-2 3-3 N=5	22.1		
6A	12/24 50%	SS	1-1 2-3 N=3	26.9		
7A	18/24 75%	SS	2-4 5-6 N=9	24.5		
7B				27.7		
8A	24/24 100%	SS	2-2 3-4 N=5	25.2		
8B				25.1		
9A	7/24 29%	SS	woh-woh woh-woh	24.9		
10A	24/24 100%	SS	2-3 4-5 N=7	22.5		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	TOPSOIL - Black (10YR2/1), moist, friable, clayey SILT, roots.	
2	Dark grayish brown (10YR4/2) with 40% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	620
4	Gray (10YR6/1) with 25% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	618
6	Brown (10YR5/3) with 20% dark yellowish brown (10YR4/6) mottles, moist, very soft, clayey SILT.	616
8	Gray (10YR6/1) with 25% dark yellowish brown (10YR4/6) mottles, moist, very soft, SILT with trace sand.	614
10 ▼		612
12		610
14	Dark gray (10YR4/1), moist, very soft, silty CLAY with trace sand.	608
16	Brown (10YR5/3), moist, very soft, silty CLAY with trace sand.	606
18 ▼	Brown (7.5YR5/3), wet, very soft, silty CLAY with slight trace sand.	604
20		602

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/10/2008
Finish: 11/10/2008
WEATHER: cool, sunny, lo-40's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: P01
Well ID: P01I
Surface Elev: 622.00 ft. MSL
Completion: 46.00 ft. BGS
Station: 16,749.97N
-194.61E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 7, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 18.00 - during drilling
▼ = 9.58 - 01/08/09
▽ =

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
11A	23/24 96%	SS	2-2 3-6 N=5	28.0		
11B				21.9		
12A	24/24 100%	SS	0-0 3-5 N=3	24.5		
12B				21.8		
13A	24/24 100%	SS	1-2 2-4 N=4	20.3		
14A	24/24 100%	SS	0-3 3-3 N=6	19.9		
14B				16.4		
15A	24/24 100%	SS	4-5 7-10 N=12	16.5		
16A	24/24 100%	SS	2-3 4-5 N=7	16.4		
17A	18/24 75%	SS	3-3 4-5 N=7	30.6		
18A	24/24 100%	SS	7-9 14-21 N=23	23.5		
18B				12.5		
19A	24/24 100%	SS	8-10 15-20 N=25	12.4		
19B				11.4		
20A	12/16 75%	SS	16-26 50/4"	12.5		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark gray (10YR4/1), wet, very soft, silty CLAY with slight trace sand.	
	Dark greenish gray (5GY4/1), moist, hard, silty CLAY with some sand and trace gravel.	
22	Dark gray (10YR4/1), wet, soft, silty CLAY with little sand.	600
	Dark greenish gray (5GY4/1), moist, hard, silty CLAY with some sand and trace gravel.	
24		598
	Greenish gray (5GY6/1), wet, loose, clayey fine- to coarse-grained SAND with trace gravel.	
26		596
	Olive (5Y5/3), moist, soft, clayey SILT with slight trace sand.	
28		594
30	Gray (N5/1), moist, firm, clayey SILT with slight trace sand and gravel.	592
32		590
34		588
	Dark gray (10YR4/1), moist, firm, clayey SILT.	
36	Greenish gray (5G5/1) with 30% reddish brown (5YR5/3) mottles, slightly moist, hard, clayey SILT with little sand and gravel.	586
	Gray (N5/1), wet, silty fine- to coarse-grained SAND with trace gravel.	
38	Gray (10YR5/1) slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	584
40		582

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/10/2008
Finish: 11/10/2008
WEATHER: cool, sunny, lo-40's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

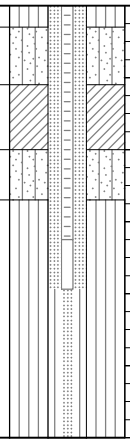
BOREHOLE ID: P01
Well ID: P01I
Surface Elev: 622.00 ft. MSL
Completion: 46.00 ft. BGS
Station: 16,749.97N
-194.61E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 7, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 18.00 - during drilling
▼ = 9.58 - 01/08/09
▽ =

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
21A	24/24 100%	SS	7-15 18-21 N=33	11.5				Dark greenish gray (10Y4/1), wet, silty fine- to coarse-grained SAND with trace gravel.	
21B				15.2				Dark gray (N4/1), moist, very hard, silty CLAY with some sand and gravel.	
22A	24/24 100%	SS	8-6 17-21 N=23	14.3			42	Dark greenish gray (10Y4/1), wet, silty fine- to coarse-grained SAND with trace gravel.	580
22B				13.0			44	Dark gray (N4/1), slightly moist, very hard, clayey SILT with little sand and trace gravel.	578
23A	13/24 54%	SS	24-22 20-22 N=42	13.7			46		576

Borehole Detail



Remarks

End of Boring = 46.00 ft bgs

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/10/2008
Finish: 11/10/2008
WEATHER: cool, sunny, lo-40's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

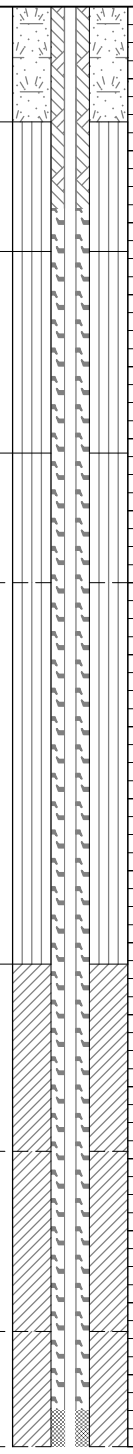
BOREHOLE ID: ~~P01a~~
Well ID: P01S
Surface Elev: 622.00 ft. MSL
Completion: 27.74 ft. BGS
Station: 16,754.60N
-194.67E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 7, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 18.00 - during drilling
▼ = 8.46 - 01/08/09
▽ =

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	Elevation ft. MSL
								TOPSOIL - Black (10YR2/1), moist, friable, clayey SILT, roots.	
							2	Dark grayish brown (10YR4/2) with 40% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	620
							4	Gray (10YR6/1) with 25% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	618
							6	Brown (10YR5/3) with 20% dark yellowish brown (10YR4/6) mottles, moist, very soft, clayey SILT.	616
							8 ▼	Gray (10YR6/1) with 25% dark yellowish brown (10YR4/6) mottles, moist, very soft, SILT with trace sand.	614
							10		612
							12		610
							14	Dark gray (10YR4/1), moist, very soft, silty CLAY with trace sand.	608
							16	Brown (10YR5/3), moist, very soft, silty CLAY with trace sand.	606
							18 ▼	Brown (7.5YR5/3), wet, very soft, silty CLAY with slight trace sand.	604
							20		602

Borehole Detail



NOTE(S): See P01I Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/10/2008
Finish: 11/10/2008
WEATHER: cool, sunny, lo-40's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

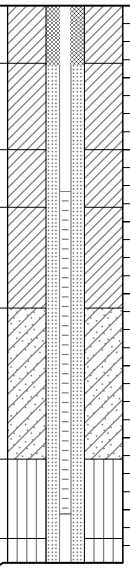
BOREHOLE ID: P01a
Well ID: P01S
Surface Elev: 622.00 ft. MSL
Completion: 27.74 ft. BGS
Station: 16,754.60N
-194.67E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 7, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 18.00 - during drilling
▼ = 8.46 - 01/08/09
▽ =

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	Elevation ft. MSL
								Dark gray (10YR4/1), wet, very soft, silty CLAY with slight trace sand.	
								Dark greenish gray (5GY4/1), moist, hard, silty CLAY with some sand and trace gravel.	
							22	Dark gray (10YR4/1), wet, soft, silty CLAY with little sand.	600
								Dark greenish gray (5GY4/1), moist, hard, silty CLAY with some sand and trace gravel.	
							24	Greenish gray (5GY6/1), wet, loose, clayey fine- to coarse-grained SAND with trace gravel.	598
							26	Olive (5Y5/3), moist, soft, clayey SILT with slight trace sand.	596
								Gray (N5/1), moist, firm, clayey SILT with slight trace sand and gravel.	

Borehole Detail



Remarks

End of Boring = 27.74 ft bgs

NOTE(S): See P01I Boring log for sample and testing data.

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/10/2008
Finish: 11/10/2008
WEATHER: cool, sunny, lo-40's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: ~~P01~~
Well ID: P01I
Surface Elev: 622.00 ft. MSL
Completion: 46.00 ft. BGS
Station: 16,749.97N
-194.61E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 7, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 18.00 - during drilling
▼ = 9.58 - 01/08/09
▽ =

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	24/24 100%	SS	4-4 5-10 N=9	17.2		
1B				30.5		
2A	24/24 100%	SS	2-2 3-4 N=5	30.3		
2B				24.9		
3A	23/24 96%	SS	2-2 3-4 N=5	24.9		
4A	24/24 100%	SS	2-3 4-4 N=7	22.9		
5A	20/24 83%	SS	2-2 3-3 N=5	22.1		
6A	12/24 50%	SS	1-1 2-3 N=3	26.9		
7A	18/24 75%	SS	2-4 5-6 N=9	24.5		
7B				27.7		
8A	24/24 100%	SS	2-2 3-4 N=5	25.2		
8B				25.1		
9A	7/24 29%	SS	woh-woh woh-woh	24.9		
10A	24/24 100%	SS	2-3 4-5 N=7	22.5		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	TOPSOIL - Black (10YR2/1), moist, friable, clayey SILT, roots.	
2	Dark grayish brown (10YR4/2) with 40% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	620
4	Gray (10YR6/1) with 25% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	618
6	Brown (10YR5/3) with 20% dark yellowish brown (10YR4/6) mottles, moist, very soft, clayey SILT.	616
8	Gray (10YR6/1) with 25% dark yellowish brown (10YR4/6) mottles, moist, very soft, SILT with trace sand.	614
10 ▼		612
12		610
14	Dark gray (10YR4/1), moist, very soft, silty CLAY with trace sand.	608
16	Brown (10YR5/3), moist, very soft, silty CLAY with trace sand.	606
18 ▼	Brown (7.5YR5/3), wet, very soft, silty CLAY with slight trace sand.	604
20		602

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/10/2008
Finish: 11/10/2008
WEATHER: cool, sunny, lo-40's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: P01
Well ID: P01I
Surface Elev: 622.00 ft. MSL
Completion: 46.00 ft. BGS
Station: 16,749.97N
-194.61E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 7, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 18.00 - during drilling
▼ = 9.58 - 01/08/09
▽ =

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
11A	23/24 96%	SS	2-2 3-6 N=5	28.0		
11B				21.9		
12A	24/24 100%	SS	0-0 3-5 N=3	24.5		
12B				21.8		
13A	24/24 100%	SS	1-2 2-4 N=4	20.3		
14A	24/24 100%	SS	0-3 3-3 N=6	19.9		
14B				16.4		
15A	24/24 100%	SS	4-5 7-10 N=12	16.5		
16A	24/24 100%	SS	2-3 4-5 N=7	16.4		
17A	18/24 75%	SS	3-3 4-5 N=7	30.6		
18A	24/24 100%	SS	7-9 14-21 N=23	23.5		
18B				12.5		
19A	24/24 100%	SS	8-10 15-20 N=25	12.4		
19B				11.4		
20A	12/16 75%	SS	16-26 50/4"	12.5		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark gray (10YR4/1), wet, very soft, silty CLAY with slight trace sand.	
	Dark greenish gray (5GY4/1), moist, hard, silty CLAY with some sand and trace gravel.	
22	Dark gray (10YR4/1), wet, soft, silty CLAY with little sand.	600
	Dark greenish gray (5GY4/1), moist, hard, silty CLAY with some sand and trace gravel.	
24		598
	Greenish gray (5GY6/1), wet, loose, clayey fine- to coarse-grained SAND with trace gravel.	
26		596
	Olive (5Y5/3), moist, soft, clayey SILT with slight trace sand.	
28		594
30	Gray (N5/1), moist, firm, clayey SILT with slight trace sand and gravel.	592
32		590
34		588
	Dark gray (10YR4/1), moist, firm, clayey SILT.	
36	Greenish gray (5G5/1) with 30% reddish brown (5YR5/3) mottles, slightly moist, hard, clayey SILT with little sand and gravel.	586
	Gray (N5/1), wet, silty fine- to coarse-grained SAND with trace gravel.	
38	Gray (10YR5/1) slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	584
40		582

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/10/2008
Finish: 11/10/2008
WEATHER: cool, sunny, lo-40's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

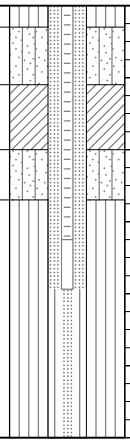
BOREHOLE ID: P01
Well ID: P01I
Surface Elev: 622.00 ft. MSL
Completion: 46.00 ft. BGS
Station: 16,749.97N
-194.61E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 7, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 18.00 - during drilling
▼ = 9.58 - 01/08/09
▽ =

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
21A	24/24 100%	SS	7-15 18-21 N=33	11.5				Dark greenish gray (10Y4/1), wet, silty fine- to coarse-grained SAND with trace gravel.	
21B				15.2				Dark gray (N4/1), moist, very hard, silty CLAY with some sand and gravel.	
22A	24/24 100%	SS	8-6 17-21 N=23	14.3			42	Dark greenish gray (10Y4/1), wet, silty fine- to coarse-grained SAND with trace gravel.	580
22B				13.0			44	Dark gray (N4/1), slightly moist, very hard, clayey SILT with little sand and trace gravel.	578
23A	13/24 54%	SS	24-22 20-22 N=42	13.7			46		576

Borehole Detail



Remarks

End of Boring = 46.00 ft bgs

NOTE(S):

HANSON

P41D (MW-5D)

RECORD OF SOIL EXPLORATION

Project Name	Ameren Duck Creek	Sheet	1 of 3
Job #	03S5010	Boring #	~~B-14/MW-5~~
Location	CCB Landfill - Phase II Site Invest.	Station	-
Driller	Western Environmental Drilling Inc.	Surface Elevation	610.3
Foreman	Randy Howard CME 850	Drilling Method	HSA/ 2-3/4" Mud Rotary
Engineer/Geologist	ASY	Sampling Method	SS/Core
Weather & Temp.	82°, Sunny, Breezy	Hammer Type	Auto
Date: Start	9/17/2003 1250	Water Depth: DD	18'
Finish	9/19/2003 1255	AAR	-
		Delayed	-

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
0.0	0.5	Brn. silt loam, moist, topsoil.	SS-1	1.5	3.5	3-5-5-5 Rec = 18" Qp = 2.5
0.5	4.5	Lt. brn.-gray to yellow-brn. silt, tr.-so. clay, moist, mottled, iron staining, roots (loess).	SS-2	4.0	6.0	3-4-4-4 Rec = 20" Qp = 1.7
4.5	7.8	Gray silt, so. iron staining, v. moist @ 6' 7", occ. roots, moist (loess).	SS-3	6.5	8.5	2-2-3-3 Rec = 24" Qp = 1.6
7.8	9.0	Brn. and gray mottled silt, tr. clay, moist (loess).	SS-4	9.0	11.0	1-2-3-4 Rec = 20" Qp = 1.3
9.0	11.0	Yel.-brn. silt, tr. clay, moist (loess).	SS-5	11.5	13.5	1-2-3-3 Rec = 24" Qp = 1.3
11.0	14.5	Red-brn. and gray clayey silt, tr. f. sand, moist (till).	SS-6	14.0	16.0	2-3-3-3 Rec = 22" Qp = 1.4 to 2.4
14.5	18.0	As above, so. f.-m. sand, tr. coal frags and gravel (till).	SS-7	16.5	18.5	2-2-2-2 Rec = 24" Qp = -
18.0	20.8	Yellow-brn. sa. silt, so. clay, tr. gravel, v. moist to wet.	SS-8	19.0	21.0	1-1-2-2 Rec = 24" Qp = -
20.8	23.3	Red-brn and gray clayey silt, tr.-so. f. sand, tr. gravel and coal frags., moist (till).	SS-9	21.5	23.5	2-4-3-5 Rec = 19" Qp = 2.2
23.3	24.0	Brn-gray silty v.f. sand, wet.	SS-10	24.0	26.0	1-2-2-3 Rec = 19" Qp = -
24.0	26.0	Lt. gray to yellow-gray silt, v. moist-wet, laminated, so. dark gray laminae, occ. wood frags.	SS-11	26.5	28.5	4-9-17-25 Rec = 23" Qp = 3.2 (till)

General Remarks:

Project Name Ameren Duck Creek - Phase II Site Invest. **Boring #** B-14/MW-5

Sheet 2 of 3

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
26.0	27.5	Gray cl. silt, so. sand (f.-m.), stiff, moist, occ. f. gravel (till).	SS-12	29.0	31.0	6-11-18-24 Rec = 24" Qp = 4.5+
27.5	28.4	Red brown to brn. f.-m. sand, wet.	SS-13	31.5	33.5	5-13-25-40 Rec = 21" Qp = 4.5+ to -
28.4	33.0	Gray sa. silt, so. clay, tr. gravel, moist, v. stiff (till).	SS-14	34.0	36.0	13-29-33-44 Rec = 19" Qp = -
33.0	38.4	Gray f.-m. sand, wet, tr. crs. sand (gravel @ base), dense.	SS-15	36.5	38.5	3-17-28-22 Rec = 18" Qp = -
38.4	46.0	Gray silty clay, tr.-so. gravel (f.-m.), tr. v.f.-f. sand, occ. coal fragments, dry to mst. v. stiff (till).	SS-16	39.0	41.0	5-11-16-23 Rec = 22" Qp = 4.5+
46.0	48.6	Brown to brn.-gray f.-m. sandy silt, so. clay, tr. gravel, stiff, moist (till).	SS-17	41.5	43.5	5-12-17-24 Rec = 24" Qp = 4.5+
48.6	50.0	Gray f.-crs. sand, dry, v. dense, tr.-so. gravel, v. moist @ base, methane production.	SS-18	44.0	46.0	6-10-17-21 Rec = 23" Qp = 4.5+
50.0	51.5	Lt. gray to yel-gray silt, v. moist-wet, iron staining, methane production.	SS-19	46.5	48.0	5-20-50/5" Rec = 15" Qp = 4.3 to 4.5+
51.5	55.8	Gray-brn. v.f. sa. silt, so. clay, tr. f. gravel, moist, v. stiff (till).	SS-20	49.0	51.0	35-40-47-50/5" Rec = 24" Qp = 1.0 (silt)
55.8	65.5	Gray f.-crs. sand, tr. f. gravel and silt, wet, partially cemented (calcareous), v. dense, more gravel 61.5' - 65.5'.	SS-21	51.5	53.0	14-34-50/4" (overpacked w/sand) Rec = 12" silt Qp = 1.0 (silt)
65.5	66.5	Gray silty v.f.-m. sand, tr. gravel, partially cemented, v. dense.	SS-22	54.0	55.0	14-50 Rec = 12" Qp = 4.5+
66.5	71.7	Gray clayey silt, so. v.f.-f. sand, tr. gravel (f.-m.), calcareous, sl. moist, v. stiff (till), so. shale frags.	SS-23	56.5	58.5	18-31-31-37 Rec = 21" Qp = -
71.7	80.8	Gray v.f.-f. sa. silt, tr.-so. clay, tr. f.-m. gravel, occ. coal frags., v. stiff, sl. moist, calcareous (till).	SS-24	59.0	61.0	16-27-32-41 Rec = 18" Qp = -
80.8	84.0	Gray to dk. gray silt, tr.-so. clay, tr. v.f.-f. sand and f.-m. gravel, occ. varves, wood frags., stiff, sl. calcareous (till).	SS-25	61.5	63.5	16-26-29-30 Rec = 19" Qp = -
84.0	89.6	Dk. gray silt, tr. clay, tr. v.f. sand, occ. zones of diss. carbonaceous material (m. sand sized), occ. coal frags., occ. varved zones, v. stiff.	SS-26	64.0	65.5	12-30-50/4" Rec = 14" Qp = -

General Remarks:

1640 Switch to mud rotary @ 55'.
1748 Begin mud rotary w/polymer.
1905 end drilling for today at 64.0'.
Methane produced from 49' - 53' inside borehole.

Project Name Ameren Duck Creek - Phase II Site Invest.

Boring # B-14/MW-5

Sheet 3 of 3

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
89.6	93.0	Gray wthrd. siltstone, thinly bedded, tr. clay.	SS-27	66.5	68.5	18-34-45-50/5" Rec = 24" Qp = 4.5++
			SS-28	69.0	71.0	15-29-32-45 Rec = 24" Qp = 4.5++
			SS-29	71.5	73.0	23-45-50/4" Rec = 15" Qp = 4.5+
			SS-30	74.0	75.5	24-36-37 Rec = 17" Qp = 4.5++
			SS-31	76.5	78.0	26-37-44 Rec = 18" Qp = 4.5+
			SS-32	79.0	81.0	Drop Rod-27-39-50 Rec = 22" Qp = 4.5+
			SS-33	81.5	83.5	13-23-33-44 Rec = 24" Qp = 4.5+
			SS-34	84.0	86.0	7-13-21-27 Rec = 24" Qp = 4.5+
			SS-35	87.5	89.5	8-16-32-50/3" Rec = 17" Qp = 4.5+
			SS-36	90.0	90.5	50/5-1/2" Rec = 6" Qp = 4.5+
		End SS @ 93.0'. Begin coring @ 93.7'.	SS-37	92.5	93.0	50/4"

General Remarks:

* 9-18-03 Resume B-14 @ 0800 @ 64.0'.
* Drilled much harder @ 89.6'.
* 9-18-03 1240 Stopped drilling @ 92.5'.

HANSON

BORING NO.	B-14/MW-5
PROJECT No. 03S5010	SHEET 1 OF 3

PROJECT NAME:	DATE	Engineer/Geologist:
Ameren Duck Creek	9/19/2003	Scott Yankey

Depth In Feet	ROCK, COLOR, HARDNESS, WEATHERING, GRAIN OR CRYSTALLINITY, BEDDING, VOIDS (OTHER: THICKNESS & LOCATION OF CLAY/SHALE SEAMS)	Sample or Run Number	% REC --------- % RQD	Box Number	Time 8:35	DWR %	DWRC	Down Pressure	Depth In Feet
93.0	Start core 93.7'	1	Run 9.3'	1		100%	Gray	250#	
94.0	Loss 94.8'		Rec 8.15' 88%		1:53				
95.0	Gray silty shale, thinly bedded. 95.6' High angle fracture 96.0'		RQD 7.95'/ 9.3' 85%		1:35				
96.0					2:07		Lt. gray		
97.0					1:47				
98.0	98.3'				1:54	4'4" added 5.0'			
99.0	Gray shale, so. silt, thinly bedded.				1:35				
100.0					1:12		Dk. gray		
101.0					1:03				
102.0					0:53				
103.0									

Core barrel 13.0' - End Run 1 - 103.0

HANSON	BORING NO. B-14/MW-5	
	PROJECT No. 03S5010	SHEET 2 OF 3

PROJECT NAME: Ameren Duck Creek	DATE 9/19/2003	Engineer/Geologist: Scott Yankey

Depth In Feet	ROCK, COLOR, HARDNESS, WEATHERING, GRAIN OR CRYSTALLINITY, BEDDING, VOIDS (OTHER: THICKNESS & LOCATION OF CLAY/SHALE SEAMS)	Sample or Run Number	% REC / % RQD	Box Number	Time	DWR %	DWRC	Down Pressure	Depth In Feet
103.0	Dark gray shale, fissil.	2		1		100	Gray	450#	
			Run 10.0'						
104.0					1:45				
			Rec 8.6'						
				104.8'					
105.0					1:52				
				2					
			RQD 7.5'/ 10.0'						
106.0					1:58				
107.0					2:30				
108.0	108.0'				1:53				
	108.3' Gray shaley limestone.								
	Loss					sl. drop			
109.0	109.1'				1:50				
	Dark gray limey shale, fractured, near vert., open, clean. 109.7'					sl. drop			
110.0	Loss 110.1'				2:23				
	Gray shaley limestone, tr. fossils.								
	Dark gray shale, fissil.								
111.0					-			250#	
112.0					3:30				
	112.65'								
	112.75' Gray shaley limestone.								
113.0					3:02				

HANSON

BORING NO.	B-14/MW-5
PROJECT No. 03S5010	SHEET 3 OF 3

PROJECT NAME:	DATE	Engineer/Geologist: Scott Yankey
Ameren Duck Creek	9/19/2003	

Depth In Feet	ROCK, COLOR, HARDNESS, WEATHERING, GRAIN OR CRYSTALLINITY, BEDDING, VOIDS (OTHER: THICKNESS & LOCATION OF CLAY/SHALE SEAMS)	Sample or Run Number	% REC / % RQD	Box Number	Time	DWR %	DWRC	Down Pressure	Depth In Feet
113.0	Dark gray limey shale.	2		2		100	Gray	250#	
	113.85'								
114.0	104.05' Dark gray shaley, limestone, fossiliferous.								
	Dk. gray to black shale, so. lime, scattered fossils.								
115.0									
	115.9'			115.9'					
116.0				3					
	Black shale, so. lime. 116.5'								
117.0	Dk. gray shaley limestone to limey shale, fossiliferous.								
	117.3'								
	Loss (in hole)								
118.0	118.0'								
	EOB @ 118.0'								

9-19-03 Coring completed 1255

HANSON

RECORD OF SOIL EXPLORATION

P41I1 (MW-5I1)

Project Name	Ameren Duck Creek	Sheet	1 of 1
Job #	03S5010	Boring #	~~B-14A/P-5I1~~
Location	CCB Landfill - Phase III Site Invest.	Station	-
Driller	Western Environmental Drilling Inc.	Surface Elevation	609.9
Foreman	Randy Howard	Drilling Method	HSA CME 850 ATV
Engineer/Geologist	ASY	Sampling Method	SS
Weather & Temp.	35°, Sunny, Windy	Hammer Type	Auto

Date:	Start	12/15/2003 1330	Water Depth: DD	-
	Finish	12/15/2003 1600	AAR	-
			Delayed	-

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
		No sampling to 29' (see B-14)				
29.0	30.5	Brown-red f.-m. sand, wet.	SS-1	29.0	31.0	16-26-25-23 sand: - Rec = 24" Qp = till: 4.5+
30.5	32.5	Gray sandy clay, so. silt, tr. gravel, v. stiff, moist (till).	SS-2	31.5	33.5	8-18-26-46 sand: - Rec = 24" Qp = till: 4.5+
32.5	37.0	Gray f.-m. sand, wet.	SS-3	34.0	36.0	No sample. Sand blown-in inside auger. Rec = Qp =
37.0	38.5	Gray silty clay, tr. sand and gravel, tr.-so. coal frags., v. stiff, moist (till).	SS-4	36.5	38.5	14-10-11-14 Rec = 20" Qp = 4.5+
		EOB @ 38.5'				

General Remarks:

HANSON

RECORD OF SOIL EXPLORATION

Project Name	Ameren Duck Creek	Sheet	1 of 3
Job #	03S5010	Boring #	B-14/MW-5
Location	CCB Landfill - Phase II Site Invest.	Station	-
Driller	Western Environmental Drilling Inc.	Surface Elevation	610.3
Foreman	Randy Howard CME 850	Drilling Method	HSA/ 2-3/4" Mud Rotary
Engineer/Geologist	ASY	Sampling Method	SS/Core
Weather & Temp.	82°, Sunny, Breezy	Hammer Type	Auto
Date: Start	9/17/2003 1250	Water Depth: DD	18'
Finish	9/19/2003 1255	AAR	-
		Delayed	-

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
0.0	0.5	Brn. silt loam, moist, topsoil.	SS-1	1.5	3.5	3-5-5-5 Rec = 18" Qp = 2.5
0.5	4.5	Lt. brn.-gray to yellow-brn. silt, tr.-so. clay, moist, mottled, iron staining, roots (loess).	SS-2	4.0	6.0	3-4-4-4 Rec = 20" Qp = 1.7
4.5	7.8	Gray silt, so. iron staining, v. moist @ 6' 7", occ. roots, moist (loess).	SS-3	6.5	8.5	2-2-3-3 Rec = 24" Qp = 1.6
7.8	9.0	Brn. and gray mottled silt, tr. clay, moist (loess).	SS-4	9.0	11.0	1-2-3-4 Rec = 20" Qp = 1.3
9.0	11.0	Yel.-brn. silt, tr. clay, moist (loess).	SS-5	11.5	13.5	1-2-3-3 Rec = 24" Qp = 1.3
11.0	14.5	Red-brn. and gray clayey silt, tr. f. sand, moist (till).	SS-6	14.0	16.0	2-3-3-3 Rec = 22" Qp = 1.4 to 2.4
14.5	18.0	As above, so. f.-m. sand, tr. coal frags and gravel (till).	SS-7	16.5	18.5	2-2-2-2 Rec = 24" Qp = -
18.0	20.8	Yellow-brn. sa. silt, so. clay, tr. gravel, v. moist to wet.	SS-8	19.0	21.0	1-1-2-2 Rec = 24" Qp = -
20.8	23.3	Red-brn and gray clayey silt, tr.-so. f. sand, tr. gravel and coal frags., moist (till).	SS-9	21.5	23.5	2-4-3-5 Rec = 19" Qp = 2.2
23.3	24.0	Brn-gray silty v.f. sand, wet.	SS-10	24.0	26.0	1-2-2-3 Rec = 19" Qp = -
24.0	26.0	Lt. gray to yellow-gray silt, v. moist-wet, laminated, so. dark gray laminae, occ. wood frags.	SS-11	26.5	28.5	4-9-17-25 Rec = 23" Qp = 3.2 (till)

General Remarks:

Project Name Ameren Duck Creek - Phase II Site Invest. **Boring #** B-14/MW-5

Sheet 2 of 3

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
26.0	27.5	Gray cl. silt, so. sand (f.-m.), stiff, moist, occ. f. gravel (till).	SS-12	29.0	31.0	6-11-18-24 Rec = 24" Qp = 4.5+
27.5	28.4	Red brown to brn. f.-m. sand, wet.	SS-13	31.5	33.5	5-13-25-40 Rec = 21" Qp = 4.5+ to -
28.4	33.0	Gray sa. silt, so. clay, tr. gravel, moist, v. stiff (till).	SS-14	34.0	36.0	13-29-33-44 Rec = 19" Qp = -
33.0	38.4	Gray f.-m. sand, wet, tr. crs. sand (gravel @ base), dense.	SS-15	36.5	38.5	3-17-28-22 Rec = 18" Qp = -
38.4	46.0	Gray silty clay, tr.-so. gravel (f.-m.), tr. v.f.-f. sand, occ. coal fragments, dry to mst. v. stiff (till).	SS-16	39.0	41.0	5-11-16-23 Rec = 22" Qp = 4.5+
46.0	48.6	Brown to brn.-gray f.-m. sandy silt, so. clay, tr. gravel, stiff, moist (till).	SS-17	41.5	43.5	5-12-17-24 Rec = 24" Qp = 4.5+
48.6	50.0	Gray f.-crs. sand, dry, v. dense, tr.-so. gravel, v. moist @ base, methane production.	SS-18	44.0	46.0	6-10-17-21 Rec = 23" Qp = 4.5+
50.0	51.5	Lt. gray to yel-gray silt, v. moist-wet, iron staining, methane production.	SS-19	46.5	48.0	5-20-50/5" Rec = 15" Qp = 4.3 to 4.5+
51.5	55.8	Gray-brn. v.f. sa. silt, so. clay, tr. f. gravel, moist, v. stiff (till).	SS-20	49.0	51.0	35-40-47-50/5" Rec = 24" Qp = 1.0 (silt)
55.8	65.5	Gray f.-crs. sand, tr. f. gravel and silt, wet, partially cemented (calcareous), v. dense, more gravel 61.5' - 65.5'.	SS-21	51.5	53.0	14-34-50/4" (overpacked w/sand) Rec = 12" silt Qp = 1.0 (silt)
65.5	66.5	Gray silty v.f.-m. sand, tr. gravel, partially cemented, v. dense.	SS-22	54.0	55.0	14-50 Rec = 12" Qp = 4.5+
66.5	71.7	Gray clayey silt, so. v.f.-f. sand, tr. gravel (f.-m.), calcareous, sl. moist, v. stiff (till), so. shale frags.	SS-23	56.5	58.5	18-31-31-37 Rec = 21" Qp = -
71.7	80.8	Gray v.f.-f. sa. silt, tr.-so. clay, tr. f.-m. gravel, occ. coal frags., v. stiff, sl. moist, calcareous (till).	SS-24	59.0	61.0	16-27-32-41 Rec = 18" Qp = -
80.8	84.0	Gray to dk. gray silt, tr.-so. clay, tr. v.f.-f. sand and f.-m. gravel, occ. varves, wood frags., stiff, sl. calcareous (till).	SS-25	61.5	63.5	16-26-29-30 Rec = 19" Qp = -
84.0	89.6	Dk. gray silt, tr. clay, tr. v.f. sand, occ. zones of diss. carbonaceous material (m. sand sized), occ. coal frags., occ. varved zones, v. stiff.	SS-26	64.0	65.5	12-30-50/4" Rec = 14" Qp = -

General Remarks:

1640 Switch to mud rotary @ 55'.
1748 Begin mud rotary w/polymer.
1905 end drilling for today at 64.0'.
Methane produced from 49' - 53' inside borehole.

Project Name Ameren Duck Creek - Phase II Site Invest.

Boring # B-14/MW-5

Sheet 3 of 3

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
89.6	93.0	Gray wthrd. siltstone, thinly bedded, tr. clay.	SS-27	66.5	68.5	18-34-45-50/5" Rec = 24" Qp = 4.5++
			SS-28	69.0	71.0	15-29-32-45 Rec = 24" Qp = 4.5++
			SS-29	71.5	73.0	23-45-50/4" Rec = 15" Qp = 4.5+
			SS-30	74.0	75.5	24-36-37 Rec = 17" Qp = 4.5++
			SS-31	76.5	78.0	26-37-44 Rec = 18" Qp = 4.5+
			SS-32	79.0	81.0	Drop Rod-27-39-50 Rec = 22" Qp = 4.5+
			SS-33	81.5	83.5	13-23-33-44 Rec = 24" Qp = 4.5+
			SS-34	84.0	86.0	7-13-21-27 Rec = 24" Qp = 4.5+
			SS-35	87.5	89.5	8-16-32-50/3" Rec = 17" Qp = 4.5+
			SS-36	90.0	90.5	50/5-1/2" Rec = 6" Qp = 4.5+
		End SS @ 93.0'. Begin coring @ 93.7'.	SS-37	92.5	93.0	50/4"

General Remarks:

* 9-18-03 Resume B-14 @ 0800 @ 64.0'.
* Drilled much harder @ 89.6'.
* 9-18-03 1240 Stopped drilling @ 92.5'.

HANSON

BORING NO.	B-14/MW-5
PROJECT No. 03S5010	SHEET 1 OF 3

PROJECT NAME:	DATE	Engineer/Geologist:
Ameren Duck Creek	9/19/2003	Scott Yankey

Depth In Feet	ROCK, COLOR, HARDNESS, WEATHERING, GRAIN OR CRYSTALLINITY, BEDDING, VOIDS (OTHER: THICKNESS & LOCATION OF CLAY/SHALE SEAMS)	Sample or Run Number	% REC --------- % RQD	Box Number	Time 8:35	DWR %	DWRC	Down Pressure	Depth In Feet
93.0	Start core 93.7'	1	Run 9.3'	1		100%	Gray	250#	
94.0	Loss 94.8'		Rec 8.15' 88%		1:53				
95.0	Gray silty shale, thinly bedded. 95.6' High angle fracture 96.0'		RQD 7.95'/ 9.3' 85%		1:35				
96.0					2:07		Lt. gray		
97.0					1:47				
98.0	98.3'				1:54	4'4" added 5.0'			
99.0	Gray shale, so. silt, thinly bedded.				1:35				
100.0					1:12		Dk. gray		
101.0					1:03				
102.0					0:53				
103.0									

Core barrel 13.0' - End Run 1 - 103.0

HANSON	BORING NO. B-14/MW-5	
	PROJECT No. 03S5010	SHEET 2 OF 3

PROJECT NAME: Ameren Duck Creek	DATE 9/19/2003	Engineer/Geologist: Scott Yankey

Depth In Feet	ROCK, COLOR, HARDNESS, WEATHERING, GRAIN OR CRYSTALLINITY, BEDDING, VOIDS (OTHER: THICKNESS & LOCATION OF CLAY/SHALE SEAMS)	Sample or Run Number	% REC / % RQD	Box Number	Time	DWR %	DWRC	Down Pressure	Depth In Feet
103.0	Dark gray shale, fissil.	2		1		100	Gray	450#	
			Run 10.0'						
104.0					1:45				
			Rec 8.6'						
				104.8'					
105.0					1:52				
				2					
			RQD 7.5'/ 10.0'						
106.0					1:58				
107.0					2:30				
108.0	108.0'				1:53				
	108.3' Gray shaley limestone.								
	Loss					sl. drop			
109.0	109.1'				1:50				
	Dark gray limey shale, fractured, near vert., open, clean. 109.7'					sl. drop			
110.0	Loss 110.1'				2:23				
	Gray shaley limestone, tr. fossils.								
	Dark gray shale, fissil.								
111.0					-			250#	
112.0					3:30				
	112.65'								
	112.75' Gray shaley limestone.								
113.0					3:02				

HANSON

BORING NO.	B-14/MW-5
PROJECT No. 03S5010	SHEET 3 OF 3

PROJECT NAME:	DATE	Engineer/Geologist: Scott Yankey
Ameren Duck Creek	9/19/2003	

Depth In Feet	ROCK, COLOR, HARDNESS, WEATHERING, GRAIN OR CRYSTALLINITY, BEDDING, VOIDS (OTHER: THICKNESS & LOCATION OF CLAY/SHALE SEAMS)	Sample or Run Number	% REC / % RQD	Box Number	Time	DWR %	DWRC	Down Pressure	Depth In Feet
113.0	Dark gray limey shale.	2		2		100	Gray	250#	
	113.85'								
114.0	104.05' Dark gray shaley, limestone, fossiliferous.								
	Dk. gray to black shale, so. lime, scattered fossils.								
115.0									
	115.9'			115.9'					
116.0				3					
	Black shale, so. lime. 116.5'								
117.0	Dk. gray shaley limestone to limey shale, fossiliferous.								
	117.3'								
	Loss (in hole)								
118.0	118.0'								
	EOB @ 118.0'								

9-19-03 Coring completed 1255

P41I2 (MW-5I2)

HANSON

RECORD OF SOIL EXPLORATION

Project Name	Ameren Duck Creek	Sheet	1 of 1
Job #	03S5010	Boring #	~~B-14B/P-5I2~~
Location	CCB Landfill - Phase III Site Invest.	Station	-
Driller	Western Environmental Drilling Inc.	Surface Elevation	609.8
Foreman	Randy Howard	Drilling Method	HSA CME 850 ATV
Engineer/Geologist	ASY	Sampling Method	SS
Weather & Temp.		Hammer Type	Auto

Date:	Start	12/16/2003 0805	Water Depth: DD	-
	Finish	12/16/2003 1230	AAR	-
			Delayed	-

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
		No sampling to 44' (see B-14)				
44.0	47.0	Gray to brown-gray silty clay, tr. sand and gravel, occ. coal frags., v. stiff, sl. moist (till).	SS-1	44.0	46.0	5-10-15-24 Rec = 24" Qp = 4.5+
47.0	49.0	Gray f.-crs. sand, so. gravel, partially cemented, wet, methane production.	SS-2	46.5	47.3	12-50/4" till: 4.5+ Rec = 10" Qp = sand: -
49.0	50.3	Gray-brown silt, partially cemented, wet, methane production.	SS-3	49.0	51.0	8-18-28-32 silt: - to 0.5 Rec = 10" Qp = till: 4.5+
50.3	51.0	Gray-brown clayey silt, so. v.f. sand, tr. gravel, v. stiff, moist (till).				
		EOB @ 51.0'				

General Remarks:

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RECORD OF SOIL EXPLORATION

Project Name	Ameren Duck Creek	Sheet	1 of 3
Job #	03S5010	Boring #	B-14/MW-5
Location	CCB Landfill - Phase II Site Invest.	Station	-
Driller	Western Environmental Drilling Inc.	Surface Elevation	610.3
Foreman	Randy Howard CME 850	Drilling Method	HSA/ 2-3/4" Mud Rotary
Engineer/Geologist	ASY	Sampling Method	SS/Core
Weather & Temp.	82°, Sunny, Breezy	Hammer Type	Auto
Date: Start	9/17/2003 1250	Water Depth: DD	18'
Finish	9/19/2003 1255	AAR	-
		Delayed	-

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
0.0	0.5	Brn. silt loam, moist, topsoil.	SS-1	1.5	3.5	3-5-5-5 Rec = 18" Qp = 2.5
0.5	4.5	Lt. brn.-gray to yellow-brn. silt, tr.-so. clay, moist, mottled, iron staining, roots (loess).	SS-2	4.0	6.0	3-4-4-4 Rec = 20" Qp = 1.7
4.5	7.8	Gray silt, so. iron staining, v. moist @ 6' 7", occ. roots, moist (loess).	SS-3	6.5	8.5	2-2-3-3 Rec = 24" Qp = 1.6
7.8	9.0	Brn. and gray mottled silt, tr. clay, moist (loess).	SS-4	9.0	11.0	1-2-3-4 Rec = 20" Qp = 1.3
9.0	11.0	Yel.-brn. silt, tr. clay, moist (loess).	SS-5	11.5	13.5	1-2-3-3 Rec = 24" Qp = 1.3
11.0	14.5	Red-brn. and gray clayey silt, tr. f. sand, moist (till).	SS-6	14.0	16.0	2-3-3-3 Rec = 22" Qp = 1.4 to 2.4
14.5	18.0	As above, so. f.-m. sand, tr. coal frags and gravel (till).	SS-7	16.5	18.5	2-2-2-2 Rec = 24" Qp = -
18.0	20.8	Yellow-brn. sa. silt, so. clay, tr. gravel, v. moist to wet.	SS-8	19.0	21.0	1-1-2-2 Rec = 24" Qp = -
20.8	23.3	Red-brn and gray clayey silt, tr.-so. f. sand, tr. gravel and coal frags., moist (till).	SS-9	21.5	23.5	2-4-3-5 Rec = 19" Qp = 2.2
23.3	24.0	Brn-gray silty v.f. sand, wet.	SS-10	24.0	26.0	1-2-2-3 Rec = 19" Qp = -
24.0	26.0	Lt. gray to yellow-gray silt, v. moist-wet, laminated, so. dark gray laminae, occ. wood frags.	SS-11	26.5	28.5	4-9-17-25 Rec = 23" Qp = 3.2 (till)

General Remarks:

Project Name Ameren Duck Creek - Phase II Site Invest. **Boring #** B-14/MW-5

Sheet 2 of 3

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
26.0	27.5	Gray cl. silt, so. sand (f.-m.), stiff, moist, occ. f. gravel (till).	SS-12	29.0	31.0	6-11-18-24 Rec = 24" Qp = 4.5+
27.5	28.4	Red brown to brn. f.-m. sand, wet.	SS-13	31.5	33.5	5-13-25-40 Rec = 21" Qp = 4.5+ to -
28.4	33.0	Gray sa. silt, so. clay, tr. gravel, moist, v. stiff (till).	SS-14	34.0	36.0	13-29-33-44 Rec = 19" Qp = -
33.0	38.4	Gray f.-m. sand, wet, tr. crs. sand (gravel @ base), dense.	SS-15	36.5	38.5	3-17-28-22 Rec = 18" Qp = -
38.4	46.0	Gray silty clay, tr.-so. gravel (f.-m.), tr. v.f.-f. sand, occ. coal fragments, dry to mst. v. stiff (till).	SS-16	39.0	41.0	5-11-16-23 Rec = 22" Qp = 4.5+
46.0	48.6	Brown to brn.-gray f.-m. sandy silt, so. clay, tr. gravel, stiff, moist (till).	SS-17	41.5	43.5	5-12-17-24 Rec = 24" Qp = 4.5+
48.6	50.0	Gray f.-crs. sand, dry, v. dense, tr.-so. gravel, v. moist @ base, methane production.	SS-18	44.0	46.0	6-10-17-21 Rec = 23" Qp = 4.5+
50.0	51.5	Lt. gray to yel-gray silt, v. moist-wet, iron staining, methane production.	SS-19	46.5	48.0	5-20-50/5" Rec = 15" Qp = 4.3 to 4.5+
51.5	55.8	Gray-brn. v.f. sa. silt, so. clay, tr. f. gravel, moist, v. stiff (till).	SS-20	49.0	51.0	35-40-47-50/5" Rec = 24" Qp = 1.0 (silt)
55.8	65.5	Gray f.-crs. sand, tr. f. gravel and silt, wet, partially cemented (calcareous), v. dense, more gravel 61.5' - 65.5'.	SS-21	51.5	53.0	14-34-50/4" (overpacked w/sand) Rec = 12" silt Qp = 1.0 (silt)
65.5	66.5	Gray silty v.f.-m. sand, tr. gravel, partially cemented, v. dense.	SS-22	54.0	55.0	14-50 Rec = 12" Qp = 4.5+
66.5	71.7	Gray clayey silt, so. v.f.-f. sand, tr. gravel (f.-m.), calcareous, sl. moist, v. stiff (till), so. shale frags.	SS-23	56.5	58.5	18-31-31-37 Rec = 21" Qp = -
71.7	80.8	Gray v.f.-f. sa. silt, tr.-so. clay, tr. f.-m. gravel, occ. coal frags., v. stiff, sl. moist, calcareous (till).	SS-24	59.0	61.0	16-27-32-41 Rec = 18" Qp = -
80.8	84.0	Gray to dk. gray silt, tr.-so. clay, tr. v.f.-f. sand and f.-m. gravel, occ. varves, wood frags., stiff, sl. calcareous (till).	SS-25	61.5	63.5	16-26-29-30 Rec = 19" Qp = -
84.0	89.6	Dk. gray silt, tr. clay, tr. v.f. sand, occ. zones of diss. carbonaceous material (m. sand sized), occ. coal frags., occ. varved zones, v. stiff.	SS-26	64.0	65.5	12-30-50/4" Rec = 14" Qp = -

General Remarks:

1640 Switch to mud rotary @ 55'.
1748 Begin mud rotary w/polymer.
1905 end drilling for today at 64.0'.
Methane produced from 49' - 53' inside borehole.

Project Name Ameren Duck Creek - Phase II Site Invest.

Boring # B-14/MW-5

Sheet 3 of 3

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
89.6	93.0	Gray wthrd. siltstone, thinly bedded, tr. clay.	SS-27	66.5	68.5	18-34-45-50/5" Rec = 24" Qp = 4.5++
			SS-28	69.0	71.0	15-29-32-45 Rec = 24" Qp = 4.5++
			SS-29	71.5	73.0	23-45-50/4" Rec = 15" Qp = 4.5+
			SS-30	74.0	75.5	24-36-37 Rec = 17" Qp = 4.5++
			SS-31	76.5	78.0	26-37-44 Rec = 18" Qp = 4.5+
			SS-32	79.0	81.0	Drop Rod-27-39-50 Rec = 22" Qp = 4.5+
			SS-33	81.5	83.5	13-23-33-44 Rec = 24" Qp = 4.5+
			SS-34	84.0	86.0	7-13-21-27 Rec = 24" Qp = 4.5+
			SS-35	87.5	89.5	8-16-32-50/3" Rec = 17" Qp = 4.5+
			SS-36	90.0	90.5	50/5-1/2" Rec = 6" Qp = 4.5+
		End SS @ 93.0'. Begin coring @ 93.7'.	SS-37	92.5	93.0	50/4"

General Remarks:

* 9-18-03 Resume B-14 @ 0800 @ 64.0'.
* Drilled much harder @ 89.6'.
* 9-18-03 1240 Stopped drilling @ 92.5'.

HANSON

BORING NO.	B-14/MW-5
PROJECT No. 03S5010	SHEET 1 OF 3

PROJECT NAME:	DATE	Engineer/Geologist:
Ameren Duck Creek	9/19/2003	Scott Yankey

Depth In Feet	ROCK, COLOR, HARDNESS, WEATHERING, GRAIN OR CRYSTALLINITY, BEDDING, VOIDS (OTHER: THICKNESS & LOCATION OF CLAY/SHALE SEAMS)	Sample or Run Number	% REC --------- % RQD	Box Number	Time 8:35	DWR %	DWRC	Down Pressure	Depth In Feet
93.0	Start core 93.7'	1	Run 9.3'	1		100%	Gray	250#	
94.0	Loss 94.8'		Rec 8.15' 88%		1:53				
95.0	Gray silty shale, thinly bedded. 95.6' High angle fracture 96.0'		RQD 7.95'/ 9.3' 85%		1:35				
96.0					2:07		Lt. gray		
97.0					1:47				
98.0	98.3'				1:54	4'4" added 5.0'			
99.0	Gray shale, so. silt, thinly bedded.				1:35				
100.0					1:12		Dk. gray		
101.0					1:03				
102.0					0:53				
103.0									

Core barrel 13.0' - End Run 1 - 103.0

HANSON	BORING NO. B-14/MW-5	
	PROJECT No. 03S5010	SHEET 2 OF 3

PROJECT NAME: Ameren Duck Creek	DATE 9/19/2003	Engineer/Geologist: Scott Yankey

Depth In Feet	ROCK, COLOR, HARDNESS, WEATHERING, GRAIN OR CRYSTALLINITY, BEDDING, VOIDS (OTHER: THICKNESS & LOCATION OF CLAY/SHALE SEAMS)	Sample or Run Number	% REC / % RQD	Box Number	Time	DWR %	DWRC	Down Pressure	Depth In Feet
103.0	Dark gray shale, fissil.	2		1		100	Gray	450#	
			Run 10.0'						
104.0					1:45				
			Rec 8.6'						
				104.8'					
105.0					1:52				
				2					
			RQD 7.5'/ 10.0'						
106.0					1:58				
107.0					2:30				
108.0	108.0'				1:53				
	108.3' Gray shaley limestone.								
	Loss					sl. drop			
109.0	109.1'				1:50				
	Dark gray limey shale, fractured, near vert., open, clean. 109.7'					sl. drop			
110.0	Loss 110.1'				2:23				
	Gray shaley limestone, tr. fossils.								
	Dark gray shale, fissil.								
111.0					-			250#	
112.0					3:30				
	112.65'								
	112.75' Gray shaley limestone.								
113.0					3:02				

HANSON

BORING NO.	B-14/MW-5
PROJECT No. 03S5010	SHEET 3 OF 3

PROJECT NAME:	DATE	Engineer/Geologist: Scott Yankey
Ameren Duck Creek	9/19/2003	

Depth In Feet	ROCK, COLOR, HARDNESS, WEATHERING, GRAIN OR CRYSTALLINITY, BEDDING, VOIDS (OTHER: THICKNESS & LOCATION OF CLAY/SHALE SEAMS)	Sample or Run Number	% REC / % RQD	Box Number	Time	DWR %	DWRC	Down Pressure	Depth In Feet
113.0	Dark gray limey shale.	2		2		100	Gray	250#	
	113.85'								
114.0	104.05' Dark gray shaley, limestone, fossiliferous.								
	Dk. gray to black shale, so. lime, scattered fossils.								
115.0									
	115.9'			115.9'					
116.0				3					
	Black shale, so. lime. 116.5'								
117.0	Dk. gray shaley limestone to limey shale, fossiliferous.								
	117.3'								
	Loss (in hole)								
118.0	118.0'								
	EOB @ 118.0'								

9-19-03 Coring completed 1255

P42D (MW-9D)

HANSON

RECORD OF SOIL EXPLORATION

Project Name	Ameren Duck Creek	Sheet	1 of 2
Job #	03S5010	Boring #	~~B-22 / MW-9~~
Location	CCB Landfill - Phase IV Site Invest.	Station	-
Driller	Testing Service Corporation	Surface Elevation	615.7
Foreman	Bruno Williamson	Drilling Method	HSA 3 1/4" I.D.
Engineer/Geologist	Scott Yankey	Sampling Method	SB/SS
Weather & Temp.	32°, Sunny, Calm	Hammer Type	Auto
Date: Start	12/8/2004	Water Depth: DD	8.5'
Finish	12/8/2004	AAR	-
		Delayed	-

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
0.0	0.5	Brown silt loam (topsoil).	SB-1	0.0	4.5	Rec = 4' Qp = 0.6
0.5	8.0	Yellow-brown silt, so. gray mottling, so. clay, iron staining, concretions, soft, moist (loess).	SB-2	4.5	9.5	Rec = 4' Qp = 0.8
8.0	11.2	Gray silt, tr. clay and v.f. sand, so. brown mottling, iron staining, concretions, moist, wet at 8.5' (loess).	SB-3	9.5	14.5	Rec = 5' Qp = 2.4
11.2	17.0	Dark gray and brown mottled clayey silt, so. v.f. sand, iron staining, stiff, moist (paleosol?).	SB-4	14.5	19.5	Rec = 5' Qp = 2.0
17.0	23.0	Brown and gray mottled silty clay, tr. v.f. sand and f. gravel, stiff, moist (till).	SB-5	19.5	24.5	Rec = 5' Qp = 2.0
23.0	24.5	Gray silt, so. v.f.-f. sand, soft v. moist.	SB-6	24.5	29.5	Rec = 2.0' Qp = -
24.5	29.5	Brown-gray f.-med. sand, wet.	SB-7	29.5	34.5	Rec = 5' Qp = 1.5-4.0
29.5	30.5	Gray clayey silt, so. sand and gravel, stiff, moist (till).	SB-8	34.5	39.5	Rec = 3' Qp = 1.7-4.5+
30.5	31.7	Gray silt, so. v.f.-f. sand, tr. gravel, wet.	SB-9	39.5	44.5	Rec = 5' Qp = 4.5+
31.7	32.2	Brown med. sand, wet.	SB-10	44.5	49.5	Rec = 5' Qp = 4.5+
32.2	35.0	Brown clayey silt, so. sand, tr.-so. gravel, v. stiff, moist (till).	SB-11	49.5	54.5	Rec = 1.0' Qp = -

General Remarks:

Project Name Ameren Duck Creek - Phase IV Site Invest. **Boring #** B-22 / MW-9

Sheet 2 of 2

STRATUM DEPTH From	STRATUM DEPTH To	SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE DEPTH From	SAMPLE DEPTH To	STD. PENETRATION TEST BLOWS / 6 INCHES P=Penetrometer
35.0	39.0	Gray silt, with some sand seams, wet.	SB-12	54.5	59.5	Rec = 5' Qp = 4.5+
39.0	47.0	Gray silty clay, so. v.f.-f. sand, tr.-so. gravel, occ. coal and wood fragments, v. stiff (till).	SB-13	59.5	64.5	Rec = 5' Qp = 4.5+
47.0	48.0	Gray clayey sand. so. silt and gravel, so. thin sand partings.	SB-14	64.5	69.5	Rec = 5' Qp = 4.5+
48.0	49.5	Gray silty clay, so. v.f.-f. sand, tr.-so. gravel, occ. coal and wood fragments, v. stiff, organic zone 49.1-49.2' (till).	SB-15	69.5	74.5	Rec = 2.5' Qp = -
49.5	54.5	Gray f.-v.crs. sand, partially cemented, calcareous, wet.	SB-16	74.5	79.5	Rec = 5' Qp = 4.5+
54.5	67.0	Gray clayey silt, so. v.f.-f. sand, tr.-so. gravel, calcareous (till).	SB-17	79.5	84.5	Rec = 5' Qp = 4.5+
67.0	67.5	Gray silt, wet.	SB-18	84.5	85.5	Refusal Rec = 1' Qp = 4.5+
67.5	69.5	Gray sandy silt, partially cemented, wet.	SS-1	85.5	87.0	28-50-100/3" Rec = 16" Qp = 4.5+
69.5	73.8	Gray f.-v.crs. sand, partially cemented, calcareous, wet.	SS-2	89.5	89.7	100/3" Rec = 2.5" Qp = 4.5+
73.8	74.5	Gray silt, so. v.f. sand, partially cemented, calcareous.				
74.5	79.5	Gray clayey silt, so. v.f. sand, tr.-so. gravel, occ. coal and wood fragments, v. stiff, abund. wood frags. and organics 79-79.5' (till).				
79.5	83.0	Darh gray clayey silt, so. v.f. sand, tr. gravel, v. stiff (till).				
83.0	85.5	Gray silty sand, so. silt and clay, cemented, calcareous, so. v. thin sand partings.				
85.5	89.5	Dark gray-brown sandy silt, tr. clay and gravel, cemented, calcareous.				
89.5	89.7	Dark gray weathered shale.				

General Remarks:

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Generating Company, LLC
Site: Duck Creek Power Station - Ash Landfill
Location: 17751 N. CILCO Rd., Canton, IL 61520
Project: 17E0057
DATES: Start: 3/15/2017
Finish: 3/15/2017
WEATHER: Sunny, cold (lo-30s)

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4¼" Hollow Stem Auger, split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: P60
Well ID: P60
Surface Elev: 620.12 ft. MSL
Completion: 34.62 ft. BGS
Station: 15,477.09N
992.24E

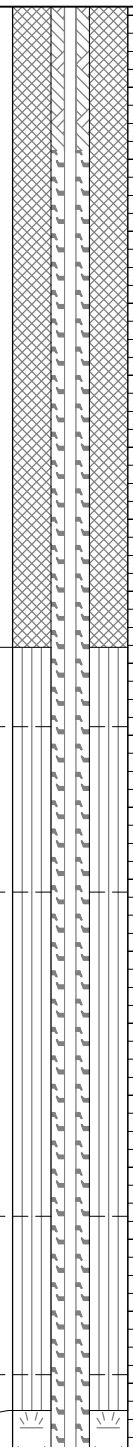
TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 16.80 - During drilling
▼ = Dry - At completion
▽ =

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	14/24 58%	SS	2-3 3-4 N=6			
2A	18/24 75%	SS	3-6 8-11 N=14	17.5		
3A	15/24 63%	SS	3-4 6-7 N=10	19.6		
4A	20/24 83%	SS	6-8 11-14 N=19	18.5		
5A	22/24 92%	SS	3-5 6-7 N=11	26.8		
6A	21/24 88%	SS	2-4 5-5 N=9	23.8		
7A	20/24 83%	SS	4-4 6-7 N=10	22.8		
8A	21/24 88%	SS	5-6 7-7 N=13	22.1		
9A	21/24 88%	SS	5-5 6-6 N=11	21.0		
10A	24/24 100%	SS	2-3 4-7 N=7	28.1		
10B				61.7		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
0	FILL - Yellowish brown (10YR5/6), moist, medium, CLAY with some silt and trace sand.	620
2		618
4		616
6		614
8		612
9	Yellowish brown (10YR5/6), moist, medium, SILT with few clay and trace sand.	
10	Yellowish brown (10YR5/8) with 30% gray (10YR5/1) mottles, moist, medium, SILT with few clay and trace sand.	610
12		608
14	Gray (10YR5/1) with 20% yellowish brown (10YR5/8) mottles, moist, medium, SILT with few clay and trace sand.	606
16		604
17 ▼		
18	Gray (10YR5/1) with 25% yellowish brown (10YR5/8) mottles, wet, medium, SILT with few clay and trace sand.	602
19	Dark yellowish brown (10YR3/4), moist, medium, SILT with few clay and trace sand, trace organics.	
20	Dark brown (10YR3/3), moist, medium, PEAT.	

Borehole Detail



Remarks

NOTE(S): P60 installed in boring.
Coordinates are on Plant (Local) grid.

FIELD BORING LOG

CLIENT: Illinois Power Generating Company, LLC
Site: Duck Creek Power Station - Ash Landfill
Location: 17751 N. CILCO Rd., Canton, IL 61520
Project: 17E0057
DATES: Start: 3/15/2017
Finish: 3/15/2017
WEATHER: Sunny, cold (lo-30s)

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4¼" Hollow Stem Auger, split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: P60
Well ID: P60
Surface Elev: 620.12 ft. MSL
Completion: 34.62 ft. BGS
Station: 15,477.09N
992.24E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 16.80 - During drilling
▼ = Dry - At completion
▽ =

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
11A	20/24 83%	SS	2-5 6-7 N=11	31.4		
12A	24/24 100%	SS	9-8 7-6 N=15	33.7		
13A	20/24 83%	SS	4-3 4-4 N=7	23.0		
14A	22/24 92%	SS	4-5 6-6 N=11	20.6		
15A	24/24 100%	SS	3-3 4-5 N=7	17.5		
16A	24/24 100%	SS	1-3 3-3 N=6	20.2		
17A	24/24 100%	SS	5-6 6-7 N=12	15.9		
	0/7 0%	BD				

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark brown (10YR3/3), moist, medium, PEAT. *[Continued from previous page]*	600
22	Very dark gray (10YR3/1), moist, medium, SILT with some clay and trace sand, trace organics.	598
24	Very dark gray (10YR3/1), wet, medium, SILT with some clay and trace sand, trace organics.	596
	Dark brown (10YR3/3), moist, medium, PEAT.	
26	Gray (10YR5/1), moist, medium, CLAY with some silt and trace sand and gravel.	594
28		592
30	Greenish gray (5G6/1), moist, medium, CLAY with some silt and trace sand and gravel.	590
32		588
34	Greenish gray (5G6/1), wet, soft, SILT with few clay, little sand, and trace gravel.	586

Borehole Detail

End of Boring = 34.62 ft bgs

NOTE(S): P60 installed in boring.
Coordinates are on Plant (Local) grid.

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/24/2021
Finish: 2/24/2021
WEATHER: Sunny, cool (lo-40's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Doug
Eng/Geo: R. Hasenyager

BOREHOLE ID: P61
Well ID: P61
Surface Elev: 611.09 ft. MSL
Completion: 20.00 ft. BGS
Station: 1,398,670.81N
2,346,779.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▽ = 8.00 - durring drilling
▼ =
▼ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	0/24 *0%*	SS	--- ---					Yellowish brown (10YR5/6), moist, medium, CLAY with some silt and trace sand.	610	
2A	19/24 *79%*	SS	*1-3* *3-3* N=6				2	Yellowish brown (10YR5/6) with 5% gray (10YR5/1) mottles, moist, medium CLAY with some silt and trace sand.	608	
3A	21/24 *88%*	SS	*2-4* *4-5* N=8				4	Yellowish brown (10YR5/6) with 25% gray (10YR5/1) mottles, moist, medium, SILT with few clay and trace sand.	606	
4A	19/24 *79%*	SS	*woh-2* *4-4* N=6				6	Gray (10YR5/1) with 20% yellowish brown (10YR5/6) mottles, moist, soft, SILT with few clay and trace sand.	604	
5A	10/24 *42%*	SS	*1-2* *2-3* N=4				▽ 8	Gray (10YR5/1) with 20% yellowish brown (10YR5/6) mottles, wet, soft, SILT with few clay and trace sand.	602	
6A	17/24 *71%*	SS	*2-2* *3-3* N=5				10	Yellowish brown (10YR5/8), moist, soft, SILT with few clay and trace sand. Gray (10YR5/1) with 25% yellowish brown (10YR5/8) mottles, wet, soft, SILT with few clay and trace sand.	600	
7A	24/24 *100%*	SS	*woh-1* *2-2* N=3				12	Brown (10YR4/3), wet, soft, SILT with few clay and trace sand.	598	
8A	24/24 *100%*	SS	*1-2* *3-3* N=5				14	Black (10YR2/1), moist, medium, CLAY with few silt and trace sand.	596	
9A	24/24 *100%*	SS	*1-3* *3-4* N=6				16		594	
10A	24/24 *100%*	SS	*1-1* *3-3* N=4				18	Gray (10YR5/1), moist, medium CLAY with some silt and trace sand.	592	
							20	**End of boring = 20 ft.**		

NOTE(S):

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/24/2021
Finish: 2/24/2021
WEATHER: Sunny, cool (lo-40's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Doug
Eng/Geo: R. Hasenyager

BOREHOLE ID: P62
Well ID: P62
Surface Elev: 610.81 ft. MSL
Completion: 16.30 ft. BGS
Station: 1,398,887.32N
2,346,602.30E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
= Dry - durring drilling
=
=

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	0/24 0%	SS	--- ---					Yellowish brown (10YR5/6), moist, medium, SILT with some clay and trace sand.	610	
							2	Yellowish brown (10YR5/6), moist, hard, CLAY with some silt, trace sand, and trace gravel.		
2A	23/24 96%	SS	1-7 9-9 N=16					Yellowish brown (10YR5/6), moist, hard, SILT with few clay, trace sand, and trace gravel.	608	
							4			
3A	24/24 100%	SS	2-5 5-6 N=10					Gray (10YR5/1), moist, medium, SILT with few clay, trace sand, and trace gravel.	606	
							6			
4A	24/24 100%	SS	4-4 7-8 N=11						604	
							8	Yellowish brown (10YR5/6), moist, medium, SILT with few clay and trace sand.		
5A	24/24 100%	SS	2-5 5-6 N=10						602	
							10			
6A	24/24 100%	SS	3-4 6-10 N=10					Yellowish brown (10YR5/6) with 15% gray (10YR5/1) mottles, moist, medium, SILT with few clay and trace sand.	600	
							12			
7A	23/24 96%	SS	2-3 5-6 N=8					Dark yellowish brown (10YR4/6), moist, medium, SILT with few clay and trace sand.	598	
							14			
8A	24/24 100%	SS	1-2 3-4 N=5					Gray (10YR5/1) with 5% yellowish brown (10YR5/8) mottles, moist, soft, CLAY with some silt, trace sand, and trace gravel	596	
	0/4 0%	BD					16			

Borehole Detail

End of boring = 16.3 ft.

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/24/2021
Finish: 2/24/2021
WEATHER: Sunny, cool (lo-40's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Doug
Eng/Geo: R. Hasenyager

BOREHOLE ID: P63
Well ID: P63
Surface Elev: 612.33 ft. MSL
Completion: 18.25 ft. BGS
Station: 1,399,026.62N
2,346,605.85E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▽ = 8.00 - durring drilling
▼ =
▼ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	0/24 *0%*	SS	--- ---					Grayish brown (10R5/2), moist, medium, CLAY with some silt, trace sand, and trace gravel.	612	
2A	24/24 *100%*	SS	*3-7* *7-10* N=14				2	Yellowish brown (10YR5/6), moist, hard, CLAY with some silt, trace sand, and trace gravel.	610	
3A	24/24 *100%*	SS	*2-4* *4-4* N=8				4	Gray (10YR5/1) with 20% yellowish brown (10YR5/6) mottles, moist, medium, CLAY with some silt and trace sand.	608	
4A	22/24 *92%*	SS	*1-1* *4-5* N=5				6	Yellowish brown (10YR5/8) with 25% gray (10YR5/1) mottles, moist, soft, SILT with few clay and trace sand.	606	
5A	21/24 *88%*	SS	*2-2* *3-4* N=5				▽ 8		604	
6A	23/24 *96%*	SS	*2-3* *3-5* N=6				10	Yellowish brown (10YR5/8) with 25% gray (10YR5/1) mottles, wet, soft, SILT with few clay and trace sand.	602	
7A	20/24 *83%*	SS	*2-2* *3-4* N=5				12	Dark yellowish brown (10YR3/4), moist, medium SILT with few clay and trace sand.	600	
8A	24/24 *100%*	SS	*2-2* *3-3* N=5				14	Gray (10YR5/1) with 35% yellowish brown (10YR5/6) mottles, wet, soft, SILT with few clay and trace sand.	598	
9A	24/24 *100%*	SS	*1-2* *3-3* N=5				16	Yellowish brown(10YR5/6), moist, soft, CLAY with some silt, trace sand, and trace gravel.	596	
	0/4 *0%*	BD					18			

End of boring = 18.25 ft.

NOTE(S):

FIELD BORING LOG

CLIENT: Illinois Power Resource Generating, LLC
Site: Duck Creek Part 845 Groundwater
Location: Canton, Illinois
Project: 20E0111A
DATES: Start: 2/25/2021
Finish: 2/25/2021
WEATHER: Sunny, cool (lo-40's)

CONTRACTOR: Geotechnics
Rig mfg/model: CME-750X ATV Drill
Drilling Method: Hollow Stem Auger
FIELD STAFF: Driller: Matt
Helper: Doug
Eng/Geo: R. Hasenyager

BOREHOLE ID: P64
Well ID: P64
Surface Elev: 614.04 ft. MSL
Completion: 16.47 ft. BGS
Station: 1,399,305.91N
2,346,597.96E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▽ = 6.70 - durring drilling
▽ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	0/24 0%	SS	--- ---					Yellowish brown (10YR5/6), medium CLAY with some silt and trace sand.		
2A	23/24 96%	SS	2-4 4-5 N=8				2	Yellowish brown (10YR5/6) with 10% gray (10YR5/1) mottles, moist, medium, CLAY with some silt and trace sand.	612	
3A	23/24 96%	SS	2-2 2-3 N=4				4	Yellowish brown (10YR5/6) with 15% gray (10YR5/1) mottles, moist, soft, SILT with few clay, trace sand, and trace wood fragments.	610	
4A	20/24 83%	SS	1-2 4-4 N=6				6 ▽	Gray (10YR5/1) with 20% yellowish brown (10YR5/6) mottles, wet, soft, SILT with few clay and trace sand.	608	
5A	15/24 63%	SS	1-2 2-3 N=4				8		606	
6A	19/24 79%	SS	1-2 2-3 N=4				10		604	
7A	24/24 100%	SS	1-1 2-3 N=3				12	Yellowish brown (10YR5/6), moist, soft, SILT with some clay and trace sand.	602	
8A	24/24 100%	SS	1-2 2-3 N=4				14	Yellowish brown (10YR5/6) with 25% gray (10YR5/1) mottles, moist, soft, CLAY with some silt and trace sand.	600	
	0/6 0%	BD					16		598	

End of boring = 16.5 ft.

NOTE(S):

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Generating Company, LLC
Site: Duck Creek Power Station - Ash Landfill
Location: 17751 N. CILCO Rd., Canton, IL 61520
Project: 17E0057
DATES: Start: 3/14/2017
Finish: 3/14/2017
WEATHER: Sunny, cold (lo-30s)

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4¼" Hollow Stem Auger, split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

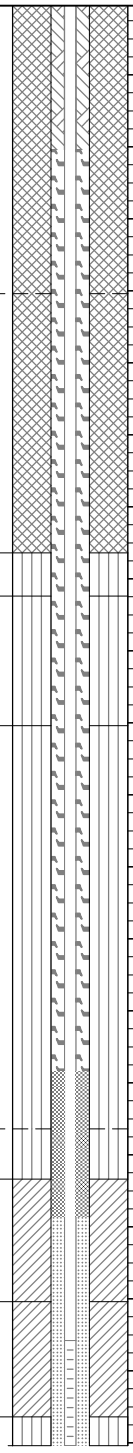
BOREHOLE ID: R61L
Well ID: R61L
Surface Elev: 619.96 ft. MSL
Completion: 28.67 ft. BGS
Station: 15,649.93N
994.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = Dry - At completion
▼ =
▽ =

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	Elevation ft. MSL
							2	FILL - Yellowish brown (10YR5/4) with 15% yellowish brown (10YR5/6) mottles, moist, firm, clayey SILT.	618
							4		616
							6	FILL - Yellowish brown (10YR5/4) with 15% yellowish brown (10YR5/6) and 15% gray (10YR6/1) mottles, moist, firm, clayey SILT.	614
							8	Grayish brown (10YR5/2), moist, hard, clayey SILT.	612
								Light brownish gray (10YR6/2) with 35% dark yellowish brown (10YR4/6) mottles, moist, hard, clayey SILT.	
							10		610
							12	Gray (10YR6/1) with 40% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	608
							14		606
							16	Gray (10YR6/1) with 40% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	604
								Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	
							18		602
								Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	
							20	Very dark gray (10YR3/1), moist, friable, micaceous,	600

Borehole Detail



Remarks

NOTE(S): R61L installed in blind drilled boring approximately 10 ft. west of G61L. Lithologies from boring G61L, except as indicated.

FIELD BORING LOG

CLIENT: Illinois Power Generating Company, LLC
Site: Duck Creek Power Station - Ash Landfill
Location: 17751 N. CILCO Rd., Canton, IL 61520
Project: 17E0057
DATES: Start: 3/14/2017
Finish: 3/14/2017
WEATHER: Sunny, cold (lo-30s)

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4¼" Hollow Stem Auger, split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: R61L
Well ID: R61L
Surface Elev: 619.96 ft. MSL
Completion: 28.67 ft. BGS
Station: 15,649.93N
994.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = Dry - At completion
▼ =
▽ =

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	13/24 *54%*	SS	*2-2 2-3* N=4	23.1		
2A	24/24 *100%*	SS	*5-5 6-6* N=11	23.9		
3A	20/24 *83%*	SS	*2-3 4-5* N=7	22.5		
4A	24/24 *100%*	SS	*5-5 6-6* N=11	22.1		
	0/8 *0%*	BD				

Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	clayey SILT.			
	Very dark grayish brown (10YR3/2), moist, soft, CLAY with some silt and trace sand and gravel.			
22			598	
	Very dark grayish brown (10YR3/2), moist, medium, CLAY with some silt and trace sand.			
24			596	
	Dark gray (10YR4/1), moist, medium, CLAY with some silt and trace sand.			
26			594	
28			592	

End of Boring = 28.67 ft bgs

NOTE(S): R61L installed in blind drilled boring approximately 10 ft. west of G61L. Lithologies from boring G61L, except as indicated.

FIELD BORING LOG

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/20/2009
Finish: 1/21/2009
WEATHER: cold, sunny, windy, mid-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G61
Well ID: G61S
Surface Elev: 620.00 ft. MSL
Completion: 38.00 ft. BGS
Station: 15,644.94N
994.79E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ = 19.50 - 01/21/09
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	24/24 100%	ss	18-12 9-8 N=21					FILL - Yellowish brown (10YR5/4) with 15% yellowish brown (10YR5/6) mottles, slightly moist, firm, clayey SILT.		
2A	24/24 100%	ss	8-5 7-8 N=12	18.4			2		618	
							4		616	
3A	20/24 83%	ss	2-4 4-6 N=8	20.9				FILL - Yellowish brown (10YR5/4) with 15% yellowish brown (10YR5/6) and 15% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT.		
4A	24/24 100%	ss	7-9 10-11 N=19	20.1			6		614	
4B				20.5				Grayish brown (10YR5/2), slightly moist, hard, clayey SILT.		
5A	19/24 79%	ss	2-3 6-7 N=9	26.5			8		612	
								Light brownish gray (10YR6/2) with 35% dark yellowish brown (10YR4/6) mottles, slightly moist, hard, clayey SILT.		
6A	20/24 83%	ss	2-3 4-4 N=7	24.4			10		610	
							12		608	
7A	24/24 100%	ss	4-4 5-6 N=9	24.0				Gray (10YR6/1) with 40% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.		
							14		606	
8A	22/24 92%	ss	3-4 5-5 N=9	25.0						
							16	Gray (10YR6/1) with 40% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	604	
9A	24/24 100%	ss	3-3 4-6 N=7	23.9				Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.		
							18		602	
10A	22/24 92%	ss	2-3 3-4 N=6	25.0				Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.		
10B				28.2			▼ 20	Very dark gray (10YR3/1), slightly moist, friable,	600	

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/20/2009
Finish: 1/21/2009
WEATHER: cold, sunny, windy, mid-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G61
Well ID: G61S
Surface Elev: 620.00 ft. MSL
Completion: 38.00 ft. BGS
Station: 15,644.94N
994.79E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ = 19.50 - 01/21/09
▽ =

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
11A	19/24 79%	SS	3-4 5-6 N=9	35.8		
11B				26.0		
12A	24/24 100%	SS	4-3 6-9 N=9	25.3		
13A	20/24 83%	SS	woh-3 4-6 N=7	24.4		
14A	24/24 100%	SS	3-3 5-6 N=8	22.4		
15A	22/24 92%	SS	woh-3 3-4 N=6	21.5		
16A	19/24 79%	SS	woh-1 3-3 N=4	16.7		
17A	24/24 100%	SS	3-4 5-5 N=9	18.8		
17B				13.6		
18A	19/24 79%	SS	1-7 7-7 N=14	20.7		
19A	24/24 100%	SS	7-11 19-32 N=30	12.4		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	micaceous, clayey SILT.	
22	Dark gray (10YR4/1), moist, soft, clayey SILT.	598
24		596
26	Greenish gray (5GY5/1), moist, soft, silty CLAY with slight trace sand.	594
28		592
30	Greenish gray (5GY5/1), very moist, very soft, sandy CLAY with slight trace gravel.	590
32		588
	Greenish gray (10Y5/1), slightly moist, soft, clayey SILT with trace sand and slight trace gravel.	
34		586
	Medium light gray (N6/1), wet, firm, SILT with slight trace sand and gravel.	
36		584
	Greenish gray (10Y5/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.	
38		582

End of Boring = 38.0 ft bgs

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 1/21/2009
Finish: 1/21/2009
WEATHER: cold, sunny, windy, mid-20's

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Suzanna Simpson

BOREHOLE ID: G61a
Well ID: G61L
Surface Elev: 620.00 ft. MSL
Completion: 19.90 ft. BGS
Station: 15,640.94N
994.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ = 19.50 - 01/21/09
▽ =

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	Elevation ft. MSL	Remarks
							2	FILL - Yellowish brown (10YR5/4) with 15% yellowish brown (10YR5/6) mottles, slightly moist, firm, clayey SILT.	618	
							4		616	
							6	FILL - Yellowish brown (10YR5/4) with 15% yellowish brown (10YR5/6) and 15% gray (10YR6/1) mottles, slightly moist, firm, clayey SILT.	614	
							8	Grayish brown (10YR5/2), slightly moist, hard, clayey SILT.	612	
								Light brownish gray (10YR6/2) with 35% dark yellowish brown (10YR4/6) mottles, slightly moist, hard, clayey SILT.		
							10		610	
							12	Gray (10YR6/1) with 40% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.	608	
							14		606	
							16	Gray (10YR6/1) with 40% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.	604	
								Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT.		
							18		602	
								Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT.		
							▼	Very dark gray (10YR3/1), slightly moist, friable, micaceous, clayey SILT.		

End of Boring = 19.9 ft bgs

NOTE(S): See G61S Boring log for sample and testing data.

FIELD BORING LOG

R72S

HANSON

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/19/2008
Finish: 11/19/2008
WEATHER: sunny, cold, (40's)

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: ~~G72~~
Well ID: ~~G72S~~
Surface Elev: 615.01 ft. MSL
Completion: 39.40 ft. BGS
Station: 13,905.05N
504.94E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 28.30 - 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	24/24 100%	SS	3-3 6-6 N=9	20.4		
2A	24/24 100%	SS	3-5 6-6 N=11	18.3		
3A	24/24 100%	SS	3-5 6-9 N=11	15.7		
4A	24/24 100%	SS	10-14 16-16 N=30	21.3		
5A	24/24 100%	SS	3-4 6-7 N=10	19.3		
6A	24/24 100%	SS	2-3 6-8 N=9	18.2		
7A	20/24 83%	SS	5-7 12-13 N=19	9.2		
8A	24/24 100%	SS	1-3 4-6 N=7	11.1		
9A	24/24 100%	SS	5-7 10-9 N=17	12.3		
10A	24/24 100%	SS	1-3 4-7 N=7	17.5		
	24/24		1-3			

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
2	FILL - Yellowish brown (10YR5/8), moist, firm, clayey SILT with slight trace sand and gravel.	614
4		612
6		610
8	Yellowish brown (10YR5/8), moist, firm, silty CLAY with slight trace sand and gravel.	608
10		606
12	Yellowish brown (10YR5/8), moist, soft, silty CLAY with slight trace sand.	604
14	Light gray (10YR7/1) with 30% yellowish brown (10YR5/8) mottles, moist, friable, clayey SILT with slight trace sand.	602
16		600
18	Light gray (10YR7/1) with 10% yellowish brown (10YR5/8) mottles, moist, friable, SILT with some clay and slight trace sand.	598
20	Dark gray (10YR4/1) with 80% dark yellowish brown (10YR4/4) mottles, moist, friable, clayey SILT with slight trace sand.	596
	Dark yellowish brown (10YR4/8), moist, friable, very clayey SILT with trace sand.	

Borehole Detail

Remarks

NOTE(S):

FIELD BORING LOG

CLIENT: AERG Duck Creek Power Generating Station
Site: Gypsum Management Facility
Location: Canton, Illinois
Project: 03S5010D 1000
DATES: Start: 11/19/2008
Finish: 11/19/2008
WEATHER: sunny, cold, (40's)

CONTRACTOR: Testing Service Corp.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 3¼" HSA w/SS & CME samplers
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: G72
Well ID: G72S
Surface Elev: 615.01 ft. MSL
Completion: 39.40 ft. BGS
Station: 13,905.05N
504.94E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner, IL
Township: Banner
Section 18, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 28.30 - 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
11A	100%	SS	4-8 N=7	16.6		
12A	24/24 100%	SS	4-8 12-13 N=20	19.1		
13A	24/24 100%	SS	1-3 5-8 N=8	17.4		
14A	24/24 100%	SS	5-6 8-8 N=14	21.2		
15A	24/24 100%	SS	woh-1 2-3 N=3	26.5		
16A	24/24 100%	SS	1-3 6-10 N=9	19.3		
16B				15.9		
17A	20/24 83%	SS	5-10 13-11 N=23	24.9		
18A	24/24 100%	SS	2-6 7-9 N=13	27.8		
18B				11.1		
19A	24/24 100%	SS	7-9 12-14 N=21	11.1		
20A	17/17 100%	SS	26-45 50/5"	9.4		

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
	Dark yellowish brown (10YR4/8), moist, friable, very clayey SILT with trace sand. *[Continued from previous page]*	
22		
	Dark yellowish brown (10YR4/6) with 40% yellowish brown (10YR5/8) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.	592
24		
	Grayish brown (10YR5/2) with 30% yellowish brown (10YR5/8) mottles, moist, soft, clayey SILT with trace sand.	590
26		
	Yellowish brown (10YR5/8) with 10% gray (10YR6/1) mottles, very moist, soft, silty CLAY with trace sand.	588
▼ 28		
	Gray (10YR6/1) with 20% yellowish brown (10YR5/8) mottles, very moist to wet, very soft, silty CLAY with trace sand and slight trace gravel.	586
30		
	Light gray (10YR7/1) with 30% yellowish brown (10YR5/8) mottles, wet, very soft, clayey SILT with some very fine-grained sand and slight trace gravel.	584
	Dark gray (10YR4/1), moist, firm, silty CLAY with trace sand and slight trace gravel.	
32		
	Brownish yellow (10YR6/6), wet, soft, clayey SILT with trace very fine-grained sand.	582
34	Dark gray (10YR4/1), moist, firm, very silty CLAY with slight trace sand.	
	Dark gray (10YR4/1), moist, loose, SILT and very fine-grained SAND.	580
36		
	Dark gray (10YR4/1), moist, firm, silty CLAY with trace sand and slight trace gravel.	578
38		
		576

End of Boring = 39.40 ft bgs

NOTE(S):

WELL CONSTRUCTION LOGS

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: G54C

Site Name: Duck Creek Part 845 Groundwater Borehole #: G54C

State Plane Coordinate: X 2,348,250.1 Y 1,384,885.2 (or) Latitude: _____ Longitude: _____

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Geotechnics Driller: Matt

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

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

Logged By: Tad A. Gass Date Started: 2/3/2021 Date Finished: 2/5/2021

Report Form Completed By: Tad A. Gass Date: 2/23/2021

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High solids bentonite

Installation Method: tremie

Setting Time: 45 min.

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

Installation Method: gravity

Setting Time: 25 min.

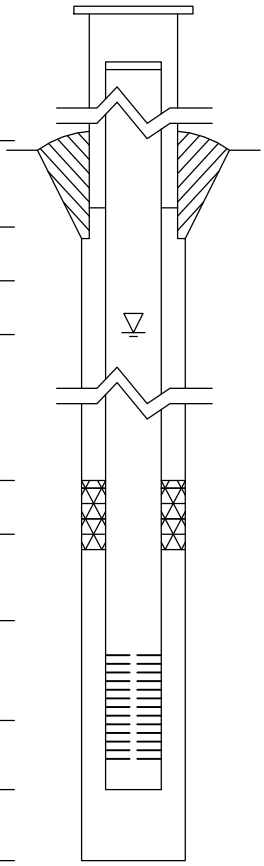
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: gravity

Type of Backfill Material: _____ (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
623.03	-3.43	Top of Protective Casing
622.72	-3.13	Top of Riser Pipe
619.59	0.00	Ground Surface
615.59	4.00	Top of Annular Sealant
		Static Water Level (After Completion)
n/a	n/a	Top of Seal
530.00	89.59	Top of Sand Pack
528.00	91.59	Top of Screen
518.09	101.50	Bottom of Screen
517.59	102.00	Bottom of Well
517.59	102.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	95.56
Bottom of Screen to End Cap	(feet)	0.50
Screen Length (1st slot to last slot)	(feet)	9.07
Total Length of Casing	(feet)	105.13
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: P61

Site Name: Duck Creek Part 845 Groundwater Borehole #: P61

State Plane Coordinate: X 2,346,779.3 Y 1,398,670.8 (or) Latitude: _____ Longitude: _____

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Geotechnics Driller: Matt

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

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

Logged By: Rhonald W. Hasenyager Date Started: 2/24/2021 Date Finished: 2/24/2021

Report Form Completed By: Tad A. Gass Date: 2/24/2021

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Granular bentonite

Installation Method: gravity

Setting Time: +24 hrs.

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

Installation Method: _____

Setting Time: _____

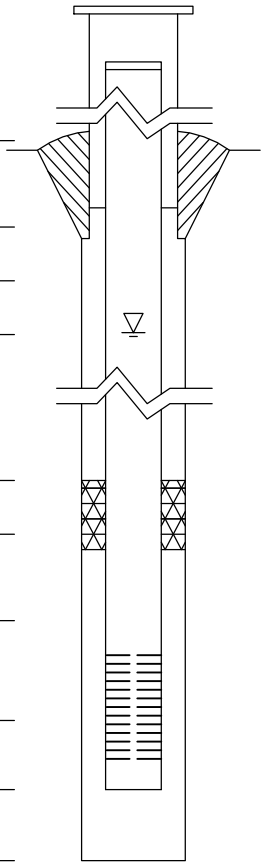
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: gravity

Type of Backfill Material: _____ (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
614.31	-3.21	Top of Protective Casing
613.96	-2.87	Top of Riser Pipe
611.09	0.00	Ground Surface
607.58	3.51	Top of Annular Sealant
		Static Water Level (After Completion)
n/a	n/a	Top of Seal
603.54	7.55	Top of Sand Pack
602.38	8.71	Top of Screen
592.72	18.37	Bottom of Screen
592.33	18.76	Bottom of Well
591.09	20.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	10.0
Riser Pipe Length	(feet)	11.58
Bottom of Screen to End Cap	(feet)	0.39
Screen Length (1st slot to last slot)	(feet)	9.66
Total Length of Casing	(feet)	21.63
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: P62

Site Name: Duck Creek Part 845 Groundwater Borehole #: P62

State Plane Coordinate: X 2,346,602.3 Y 1,398,887.3 (or) Latitude: _____ Longitude: _____

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Geotechnics Driller: Matt

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

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

Logged By: Rhonald W. Hasenyager Date Started: 2/24/2021 Date Finished: 2/24/2021

Report Form Completed By: Tad A. Gass Date: 2/24/2021

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Granular bentonite

Installation Method: gravity

Setting Time: +24 hrs.

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

Installation Method: _____

Setting Time: _____

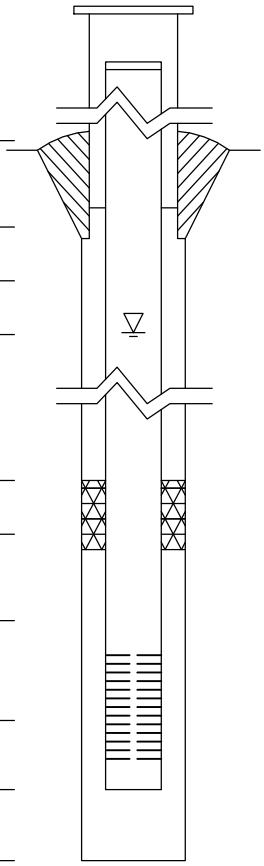
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: gravity

Type of Backfill Material: _____ (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
613.96	-3.15	Top of Protective Casing
613.54	-2.73	Top of Riser Pipe
610.81	0.00	Ground Surface
607.89	2.92	Top of Annular Sealant
		Static Water Level (After Completion)
n/a	n/a	Top of Seal
601.33	9.48	Top of Sand Pack
599.63	11.18	Top of Screen
595.03	15.78	Bottom of Screen
594.51	16.30	Bottom of Well
594.51	16.30	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	16.30
Bottom of Screen to End Cap	(feet)	0.52
Screen Length (1st slot to last slot)	(feet)	4.60
Total Length of Casing	(feet)	21.42
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: P63

Site Name: Duck Creek Part 845 Groundwater Borehole #: P63

State Plane Coordinate: X 2,346,605.9 Y 1,399,026.6 (or) Latitude: _____ Longitude: _____

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Geotechnics Driller: Matt

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

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

Logged By: Rhonald W. Hasenyager Date Started: 2/24/2021 Date Finished: 2/24/2021

Report Form Completed By: Tad A. Gass Date: 2/24/2021

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Granular bentonite

Installation Method: gravity

Setting Time: +24 hrs.

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

Installation Method: _____

Setting Time: _____

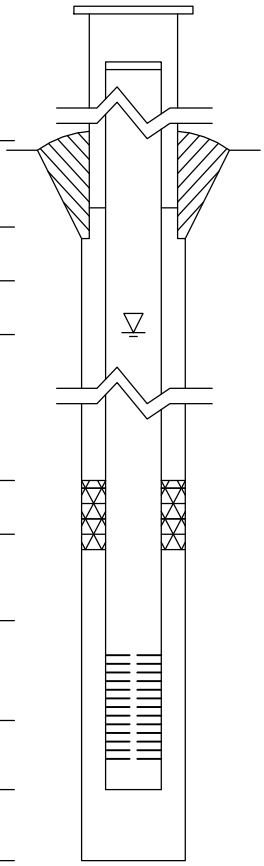
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: gravity

Type of Backfill Material: _____ (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
614.85	-2.52	Top of Protective Casing
614.47	-2.15	Top of Riser Pipe
612.33	0.00	Ground Surface
609.23	3.10	Top of Annular Sealant
		Static Water Level (After Completion)
n/a	n/a	Top of Seal
600.98	11.35	Top of Sand Pack
599.29	13.04	Top of Screen
594.70	17.63	Bottom of Screen
594.08	18.25	Bottom of Well
594.08	18.25	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	15.19
Bottom of Screen to End Cap	(feet)	0.62
Screen Length (1st slot to last slot)	(feet)	4.59
Total Length of Casing	(feet)	20.40
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: P64

Site Name: Duck Creek Part 845 Groundwater Borehole #: P64

State Plane Coordinate: X 2,346,598.0 Y 1,399,305.9 (or) Latitude: _____ Longitude: _____

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Geotechnics Driller: Matt

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

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

Logged By: Rhonald W. Hasenyager Date Started: 2/25/2021 Date Finished: 2/25/2021

Report Form Completed By: Tad A. Gass Date: 2/25/2021

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Granular bentonite

Installation Method: gravity

Setting Time: +24 hrs.

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

Installation Method: _____

Setting Time: _____

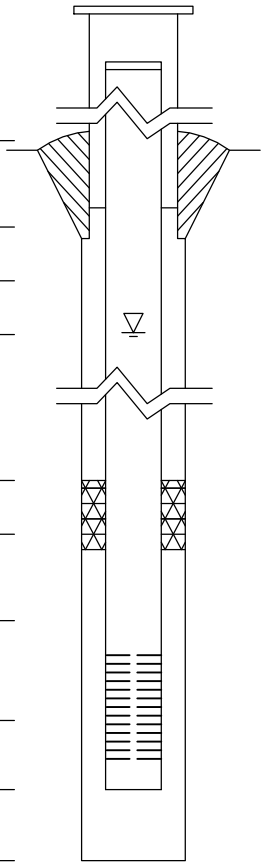
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: gravity

Type of Backfill Material: _____ (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
616.83	-2.78	Top of Protective Casing
616.47	-2.43	Top of Riser Pipe
614.04	0.00	Ground Surface
611.04	3.00	Top of Annular Sealant
		Static Water Level (After Completion)
n/a	n/a	Top of Seal
608.96	5.08	Top of Sand Pack
607.87	6.17	Top of Screen
598.08	15.96	Bottom of Screen
597.57	16.47	Bottom of Well
597.57	16.47	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

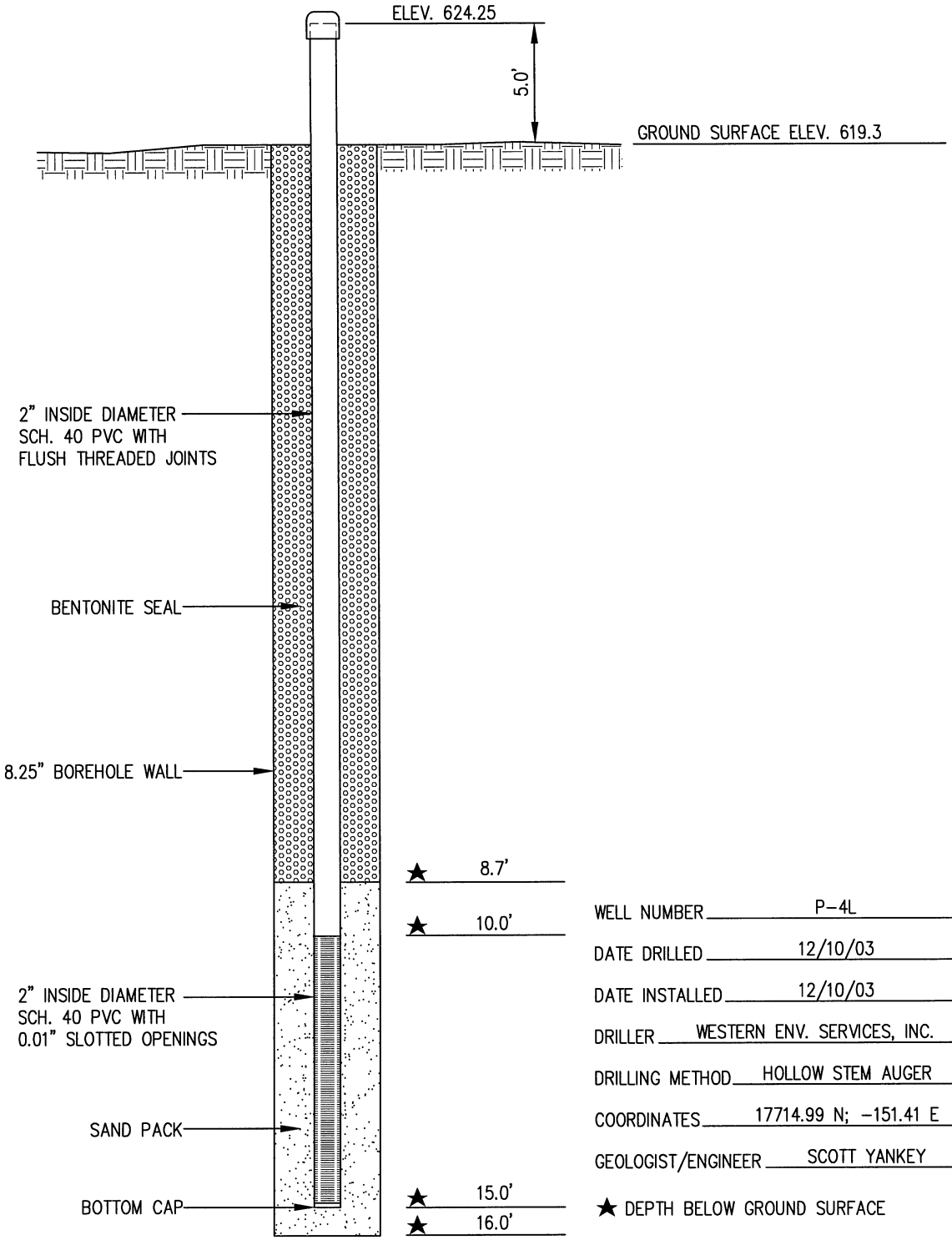
Protective Casing	SS304	SS316	PTFE	PVC	OTHER: Steel
Riser Pipe Above W.T.	SS304	SS316	PTFE	PVC	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	PVC	OTHER:
Screen	SS304	SS316	PTFE	PVC	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	10.0
Riser Pipe Length	(feet)	9.19
Bottom of Screen to End Cap	(feet)	0.52
Screen Length (1st slot to last slot)	(feet)	9.19
Total Length of Casing	(feet)	18.90
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

G02L (MW-4L)



WELL NUMBER P-4L

DATE DRILLED 12/10/03

DATE INSTALLED 12/10/03

DRILLER WESTERN ENV. SERVICES, INC.

DRILLING METHOD HOLLOW STEM AUGER

COORDINATES 17714.99 N; -151.41 E

GEOLOGIST/ENGINEER SCOTT YANKEY

★ DEPTH BELOW GROUND SURFACE

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PIEZOMETER P-4L CONSTRUCTION DETAIL

PHASE III HYDROGEOLOGIC SITE INVESTIGATION
AERG - DUCK CREEK STATION CCB LANDFILL
CANTON, ILLINOIS

JOB NO. 03S5010 ATTACHMENT B

AUG 24, 2004 3:13 PM KDE
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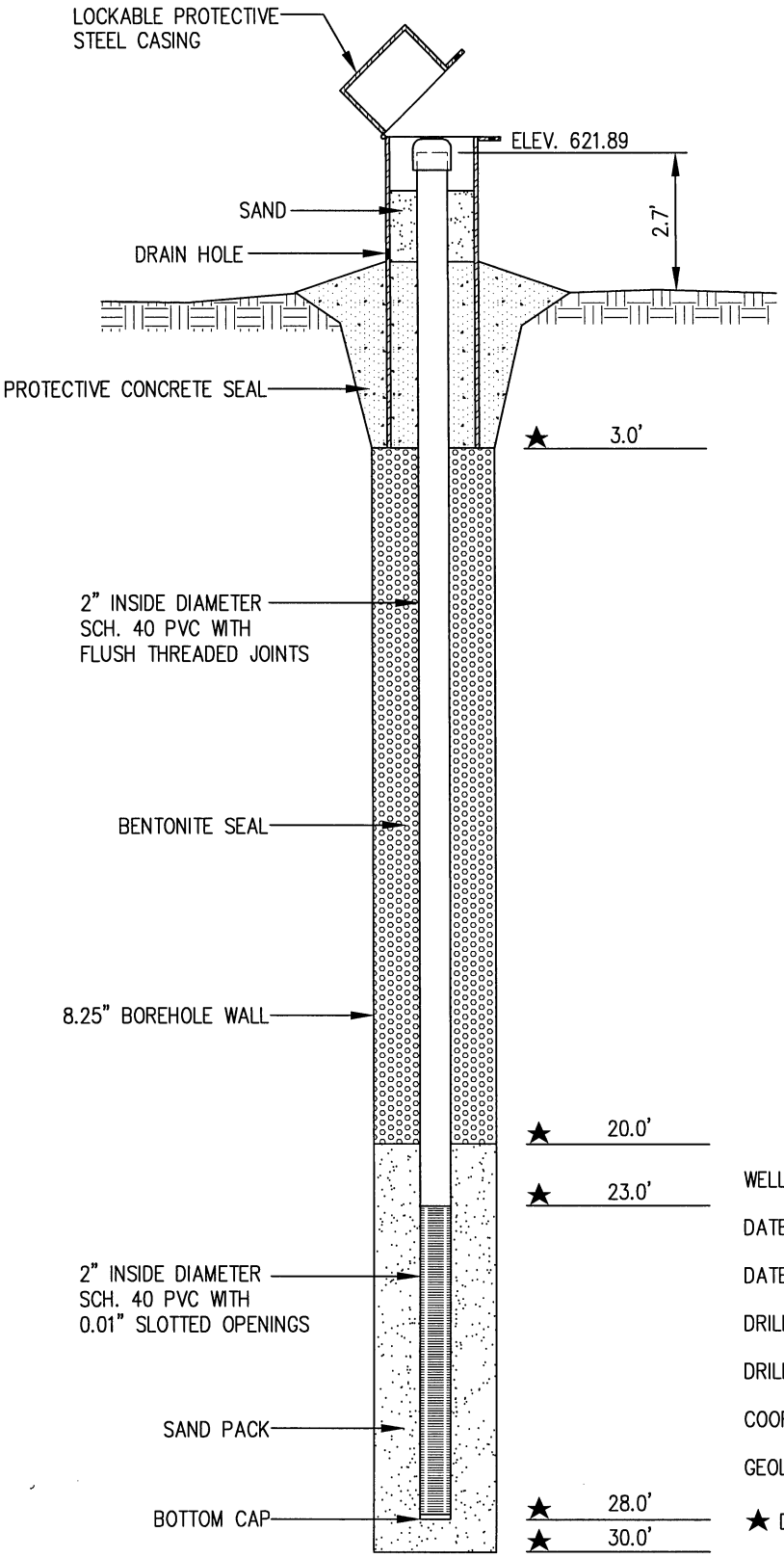
G02S (P02S, MW-4S)



WELL NUMBER MW-4S G02S

DATE DRILLED 9/29/03

DATE INSTALLED 9/29/03

DRILLER WESTERN ENV. SERVICES, INC.

DRILLING METHOD HOLLOW STEM AUGER

COORDINATES 17706.74 N; -148.45 E

GEOLOGIST/ENGINEER SCOTT YANKEY

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MONITORING WELL MW-4S CONSTRUCTION DETAIL

PHASE II HYDROGEOLOGIC SITE INVESTIGATION
AERG - DUCK CREEK STATION
CANTON, ILLINOIS

JOB NO. 03S5010 ATTACHMENT B

AUG 23, 2004 1:50 PM KDE
I:\03JOBS\03S5010\ENVIRONMENTAL\PHASE II\H-MW-4S.DWG

Illinois Environmental Protection Agency — Well Completion Report

G50L (MW51L)

Site #: _____ County: Fulton Well #: ~~MW51L~~

Site Name: Ameren Gypsum Stack Borehole #: ~~B 51a~~

State Plane Coordinate: X 16,174.9 Y -5.3 (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

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

Drilling Contractor: Testing Service Corporation Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Ryan Keedy Date Started: 3/13/2007 Date Finished: 3/13/2007

Report Form Completed By: Rhonald W Hasenyager Date: 4/17/2007

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite chips

Installation Method: gravity

Setting Time: >24 hr

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

Installation Method: Gravity

Setting Time: >24 hr

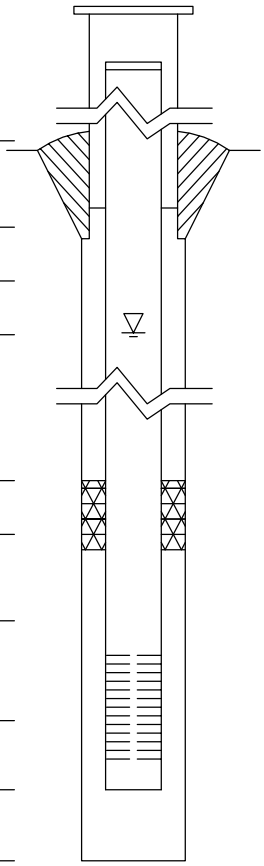
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: _____ (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
624.31	-3.47	Top of Protective Casing
623.83	-2.99	Top of Riser Pipe
620.84	0.00	Ground Surface
620.54	0.30	Top of Annular Sealant
615.27	5.57	Static Water Level (After Completion) 3/29/2007
620.54	0.30	Top of Seal
610.81	10.03	Top of Sand Pack
609.23	11.61	Top of Screen
604.52	16.32	Bottom of Screen
604.13	16.71	Bottom of Well
604.13	16.71	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	14.60
Bottom of Screen to End Cap	(feet)	0.39
Screen Length (1st slot to last slot)	(feet)	4.71
Total Length of Casing	(feet)	19.70
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

G50S (MW51S)

Site #: _____ County: Fulton Well #: ~~MW51S~~

Site Name: Ameren Gypsum Stack Borehole #: ~~B-51b~~

State Plane Coordinate: X 16,180.8 Y -5.1 (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

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

Drilling Contractor: Testing Service Corporation Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Ryan Keedy Date Started: 3/13/2007 Date Finished: 3/13/2007

Report Form Completed By: Rhonald W Hasenyager Date: 4/17/2007

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite grout

Installation Method: Tremie

Setting Time: >24 hr

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

Installation Method: Gravity

Setting Time: 20 min

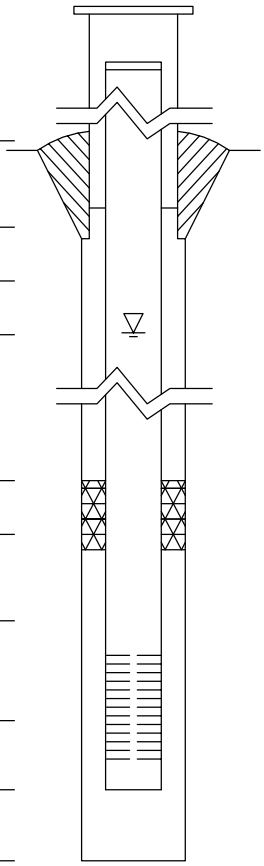
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: _____ (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
624.22	-3.38	Top of Protective Casing
623.82	-2.98	Top of Riser Pipe
620.84	0.00	Ground Surface
620.54	0.30	Top of Annular Sealant
614.98	5.86	Static Water Level (After Completion) 3/29/2007
597.42	23.42	Top of Seal
593.80	27.04	Top of Sand Pack
591.67	29.17	Top of Screen
586.86	33.98	Bottom of Screen
586.52	34.32	Bottom of Well
586.52	34.32	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	32.25
Bottom of Screen to End Cap	(feet)	0.34
Screen Length (1st slot to last slot)	(feet)	4.71
Total Length of Casing	(feet)	37.30
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G51L

Site Name: Duck Creek Gypsum Managment Facility Borehole #: ~~BG51b~~

~~State~~ Plant ~~Plane~~ Coordinate: X -75.7 Y 15,409.7 (or) Latitude: Longitude:

Surveyed By: Kimberley R. Lyons IL Registration #: 035-003669

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Testing Services Corp. Date Started: 1/28/2008 Date Finished: 1/28/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 2/20/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite chips

Installation Method: Gravity

Setting Time: >24 hr

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

Installation Method:

Setting Time:

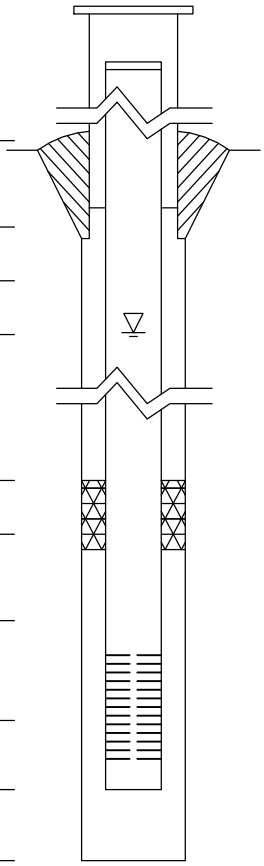
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Quartz sand (if applicable)

Installation Method: Gravity



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
620.35	-3.44	Top of Protective Casing
619.91	-3.00	Top of Riser Pipe
616.91	0.00	Ground Surface
614.81	2.10	Top of Annular Sealant
606.34	10.57	Static Water Level (After Completion) 1/30/2008
614.81	2.10	Top of Seal
606.77	10.14	Top of Sand Pack
604.87	12.04	Top of Screen
600.08	16.83	Bottom of Screen
599.70	17.21	Bottom of Well
599.19	17.72	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	15.15
Bottom of Screen to End Cap	(feet)	0.38
Screen Length (1st slot to last slot)	(feet)	4.79
Total Length of Casing	(feet)	20.32
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G51S

Site Name: Duck Creek Gypsum Managment Facility Borehole #: ~~BG51a~~

~~State~~ Plant ~~Plane~~ Coordinate: X -75.3 Y 15,405.4 (or) Latitude: Longitude:

Surveyed By: Kimberley R. Lyons IL Registration #: 035-003669

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Testing Services Corp. Date Started: 1/28/2008 Date Finished: 1/28/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 2/20/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite grout

Installation Method: Tremie

Setting Time: >24 hr

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

Installation Method: Gravity

Setting Time: 20 min

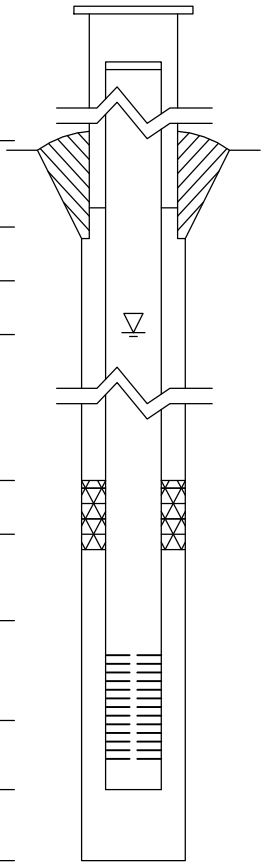
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: (if applicable)

Installation Method:



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
620.32	-3.52	Top of Protective Casing
619.81	-3.01	Top of Riser Pipe
616.80	0.00	Ground Surface
614.50	2.30	Top of Annular Sealant
606.39	10.41	Static Water Level (After Completion) 1/30/2008
597.05	19.75	Top of Seal
594.58	22.22	Top of Sand Pack
592.79	24.01	Top of Screen
588.01	28.79	Bottom of Screen
587.64	29.16	Bottom of Well
587.64	29.16	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	27.02
Bottom of Screen to End Cap	(feet)	0.37
Screen Length (1st slot to last slot)	(feet)	4.78
Total Length of Casing	(feet)	32.17
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G52L

Site Name: Duck Creek Gypsum Managment Facility Borehole #: ~~BG52b~~

~~State Plane~~ Plant Coordinate: X -76.5 Y 14,660.1 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Kimberley R. Lyons IL Registration #: 035-003669

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Testing Services Corp. Date Started: 1/22/2008 Date Finished: 1/22/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 2/20/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite grout

Installation Method: Tremie

Setting Time: >24 hr

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

Installation Method: ____

Setting Time: 12 hrs

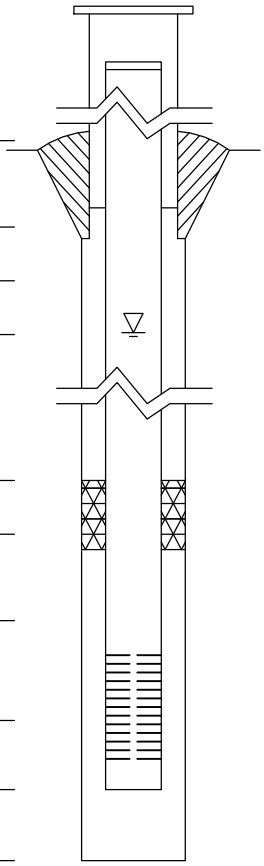
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: ____ (if applicable)

Installation Method: ____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
620.10	-3.40	Top of Protective Casing
619.64	-2.94	Top of Riser Pipe
616.70	0.00	Ground Surface
614.50	2.20	Top of Annular Sealant
587.92	28.78	Static Water Level (After Completion) 1/30/2008
591.25	25.45	Top of Seal
588.79	27.91	Top of Sand Pack
587.49	29.21	Top of Screen
582.90	33.80	Bottom of Screen
582.53	34.17	Bottom of Well
582.53	34.17	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	32.15
Bottom of Screen to End Cap	(feet)	0.37
Screen Length (1st slot to last slot)	(feet)	4.79
Total Length of Casing	(feet)	37.31
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G52S

Site Name: Duck Creek Gypsum Managment Facility Borehole #: ~~BG52~~

~~State Plane~~ Plant Coordinate: X -76.1 Y 14,655.3 (or) Latitude: Longitude:

Surveyed By: Kimberley R. Lyons IL Registration #: 035-003669

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Testing Services Corp. Date Started: 1/21/2008 Date Finished: 1/22/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 2/20/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite grout

Installation Method: Tremie

Setting Time: >24 hr

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

Installation Method: Gravity

Setting Time: 25 min

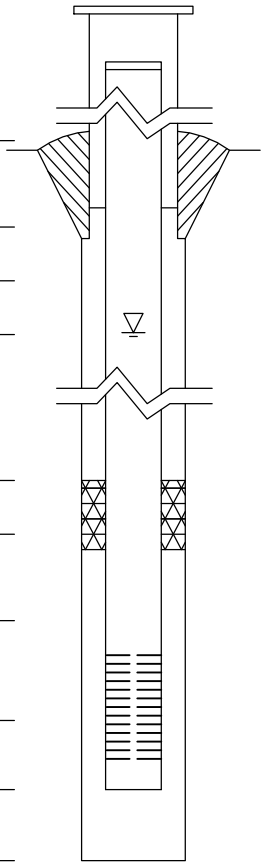
Type of Sand Pack: Quartz sand

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.)
620.19	-3.66	Top of Protective Casing
619.64	-3.11	Top of Riser Pipe
616.53	0.00	Ground Surface
613.33	3.20	Top of Annular Sealant
584.08	32.45	Static Water Level (After Completion) 1/30/2008
582.26	34.27	Top of Seal
579.31	37.22	Top of Sand Pack
577.38	39.15	Top of Screen
572.60	43.93	Bottom of Screen
572.33	44.20	Bottom of Well
570.53	46.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	42.29
Bottom of Screen to End Cap	(feet)	0.37
Screen Length (1st slot to last slot)	(feet)	4.78
Total Length of Casing	(feet)	47.44
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G53L

Site Name: Gypsum Management Facility Borehole #: ~~G53a~~

~~State~~ Plant ~~Plane~~ Coordinate: X 506.3 Y 16,200.0 (or) Latitude: ___ ___ ___ Longitude: ___ ___ ___

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/5/2009 Date Finished: 2/5/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 25 minutes

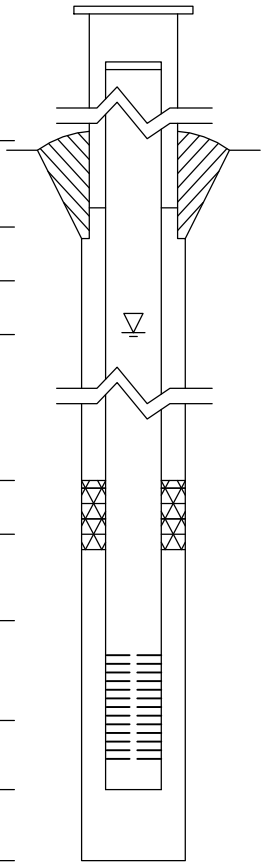
Type of Sand Pack: Quartz sand

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.)
623.61	-3.32	Top of Protective Casing
623.28	-2.99	Top of Riser Pipe
620.29	0.00	Ground Surface
618.29	2.00	Top of Annular Sealant
600.45	19.84	Static Water Level (After Completion) 3/4/2009
607.79	12.50	Top of Seal
605.67	14.62	Top of Sand Pack
603.32	16.97	Top of Screen
593.97	26.32	Bottom of Screen
593.50	26.79	Bottom of Well
593.50	26.79	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	19.96
Bottom of Screen to End Cap	(feet)	0.47
Screen Length (1st slot to last slot)	(feet)	9.35
Total Length of Casing	(feet)	29.78
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G53S

Site Name: Gypsum Management Facility Borehole #: ~~G53~~

~~State~~ Plant ~~Plane~~ Coordinate: X 510.5 Y 16,199.6 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/5/2009 Date Finished: 2/5/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 60 minutes

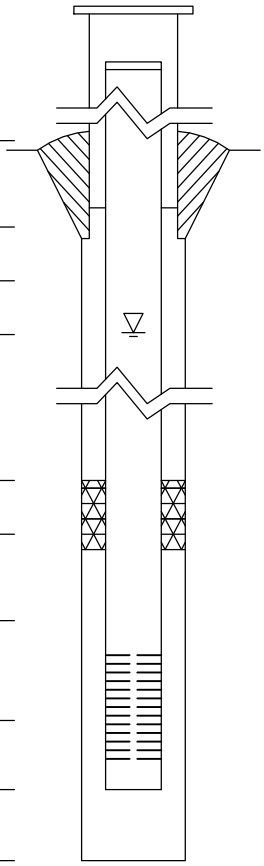
Type of Sand Pack: Quartz sand

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.)
623.33	-3.04	Top of Protective Casing
623.17	-2.88	Top of Riser Pipe
620.29	0.00	Ground Surface
618.29	2.00	Top of Annular Sealant
599.63	20.66	Static Water Level (After Completion) 3/4/2009
595.29	25.00	Top of Seal
592.29	28.00	Top of Sand Pack
589.65	30.64	Top of Screen
585.16	35.13	Bottom of Screen
584.73	35.56	Bottom of Well
584.25	36.04	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS
(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	33.52
Bottom of Screen to End Cap	(feet)	0.43
Screen Length (1st slot to last slot)	(feet)	4.49
Total Length of Casing	(feet)	38.44
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: G54C

Site Name: Duck Creek Part 845 Groundwater Borehole #: G54C

State Plane Coordinate: X 2,348,250.1 Y 1,384,885.2 (or) Latitude: _____ Longitude: _____

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Geotechnics Driller: Matt

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

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

Logged By: Tad A. Gass Date Started: 2/3/2021 Date Finished: 2/5/2021

Report Form Completed By: Tad A. Gass Date: 2/23/2021

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High solids bentonite

Installation Method: tremie

Setting Time: 45 min.

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

Installation Method: gravity

Setting Time: 25 min.

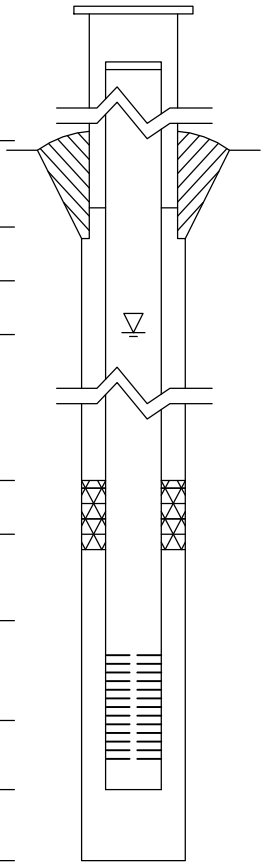
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: gravity

Type of Backfill Material: _____ (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
623.03	-3.43	Top of Protective Casing
622.72	-3.13	Top of Riser Pipe
619.59	0.00	Ground Surface
615.59	4.00	Top of Annular Sealant
		Static Water Level (After Completion)
n/a	n/a	Top of Seal
530.00	89.59	Top of Sand Pack
528.00	91.59	Top of Screen
518.09	101.50	Bottom of Screen
517.59	102.00	Bottom of Well
517.59	102.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	95.56
Bottom of Screen to End Cap	(feet)	0.50
Screen Length (1st slot to last slot)	(feet)	9.07
Total Length of Casing	(feet)	105.13
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G54L

Site Name: Gypsum Management Facility Borehole #: ~~G54a~~

~~State Plane~~ Plant Coordinate: X 463.8 Y 14,664.4 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/12/2009 Date Finished: 2/12/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 20 minutes

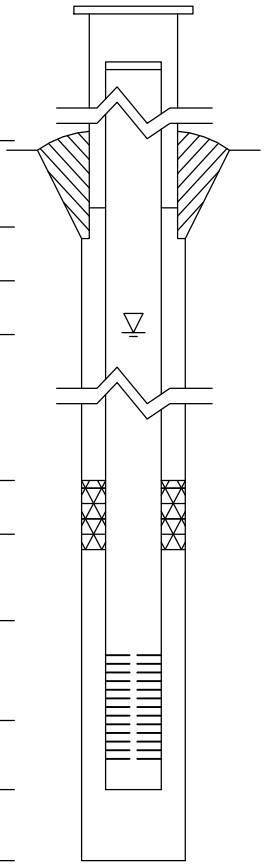
Type of Sand Pack: Quartz sand

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.)
623.37	-3.09	Top of Protective Casing
623.00	-2.72	Top of Riser Pipe
620.28	0.00	Ground Surface
618.48	1.80	Top of Annular Sealant
	DRY	Static Water Level (After Completion) 3/4/2009
597.78	22.50	Top of Seal
595.28	25.00	Top of Sand Pack
592.96	27.32	Top of Screen
583.53	36.75	Bottom of Screen
583.06	37.22	Bottom of Well
583.06	37.22	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	30.04
Bottom of Screen to End Cap	(feet)	0.47
Screen Length (1st slot to last slot)	(feet)	9.43
Total Length of Casing	(feet)	39.94
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G54S

Site Name: Gypsum Management Facility Borehole #: ~~G54~~

~~State~~ Plant ~~Plane~~ Coordinate: X 460.5 Y 14,664.8 (or) Latitude: ___ ___ ___ Longitude: ___ ___ ___

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/12/2009 Date Finished: 2/12/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 60 minutes

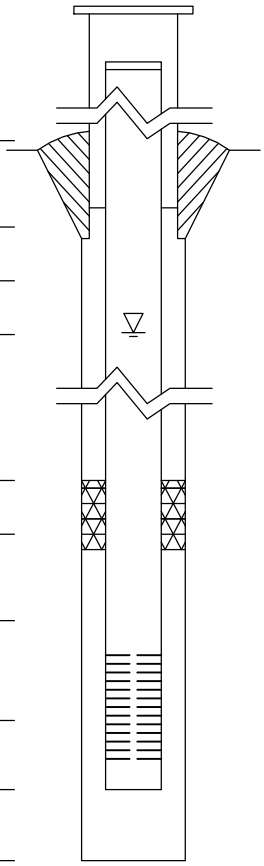
Type of Sand Pack: Quartz sand

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.)
623.54	-3.26	Top of Protective Casing
623.13	-2.85	Top of Riser Pipe
620.28	0.00	Ground Surface
618.38	1.90	Top of Annular Sealant
580.98	39.30	Static Water Level (After Completion) 3/4/2009
580.78	39.50	Top of Seal
578.61	41.67	Top of Sand Pack
576.78	43.50	Top of Screen
572.31	47.97	Bottom of Screen
571.87	48.41	Bottom of Well
571.87	48.41	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	46.50
Bottom of Screen to End Cap	(feet)	0.44
Screen Length (1st slot to last slot)	(feet)	4.47
Total Length of Casing	(feet)	51.41
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G55L

Site Name: Gypsum Management Facility Borehole #: ~~G55a~~

~~State~~ Plant ~~Plane~~ Coordinate: X 705.1 Y 14,667.7 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/19/2009 Date Finished: 2/19/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 22 minutes

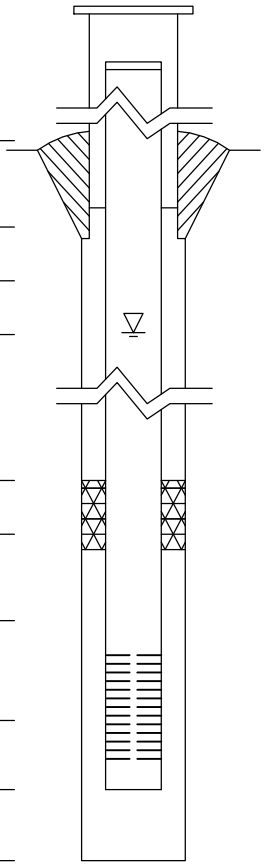
Type of Sand Pack: Quartz sand

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.)
623.47	-3.69	Top of Protective Casing
623.28	-3.50	Top of Riser Pipe
619.78	0.00	Ground Surface
617.78	2.00	Top of Annular Sealant
585.79	33.99	Static Water Level (After Completion) 3/4/2009
597.95	21.83	Top of Seal
596.28	23.50	Top of Sand Pack
593.02	26.76	Top of Screen
583.66	36.12	Bottom of Screen
583.18	36.60	Bottom of Well
583.18	36.60	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	30.26
Bottom of Screen to End Cap	(feet)	0.48
Screen Length (1st slot to last slot)	(feet)	9.36
Total Length of Casing	(feet)	40.10
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G55S

Site Name: Gypsum Management Facility Borehole #: ~~G55~~

~~State Plane~~ Plant Coordinate: X 705.0 Y 14,663.9 (or) Latitude: Longitude:

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/19/2009 Date Finished: 2/19/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 55 minutes

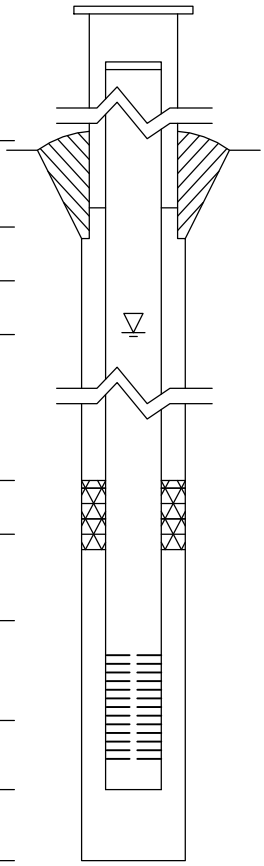
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

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

Installation Method:



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
623.21	-3.43	Top of Protective Casing
622.91	-3.13	Top of Riser Pipe
619.78	0.00	Ground Surface
617.95	1.83	Top of Annular Sealant
586.49	33.29	Static Water Level (After Completion) 3/4/2009
582.78	37.00	Top of Seal
580.95	38.83	Top of Sand Pack
578.74	41.04	Top of Screen
574.29	45.49	Bottom of Screen
573.82	45.96	Bottom of Well
573.82	45.96	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

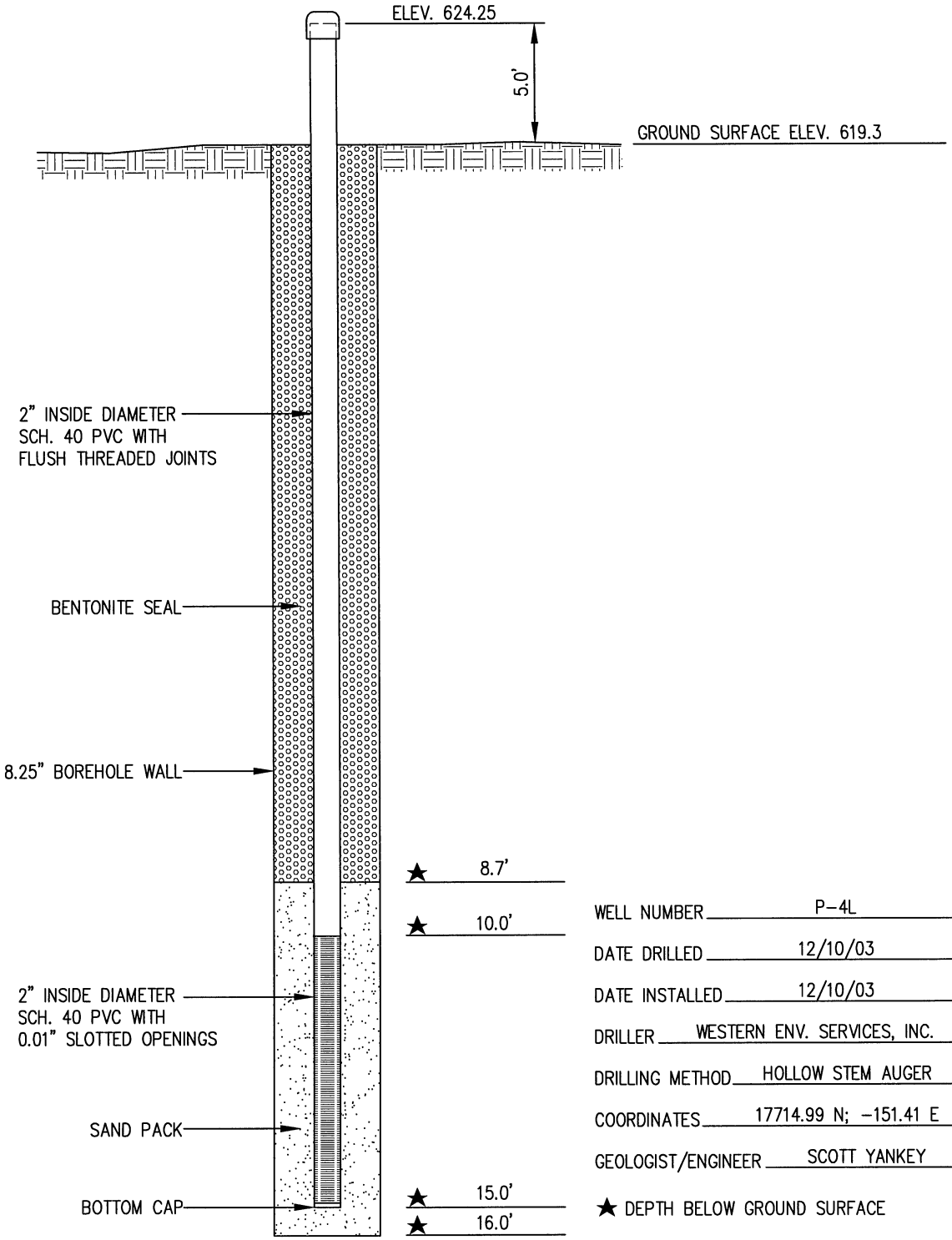
Protective Casing	SS304	SS316	PTFE	PVC	OTHER:
Riser Pipe Above W.T.	SS304	SS316	PTFE	PVC	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	PVC	OTHER:
Screen	SS304	SS316	PTFE	PVC	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	44.17
Bottom of Screen to End Cap	(feet)	0.47
Screen Length (1st slot to last slot)	(feet)	4.45
Total Length of Casing	(feet)	49.09
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

G02L (MW-4L)



WELL NUMBER P-4L

DATE DRILLED 12/10/03

DATE INSTALLED 12/10/03

DRILLER WESTERN ENV. SERVICES, INC.

DRILLING METHOD HOLLOW STEM AUGER

COORDINATES 17714.99 N; -151.41 E

GEOLOGIST/ENGINEER SCOTT YANKEY

★ DEPTH BELOW GROUND SURFACE

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PIEZOMETER P-4L CONSTRUCTION DETAIL

PHASE III HYDROGEOLOGIC SITE INVESTIGATION
AERG - DUCK CREEK STATION CCB LANDFILL
CANTON, ILLINOIS

JOB NO. 03S5010 ATTACHMENT B

AUG 24, 2004 3:13 PM KDE
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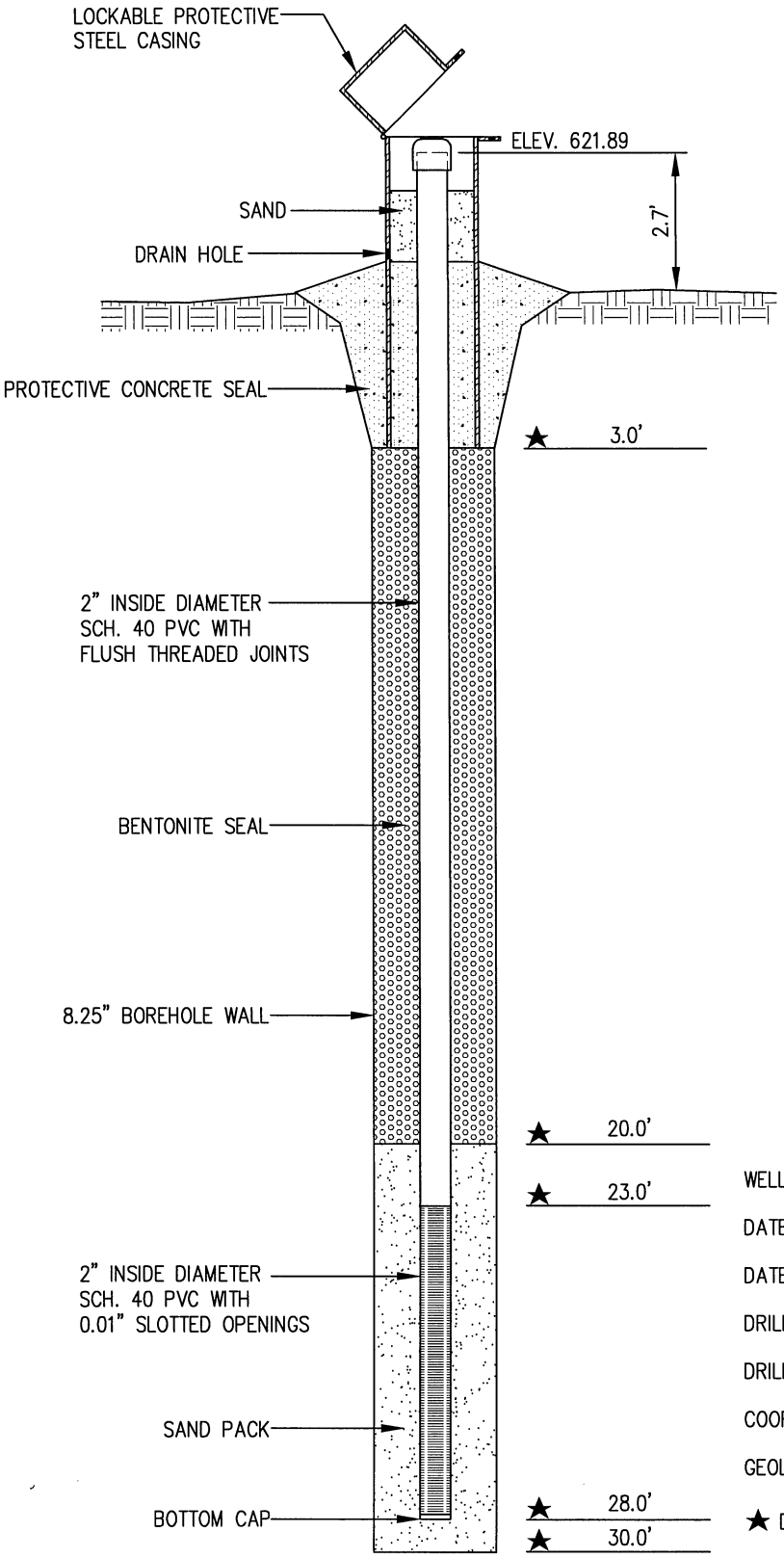
G02S (P02S, MW-4S)



WELL NUMBER MW-4S G02S

DATE DRILLED 9/29/03

DATE INSTALLED 9/29/03

DRILLER WESTERN ENV. SERVICES, INC.

DRILLING METHOD HOLLOW STEM AUGER

COORDINATES 17706.74 N; -148.45 E

GEOLOGIST/ENGINEER SCOTT YANKEY

★ DEPTH BELOW GROUND SURFACE

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MONITORING WELL MW-4S CONSTRUCTION DETAIL

PHASE II HYDROGEOLOGIC SITE INVESTIGATION
AERG - DUCK CREEK STATION
CANTON, ILLINOIS

JOB NO. 03S5010 ATTACHMENT B

AUG 23, 2004 1:50 PM KDE
I:\03JOBS\03S5010\ENVIRONMENTAL\PHASE II\H-MW-4S.DWG

Illinois Environmental Protection Agency — Well Completion Report

G50L (MW51L)

Site #: _____ County: Fulton Well #: ~~MW51L~~

Site Name: Ameren Gypsum Stack Borehole #: ~~B 51a~~

State Plane Coordinate: X 16,174.9 Y -5.3 (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

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

Drilling Contractor: Testing Service Corporation Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Ryan Keedy Date Started: 3/13/2007 Date Finished: 3/13/2007

Report Form Completed By: Rhonald W Hasenyager Date: 4/17/2007

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite chips

Installation Method: gravity

Setting Time: >24 hr

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

Installation Method: Gravity

Setting Time: >24 hr

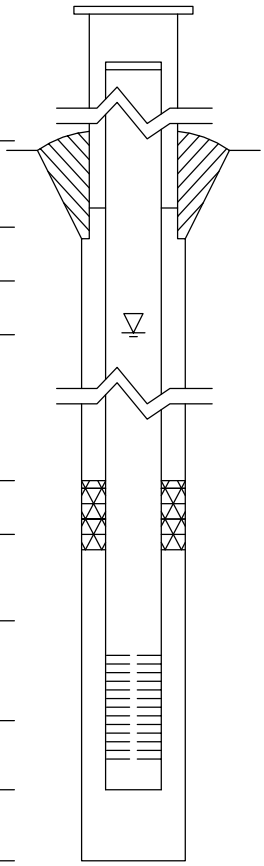
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: _____ (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
624.31	-3.47	Top of Protective Casing
623.83	-2.99	Top of Riser Pipe
620.84	0.00	Ground Surface
620.54	0.30	Top of Annular Sealant
615.27	5.57	Static Water Level (After Completion) 3/29/2007
620.54	0.30	Top of Seal
610.81	10.03	Top of Sand Pack
609.23	11.61	Top of Screen
604.52	16.32	Bottom of Screen
604.13	16.71	Bottom of Well
604.13	16.71	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	14.60
Bottom of Screen to End Cap	(feet)	0.39
Screen Length (1st slot to last slot)	(feet)	4.71
Total Length of Casing	(feet)	19.70
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

G50S (MW51S)

Site #: _____ County: Fulton Well #: ~~MW51S~~

Site Name: Ameren Gypsum Stack Borehole #: ~~B-51b~~

State Plane Coordinate: X 16,180.8 Y -5.1 (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

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

Drilling Contractor: Testing Service Corporation Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Ryan Keedy Date Started: 3/13/2007 Date Finished: 3/13/2007

Report Form Completed By: Rhonald W Hasenyager Date: 4/17/2007

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite grout

Installation Method: Tremie

Setting Time: >24 hr

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

Installation Method: Gravity

Setting Time: 20 min

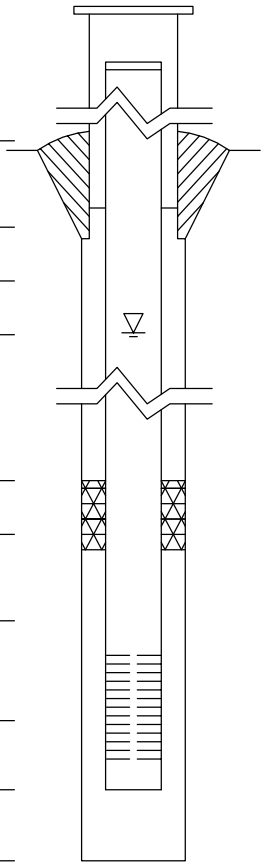
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: _____ (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
624.22	-3.38	Top of Protective Casing
623.82	-2.98	Top of Riser Pipe
620.84	0.00	Ground Surface
620.54	0.30	Top of Annular Sealant
614.98	5.86	Static Water Level (After Completion) 3/29/2007
597.42	23.42	Top of Seal
593.80	27.04	Top of Sand Pack
591.67	29.17	Top of Screen
586.86	33.98	Bottom of Screen
586.52	34.32	Bottom of Well
586.52	34.32	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	32.25
Bottom of Screen to End Cap	(feet)	0.34
Screen Length (1st slot to last slot)	(feet)	4.71
Total Length of Casing	(feet)	37.30
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G51L

Site Name: Duck Creek Gypsum Managment Facility Borehole #: ~~BG51b~~

~~State~~ Plant ~~Plane~~ Coordinate: X -75.7 Y 15,409.7 (or) Latitude: Longitude:

Surveyed By: Kimberley R. Lyons IL Registration #: 035-003669

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Testing Services Corp. Date Started: 1/28/2008 Date Finished: 1/28/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 2/20/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite chips

Installation Method: Gravity

Setting Time: >24 hr

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

Installation Method:

Setting Time:

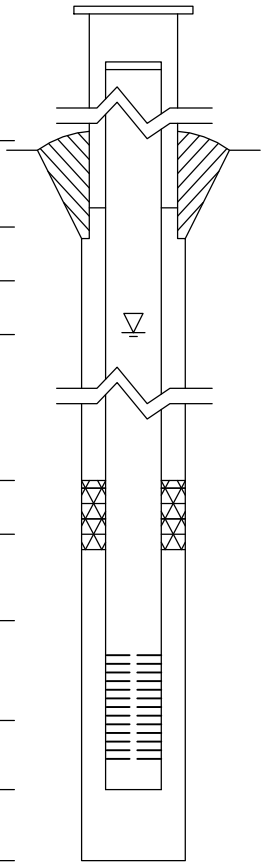
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Quartz sand (if applicable)

Installation Method: Gravity



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
620.35	-3.44	Top of Protective Casing
619.91	-3.00	Top of Riser Pipe
616.91	0.00	Ground Surface
614.81	2.10	Top of Annular Sealant
606.34	10.57	Static Water Level (After Completion) 1/30/2008
614.81	2.10	Top of Seal
606.77	10.14	Top of Sand Pack
604.87	12.04	Top of Screen
600.08	16.83	Bottom of Screen
599.70	17.21	Bottom of Well
599.19	17.72	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	15.15
Bottom of Screen to End Cap	(feet)	0.38
Screen Length (1st slot to last slot)	(feet)	4.79
Total Length of Casing	(feet)	20.32
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G51S

Site Name: Duck Creek Gypsum Managment Facility Borehole #: ~~BG51a~~

~~State~~ Plant ~~Plane~~ Coordinate: X -75.3 Y 15,405.4 (or) Latitude: Longitude:

Surveyed By: Kimberley R. Lyons IL Registration #: 035-003669

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Testing Services Corp. Date Started: 1/28/2008 Date Finished: 1/28/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 2/20/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite grout

Installation Method: Tremie

Setting Time: >24 hr

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

Installation Method: Gravity

Setting Time: 20 min

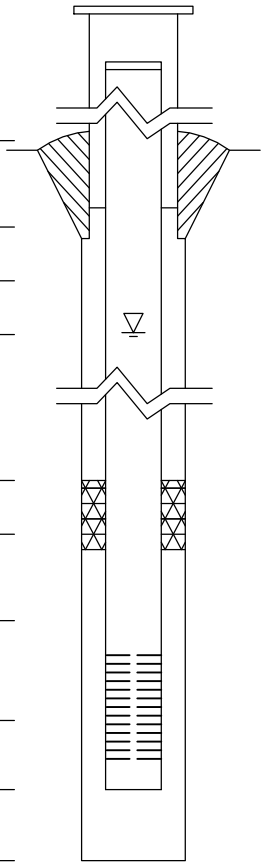
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: (if applicable)

Installation Method:



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
620.32	-3.52	Top of Protective Casing
619.81	-3.01	Top of Riser Pipe
616.80	0.00	Ground Surface
614.50	2.30	Top of Annular Sealant
606.39	10.41	Static Water Level (After Completion) 1/30/2008
597.05	19.75	Top of Seal
594.58	22.22	Top of Sand Pack
592.79	24.01	Top of Screen
588.01	28.79	Bottom of Screen
587.64	29.16	Bottom of Well
587.64	29.16	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	27.02
Bottom of Screen to End Cap	(feet)	0.37
Screen Length (1st slot to last slot)	(feet)	4.78
Total Length of Casing	(feet)	32.17
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G52L

Site Name: Duck Creek Gypsum Managment Facility Borehole #: ~~BG52b~~

~~State Plane~~ Plant Coordinate: X -76.5 Y 14,660.1 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Kimberley R. Lyons IL Registration #: 035-003669

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Testing Services Corp. Date Started: 1/22/2008 Date Finished: 1/22/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 2/20/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite grout

Installation Method: Tremie

Setting Time: >24 hr

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

Installation Method: ____

Setting Time: 12 hrs

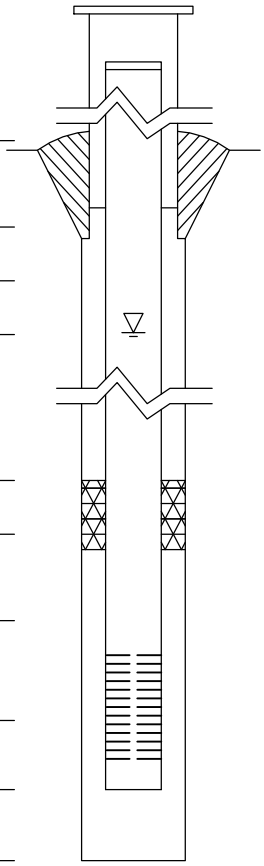
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: ____ (if applicable)

Installation Method: ____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
620.10	-3.40	Top of Protective Casing
619.64	-2.94	Top of Riser Pipe
616.70	0.00	Ground Surface
614.50	2.20	Top of Annular Sealant
587.92	28.78	Static Water Level (After Completion) 1/30/2008
591.25	25.45	Top of Seal
588.79	27.91	Top of Sand Pack
587.49	29.21	Top of Screen
582.90	33.80	Bottom of Screen
582.53	34.17	Bottom of Well
582.53	34.17	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	32.15
Bottom of Screen to End Cap	(feet)	0.37
Screen Length (1st slot to last slot)	(feet)	4.79
Total Length of Casing	(feet)	37.31
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G52S

Site Name: Duck Creek Gypsum Managment Facility Borehole #: ~~BG52~~

~~State Plane~~ Plant Coordinate: X -76.1 Y 14,655.3 (or) Latitude: Longitude:

Surveyed By: Kimberley R. Lyons IL Registration #: 035-003669

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Testing Services Corp. Date Started: 1/21/2008 Date Finished: 1/22/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 2/20/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite grout

Installation Method: Tremie

Setting Time: >24 hr

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

Installation Method: Gravity

Setting Time: 25 min

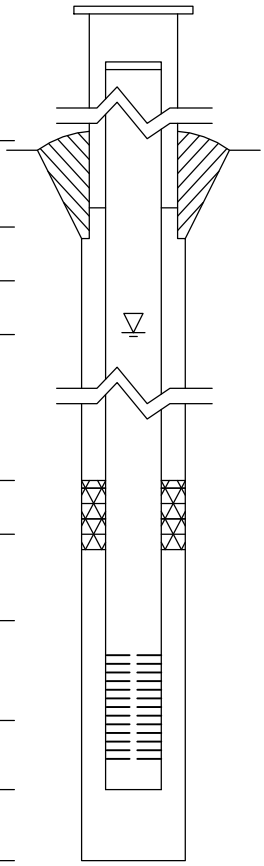
Type of Sand Pack: Quartz sand

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.)
620.19	-3.66	Top of Protective Casing
619.64	-3.11	Top of Riser Pipe
616.53	0.00	Ground Surface
613.33	3.20	Top of Annular Sealant
584.08	32.45	Static Water Level (After Completion) 1/30/2008
582.26	34.27	Top of Seal
579.31	37.22	Top of Sand Pack
577.38	39.15	Top of Screen
572.60	43.93	Bottom of Screen
572.33	44.20	Bottom of Well
570.53	46.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	42.29
Bottom of Screen to End Cap	(feet)	0.37
Screen Length (1st slot to last slot)	(feet)	4.78
Total Length of Casing	(feet)	47.44
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G53L

Site Name: Gypsum Management Facility Borehole #: ~~G53a~~

~~State~~ Plant ~~Plane~~ Coordinate: X 506.3 Y 16,200.0 (or) Latitude: ___ ___ ___ Longitude: ___ ___ ___

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/5/2009 Date Finished: 2/5/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 25 minutes

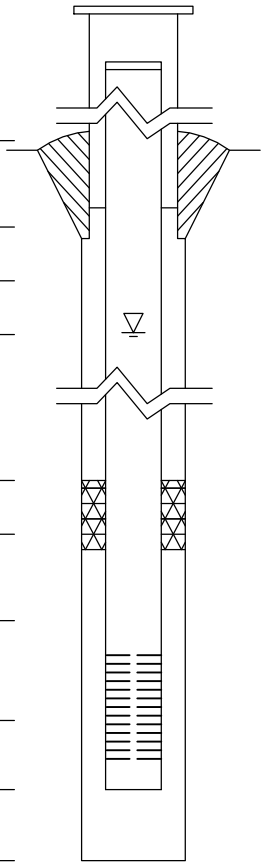
Type of Sand Pack: Quartz sand

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.)
623.61	-3.32	Top of Protective Casing
623.28	-2.99	Top of Riser Pipe
620.29	0.00	Ground Surface
618.29	2.00	Top of Annular Sealant
600.45	19.84	Static Water Level (After Completion) 3/4/2009
607.79	12.50	Top of Seal
605.67	14.62	Top of Sand Pack
603.32	16.97	Top of Screen
593.97	26.32	Bottom of Screen
593.50	26.79	Bottom of Well
593.50	26.79	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	19.96
Bottom of Screen to End Cap	(feet)	0.47
Screen Length (1st slot to last slot)	(feet)	9.35
Total Length of Casing	(feet)	29.78
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G53S

Site Name: Gypsum Management Facility Borehole #: ~~G53~~

~~State~~ Plant ~~Plane~~ Coordinate: X 510.5 Y 16,199.6 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/5/2009 Date Finished: 2/5/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 60 minutes

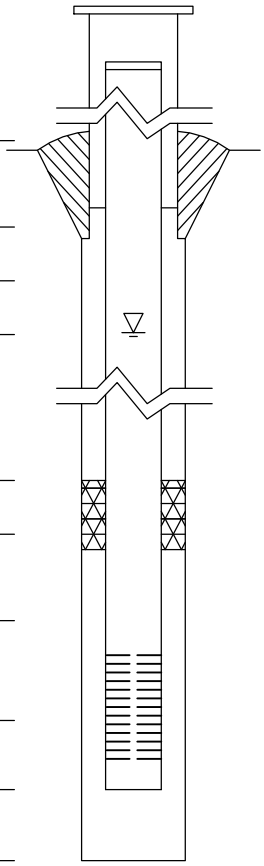
Type of Sand Pack: Quartz sand

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.)
623.33	-3.04	Top of Protective Casing
623.17	-2.88	Top of Riser Pipe
620.29	0.00	Ground Surface
618.29	2.00	Top of Annular Sealant
599.63	20.66	Static Water Level (After Completion) 3/4/2009
595.29	25.00	Top of Seal
592.29	28.00	Top of Sand Pack
589.65	30.64	Top of Screen
585.16	35.13	Bottom of Screen
584.73	35.56	Bottom of Well
584.25	36.04	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS
(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	33.52
Bottom of Screen to End Cap	(feet)	0.43
Screen Length (1st slot to last slot)	(feet)	4.49
Total Length of Casing	(feet)	38.44
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: G54C

Site Name: Duck Creek Part 845 Groundwater Borehole #: G54C

State Plane Coordinate: X 2,348,250.1 Y 1,384,885.2 (or) Latitude: _____ Longitude: _____

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Geotechnics Driller: Matt

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

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

Logged By: Tad A. Gass Date Started: 2/3/2021 Date Finished: 2/5/2021

Report Form Completed By: Tad A. Gass Date: 2/23/2021

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High solids bentonite

Installation Method: tremie

Setting Time: 45 min.

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

Installation Method: gravity

Setting Time: 25 min.

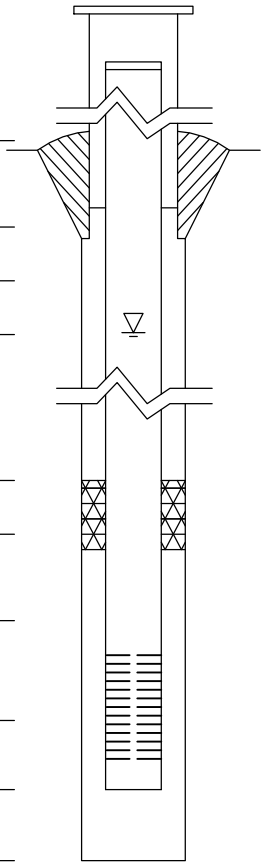
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: gravity

Type of Backfill Material: _____ (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
623.03	-3.43	Top of Protective Casing
622.72	-3.13	Top of Riser Pipe
619.59	0.00	Ground Surface
615.59	4.00	Top of Annular Sealant
		Static Water Level (After Completion)
n/a	n/a	Top of Seal
530.00	89.59	Top of Sand Pack
528.00	91.59	Top of Screen
518.09	101.50	Bottom of Screen
517.59	102.00	Bottom of Well
517.59	102.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	95.56
Bottom of Screen to End Cap	(feet)	0.50
Screen Length (1st slot to last slot)	(feet)	9.07
Total Length of Casing	(feet)	105.13
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G54L

Site Name: Gypsum Management Facility Borehole #: ~~G54a~~

~~State Plane~~ Plant Coordinate: X 463.8 Y 14,664.4 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/12/2009 Date Finished: 2/12/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 20 minutes

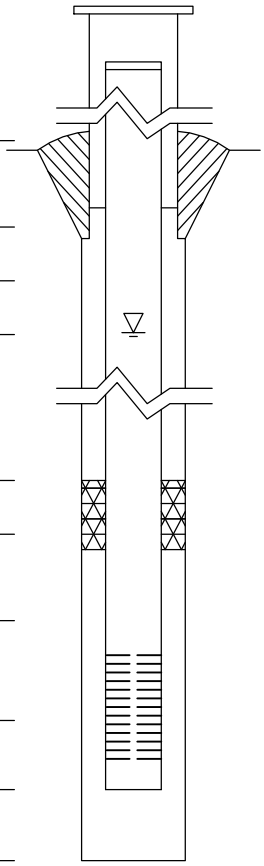
Type of Sand Pack: Quartz sand

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.)
623.37	-3.09	Top of Protective Casing
623.00	-2.72	Top of Riser Pipe
620.28	0.00	Ground Surface
618.48	1.80	Top of Annular Sealant
	DRY	Static Water Level (After Completion) 3/4/2009
597.78	22.50	Top of Seal
595.28	25.00	Top of Sand Pack
592.96	27.32	Top of Screen
583.53	36.75	Bottom of Screen
583.06	37.22	Bottom of Well
583.06	37.22	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	30.04
Bottom of Screen to End Cap	(feet)	0.47
Screen Length (1st slot to last slot)	(feet)	9.43
Total Length of Casing	(feet)	39.94
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G54S

Site Name: Gypsum Management Facility Borehole #: ~~G54~~

~~State~~ Plant ~~Plane~~ Coordinate: X 460.5 Y 14,664.8 (or) Latitude: ___ ___ ___ Longitude: ___ ___ ___

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/12/2009 Date Finished: 2/12/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 60 minutes

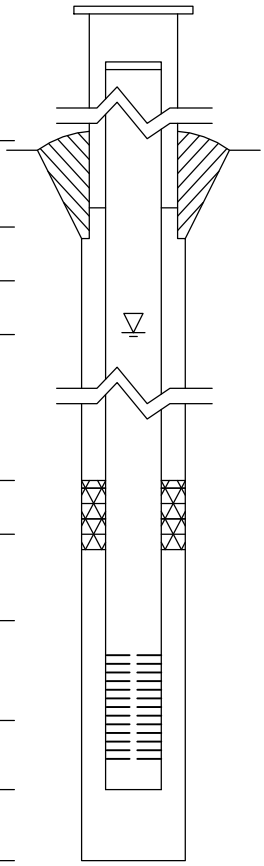
Type of Sand Pack: Quartz sand

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.)
623.54	-3.26	Top of Protective Casing
623.13	-2.85	Top of Riser Pipe
620.28	0.00	Ground Surface
618.38	1.90	Top of Annular Sealant
580.98	39.30	Static Water Level (After Completion) 3/4/2009
580.78	39.50	Top of Seal
578.61	41.67	Top of Sand Pack
576.78	43.50	Top of Screen
572.31	47.97	Bottom of Screen
571.87	48.41	Bottom of Well
571.87	48.41	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	46.50
Bottom of Screen to End Cap	(feet)	0.44
Screen Length (1st slot to last slot)	(feet)	4.47
Total Length of Casing	(feet)	51.41
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G55L

Site Name: Gypsum Management Facility Borehole #: ~~G55a~~

~~State~~ Plant ~~Plane~~ Coordinate: X 705.1 Y 14,667.7 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/19/2009 Date Finished: 2/19/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 22 minutes

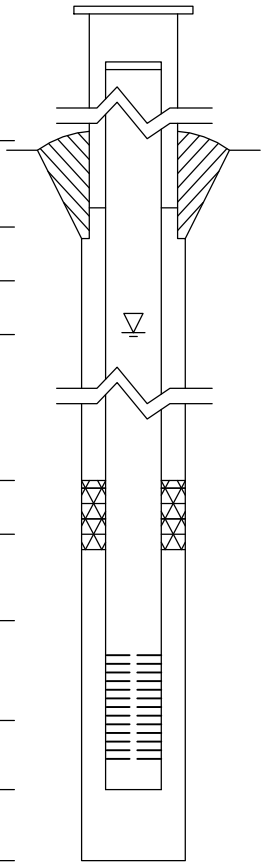
Type of Sand Pack: Quartz sand

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.)
623.47	-3.69	Top of Protective Casing
623.28	-3.50	Top of Riser Pipe
619.78	0.00	Ground Surface
617.78	2.00	Top of Annular Sealant
585.79	33.99	Static Water Level (After Completion) 3/4/2009
597.95	21.83	Top of Seal
596.28	23.50	Top of Sand Pack
593.02	26.76	Top of Screen
583.66	36.12	Bottom of Screen
583.18	36.60	Bottom of Well
583.18	36.60	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	30.26
Bottom of Screen to End Cap	(feet)	0.48
Screen Length (1st slot to last slot)	(feet)	9.36
Total Length of Casing	(feet)	40.10
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G55S

Site Name: Gypsum Management Facility Borehole #: ~~G55~~

~~State Plane~~ Plant Coordinate: X 705.0 Y 14,663.9 (or) Latitude: Longitude:

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/19/2009 Date Finished: 2/19/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 55 minutes

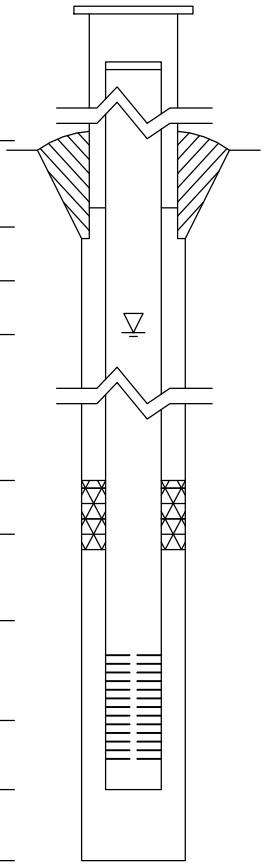
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

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

Installation Method:



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
623.21	-3.43	Top of Protective Casing
622.91	-3.13	Top of Riser Pipe
619.78	0.00	Ground Surface
617.95	1.83	Top of Annular Sealant
586.49	33.29	Static Water Level (After Completion) 3/4/2009
582.78	37.00	Top of Seal
580.95	38.83	Top of Sand Pack
578.74	41.04	Top of Screen
574.29	45.49	Bottom of Screen
573.82	45.96	Bottom of Well
573.82	45.96	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	44.17
Bottom of Screen to End Cap	(feet)	0.47
Screen Length (1st slot to last slot)	(feet)	4.45
Total Length of Casing	(feet)	49.09
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G56L

Site Name: Gypsum Management Facility Borehole #: ~~G56a~~

~~State Plane~~ Plant Coordinate: X 979.2 Y 14,708.6 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/16/2009 Date Finished: 2/16/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite chips

Installation Method: Gravity

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 24+ hours

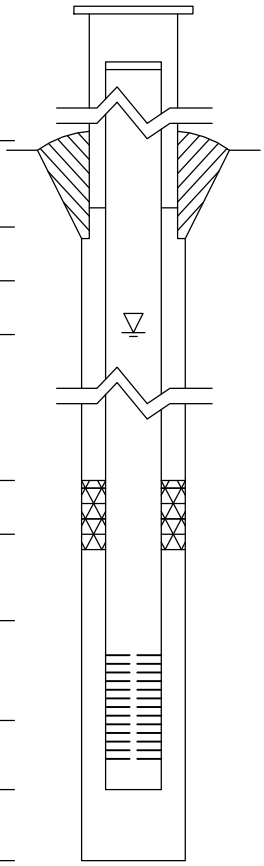
Type of Sand Pack: Quartz sand

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.)
622.94	-3.03	Top of Protective Casing
622.37	-2.46	Top of Riser Pipe
619.91	0.00	Ground Surface
617.91	2.00	Top of Annular Sealant
	DRY	Static Water Level (After Completion) 3/4/2009
617.91	2.00	Top of Seal
608.91	11.00	Top of Sand Pack
606.14	13.77	Top of Screen
597.80	22.11	Bottom of Screen
597.02	22.89	Bottom of Well
597.02	22.89	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	16.23
Bottom of Screen to End Cap	(feet)	0.78
Screen Length (1st slot to last slot)	(feet)	9.34
Total Length of Casing	(feet)	26.35
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G56S

Site Name: Gypsum Management Facility Borehole #: ~~G56~~

~~State~~ Plant ~~Plane~~ Coordinate: X 978.8 Y 14,705.0 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/16/2009 Date Finished: 2/16/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 45 minutes

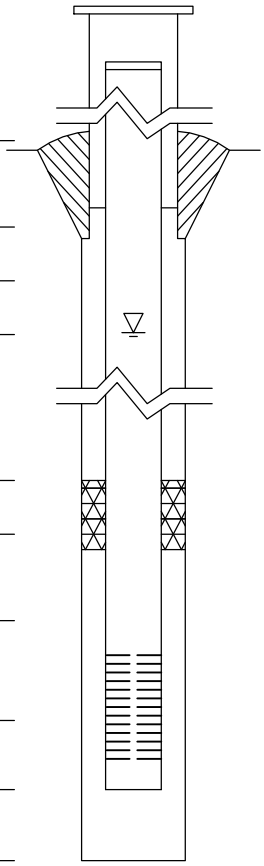
Type of Sand Pack: Quartz sand

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.)
623.14	-3.23	Top of Protective Casing
622.74	-2.83	Top of Riser Pipe
619.91	0.00	Ground Surface
617.95	1.96	Top of Annular Sealant
589.36	30.55	Static Water Level (After Completion) 3/4/2009
591.83	28.08	Top of Seal
588.76	31.15	Top of Sand Pack
586.74	33.17	Top of Screen
582.25	37.66	Bottom of Screen
581.62	38.29	Bottom of Well
579.91	40.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	36.00
Bottom of Screen to End Cap	(feet)	0.63
Screen Length (1st slot to last slot)	(feet)	4.49
Total Length of Casing	(feet)	41.12
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G57L

Site Name: Gypsum Management Facility Borehole #: ~~G57a~~

~~State Plane~~ Plant Coordinate: X 987.5 Y 15,064.7 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: ____ Date Started: 1/30/2009 Date Finished: 1/30/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 20 minutes

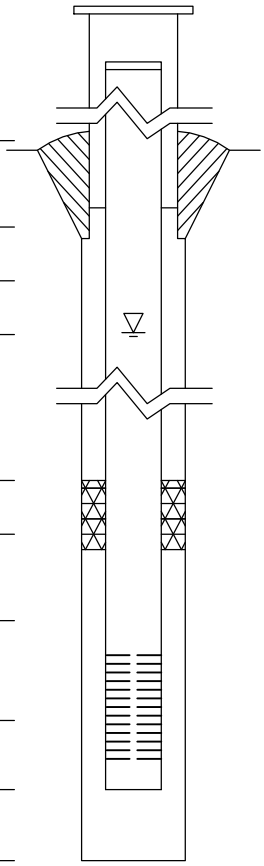
Type of Sand Pack: Quartz sand

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.)
623.12	-3.14	Top of Protective Casing
622.93	-2.95	Top of Riser Pipe
619.98	0.00	Ground Surface
617.98	2.00	Top of Annular Sealant
____	DRY	Static Water Level (After Completion) 3/4/2009
608.48	11.50	Top of Seal
605.48	14.50	Top of Sand Pack
603.81	16.17	Top of Screen
594.36	25.62	Bottom of Screen
593.98	26.00	Bottom of Well
593.98	26.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	19.12
Bottom of Screen to End Cap	(feet)	0.38
Screen Length (1st slot to last slot)	(feet)	9.45
Total Length of Casing	(feet)	28.95
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G57S

Site Name: Gypsum Management Facility Borehole #: ~~G57~~

~~State~~ Plant ~~Plane~~ Coordinate: X 987.5 Y 15,060.3 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: ____ Date Started: 1/30/2009 Date Finished: 1/30/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 42 minutes

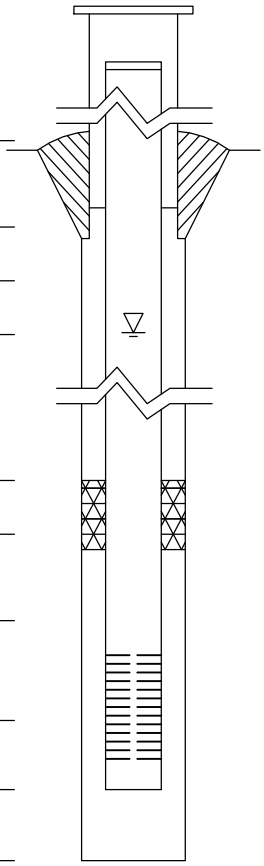
Type of Sand Pack: Quartz sand

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.)
622.96	-2.98	Top of Protective Casing
622.76	-2.78	Top of Riser Pipe
619.98	0.00	Ground Surface
617.98	2.00	Top of Annular Sealant
588.50	31.48	Static Water Level (After Completion) 3/4/2009
596.98	23.00	Top of Seal
593.18	26.80	Top of Sand Pack
590.33	29.65	Top of Screen
585.80	34.18	Bottom of Screen
585.36	34.62	Bottom of Well
581.98	38.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	32.43
Bottom of Screen to End Cap	(feet)	0.44
Screen Length (1st slot to last slot)	(feet)	4.53
Total Length of Casing	(feet)	37.40
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G58L

Site Name: Gypsum Management Facility Borehole #: ~~G58a~~

~~State~~ Plant ~~Plane~~ Coordinate: X 989.0 Y 15,204.3 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 1/26/2009 Date Finished: 1/26/2009

Report Form Completed By: Suzanna Simpson Date: 1/30/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 20 minutes

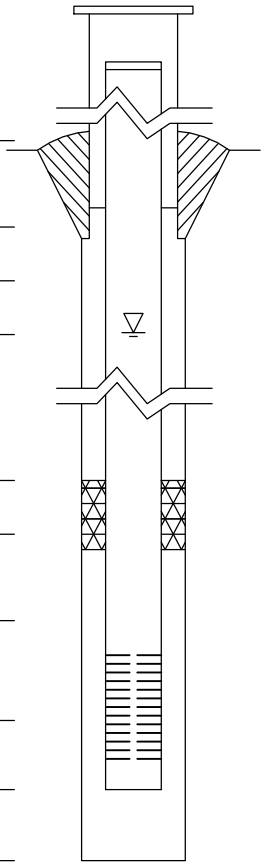
Type of Sand Pack: Quartz sand

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.)
623.24	-3.20	Top of Protective Casing
623.04	-3.00	Top of Riser Pipe
620.04	0.00	Ground Surface
617.94	2.10	Top of Annular Sealant
	DRY	Static Water Level (After Completion) 3/4/2009
604.54	15.50	Top of Seal
601.49	18.55	Top of Sand Pack
599.35	20.69	Top of Screen
589.94	30.10	Bottom of Screen
589.48	30.56	Bottom of Well
589.48	30.56	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS
(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	23.69
Bottom of Screen to End Cap	(feet)	0.46
Screen Length (1st slot to last slot)	(feet)	9.41
Total Length of Casing	(feet)	33.56
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G58S

Site Name: Gypsum Management Facility Borehole #: ~~G58~~

~~State Plane~~ Plant Coordinate: X 989.6 Y 15,200.2 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 1/26/2009 Date Finished: 1/26/2009

Report Form Completed By: Suzanna Simpson Date: 1/30/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 60 minutes

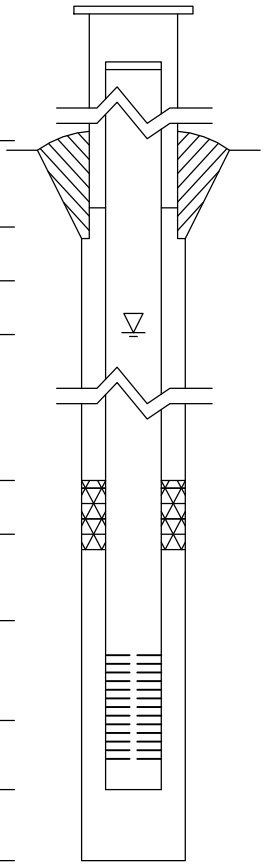
Type of Sand Pack: Quartz sand

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.)
623.27	-3.23	Top of Protective Casing
623.05	-3.01	Top of Riser Pipe
620.04	0.00	Ground Surface
617.94	2.10	Top of Annular Sealant
582.62	37.42	Static Water Level (After Completion) 3/4/2009
593.04	27.00	Top of Seal
590.79	29.25	Top of Sand Pack
588.72	31.32	Top of Screen
584.24	35.80	Bottom of Screen
583.61	36.43	Bottom of Well
583.61	36.43	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	34.33
Bottom of Screen to End Cap	(feet)	0.63
Screen Length (1st slot to last slot)	(feet)	4.48
Total Length of Casing	(feet)	39.44
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G59L

Site Name: Gypsum Management Facility Borehole #: ~~G59a~~

~~State Plane~~ Plant Coordinate: X 992.6 Y 15,343.9 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 1/23/2009 Date Finished: 1/23/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 30 minutes

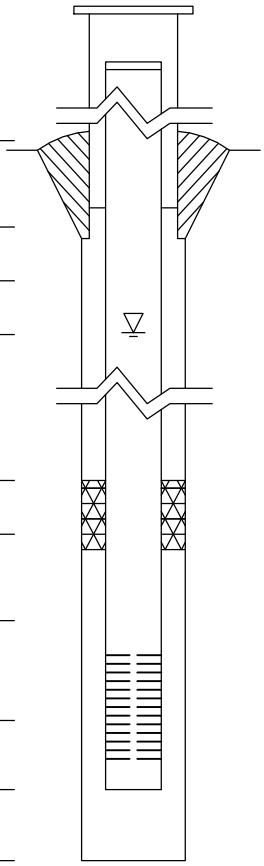
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

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

Installation Method:



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
622.76	-2.61	Top of Protective Casing
622.45	-2.30	Top of Riser Pipe
620.15	0.00	Ground Surface
618.15	2.00	Top of Annular Sealant
	DRY	Static Water Level (After Completion) 3/4/2009
602.29	17.86	Top of Seal
599.47	20.68	Top of Sand Pack
597.24	22.91	Top of Screen
587.82	32.33	Bottom of Screen
587.12	33.03	Bottom of Well
587.12	33.03	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS
(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	25.21
Bottom of Screen to End Cap	(feet)	0.70
Screen Length (1st slot to last slot)	(feet)	9.42
Total Length of Casing	(feet)	35.33
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G59S

Site Name: Gypsum Management Facility Borehole #: ~~G59~~

~~State~~ Plant ~~Plane~~ Coordinate: X 992.6 Y 15,339.8 (or) Latitude: Longitude:

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 1/23/2009 Date Finished: 1/23/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 90 minutes

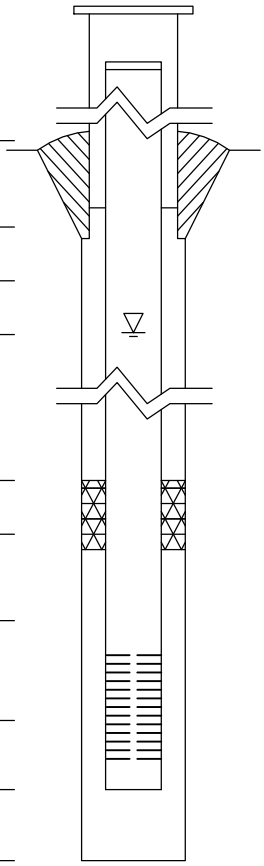
Type of Sand Pack: Quartz sand

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.)
623.23	-3.08	Top of Protective Casing
622.84	-2.69	Top of Riser Pipe
620.15	0.00	Ground Surface
618.15	2.00	Top of Annular Sealant
578.24	41.91	Static Water Level (After Completion) 3/4/2009
588.15	32.00	Top of Seal
584.81	35.34	Top of Sand Pack
582.77	37.38	Top of Screen
578.27	41.88	Bottom of Screen
577.66	42.49	Bottom of Well
577.66	42.49	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	40.07
Bottom of Screen to End Cap	(feet)	0.61
Screen Length (1st slot to last slot)	(feet)	4.50
Total Length of Casing	(feet)	45.18
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G60L

Site Name: Duck Creek Gypsum Managment Facility Borehole #: ~~BG60b~~

~~State Plane~~ Plant Coordinate: X 1,049.8 Y 15,474.7 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Kimberley R. Lyons IL Registration #: 035-003669

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Testing Services Corp. Date Started: 1/17/2008 Date Finished: 1/17/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 2/20/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite chips

Installation Method: Gravity

Setting Time: >24 hr

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

Installation Method: ____

Setting Time: ____

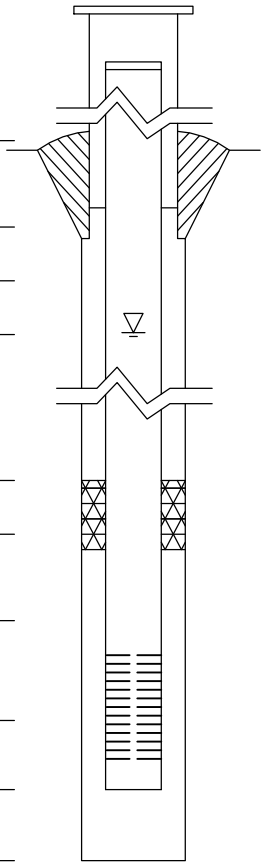
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: ____ (if applicable)

Installation Method: ____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
616.00	-3.55	Top of Protective Casing
615.49	-3.04	Top of Riser Pipe
612.45	0.00	Ground Surface
609.85	2.60	Top of Annular Sealant
591.43	21.02	Static Water Level (After Completion) 1/30/2008
596.03	16.42	Top of Seal
593.32	19.13	Top of Sand Pack
592.33	20.12	Top of Screen
587.54	24.91	Bottom of Screen
587.17	25.28	Bottom of Well
587.17	25.28	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	23.45
Bottom of Screen to End Cap	(feet)	0.37
Screen Length (1st slot to last slot)	(feet)	4.79
Total Length of Casing	(feet)	28.61
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G60S

Site Name: Duck Creek Gypsum Managment Facility Borehole #: ~~BG60~~

~~State~~ Plant ~~Plane~~ Coordinate: X 1,050.2 Y 15,469.5 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Kimberley R. Lyons IL Registration #: 035-003669

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Testing Services Corp. Date Started: 1/16/2008 Date Finished: 1/16/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 2/20/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite grout

Installation Method: Tremie

Setting Time: >24 hr

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

Installation Method: Gravity

Setting Time: 22 min

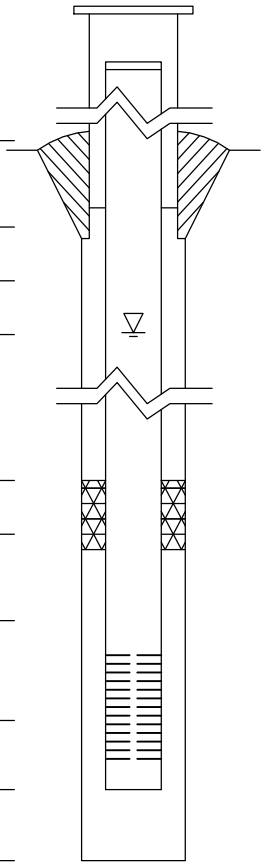
Type of Sand Pack: Quartz sand

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.)
615.56	-3.37	Top of Protective Casing
615.11	-2.92	Top of Riser Pipe
612.19	0.00	Ground Surface
609.19	3.00	Top of Annular Sealant
582.46	29.73	Static Water Level (After Completion) 1/30/2008
584.51	27.68	Top of Seal
582.39	29.80	Top of Sand Pack
581.07	31.12	Top of Screen
576.28	35.91	Bottom of Screen
575.90	36.29	Bottom of Well
574.19	38.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	34.07
Bottom of Screen to End Cap	(feet)	0.38
Screen Length (1st slot to last slot)	(feet)	4.79
Total Length of Casing	(feet)	39.24
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G61L

Site Name: Gypsum Management Facility Borehole #: ~~G61a~~

~~State Plane~~ Plant Coordinate: X 994.4 Y 15,640.9 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 1/21/2009 Date Finished: 1/21/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite chips

Installation Method: Gravity

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 24+ hours

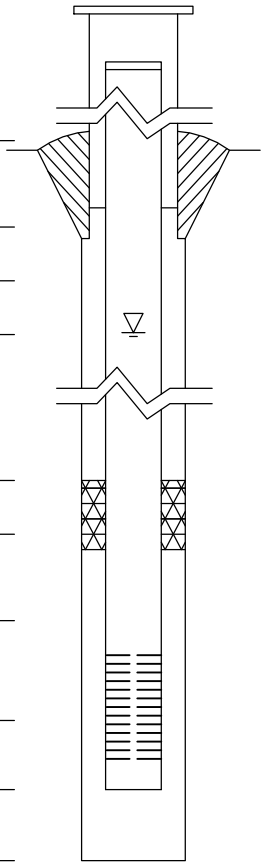
Type of Sand Pack: Quartz sand

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.)
622.97	-2.97	Top of Protective Casing
622.77	-2.77	Top of Riser Pipe
620.00	0.00	Ground Surface
618.00	2.00	Top of Annular Sealant
	DRY	Static Water Level (After Completion) 3/4/2009
618.00	2.00	Top of Seal
612.60	7.40	Top of Sand Pack
610.36	9.64	Top of Screen
601.00	19.00	Bottom of Screen
600.10	19.90	Bottom of Well
600.10	19.90	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	12.41
Bottom of Screen to End Cap	(feet)	0.90
Screen Length (1st slot to last slot)	(feet)	9.36
Total Length of Casing	(feet)	22.67
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

4/2000

ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 W. JEFFERSON ST.
SPRINGFIELD, IL 62761

WATER WELL SEALING FORM

TYPE OR PRESS FIRMLY

RETURN ALL COPIES TO IDPH OR LOCAL HEALTH DEPARTMENT

This form shall be submitted to this Department or the local health department not more than 30 days after a water well, boring or monitoring well is sealed. Such wells are to be sealed not more than 30 days after they are abandoned in accordance with the sealing requirements in the Water Well Construction Code. THE LOCAL HEALTH DEPARTMENT OR REGIONAL PUBLIC HEALTH DEPARTMENT MUST BE NOTIFIED AT LEAST 48 HOURS PRIOR TO SEALING.

1. **Ownership (Name of Controlling Party)** Duck Creek Power Station - GMF (G61L)

2. **Well Location** 17751 N Cilco Road — Canton — Fulton
   Address - Lot Number — **City** — **County**

   General Description **Township** 6 (N)(~~S~~) **Range** 5 (E)(~~W~~) **Section** 18

   SW **Quarter of the** NE **Quarter of the** NW **Quarter**

3. **Year Drilled** 2009

4. **Drilling Permit Number (and date, if known)** n/a

5. **Type of Well** **Bored** ____ **Drilled** ✓ **Other** ____

6. **Total Depth** 19.9 **Diameter (inches)** 8

7. **Formation clear of obstruction** ✓ **Yes** ____ **No**

8. **DETAILS OF PLUGGING** *(riser pipe and screen pulled and annulus was grouted)*

   Filled with Bentonite grout **from** 0 **to** 19.9 **ft.**
   (cement or other materials)

   Kind of plug ____ **from** ____ **to** ____ **ft.**

   Filled with ____ **from** ____ **to** ____ **ft.**

   Kind of plug ____ **from** ____ **to** ____ **ft.**

   Filled with ____ **from** ____ **to** ____ **ft.**

   Kind of plug ____ **from** ____ **to** ____ **ft.**

9. **CASING RECORD** **Upper 2 feet of casing removed** ✓ **Yes** ____ **No**

10. **Date well was sealed** **Month** March **Day** 14 **Year** 2017.

11. **Licensed water well driller or other person approved by the Department performing well sealing.**

    Rhonald W. Hasenyager, L.P.G. — **Name**
    196-000246 — **Complete License Number**

    Hanson Professional Services Inc., 1525 S. 6th St. — **Address**
    Springfield — **City**
    IL 62703 — **State/ZIP**

This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act 85-0863. Disclosure of this information is mandatory. This form has been approved by the Forms Management Center. IL 482-0631

Printed by Authority of the State of Illinois
P.O. #530379 9.6M 4/00

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G61S

Site Name: Gypsum Management Facility Borehole #: ~~G61~~

~~State~~ Plant ~~Plane~~ Coordinate: X 994.8 Y 15,644.9 (or) Latitude: ___ ___ ___ Longitude: ___ ___ ___

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 1/20/2009 Date Finished: 1/21/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 2.5 hours

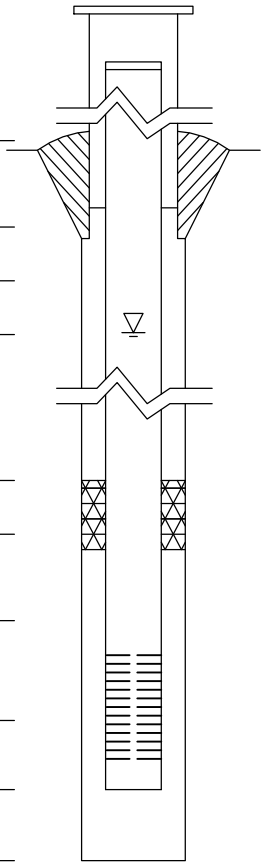
Type of Sand Pack: Quartz sand

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.)
622.80	-2.80	Top of Protective Casing
622.58	-2.58	Top of Riser Pipe
620.00	0.00	Ground Surface
618.00	2.00	Top of Annular Sealant
587.62	32.38	Static Water Level (After Completion) 3/4/2009
595.00	25.00	Top of Seal
591.80	28.20	Top of Sand Pack
589.81	30.19	Top of Screen
585.37	34.63	Bottom of Screen
584.74	35.26	Bottom of Well
582.00	38.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	32.77
Bottom of Screen to End Cap	(feet)	0.63
Screen Length (1st slot to last slot)	(feet)	4.44
Total Length of Casing	(feet)	37.84
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G62L

Site Name: Gypsum Management Facility Borehole #: ~~G62~~

~~State~~ Plant ~~Plane~~ Coordinate: X 994.7 Y 15,785.2 (or) Latitude: ___ ___ ___ Longitude: ___ ___ ___

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 1/21/2009 Date Finished: 1/22/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 20 minutes

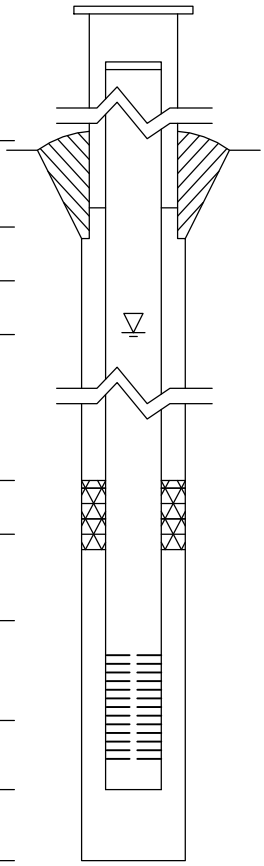
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Bentonite Chips (if applicable)

Installation Method: Gravity



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
623.67	-3.65	Top of Protective Casing
623.48	-3.46	Top of Riser Pipe
620.02	0.00	Ground Surface
618.02	2.00	Top of Annular Sealant
	DRY	Static Water Level (After Completion) 3/4/2009
605.12	14.90	Top of Seal
602.12	17.90	Top of Sand Pack
599.71	20.31	Top of Screen
590.36	29.66	Bottom of Screen
589.90	30.12	Bottom of Well
582.02	38.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS
(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	23.77
Bottom of Screen to End Cap	(feet)	0.46
Screen Length (1st slot to last slot)	(feet)	9.35
Total Length of Casing	(feet)	33.58
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G63L

Site Name: Gypsum Management Facility Borehole #: ~~G63a~~

~~State~~ Plant ~~Plane~~ Coordinate: X 998.0 Y 15,928.4 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/2/2009 Date Finished: 2/2/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 45 minutes

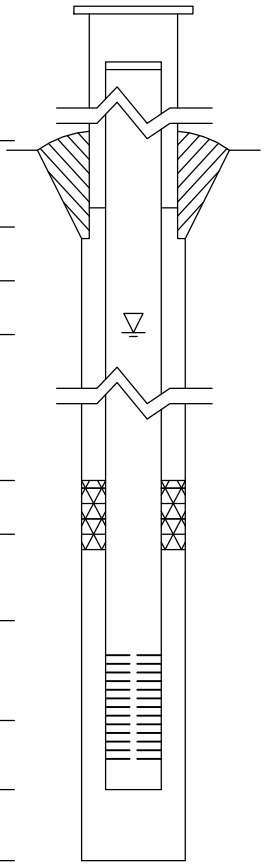
Type of Sand Pack: Quartz sand

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.)
623.33	-3.21	Top of Protective Casing
622.98	-2.86	Top of Riser Pipe
620.12	0.00	Ground Surface
618.12	2.00	Top of Annular Sealant
	DRY	Static Water Level (After Completion) 3/4/2009
606.62	13.50	Top of Seal
603.62	16.50	Top of Sand Pack
601.65	18.47	Top of Screen
592.23	27.89	Bottom of Screen
591.76	28.36	Bottom of Well
591.76	28.36	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	21.33
Bottom of Screen to End Cap	(feet)	0.47
Screen Length (1st slot to last slot)	(feet)	9.42
Total Length of Casing	(feet)	31.22
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G63S

Site Name: Gypsum Management Facility Borehole #: ~~G63~~

~~State~~ Plant ~~Plane~~ Coordinate: X 998.3 Y 15,924.4 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/2/2009 Date Finished: 2/2/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 90 minutes

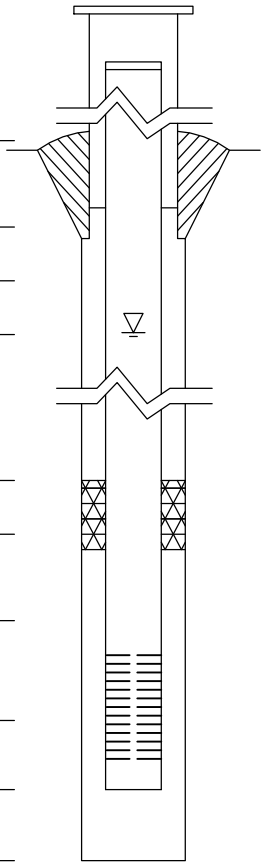
Type of Sand Pack: Quartz sand

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.)
623.28	-3.16	Top of Protective Casing
623.09	-2.97	Top of Riser Pipe
620.12	0.00	Ground Surface
618.12	2.00	Top of Annular Sealant
586.64	33.48	Static Water Level (After Completion) 3/4/2009
590.62	29.50	Top of Seal
587.62	32.50	Top of Sand Pack
585.60	34.52	Top of Screen
581.11	39.01	Bottom of Screen
580.65	39.47	Bottom of Well
580.12	40.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS
(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	37.49
Bottom of Screen to End Cap	(feet)	0.46
Screen Length (1st slot to last slot)	(feet)	4.49
Total Length of Casing	(feet)	42.44
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G64L

Site Name: Gypsum Management Facility Borehole #: ~~G64a~~

~~State~~ Plant ~~Plane~~ Coordinate: X 995.7 Y 16,069.3 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 1/22/2009 Date Finished: 1/22/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 25 minutes

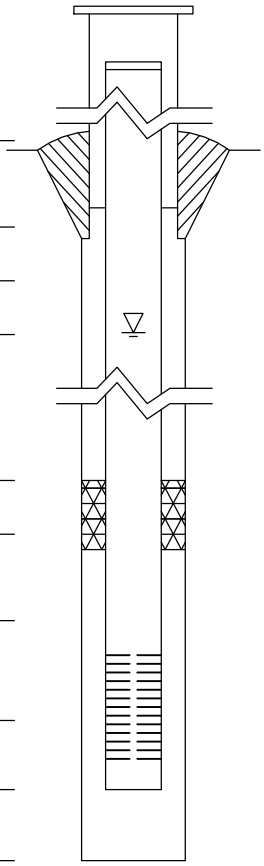
Type of Sand Pack: Quartz sand

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.)
622.76	-2.74	Top of Protective Casing
622.54	-2.52	Top of Riser Pipe
620.02	0.00	Ground Surface
618.02	2.00	Top of Annular Sealant
	DRY	Static Water Level (After Completion) 3/4/2009
607.02	13.00	Top of Seal
604.22	15.80	Top of Sand Pack
601.90	18.12	Top of Screen
592.54	27.48	Bottom of Screen
592.07	27.95	Bottom of Well
592.07	27.95	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	20.64
Bottom of Screen to End Cap	(feet)	0.47
Screen Length (1st slot to last slot)	(feet)	9.36
Total Length of Casing	(feet)	30.47
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G64S

Site Name: Gypsum Management Facility Borehole #: ~~G64~~

~~State~~ Plant ~~Plane~~ Coordinate: X 994.9 Y 16,064.6 (or) Latitude: ___ ___ ___ Longitude: ___ ___ ___

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 1/22/2009 Date Finished: 1/22/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 90 minutes

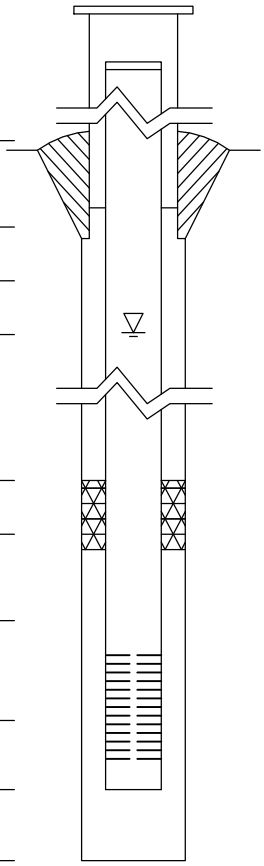
Type of Sand Pack: Quartz sand

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.)
623.49	-3.47	Top of Protective Casing
622.98	-2.96	Top of Riser Pipe
620.02	0.00	Ground Surface
618.02	2.00	Top of Annular Sealant
587.70	32.32	Static Water Level (After Completion) 3/4/2009
590.92	29.10	Top of Seal
587.82	32.20	Top of Sand Pack
585.52	34.50	Top of Screen
581.03	38.99	Bottom of Screen
580.54	39.48	Bottom of Well
580.02	40.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS
(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	37.46
Bottom of Screen to End Cap	(feet)	0.49
Screen Length (1st slot to last slot)	(feet)	4.49
Total Length of Casing	(feet)	42.44
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G65L

Site Name: Duck Creek Gypsum Managment Facility Borehole #: ~~BG65b~~

~~State~~ Plant ~~Plane~~ Coordinate: X 919.9 Y 13,986.1 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Kimberley R. Lyons IL Registration #: 035-003669

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Testing Services Corp. Date Started: 1/15/2008 Date Finished: 1/15/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 2/20/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite grout

Installation Method: Tremie

Setting Time: >24 hr

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

Installation Method: Gravity

Setting Time: 25 min

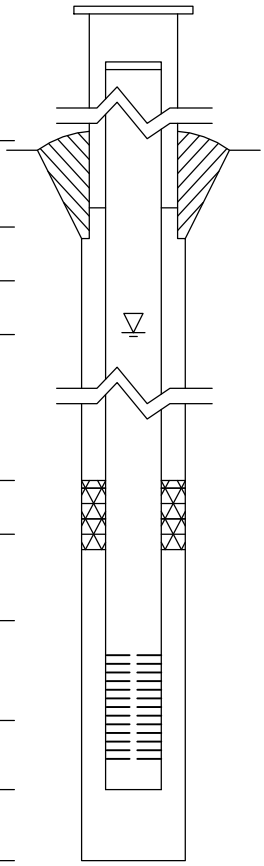
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: ____ (if applicable)

Installation Method: ____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
613.34	-3.27	Top of Protective Casing
612.84	-2.77	Top of Riser Pipe
610.07	0.00	Ground Surface
607.97	2.10	Top of Annular Sealant
587.76	22.31	Static Water Level (After Completion) 1/30/2008
596.16	13.91	Top of Seal
593.89	16.18	Top of Sand Pack
592.79	17.28	Top of Screen
587.99	22.08	Bottom of Screen
587.62	22.45	Bottom of Well
587.62	22.45	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	20.42
Bottom of Screen to End Cap	(feet)	0.37
Screen Length (1st slot to last slot)	(feet)	4.80
Total Length of Casing	(feet)	25.59
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G65S

Site Name: Duck Creek Gypsum Managment Facility Borehole #: ~~BG65a~~

~~State~~ Plant ~~Plane~~ Coordinate: X 914.1 Y 13,985.1 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Kimberley R. Lyons IL Registration #: 035-003669

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Testing Services Corp. Date Started: 1/15/2008 Date Finished: 1/15/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 2/20/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite grout

Installation Method: Tremie

Setting Time: >24 hr

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

Installation Method: Gravity

Setting Time: 20 min

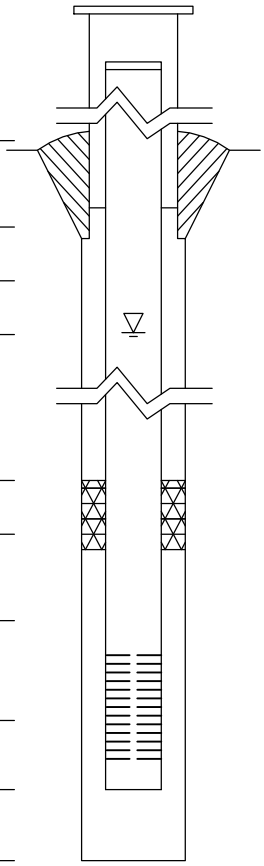
Type of Sand Pack: Quartz sand

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.)
613.55	-3.61	Top of Protective Casing
613.04	-3.10	Top of Riser Pipe
609.94	0.00	Ground Surface
607.34	2.60	Top of Annular Sealant
584.66	25.28	Static Water Level (After Completion) 1/30/2008
586.43	23.51	Top of Seal
583.83	26.11	Top of Sand Pack
583.02	26.92	Top of Screen
578.24	31.70	Bottom of Screen
577.86	32.08	Bottom of Well
577.24	32.70	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	30.26
Bottom of Screen to End Cap	(feet)	0.38
Screen Length (1st slot to last slot)	(feet)	4.78
Total Length of Casing	(feet)	35.42
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G66L

Site Name: Gypsum Management Facility Borehole #: ~~G66a~~

~~State~~ Plant ~~Plane~~ Coordinate: X 965.7 Y 14,240.5 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/4/2009 Date Finished: 2/4/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite chips

Installation Method: Gravity

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 24+ hours

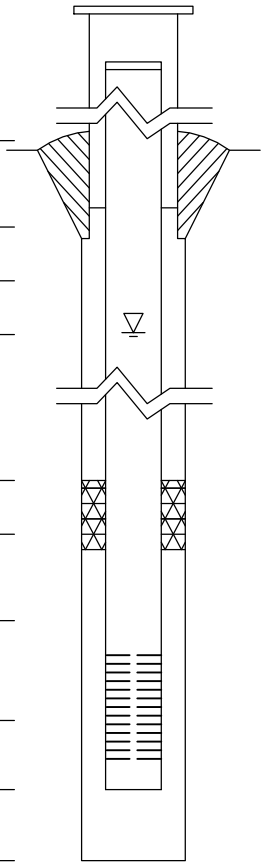
Type of Sand Pack: Quartz sand

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.)	
618.11	-3.25	Top of Protective Casing
617.82	-2.96	Top of Riser Pipe
614.86	0.00	Ground Surface
612.94	1.92	Top of Annular Sealant
	DRY	Static Water Level (After Completion) 3/4/2009
612.94	1.92	Top of Seal
607.28	7.58	Top of Sand Pack
605.02	9.84	Top of Screen
595.59	19.27	Bottom of Screen
595.12	19.74	Bottom of Well
595.12	19.74	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	12.80
Bottom of Screen to End Cap	(feet)	0.47
Screen Length (1st slot to last slot)	(feet)	9.43
Total Length of Casing	(feet)	22.70
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G66S

Site Name: Gypsum Management Facility Borehole #: ~~G66~~

~~State~~ Plant ~~Plane~~ Coordinate: X 964.9 Y 14,236.2 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/4/2009 Date Finished: 2/4/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 60 minutes

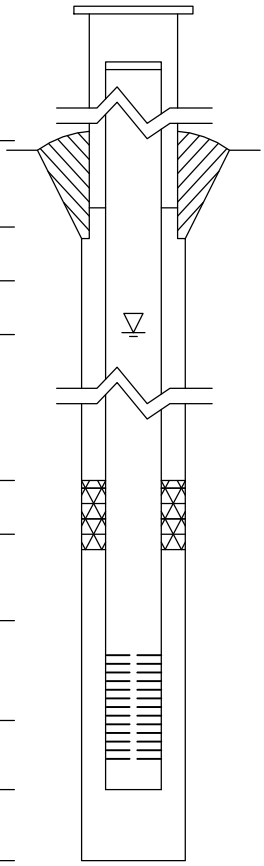
Type of Sand Pack: Quartz sand

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.)
618.13	-3.27	Top of Protective Casing
617.84	-2.98	Top of Riser Pipe
614.86	0.00	Ground Surface
612.86	2.00	Top of Annular Sealant
590.54	24.32	Static Water Level (After Completion) 3/4/2009
584.38	30.48	Top of Seal
581.78	33.08	Top of Sand Pack
579.76	35.10	Top of Screen
575.27	39.59	Bottom of Screen
574.77	40.09	Bottom of Well
574.77	40.09	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	38.08
Bottom of Screen to End Cap	(feet)	0.50
Screen Length (1st slot to last slot)	(feet)	4.49
Total Length of Casing	(feet)	43.07
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G67L

Site Name: Gypsum Management Facility Borehole #: ~~G67a~~

~~State Plane~~ Plant Coordinate: X 928.9 Y 14,527.5 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/3/2009 Date Finished: 2/3/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite chips

Installation Method: Gravity

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 24+ hours

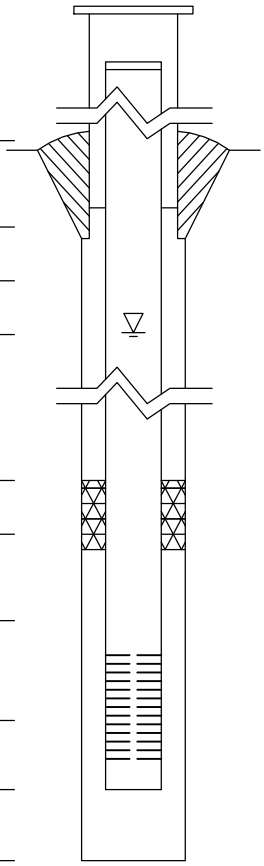
Type of Sand Pack: Quartz sand

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.)
617.64	-3.00	Top of Protective Casing
617.22	-2.58	Top of Riser Pipe
614.64	0.00	Ground Surface
612.71	1.93	Top of Annular Sealant
	DRY	Static Water Level (After Completion) 3/4/2009
612.71	1.93	Top of Seal
609.12	5.52	Top of Sand Pack
607.28	7.36	Top of Screen
597.92	16.72	Bottom of Screen
597.46	17.18	Bottom of Well
597.46	17.18	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	9.94
Bottom of Screen to End Cap	(feet)	0.46
Screen Length (1st slot to last slot)	(feet)	9.36
Total Length of Casing	(feet)	19.76
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G67S

Site Name: Gypsum Management Facility Borehole #: ~~G67~~

~~State~~ Plant ~~Plane~~ Coordinate: X 925.2 Y 14,530.3 (or) Latitude: ___ ___ ___ Longitude: ___ ___ ___

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/3/2009 Date Finished: 2/3/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 45 minutes

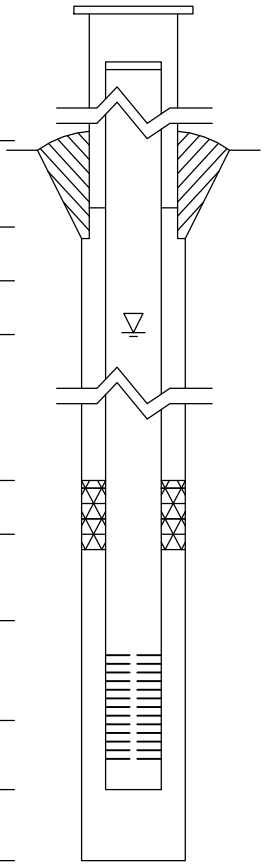
Type of Sand Pack: Quartz sand

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.)
618.03	-3.39	Top of Protective Casing
617.86	-3.22	Top of Riser Pipe
614.64	0.00	Ground Surface
612.64	2.00	Top of Annular Sealant
590.81	23.83	Static Water Level (After Completion) 3/4/2009
589.31	25.33	Top of Seal
586.04	28.60	Top of Sand Pack
583.55	31.09	Top of Screen
579.06	35.58	Bottom of Screen
578.43	36.21	Bottom of Well
576.64	38.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	34.31
Bottom of Screen to End Cap	(feet)	0.63
Screen Length (1st slot to last slot)	(feet)	4.49
Total Length of Casing	(feet)	39.43
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G71L

Site Name: Gypsum Management Facility Borehole #: ~~G71a~~

~~State~~ Plant ~~Plane~~ Coordinate: X 278.8 Y 14,106.4 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Rhonald W. Hasenyager Date Started: 11/20/2008 Date Finished: 11/20/2008

Report Form Completed By: Suzanna Simpson Date: 12/23/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 26 minutes

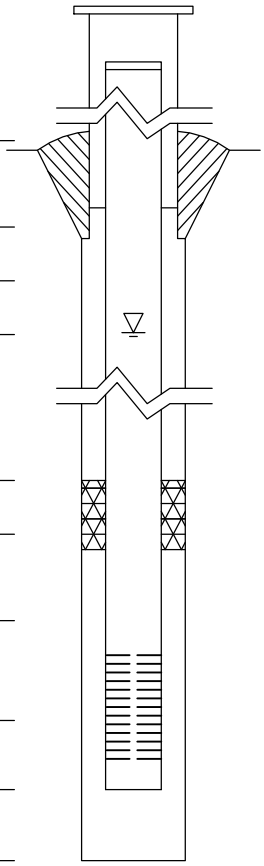
Type of Sand Pack: Quartz sand

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.)
618.05	-3.11	Top of Protective Casing
617.62	-2.68	Top of Riser Pipe
614.94	0.00	Ground Surface
612.94	2.00	Top of Annular Sealant
	DRY	Static Water Level (After Completion) 3/4/2009
599.46	15.48	Top of Seal
597.02	17.92	Top of Sand Pack
595.14	19.80	Top of Screen
585.65	29.29	Bottom of Screen
584.74	30.20	Bottom of Well
584.74	30.20	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	22.48
Bottom of Screen to End Cap	(feet)	0.91
Screen Length (1st slot to last slot)	(feet)	9.40
Total Length of Casing	(feet)	32.79
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G71S

Site Name: Gypsum Management Facility Borehole #: ~~G71~~

~~State~~ Plant ~~Plane~~ Coordinate: X 277.1 Y 14,110.5 (or) Latitude: ___ ___ ___ Longitude: ___ ___ ___

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Rhonald W. Hasenyager Date Started: 11/20/2008 Date Finished: 11/20/2008

Report Form Completed By: Suzanna Simpson Date: 12/23/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 25 minutes

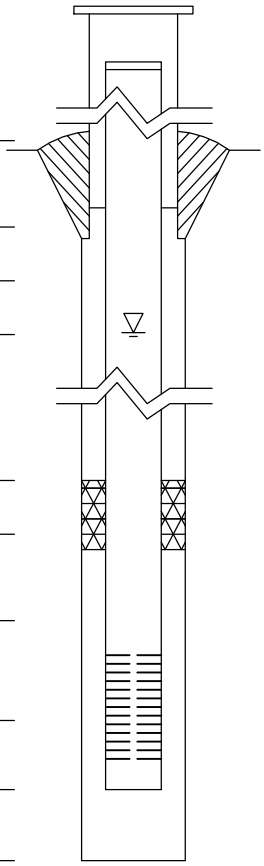
Type of Sand Pack: Quartz sand

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.)
618.13	-3.19	Top of Protective Casing
617.93	-2.99	Top of Riser Pipe
614.94	0.00	Ground Surface
612.84	2.10	Top of Annular Sealant
577.22	37.72	Static Water Level (After Completion) 3/4/2009
586.46	28.48	Top of Seal
582.94	32.00	Top of Sand Pack
580.98	33.96	Top of Screen
576.98	37.96	Bottom of Screen
576.54	38.40	Bottom of Well
574.94	40.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	36.95
Bottom of Screen to End Cap	(feet)	0.44
Screen Length (1st slot to last slot)	(feet)	4.48
Total Length of Casing	(feet)	41.87
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G72L

Site Name: Gypsum Management Facility Borehole #: ~~G72a~~

~~State Plane~~ Plant Coordinate: X 509.9 Y 13,904.8 (or) Latitude: ___ ___ ___ Longitude: ___ ___ ___

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: ___ Date Started: 11/19/2008 Date Finished: 11/19/2008

Report Form Completed By: Suzanna Simpson Date: 12/23/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 21 minutes

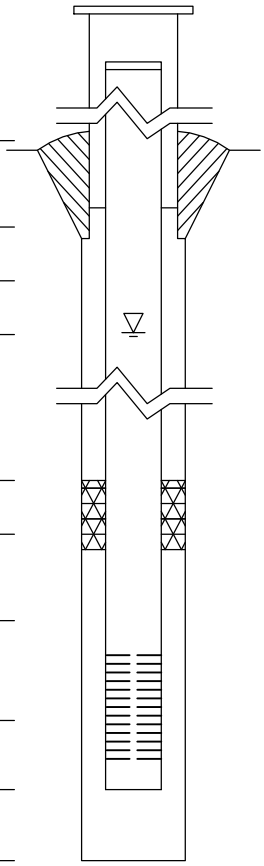
Type of Sand Pack: Quartz sand

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.)
617.99	-2.98	Top of Protective Casing
617.80	-2.79	Top of Riser Pipe
615.01	0.00	Ground Surface
613.21	1.80	Top of Annular Sealant
	DRY	Static Water Level (After Completion) 3/4/2009
604.10	10.91	Top of Seal
601.66	13.35	Top of Sand Pack
600.36	14.65	Top of Screen
591.00	24.01	Bottom of Screen
590.22	24.79	Bottom of Well
590.22	24.79	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	17.44
Bottom of Screen to End Cap	(feet)	0.78
Screen Length (1st slot to last slot)	(feet)	9.36
Total Length of Casing	(feet)	27.58
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G72S

Site Name: Gypsum Management Facility Borehole #: ~~G72~~

~~State~~ Plant ~~Plane~~ Coordinate: X 504.9 Y 13,905.1 (or) Latitude: ___ ___ ___ Longitude: ___ ___ ___

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: ___ Date Started: 11/19/2008 Date Finished: 11/19/2008

Report Form Completed By: Suzanna Simpson Date: 12/23/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 20 minutes

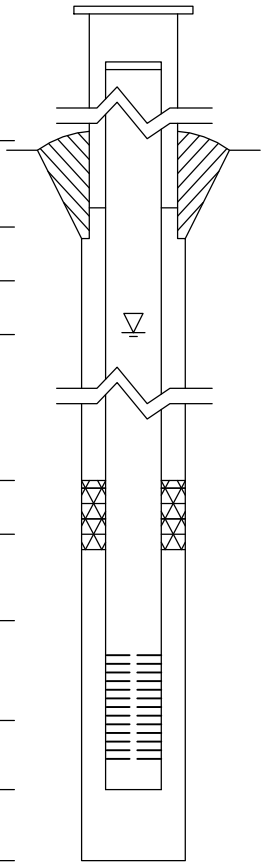
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Bentonite Chips (if applicable)

Installation Method: Gravity



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
618.12	-3.11	Top of Protective Casing
617.68	-2.67	Top of Riser Pipe
615.01	0.00	Ground Surface
612.71	2.30	Top of Annular Sealant
	DRY	Static Water Level (After Completion) 3/4/2009
589.46	25.55	Top of Seal
587.18	27.83	Top of Sand Pack
584.85	30.16	Top of Screen
580.37	34.64	Bottom of Screen
579.92	35.09	Bottom of Well
575.61	39.40	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	32.83
Bottom of Screen to End Cap	(feet)	0.45
Screen Length (1st slot to last slot)	(feet)	4.48
Total Length of Casing	(feet)	37.76
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

4/2000

ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 W. JEFFERSON ST.
SPRINGFIELD, IL 62761

WATER WELL SEALING FORM

TYPE OR PRESS FIRMLY

RETURN ALL COPIES TO IDPH OR LOCAL HEALTH DEPARTMENT

This form shall be submitted to this Department or the local health department not more than 30 days after a water well, boring or monitoring well is sealed. Such wells are to be sealed not more than 30 days after they are abandoned in accordance with the sealing requirements in the Water Well Construction Code. THE LOCAL HEALTH DEPARTMENT OR REGIONAL PUBLIC HEALTH DEPARTMENT MUST BE NOTIFIED AT LEAST 48 HOURS PRIOR TO SEALING.

1. **Ownership (Name of Controlling Party)** Duck Creek Power Station - Recycle Pond (G72S)

2. **Well Location** 17751 N Cilco Road — Canton — Fulton
   Address - Lot Number — City — County

   General Description **Township** 6 (N)(~~S~~) **Range** 5 (E)(~~W~~) **Section** 18

   NE **Quarter of the** NW **Quarter of the** SW **Quarter**

3. **Year Drilled** 2008

4. **Drilling Permit Number (and date, if known)** n/a

5. **Type of Well** **Bored** ____ **Drilled** ✓ **Other** ____

6. **Total Depth** 35.09 **Diameter (inches)** 8

7. **Formation clear of obstruction** ✓ **Yes** ____ **No**

   After G72S was sealed, replacement well R72S was installed approximately 5 feet west in a blind-drilled borehole.

8. **DETAILS OF PLUGGING**

   Filled with Bentonite grout **from** 2 **to** 35.09 **ft.**
   (cement or other materials)

   Kind of plug Random soil **from** 0 **to** 2.0 **ft.**

   Filled with ____ **from** ____ **to** ____ **ft.**

   Kind of plug ____ **from** ____ **to** ____ **ft.**

   Filled with ____ **from** ____ **to** ____ **ft.**

   Kind of plug ____ **from** ____ **to** ____ **ft.**

9. **CASING RECORD** **Upper 2 feet of casing removed** ✓ **Yes** ____ **No**

10. **Date well was sealed** **Month** November **Day** 9 **Year** 2016.

11. **Licensed water well driller or other person approved by the Department performing well sealing.**

    Rhonald W. Hasenyager, L.P.G. — **Name**
    196-000246 — **Complete License Number**

    Hanson Professional Services Inc., 1525 S. 6th St. — **Address**
    Springfield — **City**
    IL 62703 — **State/ZIP**

This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act 85-0863. Disclosure of this information is mandatory. This form has been approved by the Forms Management Center. IL 482-0631

Printed by Authority of the State of Illinois
P.O. #530379 9.6M 4/00

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: G73L

Site Name: Gypsum Management Facility Borehole #: ~~G73a~~

~~State~~ Plant ~~Plane~~ Coordinate: X 799.5 Y 13,924.5 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 2/6/2009 Date Finished: 2/6/2009

Report Form Completed By: Suzanna Simpson Date: 2/26/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 12+ hours

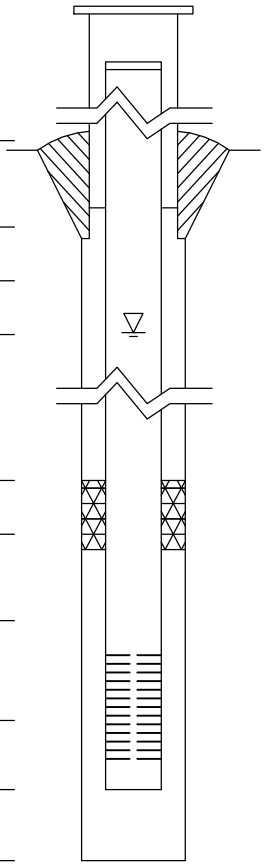
Type of Sand Pack: Quartz sand

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.)
618.23	-3.59	Top of Protective Casing
617.58	-2.94	Top of Riser Pipe
614.64	0.00	Ground Surface
612.64	2.00	Top of Annular Sealant
	DRY	Static Water Level (After Completion) 3/4/2009
594.64	20.00	Top of Seal
592.22	22.42	Top of Sand Pack
590.01	24.63	Top of Screen
580.66	33.98	Bottom of Screen
579.88	34.76	Bottom of Well
579.88	34.76	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	27.57
Bottom of Screen to End Cap	(feet)	0.78
Screen Length (1st slot to last slot)	(feet)	9.35
Total Length of Casing	(feet)	37.70
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: P01L

Site Name: Gypsum Management Facility Borehole #: ~~P01b~~

~~State~~ Plant ~~Plane~~ Coordinate: X -194.6 Y 16,744.8 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 11/10/2008 Date Finished: 11/10/2008

Report Form Completed By: Suzanna Simpson Date: 11/21/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite chips

Installation Method: Gravity

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 24+ hours

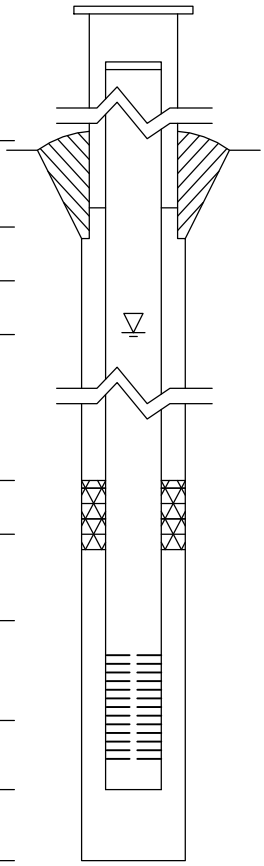
Type of Sand Pack: Quartz sand

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.)
625.26	-3.26	Top of Protective Casing
624.99	-2.99	Top of Riser Pipe
622.00	0.00	Ground Surface
619.80	2.20	Top of Annular Sealant
604.00	18.00	Static Water Level (After Completion) 1/8/2009
619.80	2.20	Top of Seal
614.00	8.00	Top of Sand Pack
611.79	10.21	Top of Screen
602.44	19.56	Bottom of Screen
601.65	20.35	Bottom of Well
601.65	20.35	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	13.20
Bottom of Screen to End Cap	(feet)	0.79
Screen Length (1st slot to last slot)	(feet)	9.35
Total Length of Casing	(feet)	23.34
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: WPC Permit No. 2007-EA-4026 County: Fulton Well #: P01S

Site Name: Gypsum Management Facility Borehole #: ~~P01a~~

~~State Plane~~ Plant Coordinate: X -194.7 Y 16,754.6 (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corp. Driller: B. Williamson

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Suzanna Simpson Date Started: 11/10/2008 Date Finished: 11/10/2008

Report Form Completed By: Suzanna Simpson Date: 11/21/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 25 minutes

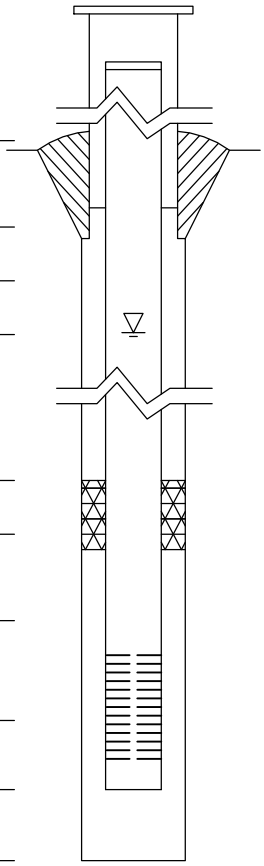
Type of Sand Pack: Quartz sand

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.)
624.76	-2.76	Top of Protective Casing
624.52	-2.52	Top of Riser Pipe
622.00	0.00	Ground Surface
619.40	2.60	Top of Annular Sealant
604.00	18.00	Static Water Level (After Completion) 1/8/2009
602.50	19.50	Top of Seal
601.18	20.82	Top of Sand Pack
599.42	22.58	Top of Screen
594.94	27.06	Bottom of Screen
594.26	27.74	Bottom of Well
594.26	27.74	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

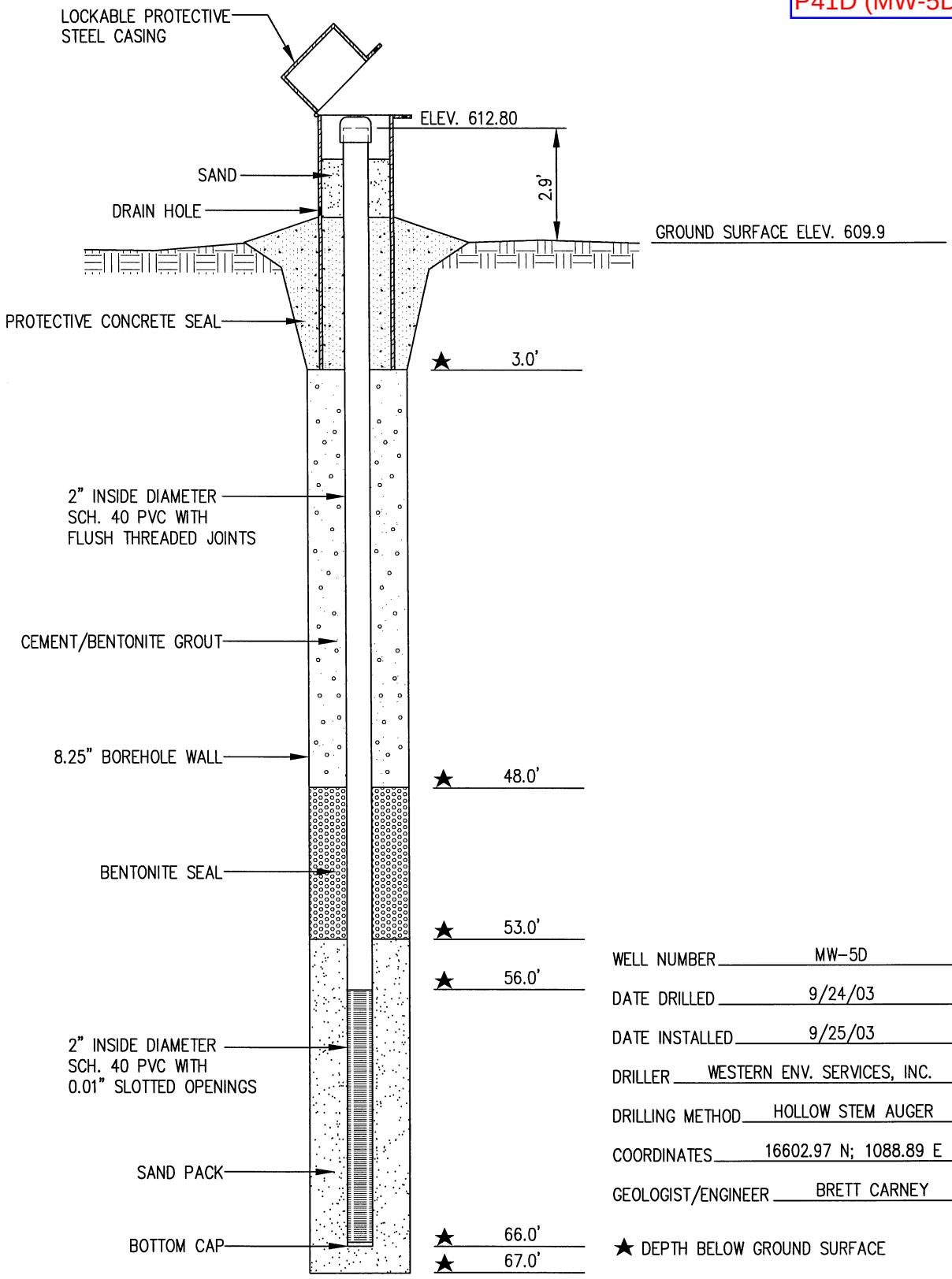
Protective Casing	SS304	SS316	PTFE	PVC	OTHER:
Riser Pipe Above W.T.	SS304	SS316	PTFE	PVC	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	PVC	OTHER:
Screen	SS304	SS316	PTFE	PVC	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	25.10
Bottom of Screen to End Cap	(feet)	0.68
Screen Length (1st slot to last slot)	(feet)	4.48
Total Length of Casing	(feet)	30.26
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

P41D (MW-5D)



WELL NUMBER MW-5D

DATE DRILLED 9/24/03

DATE INSTALLED 9/25/03

DRILLER WESTERN ENV. SERVICES, INC.

DRILLING METHOD HOLLOW STEM AUGER

COORDINATES 16602.97 N; 1088.89 E

GEOLOGIST/ENGINEER BRETT CARNEY

★ DEPTH BELOW GROUND SURFACE

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MONITORING WELL MW-5D CONSTRUCTION DETAIL

PHASE II HYDROGEOLOGIC SITE INVESTIGATION
AERG - DUCK CREEK STATION
CANTON, ILLINOIS

JOB NO. 03S5010 ATTACHMENT B

AUG 19, 2004 3:33 PM KDE
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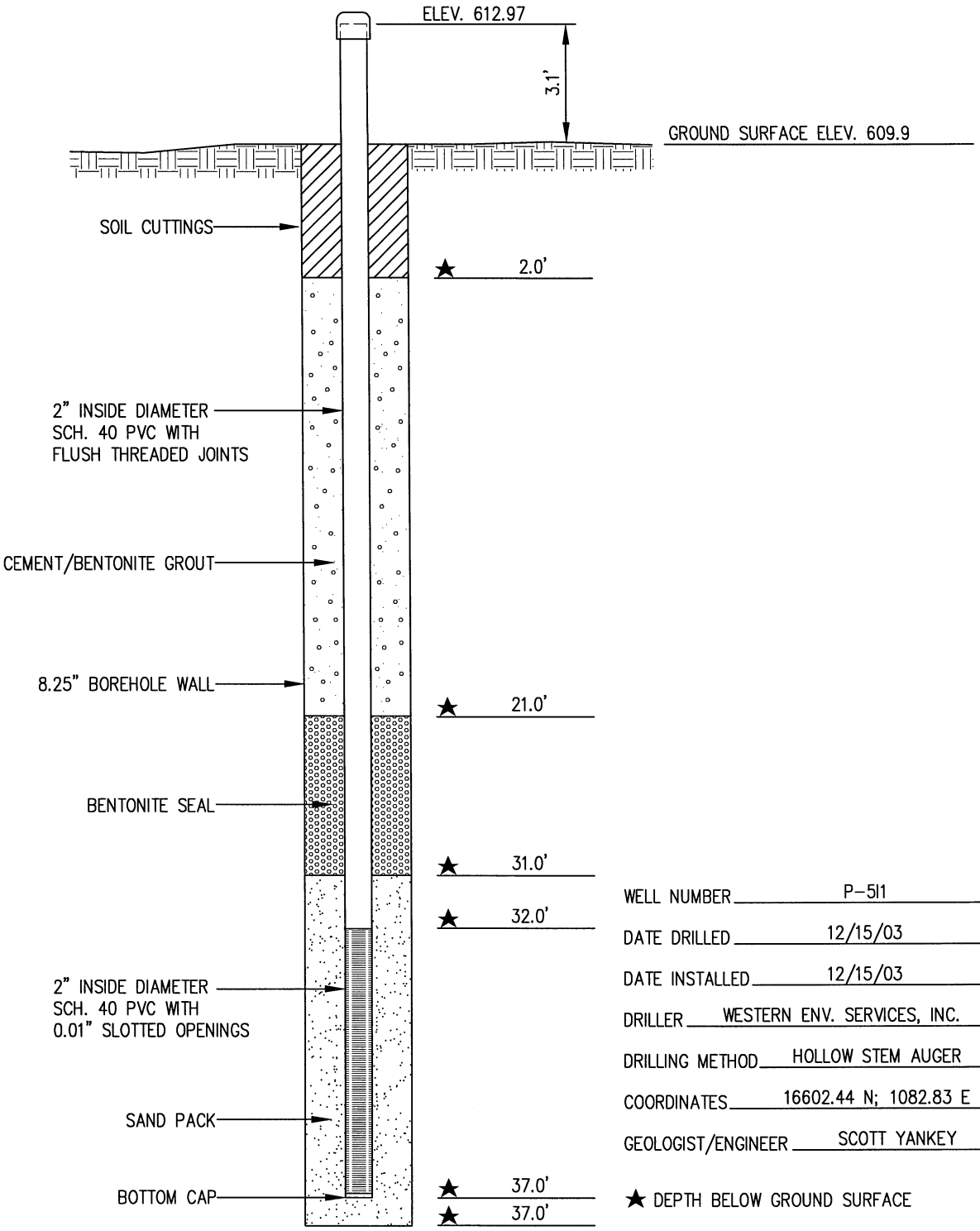

WELL NUMBER	P-5I1
DATE DRILLED	12/15/03
DATE INSTALLED	12/15/03
DRILLER	WESTERN ENV. SERVICES, INC.
DRILLING METHOD	HOLLOW STEM AUGER
COORDINATES	16602.44 N; 1082.83 E
GEOLOGIST/ENGINEER	SCOTT YANKEY

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PIEZOMETER P-5I1 CONSTRUCTION DETAIL

PHASE III HYDROGEOLOGIC SITE INVESTIGATION
AERG - DUCK CREEK STATION CCB LANDFILL
CANTON, ILLINOIS

JOB NO. 03S5010 ATTACHMENT B

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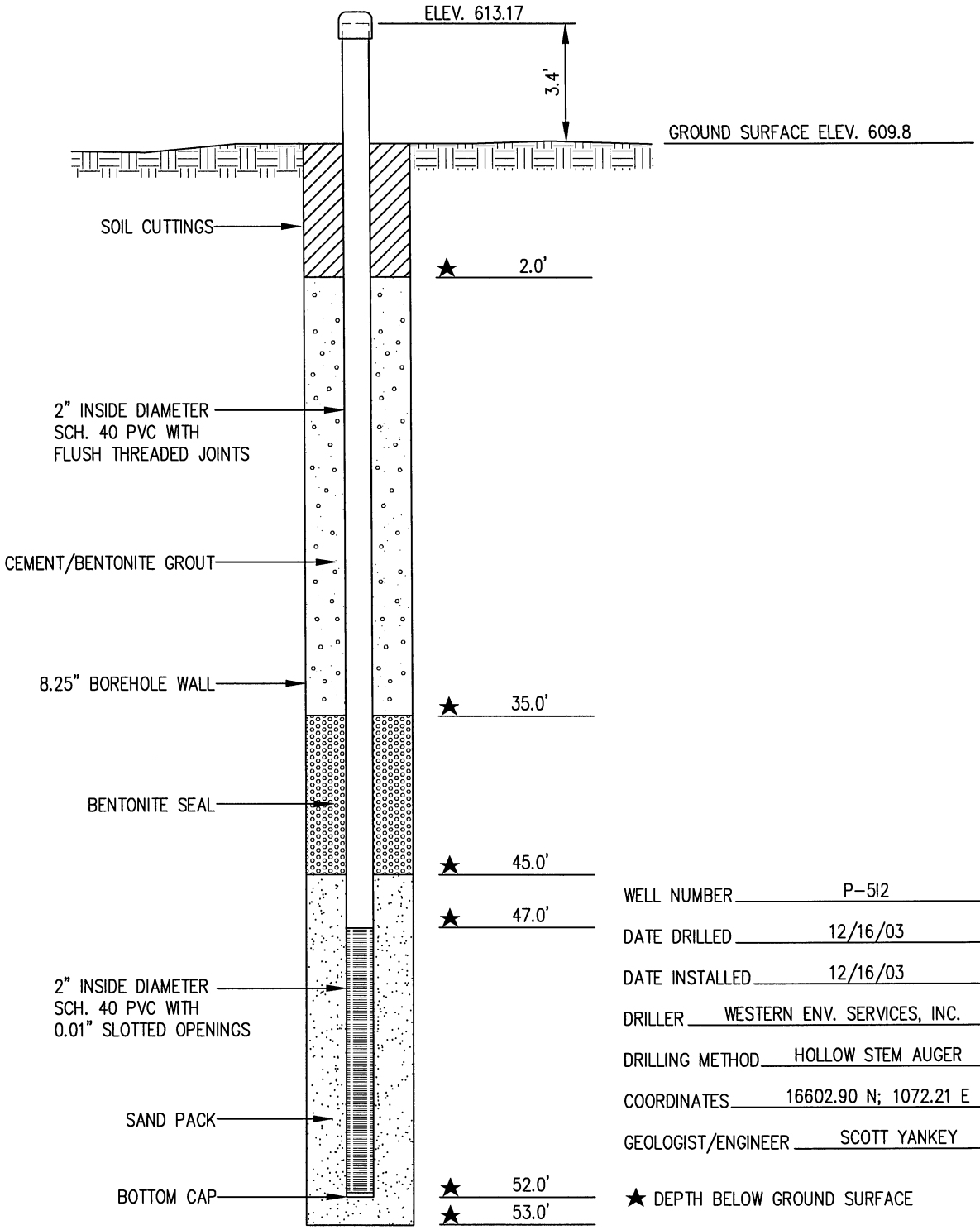
P41I2 (MW-5I2)



WELL NUMBER P-5I2

DATE DRILLED 12/16/03

DATE INSTALLED 12/16/03

DRILLER WESTERN ENV. SERVICES, INC.

DRILLING METHOD HOLLOW STEM AUGER

COORDINATES 16602.90 N; 1072.21 E

GEOLOGIST/ENGINEER SCOTT YANKEY

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PIEZOMETER P-5I2 CONSTRUCTION DETAIL

PHASE III HYDROGEOLOGIC SITE INVESTIGATION
AERG - DUCK CREEK STATION CCB LANDFILL
CANTON, ILLINOIS

JOB NO. 03S5010 ATTACHMENT B

AUG 24, 2004 3:16 PM KDE
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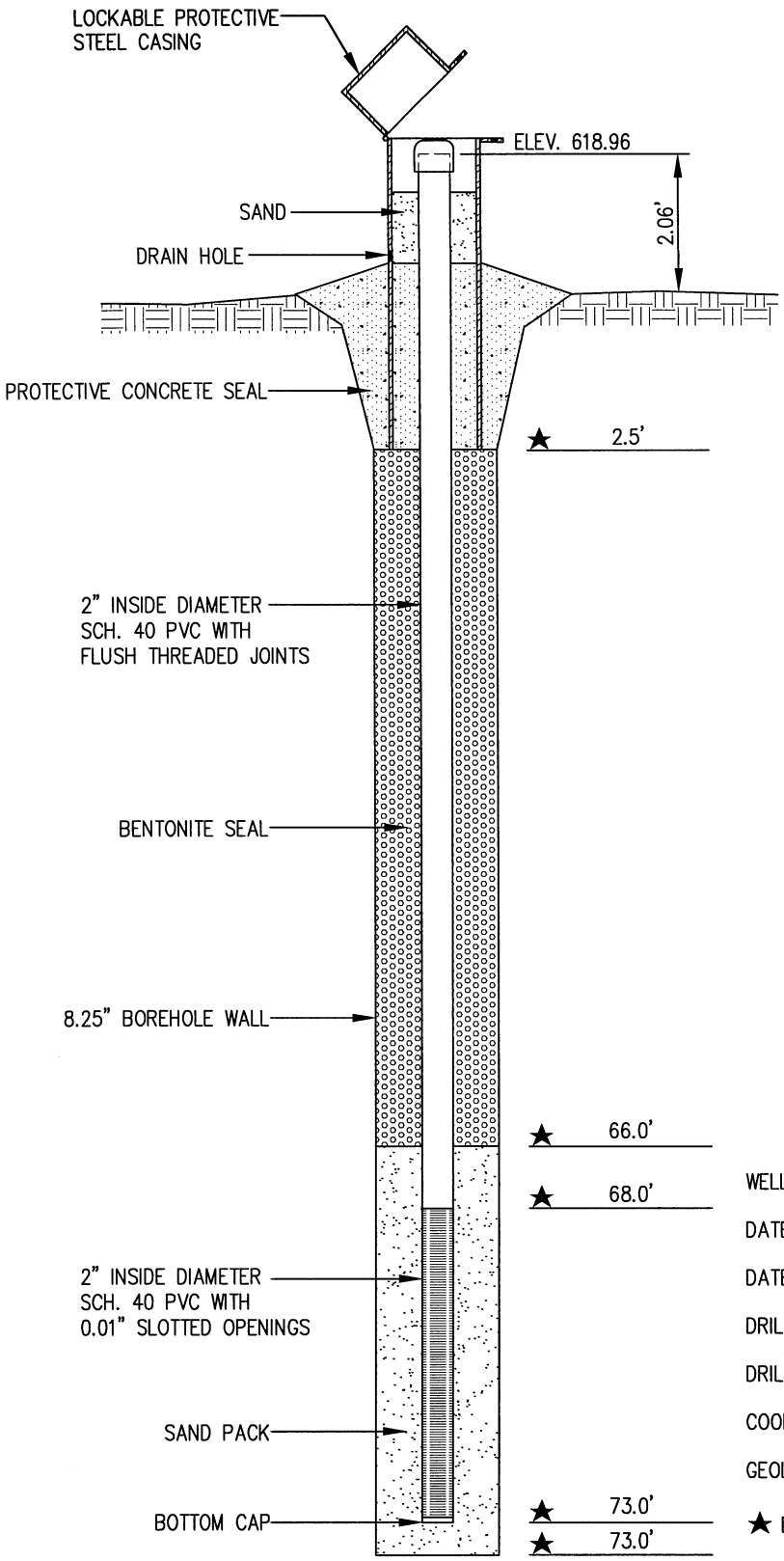
P42D (MW-9D)



WELL NUMBER	MW-9D
DATE DRILLED	12/27/04
DATE INSTALLED	12/28/04
DRILLER	TESTING SERVICE CORPORATION
DRILLING METHOD	HOLLOW STEM AUGER
COORDINATES	16595.6 N, 449.0 E
GEOLOGIST/ENGINEER	OMAR ITANI

★ DEPTH BELOW GROUND SURFACE

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HANSON
Hanson Professional Services Inc.

MONITORING WELL MW-9D CONSTRUCTION DETAIL

PHASE IV HYDROGEOLOGIC SITE INVESTIGATION
AMEREN/CILCO - DUCK CREEK STATION
CANTON, ILLINOIS

JOB NO. 03S5010

FEB 07, 2005 1:19 PM KDE
I:\03JOBS\03S5010\ENVIRONMENTAL\PHASE IV\H-MW-9D.DWG

Illinois Environmental Protection Agency — Well Completion Report

Site #: 0570255197 County: Fulton Well #: P60

Site Name: Duck Creek Power Station - Ash Landfill Borehole #: P60

~~State Plane~~ Plant Coordinate: X 992.2 Y 15,477.1 (or) Latitude: 40° 30' 24.310" Longitude: 89° 59' 13.282"

Surveyed By: Steven P. Ford IL Registration #: 035-003653

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

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Rhonald W. Hasenyager Date Started: 3/15/2017 Date Finished: 3/15/2017

Report Form Completed By: Suzanna L. Keim Date: 3/16/2017

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 Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 20 minutes

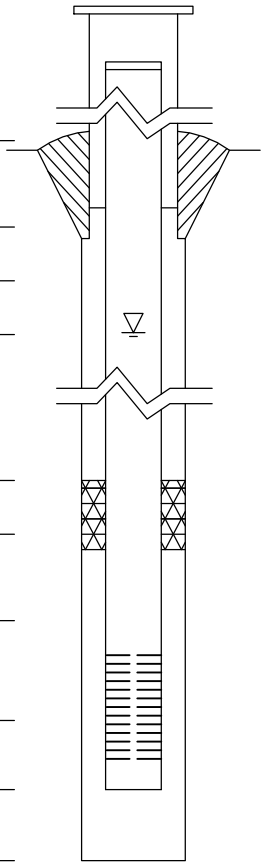
Type of Sand Pack: Quartz Sand

Grain Size: 10-40 (sieve size)

Installation Method: Gravity

Type of Backfill Material: (if applicable)

Installation Method:



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
622.82	-2.70	Top of Protective Casing
622.52	-2.40	Top of Riser Pipe
620.12	0.00	Ground Surface
618.12	2.00	Top of Annular Sealant
		Static Water Level (After Completion)
594.67	25.45	Top of Seal
592.10	28.02	Top of Sand Pack
590.57	29.55	Top of Screen
585.98	34.14	Bottom of Screen
585.50	34.62	Bottom of Well
585.50	34.62	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS
(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	31.95
Bottom of Screen to End Cap	(feet)	0.48
Screen Length (1st slot to last slot)	(feet)	4.59
Total Length of Casing	(feet)	37.02
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: P61

Site Name: Duck Creek Part 845 Groundwater Borehole #: P61

State Plane Coordinate: X 2,346,779.3 Y 1,398,670.8 (or) Latitude: _____ Longitude: _____

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Geotechnics Driller: Matt

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

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

Logged By: Rhonald W. Hasenyager Date Started: 2/24/2021 Date Finished: 2/24/2021

Report Form Completed By: Tad A. Gass Date: 2/24/2021

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Granular bentonite

Installation Method: gravity

Setting Time: +24 hrs.

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

Installation Method: _____

Setting Time: _____

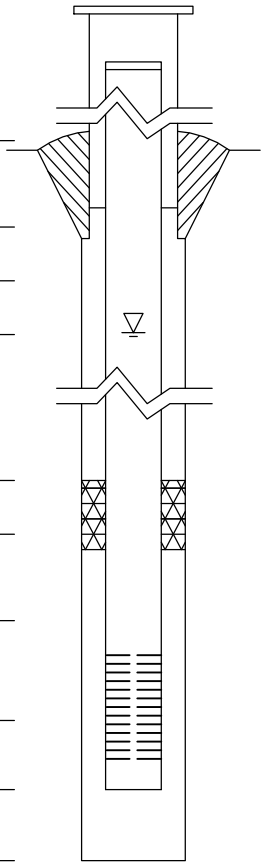
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: gravity

Type of Backfill Material: _____ (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
614.31	-3.21	Top of Protective Casing
613.96	-2.87	Top of Riser Pipe
611.09	0.00	Ground Surface
607.58	3.51	Top of Annular Sealant
		Static Water Level (After Completion)
n/a	n/a	Top of Seal
603.54	7.55	Top of Sand Pack
602.38	8.71	Top of Screen
592.72	18.37	Bottom of Screen
592.33	18.76	Bottom of Well
591.09	20.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	10.0
Riser Pipe Length	(feet)	11.58
Bottom of Screen to End Cap	(feet)	0.39
Screen Length (1st slot to last slot)	(feet)	9.66
Total Length of Casing	(feet)	21.63
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: P62

Site Name: Duck Creek Part 845 Groundwater Borehole #: P62

State Plane Coordinate: X 2,346,602.3 Y 1,398,887.3 (or) Latitude: _____ Longitude: _____

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Geotechnics Driller: Matt

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

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

Logged By: Rhonald W. Hasenyager Date Started: 2/24/2021 Date Finished: 2/24/2021

Report Form Completed By: Tad A. Gass Date: 2/24/2021

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Granular bentonite

Installation Method: gravity

Setting Time: +24 hrs.

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

Installation Method: _____

Setting Time: _____

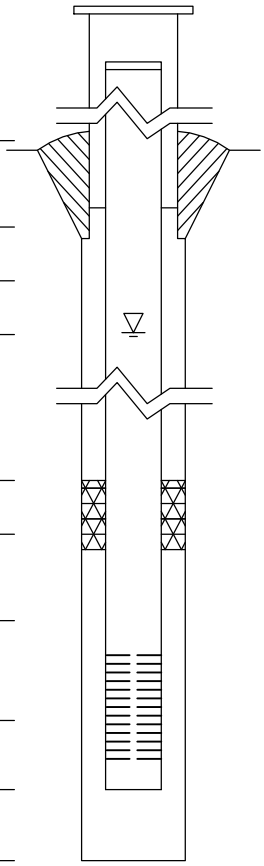
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: gravity

Type of Backfill Material: _____ (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
613.96	-3.15	Top of Protective Casing
613.54	-2.73	Top of Riser Pipe
610.81	0.00	Ground Surface
607.89	2.92	Top of Annular Sealant
		Static Water Level (After Completion)
n/a	n/a	Top of Seal
601.33	9.48	Top of Sand Pack
599.63	11.18	Top of Screen
595.03	15.78	Bottom of Screen
594.51	16.30	Bottom of Well
594.51	16.30	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	16.30
Bottom of Screen to End Cap	(feet)	0.52
Screen Length (1st slot to last slot)	(feet)	4.60
Total Length of Casing	(feet)	21.42
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: P63

Site Name: Duck Creek Part 845 Groundwater Borehole #: P63

State Plane Coordinate: X 2,346,605.9 Y 1,399,026.6 (or) Latitude: _____ Longitude: _____

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Geotechnics Driller: Matt

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

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

Logged By: Rhonald W. Hasenyager Date Started: 2/24/2021 Date Finished: 2/24/2021

Report Form Completed By: Tad A. Gass Date: 2/24/2021

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Granular bentonite

Installation Method: gravity

Setting Time: +24 hrs.

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

Installation Method: _____

Setting Time: _____

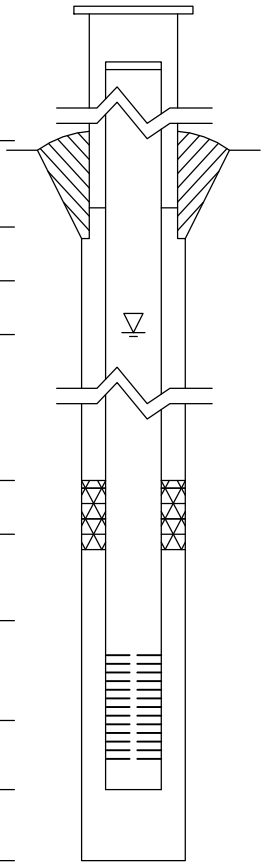
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: gravity

Type of Backfill Material: _____ (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
614.85	-2.52	Top of Protective Casing
614.47	-2.15	Top of Riser Pipe
612.33	0.00	Ground Surface
609.23	3.10	Top of Annular Sealant
		Static Water Level (After Completion)
n/a	n/a	Top of Seal
600.98	11.35	Top of Sand Pack
599.29	13.04	Top of Screen
594.70	17.63	Bottom of Screen
594.08	18.25	Bottom of Well
594.08	18.25	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	15.19
Bottom of Screen to End Cap	(feet)	0.62
Screen Length (1st slot to last slot)	(feet)	4.59
Total Length of Casing	(feet)	20.40
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: P64

Site Name: Duck Creek Part 845 Groundwater Borehole #: P64

State Plane Coordinate: X 2,346,598.0 Y 1,399,305.9 (or) Latitude: _____ Longitude: _____

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Geotechnics Driller: Matt

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

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

Logged By: Rhonald W. Hasenyager Date Started: 2/25/2021 Date Finished: 2/25/2021

Report Form Completed By: Tad A. Gass Date: 2/25/2021

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Granular bentonite

Installation Method: gravity

Setting Time: +24 hrs.

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

Installation Method: _____

Setting Time: _____

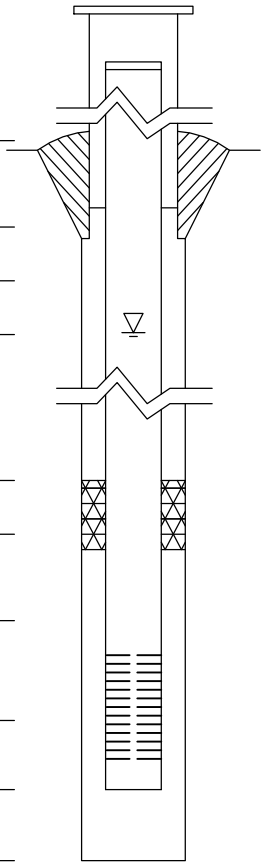
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: gravity

Type of Backfill Material: _____ (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
616.83	-2.78	Top of Protective Casing
616.47	-2.43	Top of Riser Pipe
614.04	0.00	Ground Surface
611.04	3.00	Top of Annular Sealant
		Static Water Level (After Completion)
n/a	n/a	Top of Seal
608.96	5.08	Top of Sand Pack
607.87	6.17	Top of Screen
598.08	15.96	Bottom of Screen
597.57	16.47	Bottom of Well
597.57	16.47	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	10.0
Riser Pipe Length	(feet)	9.19
Bottom of Screen to End Cap	(feet)	0.52
Screen Length (1st slot to last slot)	(feet)	9.19
Total Length of Casing	(feet)	18.90
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: 0570255197 County: Fulton Well #: R61L

Site Name: Duck Creek Power Station - Ash Landfill Borehole #: R61L

~~State Plane~~ Plant Coordinate: X 994.3 Y 15,649.9 (or) Latitude: 40° 30' 26.021" Longitude: 89° 59' 13.252"

Surveyed By: Steven P. Ford IL Registration #: 035-003653

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

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

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Rhonald W. Hasenyager Date Started: 3/14/2017 Date Finished: 3/14/2017

Report Form Completed By: Suzanna L. Keim Date: 3/16/2017

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 Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 75 minutes

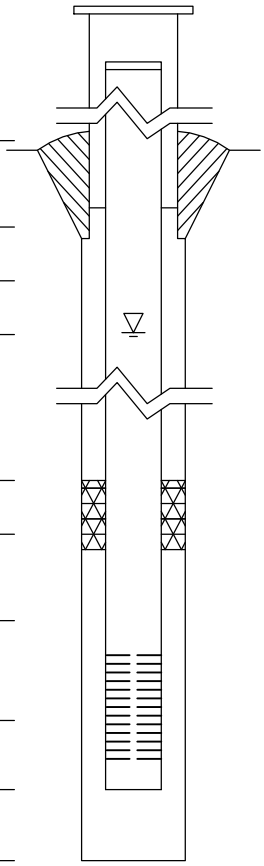
Type of Sand Pack: Quartz Sand

Grain Size: 10-40 (sieve size)

Installation Method: Gravity

Type of Backfill Material: (if applicable)

Installation Method:



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
622.99	-3.03	Top of Protective Casing
622.69	-2.73	Top of Riser Pipe
619.96	0.00	Ground Surface
617.96	2.00	Top of Annular Sealant
		Static Water Level (After Completion)
605.16	14.80	Top of Seal
603.14	16.82	Top of Sand Pack
601.42	18.54	Top of Screen
591.79	28.17	Bottom of Screen
591.29	28.67	Bottom of Well
591.29	28.67	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	21.27
Bottom of Screen to End Cap	(feet)	0.50
Screen Length (1st slot to last slot)	(feet)	9.63
Total Length of Casing	(feet)	31.40
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: R72S

Site Name: Duck Creek Power Station - Recycle Pond Borehole #: R72S

~~State Plane~~ Plant Coordinate: X 500.0 Y 13,905.4 (or) Latitude: 40° 30' 8.792" Longitude: 89° 59' 19.692"

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Ramsey Driller: B. Williamson

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

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

Logged By: Rhonald W. Hasenyager Date Started: 11/9/2016 Date Finished: 11/9/2016

Report Form Completed By: Suzanna L. Keim Date: 11/18/2016

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: 24+ hours

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

Installation Method: Gravity

Setting Time: 50 minutes

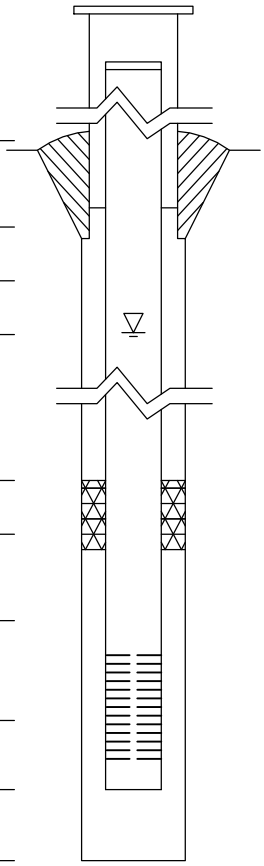
Type of Sand Pack: Quartz Sand

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.)
618.11	-3.00	Top of Protective Casing
617.87	-2.76	Top of Riser Pipe
615.11	0.00	Ground Surface
613.01	2.10	Top of Annular Sealant
		Static Water Level (After Completion)
590.01	25.10	Top of Seal
587.06	28.05	Top of Sand Pack
585.28	29.83	Top of Screen
580.62	34.49	Bottom of Screen
580.16	34.95	Bottom of Well
580.16	34.95	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

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

CASING MEASUREMENTS

Diameter of Borehole	(inches)	6.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	32.59
Bottom of Screen to End Cap	(feet)	0.46
Screen Length (1st slot to last slot)	(feet)	4.66
Total Length of Casing	(feet)	37.71
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

APPENDIX C
GEOTECHNICAL LABORATORY REPORTS

Via email: dramsey@ramgeoeng.com

April 5, 2021 J037264.01.6001

Mr. Douglas P. Ramsey, P.E.
Ramsey Geotechnical Engineering
1701 W. Market Street
Bloomington, Illinois 61701

Re: Duck Creek Power Station
Fulton County, Illinois

Dear Mr. Ramsey:

Included in this report are the test results from a bulk sample of gypsum received in our laboratory on March 15, 2021. The sample was tested in general accordance with the test method listed below.

Test to Determine	Method of Test
Hydraulic Conductivity of Soil Using Flexible Wall Permeameter	ASTM D5084

We trust this is the information you require. Please contact the undersigned if you have any questions regarding this report.

Respectfully submitted,

GEOTECHNOLOGY, INC.

Janet M. May
Illinois Laboratory Manager

JMM/LPH:jmm

Attachment: Test Result Summary
Hydraulic Conductivity Test Data Sheet
Proctor Curve (Provided by Ramsey)
Testing Assignment Sheets

TEST RESULT SUMMARY

Duck Creek Power Station
Fulton County, Illinois

Sample Number/ Material	Optimum Moisture Content, %	Maximum Dry Unit Weight, pcf	Percent Compact	Moisture Content, %	Dry Unit Weight, pcf	Hydraulic Conductivity, cm/sec	Range of Hydraulic Gradient
LSN-3781/ Gypsum	27.0	81.0	91.2	28.8	73.9	6.7×10^{-4}	0.2 - 2.2

Notes and abbreviations:
% - Percent
cm/sec - Centimeters per second
pcf - Pounds per cubic foot

HYDRAULIC CONDUCTIVITY TEST DATA

(ASTM D 5084)

				Initial Unit Weight		**Unit Weight as Tested**	
JOB NO.:	J037264.01.6002	ASTM D698 Results		WET UNIT WEIGHT, pcf:	95.2	WET UNIT WEIGHT, pcf:	95.2
PROJECT:	Duck Creek Bottom Ash Basins	Maximum Dry Unit Weight, pcf	81.0	DRY UNIT WEIGHT, pcf:	73.9	DRY UNIT WEIGHT, pcf:	69.4
SAMPLE NO.:	LSN-3781	Optimum Water Content, %	27.0	**Percent Compact:**	**91.2%**		
MATERIAL:	Gypsum						

	Initial	After Test**		Initial	As Tested	INITIAL MOISTURE CONTENT		FINAL MOISTURE CONTENT	
LENGTH, in.:	2.878		LENGTH, cm:	7.310		WET WT SPLE+TARE	754.45	WET WT SPLE+TARE	784.98
DIAMETER, in.:	2.878		DIAMETER, cm	7.310		DRY WT SPLE+TARE	649.86	DRY WT SPLE+TARE	649.86
WET WT., gms.:	467.82					TARE WEIGHT	286.63	TARE WEIGHT	286.63
AREA, sq.in.:	6.505		AREA, sq cm:	41.970		**% MOISTURE**	28.8	% MOISTURE	37.2

B VALUE (before Permeation): 95% Cell / Back Pressure, psi: 88 / 85 **Percent Wet of Optimum: 1.8**

HEAD (PSI)	DATE (YR,MO,DY)	TIME (HR,MN,SC)	TEMP ºC	ELAPSED MINUTES	BOTTOM BURETTE	TOP BURETTE	Q (CC)	K CM/SEC	HYDRAULIC GRADIENT	HYDRAULIC HEAD	HEAD LOSS,%	k (in/sec)
0.0	30-Mar-21	10:19 AM	20.8	0	7.32	23.70			2.24	16.38		
0.0	30-Mar-21	10:20 AM	20.8	1	10.18	20.51	2.86	7.0E-04	1.41	10.33	36.94	2.8E-04
0.0	30-Mar-21	10:22 AM	20.8	2	13.33	17.40	3.15	7.1E-04	0.56	4.07	60.60	2.8E-04
0.0	30-Mar-21	10:24 AM	20.8	2	14.46	16.18	1.13	6.6E-04	0.24	1.72	57.74	2.6E-04
0.0	30-Mar-21	11:32 AM	20.8	0	8.77	23.40			2.00	14.63		
0.0	30-Mar-21	11:33 AM	20.8	1	11.43	20.73	2.66	6.9E-04	1.27	9.30	36.43	2.7E-04
0.0	30-Mar-21	11:34 AM	20.8	1	13.10	19.03	1.67	6.9E-04	0.81	5.93	36.24	2.7E-04
0.0	30-Mar-21	11:36 AM	20.8	2	14.83	17.30	1.73	6.7E-04	0.34	2.47	58.35	2.6E-04

Average Temp. = 20.8

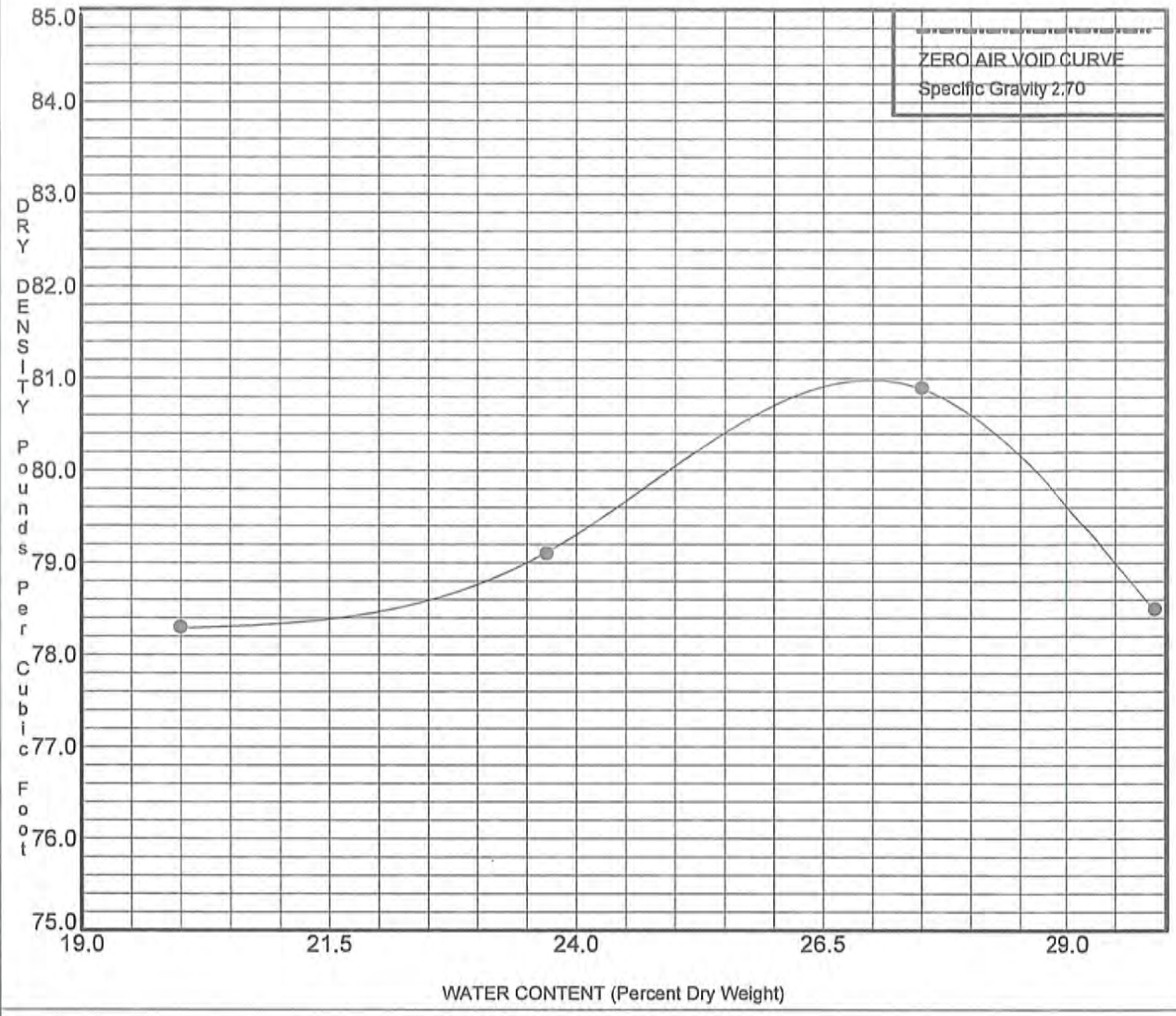
AVERAGE K = 6.9E-04

Corrected K for 20ºC = 6.7E-04

AVERAGE K = 2.7E-04

Corrected K for 20ºC = 2.6E-04

** Measurements not available at end of test.



SPECIMEN IDENTIFICATION	CLASSIFICATION
Gypsum	Gypsum
LSN-3781	

MOISTURE/DENSITY RELATIONSHIP	
Standard ASTM D698/AASHTO T99	
Modified ASTM D1557/AASHTO T180	
Maximum Dry Density (PCF)	**81.0**
Optimum Water Content (%)	**27.0**

NOTES :

PROJECT **Duck Creek Bottom Ash Basins** JOB NO. **21-026**

LOCATION **Fulton County, Illinois** DATE **March 18, 2021**

Gypsum

MOISTURE-DENSITY RELATIONSHIP

Ramsey Geotechnical Engineering

Bloomington, IL 61701

21.026

DUCK CREEK BOTTOM ASH BASIN

Hanson Professional Services Inc.

Subcontract Agreement: RGE2014

Task Order No. 20E0111A/3000A

SCHEDULE OF LABORATORY TESTING

Sample ID	Routine Testing [1]											Complex Testing [1]																Analytical Testing [1]						
	Rimac Comp Strength	Visual-Manual Classification	Unified Classification	Moisture Content	Liquid / Plastic Limits	Particle Size < #200	Particle Size - Sieves	Particle Size - Sieves + Hyd	Standard Compaction	Modified Compaction	Bulk Density	Unconfined Comp Strength	Consolidation Test	Specific Gravity	UU Triaxial Comp Strength	CU Traxail Comp Strength	CD Direct Shear Strength	Swell Test for Soil	Collapse Test for Soil	Permeability Granular Soil	Hyd Conduct Cohesive Soil	Shrinkafe Factor	Soil Resistivity	IBR and IBV of Soils	CBR Test	Elastic Moduli - Rock	Uniaxial Comp Str - Rock	Corrosivity	pH	Chloride	Sulfate	Total Organic Content	Moisture, Ash & Organ Matte	
SB01																																		
6A																																		
7A																																		
8A																																		
10A																																		
11A																																		
12A																																		
Comp1				x	x			x			x			x																				
ST9																					x	DONE.												
14A																																		
ST15																																		
Comp2				x	x			x			x			x																				
ST15																					x	DONE												
17A																																		
18A																																		
19A																																		
Comp3				x	x			x			x			x																				
20A																																		
21A																																		
22A																																		
23A																																		
Comp4				x	x			x			x			x																				

Note 1: All testing to be in accordance with *Laboratory Testing Specifications*.

See Task Order or Attachment for any special instructions regarding scheduled testing.

SCHEDULE OF LABORATORY TESTING

Sample ID	Routine Testing											Complex Testing																Analytical Testing					
	Rimac Comp Strength	Visual-Manual Classification	Unified Classification	Moisture Content	Liquid / Plastic Limits	Particle Size < #200	Particle Size - Sieves	Particle Size - Sieves + Hyd	Standard Compaction	Modified Compaction	Bulk Density	Unconfined Comp Strength	Consolidation Test	Specific Gravity	UU Triaxial Comp Strength	CU Traxail Comp Strength	CD Direct Shear Strength	Swell Test for Soil	Collapse Test for Soil	Permeability Granular Soil	Hyd Conduct Cohesive Soil	Shrinkafe Factor	Soil Resistivity	IBR and IBV of Soils	CBR Test	Elastic Moduli - Rock	Uniaxial Comp Str - Rock	Corrosivity	pH	Chloride	Sulfate	Total Organic Content	Moisture, Ash & Organ Matte
SB02																																	
3A																																	
4A																																	
6A																																	
7A																																	
8A																																	
Comp1				x	x			x			x			x																			
ST5																					x	DONE											
9A																																	
ST10																																	
11A																																	
Comp2				x	x			x			x			x																			
ST10																					x	DONE											
12A																																	
ST13																																	
Comp3				x	x			x			x			x																			
ST13																					x	DONE											
15A																																	
16A																																	
17A																																	
18A																																	
19A																																	
20A																																	
Comp4				x	x			x			x			x																			

SCHEDULE OF LABORATORY TESTING

Sample ID	Routine Testing											Complex Testing																Analytical Testing						
	Rimac Comp Strength	Visual-Manual Classification	Unified Classification	Moisture Content	Liquid / Plastic Limits	Particle Size < #200	Particle Size - Sieves	Particle Size - Sieves + Hyd	Standard Compaction	Modified Compaction	Bulk Density	Unconfined Comp Strength	Consolidation Test	Specific Gravity	UU Triaxial Comp Strength	CU Traxail Comp Strength	CD Direct Shear Strength	Swell Test for Soil	Collapse Test for Soil	Permeability Granular Soil	Hyd Conduct Cohesive Soil	Shrinkafe Factor	Soil Resistivity	IBR and IBV of Soils	CBR Test	Elastic Moduli - Rock	Uniaxial Comp Str - Rock	Corrosivity	pH	Chloride	Sulfate	Total Organic Content	Moisture, Ash & Organ Matter
SB03																																		
4A																																		
6A																																		
7A																																		
8A																																		
Comp1				x	x			x			x			x																				
ST5																					x	DONE												
ST10*				x	x			x			x			x																				
ST10^																					x	DONE												
11A																																		
12A																																		
13A																																		
Comp3				x	x			x			x			x																				
Gypsum				x	x			x	x		x			x							x*	*Remolded permeability*												

* If sand is present in Shelby tube.

^ if sufficient sample, use lower portion of Shelby tube.

GEOTECHNICS
Soil & Material Testing
A DIVISION OF KLINGNER
4510 Paris Gravel Road • Hannibal, MO 63401 • voice 573.221.7714 • fax 573.221.7762

March 26, 2021 21-1004

Hanson Professional Services, Inc.
1525 S. Sixth St.
Springfield, IL 62703-6801

Attn: Mr. Rhonald Hasenyager

RE: Duck Creek Power Station GMF: Fulton County, IL

Dear Mr. Hasenyager:

In accordance with your request, we have completed the analysis of the samples obtained from the exploration borings from the above mentioned project. The selected samples were analyzed in accordance with the applicable ASTM standards. A laboratory results summary sheet is included for your reference.

As always, if you have any questions do not hesitate to contact us.

Sincerely,

GEOTECHNICS, A DIVISION OF KLINGNER

Brian Joseph Sick

Brian Joseph Sick, P.E.
Geotechnical Services Department Manager

Enclosure: Data Results Summary, Laboratory Analysis Data Reports

Job #:
21-1004

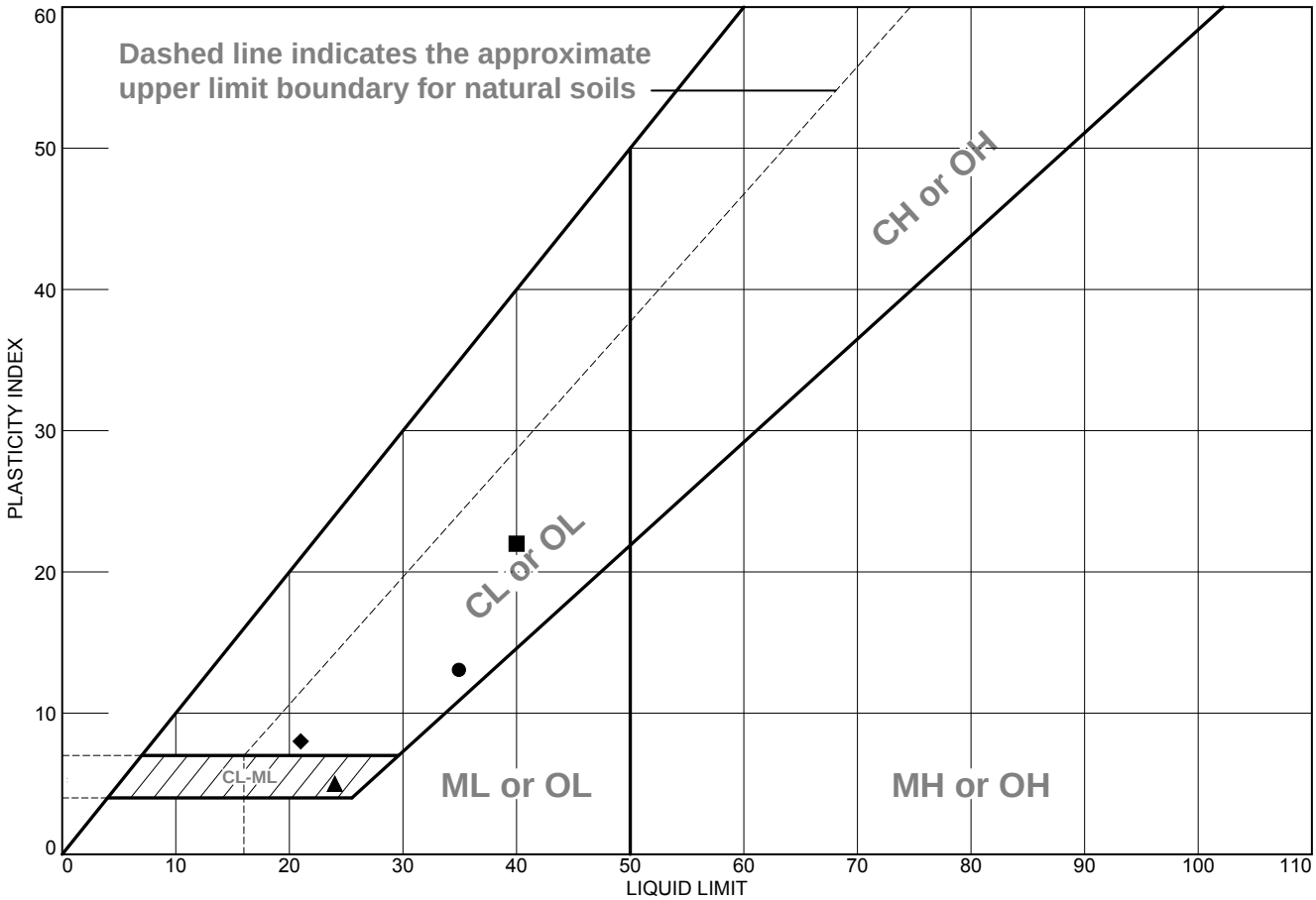
Duck Creek Power Station
Hanson Professional Services

Date:
3/26/2021

SAMPLE NO.	DEPTH	% Gravel	% Sand	% Silt	% Clay	USCS	LL	PL	PI	Sp. Gr.	Hyd. Cond.	Moist.	WET DENS.	DRY DENS.
SB50-Comp 1	5-19	0.0	2.6	81.8	15.6	CL	32	23	9	2.68		24.9	121.5	97.3
SB50-Comp 2	21-31	3.4	26.5	46.1	24.0	CL	28	18	10	2.70		21.1	141.4	116.7
SB50-Comp 3	31-39	3.6	32.0	50.5	13.9	CL	27	18	9	2.70		17.1	143.2	122.3
SB50-Comp 4	41-51	12.9	37.8	34.3	15.0	SC-SM	21	15	6	2.70		7.7	144.2	133.8
SB50/ST10-12	10-12										6.34E-07	25.9	123.5	98.0
SB50/ST22-24	22-24										2.59E-07	21.8	129.5	106.3
G54C-Comp 1	7-19	0.2	11.6	66.1	22.1	CL	35	22	13	2.68		18.6	134.2	113.1
G54C-Comp 2	25-33	1.0	18.4	49.1	31.5	CL	40	18	22	2.68		24.6	122.1	98.0
G54C-Comp 3	35-41	10.6	25.8	45.2	18.4	CL-ML	24	19	5	2.64		18.2	133.6	113.0
G54C-Comp 4	47-73	7.4	36.3	38.0	18.3	CL	21	13	8	2.67		9.8	141.0	128.4
G54C/ST14-16	14-16										7.06E-08	22.2	127.0	104.0
G54C/ST32-34	32-34										7.47E-07	21.9	128.2	105.1
G54C/ST44-46	44-46										5.39E-06	12.2	141.5	126.1
G54C/ST76-78	76-78										4.11E-08	12.6	138.7	123.2
SB62-Comp 1	7-19	0.0	11.5	62.0	26.5	CL	35	22	13	2.65		19.3	124.9	104.7
SB62-Comp 2	23-33	0.0	23.0	48.6	28.4	CL	29	17	12	2.70		21.5	126.6	104.1
SB62-Comp 3	33-39	2.9	23.4	57.5	16.2	CL-ML	26	19	7	2.65		14.5	133.0	116.1
SB62-Comp 4	41-51	2.8	40.7	38.7	17.8	CL-ML	21	15	6	2.64		10.0	138.6	126.1
SB62/ST12-14	12-14										1.94E-07	21.1	127.8	105.5
SB62/ST26-28	26-28										2.28E-06	23.2	129.8	105.3
SB62/ST38-40	38-40										1.09E-06	15.6	136.8	118.4

Lab Results

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay (CL), Yellow Brown, Silty, Trace Sand, Moist	35	22	13	94.5	88.2	CL
■	Lean Clay with Sand (CL), Yellow Brown, Silty, Moist	40	18	22	95.5	80.6	CL
▲	Sandy Silty Clay (CL-ML), Gray, Moist	24	19	5	79.9	63.6	CL-ML
◆	Sandy Lean Clay (CL), Gray, Silty	21	13	8	80.1	56.3	CL

Project No. 21-1004 **Client:** Hanson Professional Services, Inc.

Project: Duck Creek Power Station GMF

●**Location:** G54C **Depth:** 7 to 19 ft. **Sample Number:** Comp 1
■**Location:** G54C **Depth:** 25 to 33 ft. **Sample Number:** Comp 2
▲**Location:** G54C **Depth:** 35 to 41 ft. **Sample Number:** Comp 3
◆**Location:** G54C **Depth:** 47 to 73 ft. **Sample Number:** Comp 4

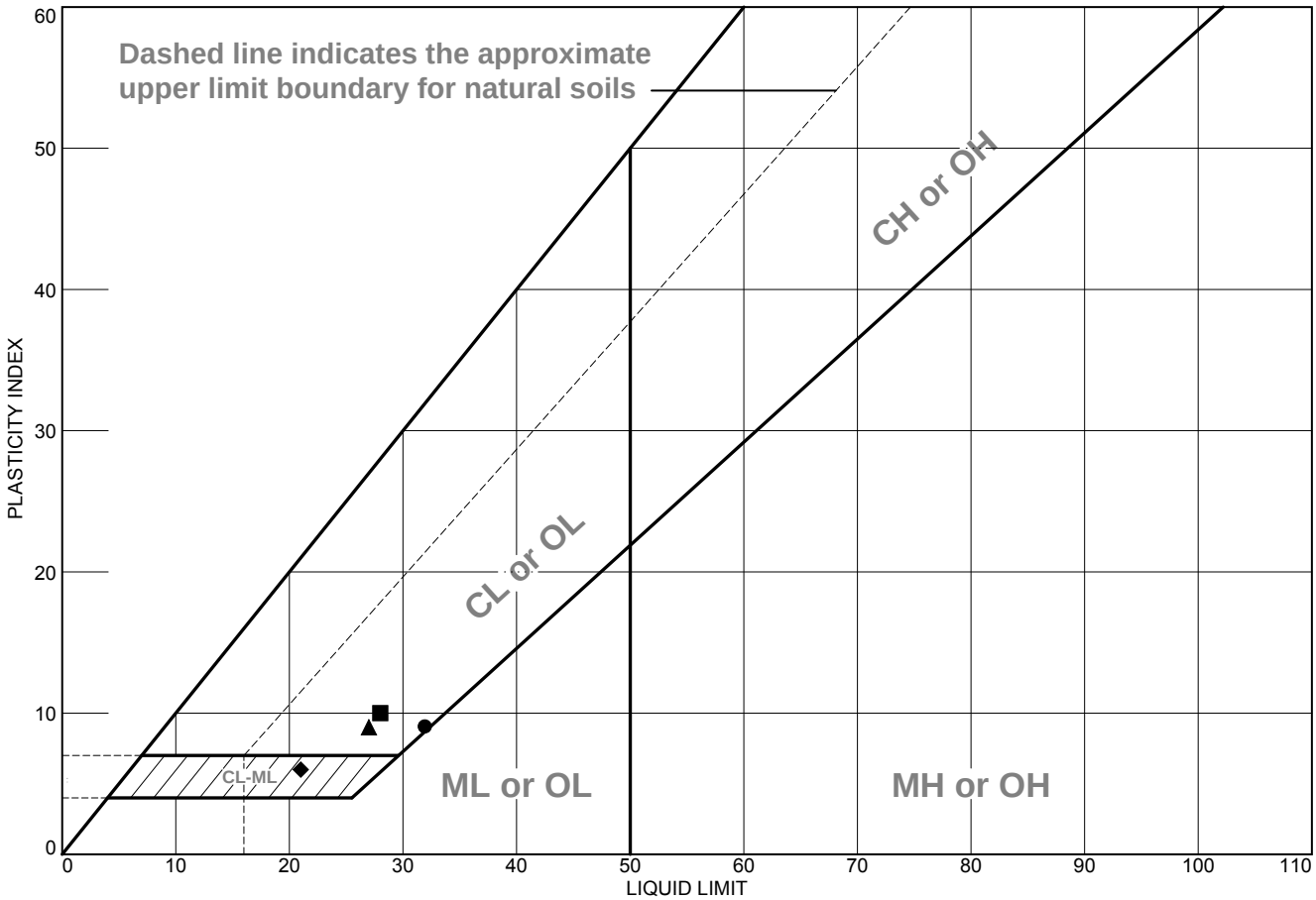
Remarks:
●Moisture Content = 18.6%
■Moisture Content = 24.6%
▲Moisture Content = 18.2%
◆Moisture Content = 9.8%

GEOTECHNICS
Soil & Material Testing
4510 Paris Gravel Road - Hannibal, MO

Figure

Tested By: AJK **Checked By:** BJS

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay (CL), Light Brown, Silty, Moist	32	23	9	99.5	97.4	CL
■	Lean Clay with Sand (CL), Yellow Brown/Light Brown mottled Light Gray, Reddish Brown Oxidation, Silty, Moist	28	18	10	86.3	70.1	CL
▲	Sandy Lean Clay (CL), Gray, Silty, Moist	27	18	9	85.9	64.4	CL
◆	Silty, Clayey Sand (SC-SM), Gray, Dry	21	15	6	75.0	49.3	SC-SM

Project No. 21-1004 **Client:** Hanson Professional Services, Inc.

Project: Duck Creek Power Station GMF

●**Location:** SB50 **Depth:** 5 to 19 ft. **Sample Number:** Comp 1
■**Location:** SB50 **Depth:** 21 to 31 ft. **Sample Number:** Comp 2
▲**Location:** SB50 **Depth:** 31 to 39 ft. **Sample Number:** Comp 3
◆**Location:** SB50 **Depth:** 41 to 51 ft. **Sample Number:** Comp 4

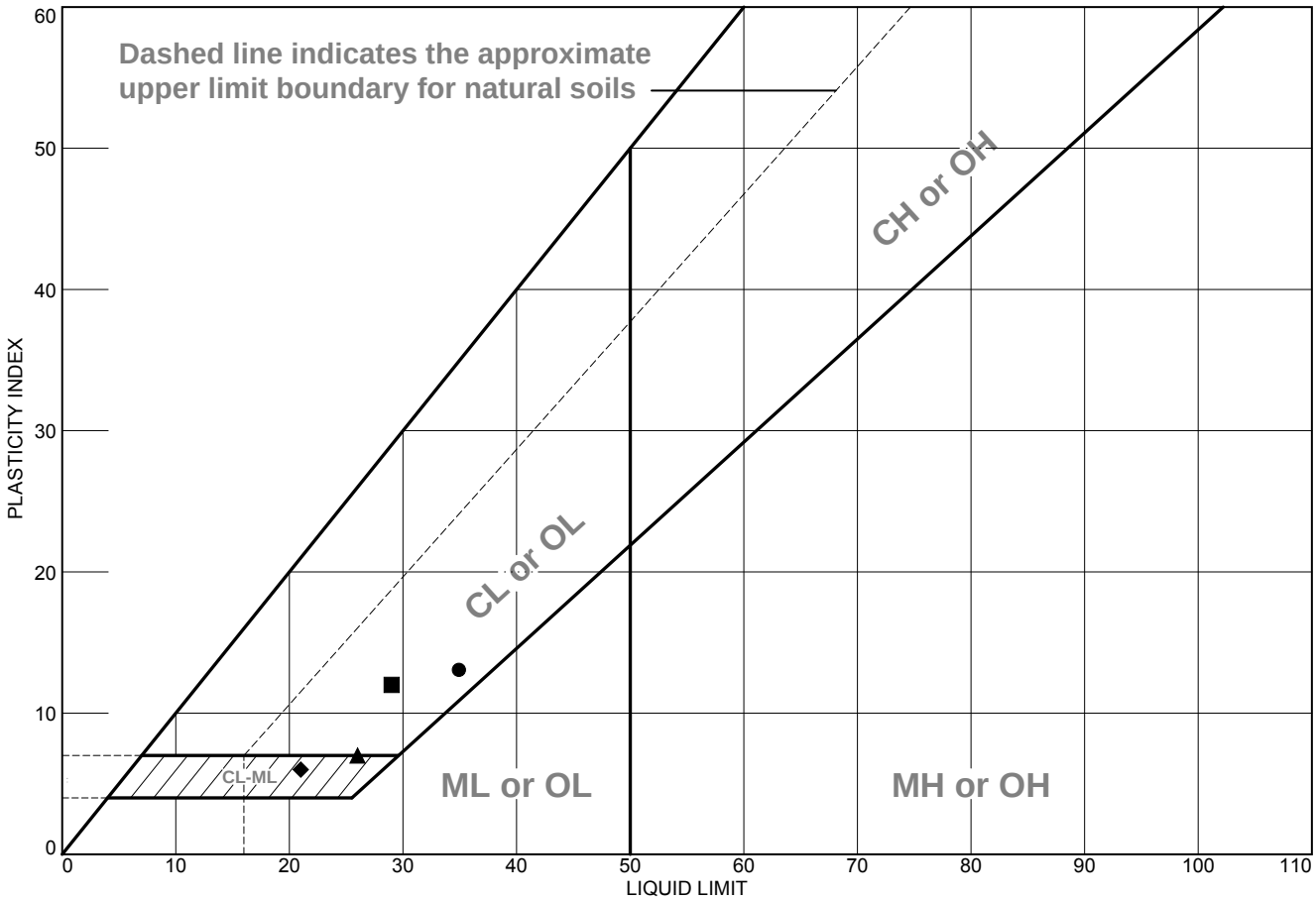
Remarks:
●Moisture Content = 24.9%
■Moisture Content = 21.1%
▲Moisture Content = 17.1%
◆Moisture Content = 7.7%

GEOTECHNICS
Soil & Material Testing
4510 Paris Gravel Road - Hannibal, MO

Figure

Tested By: ○ NAS □ NAS △ AJK ◇ AJK **Checked By:** BJS

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay (CL), Yellow Brown, Silty, Trace Sand, Moist	35	22	13	93.1	88.5	CL
■	Lean Clay with Sand (CL), Gray, Silty, Moist	29	17	12	94.3	77.0	CL
▲	Silty Clay with Sand (CL-ML), Gray, Moist	26	19	7	88.5	73.7	CL-ML
◆	Sandy Silty Clay (CL-ML), Gray, Dry	21	15	6	83.5	56.5	CL-ML

Project No. 21-1004 **Client:** Hanson Professional Services, Inc.

Project: Duck Creek Power Station GMF

●**Location:** SB62 **Depth:** 7 to 19 ft. **Sample Number:** Comp 1
■**Location:** SB62 **Depth:** 23 to 33 ft. **Sample Number:** Comp 2
▲**Location:** SB62 **Depth:** 33 to 39 ft. **Sample Number:** Comp 3
◆**Location:** SB62 **Depth:** 41 to 51 ft. **Sample Number:** Comp 4

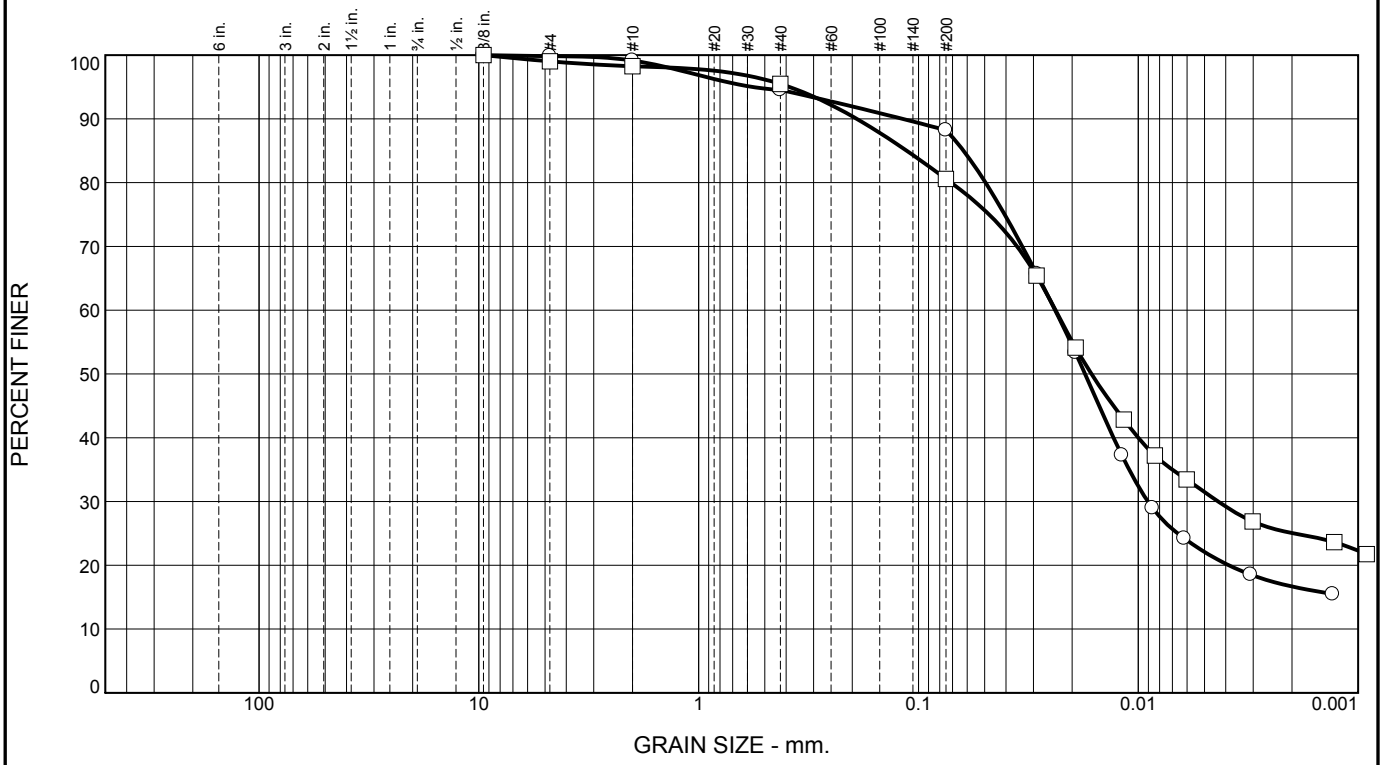
Remarks:
●Moisture Content = 19.3%
■Moisture Content = 21.5%
▲Moisture Content = 14.5%
◆Moisture Content = 10.0%

GEOTECHNICS
Soil & Material Testing
4510 Paris Gravel Road - Hannibal, MO

Figure

Tested By: AJK **Checked By:** BJS

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.2	11.6	66.1	22.1	CL	35	22	13
□	0.0	1.0	18.4	49.1	31.5	CL	40	18	22

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □
3/8	100.0	100.0
GRAIN SIZE		
D_{60}	0.0239	0.0238
D_{30}	0.0090	0.0043
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	PERCENT FINER ○	PERCENT FINER □
#4	99.8	99.0
#10	99.1	98.3
#40	94.5	95.5
#200	88.2	80.6

Material Description

○ Lean Clay (CL), Yellow Brown, Silty, Trace Sand, Moist

□ Lean Clay with Sand (CL), Yellow Brown, Silty, Moist

REMARKS:

○ Moisture Content = 18.6%

□ Moisture Content = 24.6%

○ Location: G54C Depth: 7 to 19 ft. Sample Number: Comp 1

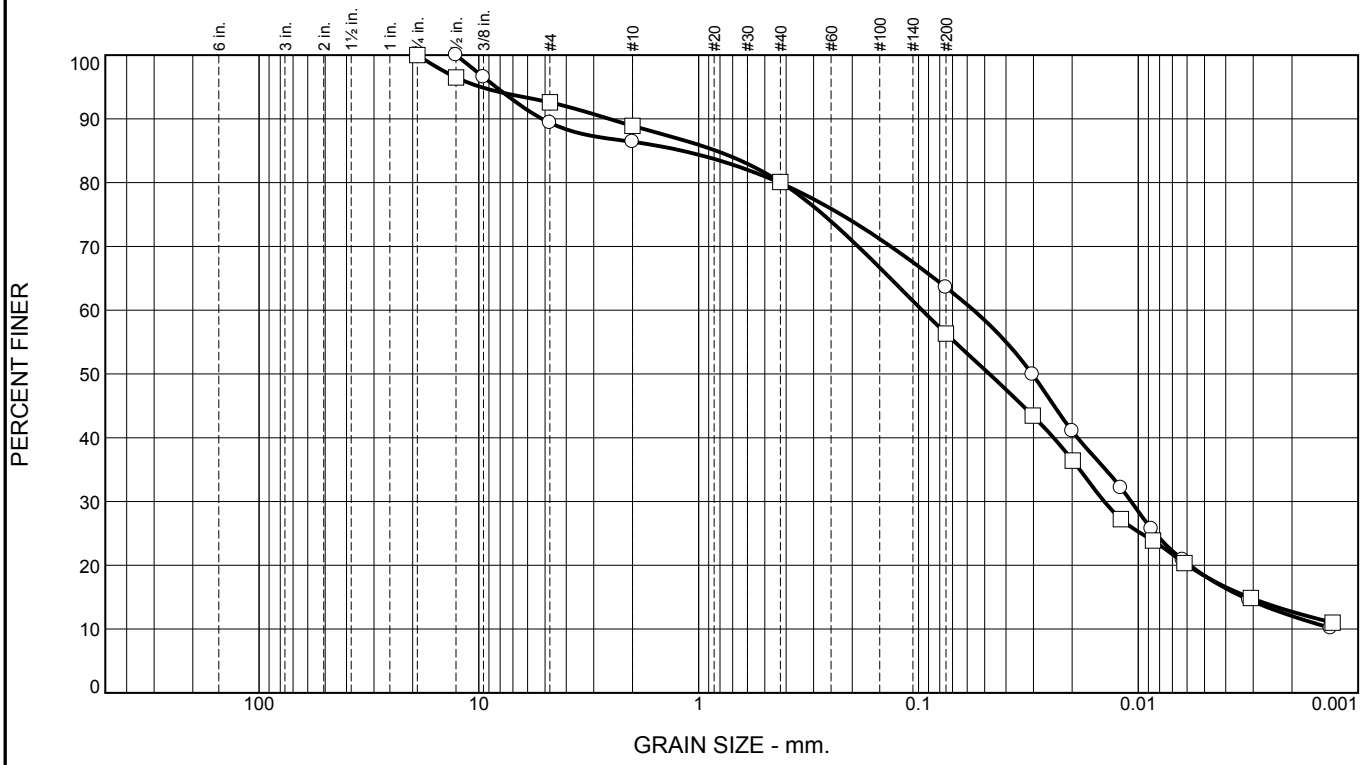
□ Location: G54C Depth: 25 to 33 ft. Sample Number: Comp 2

GEOTECHNICS
Soil & Material Testing
4510 Paris Gravel Road - Hannibal, MO

Client: Hanson Professional Services, Inc.
Project: Duck Creek Power Station GMF
Project No.: 21-1004 Figure

Tested By: MAS/NAS **Checked By:** BJS

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	10.6	25.8	45.2	18.4	CL-ML	24	19	5
□	0.0	7.4	36.3	38.0	18.3	CL	21	13	8

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □
3/4		100.0
.5	100.0	96.5
3/8	96.6	
GRAIN SIZE		
D_{60}	0.0562	0.0963
D_{30}	0.0108	0.0143
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	PERCENT FINER ○	PERCENT FINER □
#4	89.4	92.6
#10	86.4	88.9
#40	79.9	80.1
#200	63.6	56.3

Material Description

○ Sandy Silty Clay (CL-ML), Gray, Moist

□ Sandy Lean Clay (CL), Gray, Silty

REMARKS:

○ Moisture Content = 18.2%

□ Moisture Content = 9.8%

○ Location: G54C Depth: 35 to 41 ft. Sample Number: Comp 3

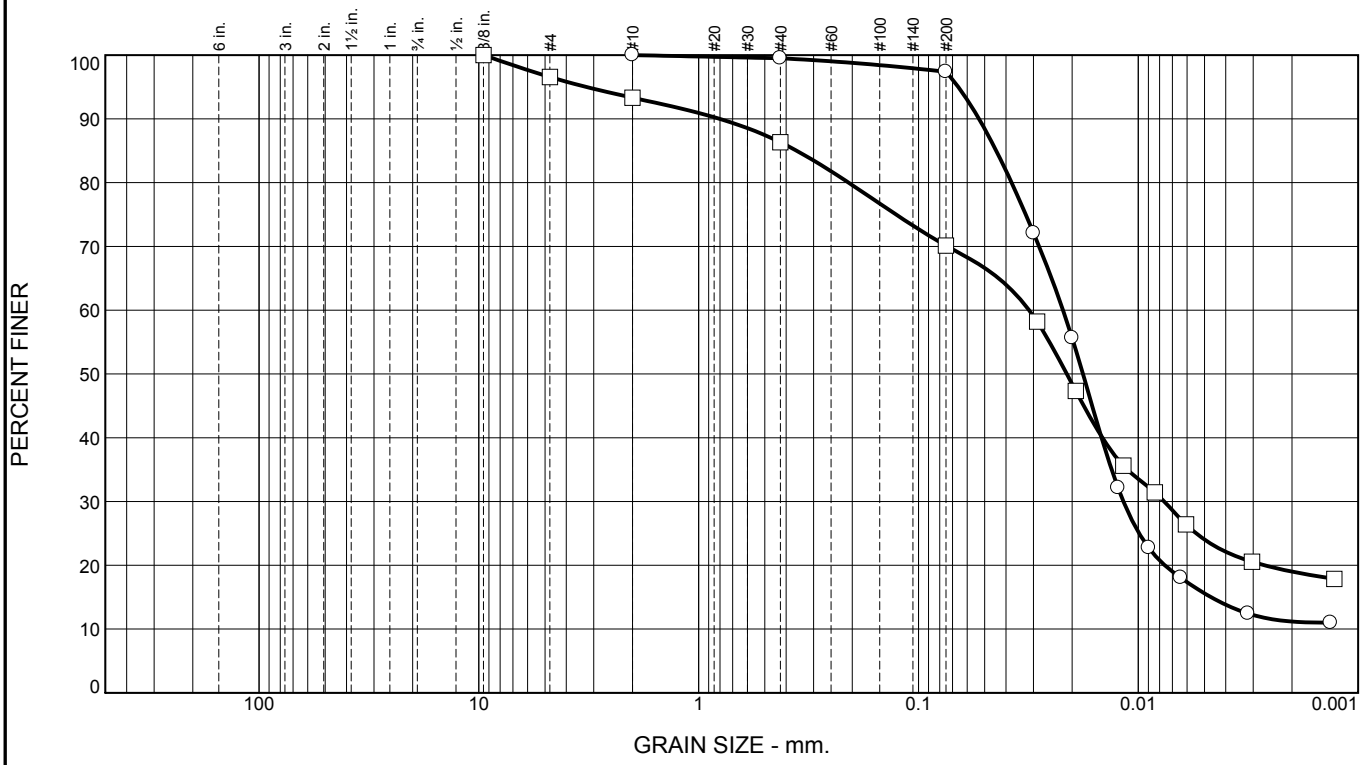
□ Location: G54C Depth: 47 to 73 ft. Sample Number: Comp 4

GEOTECHNICS
Soil & Material Testing
4510 Paris Gravel Road - Hannibal, MO

Client: Hanson Professional Services, Inc.
Project: Duck Creek Power Station GMF
Project No.: 21-1004 Figure

Tested By: ○ DAW/NAS □ MAS/NAS **Checked By:** BJS

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	2.6	81.8	15.6	CL	32	23	9
□	0.0	3.4	26.5	46.1	24.0	CL	28	18	10

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □	
3/8		100.0	
	GRAIN SIZE		
D_{60}	0.0220	0.0314	
D_{30}	0.0117	0.0076	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	PERCENT FINER □	
#4		96.6	
#10	100.0	93.3	
#40	99.5	86.3	
#200	97.4	70.1	

Material Description

○ Lean Clay (CL), Light Brown, Silty, Moist

□ Lean Clay with Sand (CL), Yellow Brown/Light Brown mottled Light Gray, Reddish Brown Oxidation, Silty, Moist

REMARKS:

○ Moisture Content = 24.9%

□ Moisture Content = 21.1%

○ Location: SB50 Depth: 5 to 19 ft. Sample Number: Comp 1

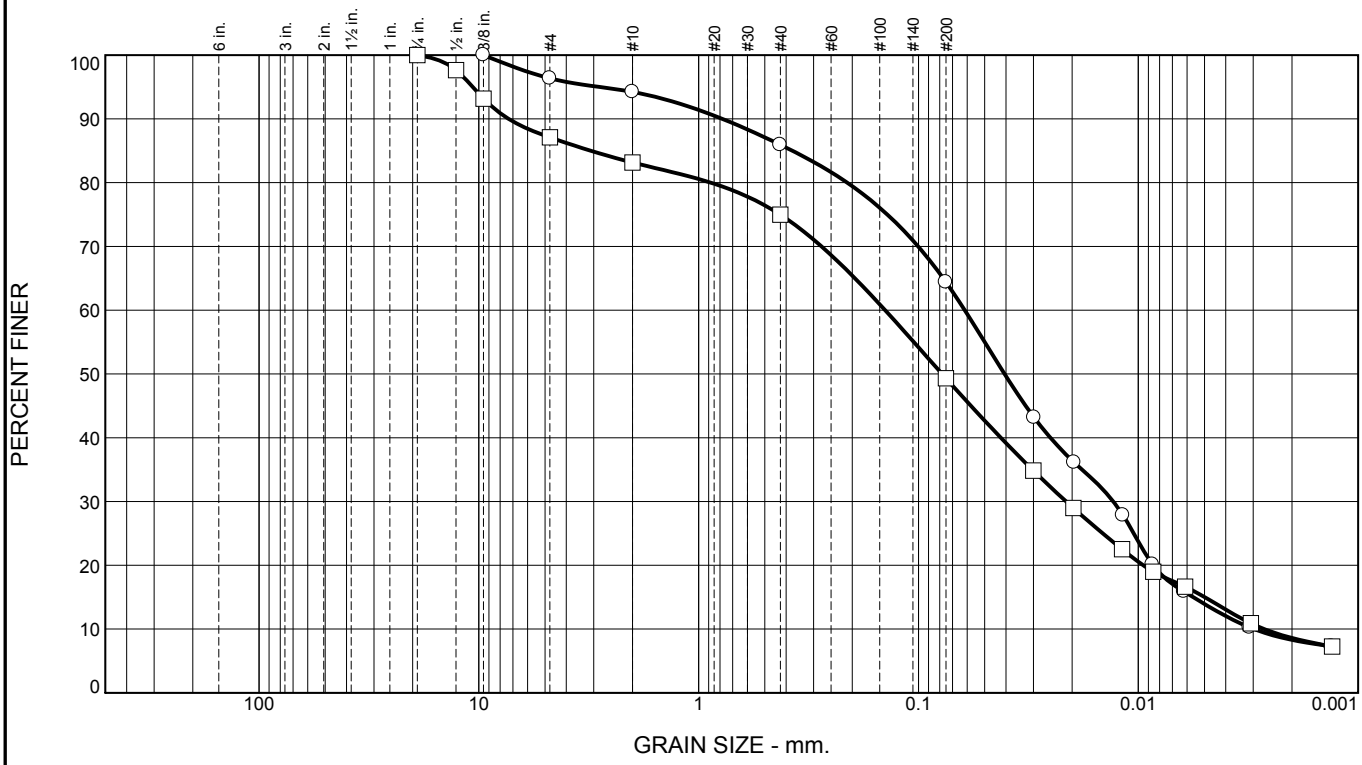
□ Location: SB50 Depth: 21 to 31 ft. Sample Number: Comp 2

GEOTECHNICS
Soil & Material Testing
4510 Paris Gravel Road - Hannibal, MO

Client: Hanson Professional Services, Inc.
Project: Duck Creek Power Station GMF
Project No.: 21-1004 Figure

Tested By: MAS/NAS **Checked By:** BJS

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	3.6	32.0	50.5	13.9	CL	27	18	9
□	0.0	12.9	37.8	34.3	15.0	SC-SM	21	15	6

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □
3/4		100.0
.5		97.6
3/8	100.0	93.2
	GRAIN SIZE	
D_{60}	0.0616	0.1419
D_{30}	0.0130	0.0213
D_{10}	0.0030	0.0027
	COEFFICIENTS	
C_c	0.92	1.19
C_u	20.67	53.01

SIEVE number size	PERCENT FINER ○	PERCENT FINER □
#4	96.4	87.1
#10	94.2	83.2
#40	85.9	75.0
#200	64.4	49.3

Material Description

○ Sandy Lean Clay (CL), Gray, Silty, Moist

□ Silty, Clayey Sand (SC-SM), Gray, Dry

REMARKS:

○ Moisture Content = 17.1%

□ Moisture Content = 7.7%

○ Location: SB50 Depth: 31 to 39 ft. Sample Number: Comp 3

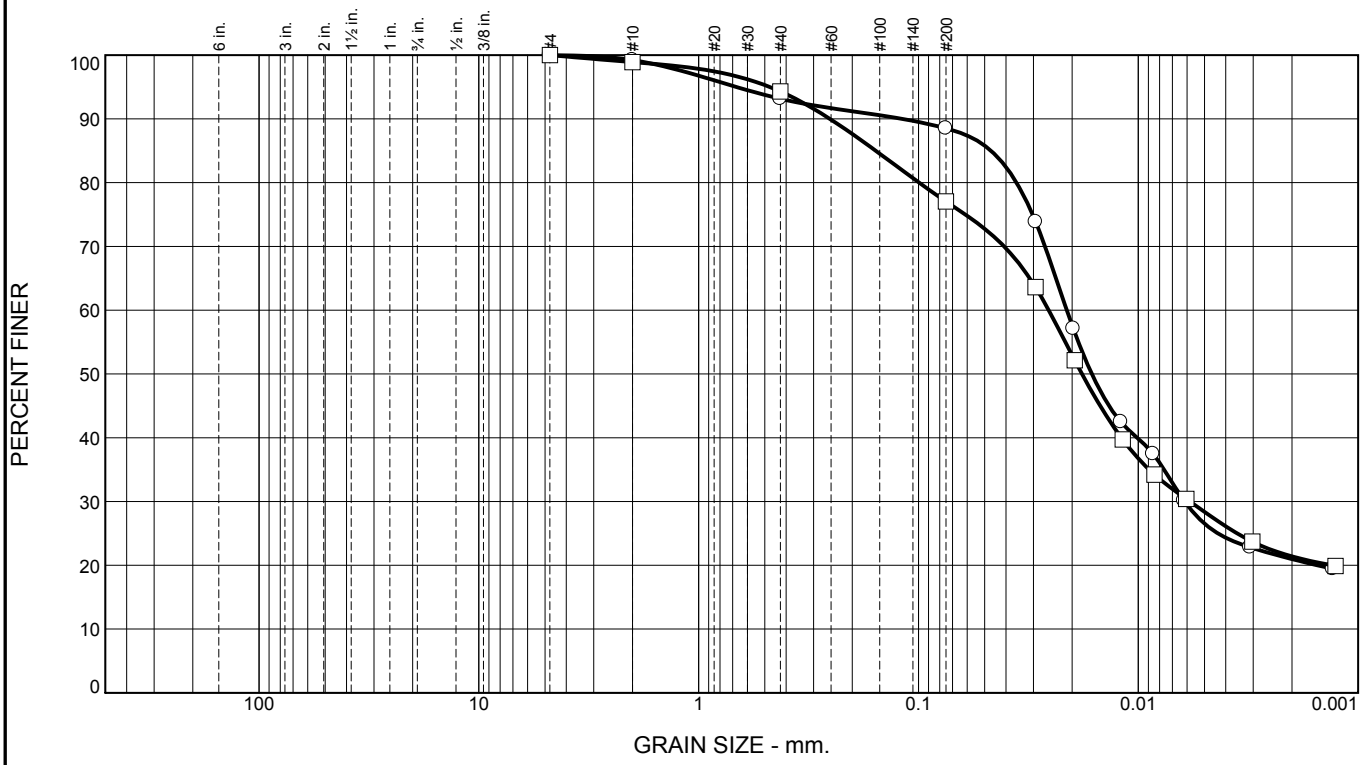
□ Location: SB50 Depth: 41 to 51 ft. Sample Number: Comp 4

GEOTECHNICS
Soil & Material Testing
4510 Paris Gravel Road - Hannibal, MO

Client: Hanson Professional Services, Inc.
Project: Duck Creek Power Station GMF
Project No.: 21-1004 Figure

Tested By: ○ MAS □ MAS/NAS **Checked By:** NAS

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	11.5	62.0	26.5	CL	35	22	13
□	0.0	0.0	23.0	48.6	28.4	CL	29	17	12

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □	
	GRAIN SIZE		
D_{60}	0.0212	0.0256	
D_{30}	0.0062	0.0058	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	PERCENT FINER □	
#4	100.0	100.0	
#10	99.2	98.9	
#40	93.1	94.3	
#200	88.5	77.0	

Material Description

○ Lean Clay (CL), Yellow Brown, Silty, Trace Sand, Moist

□ Lean Clay with Sand (CL), Gray, Silty, Moist

REMARKS:

○ Moisture Content = 19.3%

□ Moisture Content = 21.5%

○ Location: SB62 Depth: 7 to 19 ft. Sample Number: Comp 1

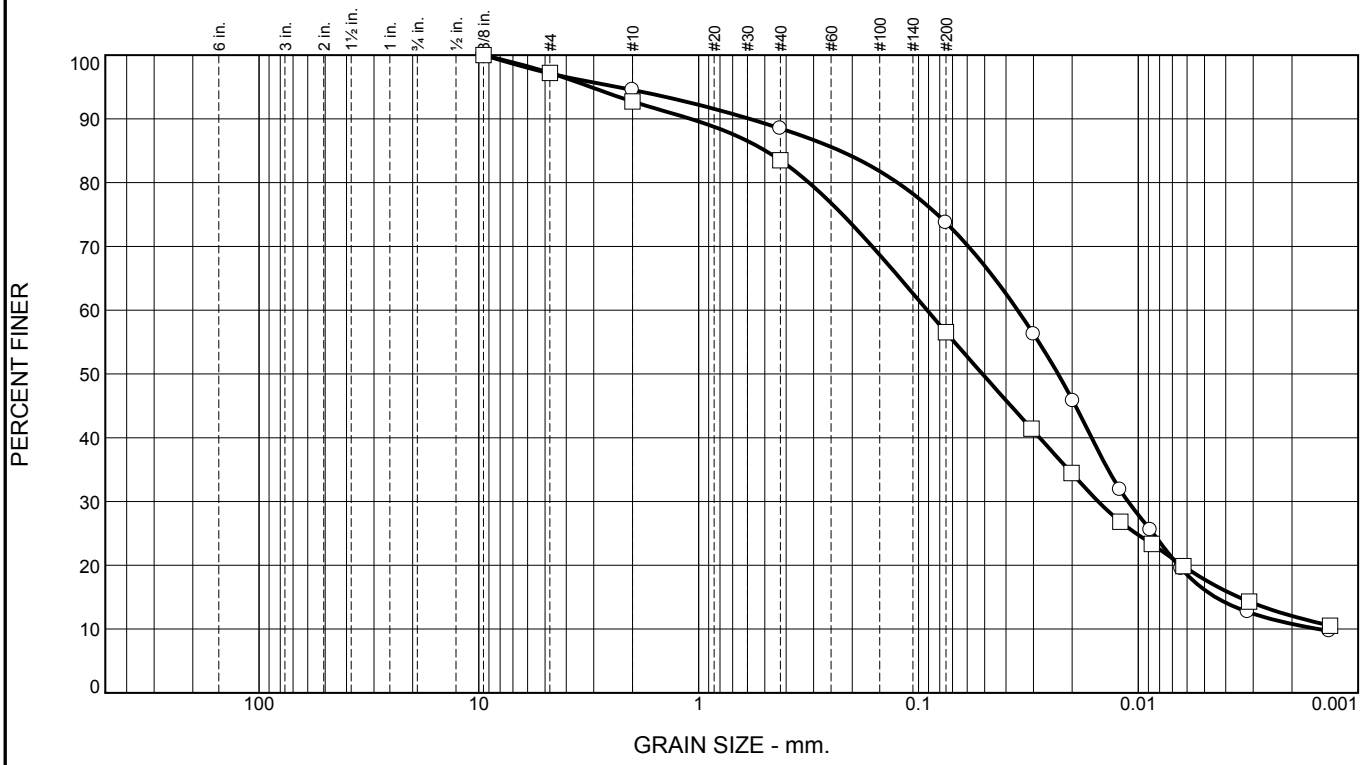
□ Location: SB62 Depth: 23 to 33 ft. Sample Number: Comp 2

GEOTECHNICS
Soil & Material Testing
4510 Paris Gravel Road - Hannibal, MO

Client: Hanson Professional Services, Inc.
Project: Duck Creek Power Station GMF
Project No.: 21-1004 Figure

Tested By: DAW/NAS **Checked By:** BJS

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	2.9	23.4	57.5	16.2	CL-ML	26	19	7
□	0.0	2.8	40.7	38.7	17.8	CL-ML	21	15	6

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □	
3/8	100.0	100.0	
	GRAIN SIZE		
D_{60}	0.0354	0.0913	
D_{30}	0.0111	0.0152	
D_{10}	0.0015		
	COEFFICIENTS		
C_c	2.31		
C_u	23.34		

SIEVE number size	PERCENT FINER ○	PERCENT FINER □	
#4	97.1	97.2	
#10	94.5	92.7	
#40	88.5	83.5	
#200	73.7	56.5	

Material Description

○ Silty Clay with Sand (CL-ML), Gray, Moist

□ Sandy Silty Clay (CL-ML), Gray, Dry

REMARKS:

○ Moisture Content = 14.5%

□ Moisture Content = 10.0%

○ Location: SB62 Depth: 33 to 39 ft. Sample Number: Comp 3

□ Location: SB62 Depth: 41 to 51 ft. Sample Number: Comp 4

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Client: Hanson Professional Services, Inc.
Project: Duck Creek Power Station GMF
Project No.: 21-1004 Figure

Tested By: DAW/NAS **Checked By:** BJS

Project No: 21-1004

Specific Gravity of Soil Solids by Water Pycnometer (ASTM D854)

Project: Duck Creek Power Station GMF Location: Canton, IL

Client: Hanson Professional Services Test Method: B

Sample Description: Lean Clay (CL), Yellow Brown, Silty, Trace Sand, Moist

Sample Source: SS Composite

Boring or Test Pit No.: G54C/Comp#1 Maximum Particle Size: 3/8”

Sample Depth: 7 to 19 ft. Percent Passing No. 4 Sieve: 99.8%

Sample Type: SS Percent Passing No. 200 Sieve: 88.2%

Specific gravity of soil solids (ASTM D854)			
Sample No.	G54C-Comp1		
Pycnometer No.	1		
Temp. of Water & Soil, T, ºC	26.0		
Correction Factor, **(K)** from Table 2 ASTM D 854	0.99844		
Tare No.	239		
Wt. of Tare & Dry Soil	99.02		
Wt. of Tare	48.70		
Wt. of Dry Soil **(M_s)**	50.32		
Wt. of Calibrated Pycnometer, dry **(M_p)**	143.91		
Wt. of Pycnometer and Water at Test Temp **($M_{pw,t}$)**	641.70		
Vol. of Pycnometer, ml **(V_p)**	500		
Density of Water at Test Temp **($P_{w,t}$)**	0.99665		
Wt. of Pycnometer, Water and Soil **($M_{pws,t}$)**	673.23		
Specific Gravity, $G_t = M_s/(M_{pw,t} - (M_{pws,t} - M_s))$	2.689		
Specific Gravity @ 20ºC=K*G_t	2.68		

Sample Obtained By: Geotechnics Date: 2/4/2021

Tested By Technician: NAS Date: 2/15/2021

Checked By Project Engineer: BJS Date: 3/26/2021

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Project No: 21-1004

Specific Gravity of Soil Solids by Water Pycnometer (ASTM D854)

Project: Duck Creek Power Station GMF Location: Canton, IL

Client: Hanson Professional Services Test Method: B

Sample Description: Lean Clay with Sand (CL), Yellow Brown, Silty, Moist

Sample Source: SS Composite

Boring or Test Pit No.: G54C/Comp#2 Maximum Particle Size: 3/8”

Sample Depth: 25 to 33 ft. Percent Passing No. 4 Sieve: 99.0%

Sample Type: SS Percent Passing No. 200 Sieve: 80.6%

Specific gravity of soil solids (ASTM D854)			
Sample No.	G54C-Comp2		
Pycnometer No.	1		
Temp. of Water & Soil, T, ºC	21.0		
Correction Factor, **(K)** from Table 2 ASTM D 854	0.99979		
Tare No.	231		
Wt. of Tare & Dry Soil	93.41		
Wt. of Tare	49.02		
Wt. of Dry Soil **(M_s)**	44.39		
Wt. of Calibrated Pycnometer, dry **(M_p)**	143.91		
Wt. of Pycnometer and Water at Test Temp **($M_{pw,t}$)**	642.30		
Vol. of Pycnometer, ml **(V_p)**	500		
Density of Water at Test Temp **($P_{w,t}$)**	0.99799		
Wt. of Pycnometer, Water and Soil **($M_{pws,t}$)**	670.15		
Specific Gravity, $G_t = M_s/(M_{pw,t} - (M_{pws,t} - M_s))$	2.684		
Specific Gravity @ 20ºC=K*G_t	2.68		

Sample Obtained By: Geotechnics Date: 2/4/2021

Tested By Technician: NAS Date: 2/15/2021

Checked By Project Engineer: BJS Date: 3/26/2021

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Project No: 21-1004

Specific Gravity of Soil Solids by Water Pycnometer (ASTM D854)

Project: Duck Creek Power Station GMF Location: Canton, IL

Client: Hanson Professional Services Test Method: B

Sample Description: Sandy Silty Clay (CL-ML), Gray, Moist

Sample Source: SS Composite

Boring or Test Pit No.: G54C/Comp#3 Maximum Particle Size: 1/2"

Sample Depth: 35 to 41 ft. Percent Passing No. 4 Sieve: 89.4%

Sample Type: SS Percent Passing No. 200 Sieve: 63.6%

Specific gravity of soil solids (ASTM D854)			
Sample No.	G54C-Comp3		
Pycnometer No.	1		
Temp. of Water & Soil, T, ºC	26.5		
Correction Factor, **(K)** from Table 2 ASTM D 854	0.99844		
Tare No.	237		
Wt. of Tare & Dry Soil	105.00		
Wt. of Tare	49.34		
Wt. of Dry Soil **(M_s)**	55.66		
Wt. of Calibrated Pycnometer, dry **(M_p)**	143.91		
Wt. of Pycnometer and Water at Test Temp **($M_{pw,t}$)**	642.24		
Vol. of Pycnometer, ml **(V_p)**	500		
Density of Water at Test Temp **($P_{w,t}$)**	0.99665		
Wt. of Pycnometer, Water and Soil **($M_{pws,t}$)**	676.82		
Specific Gravity, $G_t = M_s/(M_{pw,t} - (M_{pws,t} - M_s))$	2.640		
Specific Gravity @ 20ºC=K*G_t	2.64		

Sample Obtained By: Geotechnics Date: 2/4/2021

Tested By Technician: NAS Date: 2/16/2021

Checked By Project Engineer: BJS Date: 3/26/2021

Project No: 21-1004

Specific Gravity of Soil Solids by Water Pycnometer (ASTM D854)

Project: Duck Creek Power Station GMF Location: Canton, IL

Client: Hanson Professional Services Test Method: B

Sample Description: Sandy Lean Clay (CL), Gray, Silty, Dry

Sample Source: SS Composite

Boring or Test Pit No.: G54C/Comp#4 Maximum Particle Size: 3/4"

Sample Depth: 47 to 73 ft. Percent Passing No. 4 Sieve: 92.6%

Sample Type: SS Percent Passing No. 200 Sieve: 56.3%

Specific gravity of soil solids (ASTM D854)			
Sample No.	G54C-Comp4		
Pycnometer No.	2		
Temp. of Water & Soil, T, ºC	25.0		
Correction Factor, **(K)** from Table 2 ASTM D 854	0.99884		
Tare No.	228		
Wt. of Tare & Dry Soil	105.70		
Wt. of Tare	49.94		
Wt. of Dry Soil **(M_s)**	55.76		
Wt. of Calibrated Pycnometer, dry **(M_p)**	133.50		
Wt. of Pycnometer and Water at Test Temp **($M_{pw,t}$)**	631.40		
Vol. of Pycnometer, ml **(V_p)**	500		
Density of Water at Test Temp **($P_{w,t}$)**	0.99705		
Wt. of Pycnometer, Water and Soil **($M_{pws,t}$)**	666.34		
Specific Gravity, $G_t = M_s/(M_{pw,t}-(M_{pws,t}-M_s))$	2.678		
Specific Gravity @ 20ºC=K*G_t	2.67		

Sample Obtained By: Geotechnics Date: 2/4/2021

Tested By Technician: NAS Date: 2/16/2021

Checked By Project Engineer: BJS Date: 3/26/2021

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Project No: 21-1004

Specific Gravity of Soil Solids by Water Pycnometer (ASTM D854)

Project: Duck Creek Power Station GMF Location: Canton, IL

Client: Hanson Professional Services Test Method: B

Sample Description: Lean Clay (CL), Light Brown, Silty, Moist

Sample Source: SS Composite

Boring or Test Pit No.: SB50/Comp#1 Maximum Particle Size: #10

Sample Depth: 5 to 19 ft. Percent Passing No. 4 Sieve: 100.0%

Sample Type: SS Percent Passing No. 200 Sieve: 97.4%

Specific gravity of soil solids (ASTM D854)			
Sample No.	SB50-Comp1		
Pycnometer No.	1		
Temp. of Water & Soil, T, ºC	24.5		
Correction Factor, **(K)** from Table 2 ASTM D 854	0.99897		
Tare No.	233		
Wt. of Tare & Dry Soil	96.94		
Wt. of Tare	49.38		
Wt. of Dry Soil **(M_s)**	47.56		
Wt. of Calibrated Pycnometer, dry **(M_p)**	143.91		
Wt. of Pycnometer and Water at Test Temp **($M_{pw,t}$)**	641.88		
Vol. of Pycnometer, ml **(V_p)**	500		
Density of Water at Test Temp **($P_{w,t}$)**	0.99717		
Wt. of Pycnometer, Water and Soil **($M_{pws,t}$)**	671.72		
Specific Gravity, $G_t = M_s/(M_{pw,t} - (M_{pws,t} - M_s))$	2.684		
Specific Gravity @ 20ºC=K*G_t	2.68		

Sample Obtained By: Geotechnics Date: 2/3/2021

Tested By Technician: NAS Date: 2/12/2021

Checked By Project Engineer: BJS Date: 3/26/2021

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Project No: 21-1004

Specific Gravity of Soil Solids by Water Pycnometer (ASTM D854)

Project: Duck Creek Power Station GMF Location: Canton, IL

Client: Hanson Professional Services Test Method: B

Sample Description: Lean Clay with Sand (CL), YBrn/Lt Brn mot. Lt Gray, RBrn Ox, Silty, Moist

Sample Source: SS Composite

Boring or Test Pit No.: SB50/Comp#2 Maximum Particle Size: 3/8

Sample Depth: 21 to 31 ft. Percent Passing No. 4 Sieve: 96.6%

Sample Type: SS Percent Passing No. 200 Sieve: 70.1%

Specific gravity of soil solids (ASTM D854)			
Sample No.	SB50-Comp2		
Pycnometer No.	2		
Temp. of Water & Soil, T, ºC	21.0		
Correction Factor, **(K)** from Table 2 ASTM D 854	0.99979		
Tare No.	236		
Wt. of Tare & Dry Soil	97.27		
Wt. of Tare	49.36		
Wt. of Dry Soil **(M_s)**	47.91		
Wt. of Calibrated Pycnometer, dry **(M_p)**	133.50		
Wt. of Pycnometer and Water at Test Temp **($M_{pw,t}$)**	631.87		
Vol. of Pycnometer, ml **(V_p)**	500		
Density of Water at Test Temp **($P_{w,t}$)**	0.99799		
Wt. of Pycnometer, Water and Soil **($M_{pws,t}$)**	662.03		
Specific Gravity, $G_t = M_s/(M_{pw,t}-(M_{pws,t}-M_s))$	2.699		
Specific Gravity @ 20ºC=K*G_t	2.70		

Sample Obtained By: Geotechnics Date: 2/3/2021

Tested By Technician: NAS Date: 2/12/2021

Checked By Project Engineer: BJS Date: 3/26/2021

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Project No: 21-1004

Specific Gravity of Soil Solids by Water Pycnometer (ASTM D854)

Project: Duck Creek Power Station GMF Location: Canton, IL

Client: Hanson Professional Services Test Method: B

Sample Description: Sandy Lean Clay (CL), Gray, Silty, Moist

Sample Source: SS Composite

Boring or Test Pit No.: SB50/Comp#3 Maximum Particle Size: 3/8

Sample Depth: 31 to 39 ft. Percent Passing No. 4 Sieve: 96.4%

Sample Type: SS Percent Passing No. 200 Sieve: 64.4%

Specific gravity of soil solids (ASTM D854)			
Sample No.	SB50-Comp3		
Pycnometer No.	2		
Temp. of Water & Soil, T, ºC	26.0		
Correction Factor, **(K)** from Table 2 ASTM D 854	0.99858		
Tare No.	220		
Wt. of Tare & Dry Soil	98.97		
Wt. of Tare	49.09		
Wt. of Dry Soil **(M_s)**	49.88		
Wt. of Calibrated Pycnometer, dry **(M_p)**	133.50		
Wt. of Pycnometer and Water at Test Temp **($M_{pw,t}$)**	631.27		
Vol. of Pycnometer, ml **(V_p)**	500		
Density of Water at Test Temp **($P_{w,t}$)**	0.99679		
Wt. of Pycnometer, Water and Soil **($M_{pws,t}$)**	662.68		
Specific Gravity, $G_t = M_s/(M_{pw,t}-(M_{pws,t}-M_s))$	2.701		
Specific Gravity @ 20ºC=K*G_t	2.70		

Sample Obtained By: Geotechnics Date: 2/3/2021

Tested By Technician: NAS Date: 2/15/2021

Checked By Project Engineer: BJS Date: 3/26/2021

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Project No: 21-1004

Specific Gravity of Soil Solids by Water Pycnometer (ASTM D854)

Project: Duck Creek Power Station GMF Location: Canton, IL

Client: Hanson Professional Services Test Method: B

Sample Description: Silty, Clayey Sand (SC-SM), Gray, Dry

Sample Source: SS Composite

Boring or Test Pit No.: SB50/Comp#4 Maximum Particle Size: 3/4

Sample Depth: 41 to 51 ft. Percent Passing No. 4 Sieve: 87.1%

Sample Type: SS Percent Passing No. 200 Sieve: 49.3%

Specific gravity of soil solids (ASTM D854)			
Sample No.	SB50-Comp4		
Pycnometer No.	1		
Temp. of Water & Soil, T, ºC	25.0		
Correction Factor, **(K)** from Table 2 ASTM D 854	0.99884		
Tare No.	237		
Wt. of Tare & Dry Soil	99.71		
Wt. of Tare	49.44		
Wt. of Dry Soil **(M_s)**	50.27		
Wt. of Calibrated Pycnometer, dry **(M_p)**	143.91		
Wt. of Pycnometer and Water at Test Temp **($M_{pw,t}$)**	641.83		
Vol. of Pycnometer, ml **(V_p)**	500		
Density of Water at Test Temp **($P_{w,t}$)**	0.99705		
Wt. of Pycnometer, Water and Soil **($M_{pws,t}$)**	673.49		
Specific Gravity, $G_t = M_s/(M_{pw,t}-(M_{pws,t}-M_s))$	2.701		
Specific Gravity @ 20ºC=K*G_t	2.70		

Sample Obtained By: Geotechnics Date: 2/3/2021

Tested By Technician: NAS Date: 2/12/2021

Checked By Project Engineer: BJS Date: 3/26/2021

Project No: 21-1004

Specific Gravity of Soil Solids by Water Pycnometer (ASTM D854)

Project: Duck Creek Power Station GMF Location: Canton, IL

Client: Hanson Professional Services Test Method: B

Sample Description: Lean Clay (CL), Yellow Brown, Silty, Trace Sand, Moist

Sample Source: SS Composite

Boring or Test Pit No.: SB62/Comp#1 Maximum Particle Size: #4

Sample Depth: 7 to 19 ft. Percent Passing No. 4 Sieve: 100.0%

Sample Type: SS Percent Passing No. 200 Sieve: 88.5%

Specific gravity of soil solids (ASTM D854)			
Sample No.	SB62-Comp1		
Pycnometer No.	1		
Temp. of Water & Soil, T, ºC	24.0		
Correction Factor, **(K)** from Table 2 ASTM D 854	0.99909		
Tare No.	239		
Wt. of Tare & Dry Soil	88.7		
Wt. of Tare	48.66		
Wt. of Dry Soil **(M_s)**	40.04		
Wt. of Calibrated Pycnometer, dry **(M_p)**	143.91		
Wt. of Pycnometer and Water at Test Temp **($M_{pw,t}$)**	641.95		
Vol. of Pycnometer, ml **(V_p)**	500		
Density of Water at Test Temp **($P_{w,t}$)**	0.99730		
Wt. of Pycnometer, Water and Soil **($M_{pws,t}$)**	666.87		
Specific Gravity, $G_t = M_s/(M_{pw,t}-(M_{pws,t}-M_s))$	2.648		
Specific Gravity @ 20ºC=K*G_t	2.65		

Sample Obtained By: Geotechnics Date: 2/3/2021

Tested By Technician: NAS Date: 2/16/2021

Checked By Project Engineer: BJS Date: 3/26/2021

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Project No: 21-1004

Specific Gravity of Soil Solids by Water Pycnometer (ASTM D854)

Project: Duck Creek Power Station GMF Location: Canton, IL

Client: Hanson Professional Services Test Method: B

Sample Description: Lean Clay with Sand (CL), Gray, Silty, Moist

Sample Source: SS Composite

Boring or Test Pit No.: SB62/Comp#2 Maximum Particle Size: #4

Sample Depth: 23 to 33 ft. Percent Passing No. 4 Sieve: 100.0%

Sample Type: SS Percent Passing No. 200 Sieve: 77.0%

Specific gravity of soil solids (ASTM D854)			
Sample No.	SB62-Comp2		
Pycnometer No.	2		
Temp. of Water & Soil, T, ºC	26.0		
Correction Factor, **(K)** from Table 2 ASTM D 854	0.99858		
Tare No.	234		
Wt. of Tare & Dry Soil	101.50		
Wt. of Tare	49.10		
Wt. of Dry Soil **(M_s)**	52.40		
Wt. of Calibrated Pycnometer, dry **(M_p)**	133.50		
Wt. of Pycnometer and Water at Test Temp **($M_{pw,t}$)**	631.27		
Vol. of Pycnometer, ml **(V_p)**	500		
Density of Water at Test Temp **($P_{w,t}$)**	0.99679		
Wt. of Pycnometer, Water and Soil **($M_{pws,t}$)**	664.27		
Specific Gravity, $G_t = M_s/(M_{pw,t} - (M_{pws,t} - M_s))$	2.701		
Specific Gravity @ 20ºC=K*G_t	2.70		

Sample Obtained By: Geotechnics Date: 2/3/2021

Tested By Technician: NAS Date: 2/16/2021

Checked By Project Engineer: BJS Date: 3/26/2021

Project No: 21-1004

Specific Gravity of Soil Solids by Water Pycnometer (ASTM D854)

Project: Duck Creek Power Station GMF Location: Canton, IL

Client: Hanson Professional Services Test Method: B

Sample Description: Silty Clay with Sand (CL-ML), Gray, Moist

Sample Source: SS Composite

Boring or Test Pit No.: SB62/Comp#3 Maximum Particle Size: 3/8"

Sample Depth: 33 to 39 ft. Percent Passing No. 4 Sieve: 97.1%

Sample Type: SS Percent Passing No. 200 Sieve: 73.7%

Specific gravity of soil solids (ASTM D854)			
Sample No.	SB62-Comp3		
Pycnometer No.	1		
Temp. of Water & Soil, T, ºC	26.5		
Correction Factor, **(K)** from Table 2 ASTM D 854	0.99844		
Tare No.	223		
Wt. of Tare & Dry Soil	103.96		
Wt. of Tare	49.21		
Wt. of Dry Soil **(M_s)**	54.75		
Wt. of Calibrated Pycnometer, dry **(M_p)**	143.91		
Wt. of Pycnometer and Water at Test Temp **($M_{pw,t}$)**	647.24		
Vol. of Pycnometer, ml **(V_p)**	500		
Density of Water at Test Temp **($P_{w,t}$)**	0.99665		
Wt. of Pycnometer, Water and Soil **($M_{pws,t}$)**	676.33		
Specific Gravity, $G_t = M_s/(M_{pw,t} - (M_{pws,t} - M_s))$	2.650		
Specific Gravity @ 20ºC=K*G_t	2.65		

Sample Obtained By: Geotechnics Date: 2/3/2021

Tested By Technician: NAS Date: 2/17/2021

Checked By Project Engineer: BJS Date: 3/26/2021

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Project No: 21-1004

Specific Gravity of Soil Solids by Water Pycnometer (ASTM D854)

Project: Duck Creek Power Station GMF Location: Canton, IL

Client: Hanson Professional Services Test Method: B

Sample Description: Sandy Silty Clay (CL-ML), Gray, Dry

Sample Source: SS Composite

Boring or Test Pit No.: SB62/Comp#4 Maximum Particle Size: 3/8"

Sample Depth: 41 to 51 ft. Percent Passing No. 4 Sieve: 97.2%

Sample Type: SS Percent Passing No. 200 Sieve: 56.5%

Specific gravity of soil solids (ASTM D854)			
Sample No.	SB62-Comp4		
Pycnometer No.	2		
Temp. of Water & Soil, T, ºC	23.5		
Correction Factor, **(K)** from Table 2 ASTM D 854	0.99921		
Tare No.	231		
Wt. of Tare & Dry Soil	99.47		
Wt. of Tare	49.03		
Wt. of Dry Soil **(M_s)**	50.44		
Wt. of Calibrated Pycnometer, dry **(M_p)**	133.50		
Wt. of Pycnometer and Water at Test Temp **($M_{pw,t}$)**	631.59		
Vol. of Pycnometer, ml **(V_p)**	500		
Density of Water at Test Temp **($P_{w,t}$)**	0.99742		
Wt. of Pycnometer, Water and Soil **($M_{pws,t}$)**	662.94		
Specific Gravity, $G_t = M_s/(M_{pw,t}-(M_{pws,t}-M_s))$	2.642		
Specific Gravity @ 20ºC=K*G_t	2.64		

Sample Obtained By: Geotechnics Date: 2/3/2021

Tested By Technician: NAS Date: 2/17/2021

Checked By Project Engineer: BJS Date: 3/26/2021

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Geotechnics Form No. 17-FW

PERMEABILITY TEST REPORT
ASTM D 5084-10

PROJECT No. **21-1004**

PROJECT **Duck Creek Power Station GMF** LOCATION
CLIENT **Hanson Professional Services, Inc.** SAMPLING DATE **2/3/2021**

SAMPLE DESCRIPTION **Lean Clay (CL/CH), Light Brown mottled Light Gray, Reddish Brown Oxidation, Silty, Moist**

LIQUID LIMIT PLASTIC LIMIT P.I.

BORING NO. **G-54C** SAMPLE NO. **14-16**

SAMPLE TYPE **ST** DEPTH **14-16 ft.**

SPECIFIC GRAVITY, Gs TEST METHOD **ASTM D 5084-10**

INITIAL WATER CONTENT **22.2%** INITIAL DRY DENSITY **104.0 P.C.F.**

FINAL WATER CONTENT **23.9%** FINAL DRY DENSITY **103.0 P.C.F.**

t_1	t_2	a	L	A	t	head	tail	h_w	h_a	dt/dh	h_a+h_w	k	k_{20}
14:18		0.200	7.818	42.077		1.49	8.10	33.050	210.9		243.950		
14:18	15:10	0.200	7.818	42.077	3120	1.78	7.80	30.100	210.9	1.03	241.000	7.25E-08	7.35E-08
15:10	15:44	0.200	7.818	42.077	2040	1.96	7.62	28.300	210.9	1.00	239.200	6.83E-08	6.93E-08
15:44	16:36	0.200	7.818	42.077	3120	2.23	7.35	25.600	210.9	1.00	236.500	6.76E-08	6.86E-08
													7.06E-08

COEFFICIENT OF VERTICAL PERMEABILITY
K_{20} = 7.06 E-08 CM/SEC

REMARKS: Testing Completed 2/17/2021

TESTED BY: **BJS**

COMPUTED BY: **BJS**

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Geotechnics Form No. 17-FW

PERMEABILITY TEST REPORT
ASTM D 5084-10

PROJECT No. **21-1004**

PROJECT **Duck Creek Power Station GMF** LOCATION
CLIENT **Hanson Professional Services, Inc.** SAMPLING DATE **2/4/2021**

SAMPLE DESCRIPTION **Sandy Lean Clay (CL), Light Brown mottled Light Gray, Reddish Brown Oxidation, Silty, Moist**

LIQUID LIMIT PLASTIC LIMIT P.I.

BORING NO. **G-54C** SAMPLE NO. **32-34**

SAMPLE TYPE **ST** DEPTH **32-34 ft.**

SPECIFIC GRAVITY, Gs TEST METHOD **ASTM D 5084-10**

INITIAL WATER CONTENT **21.9%** INITIAL DRY DENSITY **105.1 P.C.F.**

FINAL WATER CONTENT **21.4%** FINAL DRY DENSITY **106.7 P.C.F.**

t_1	t_2	a	L	A	t	head	tail	h_w	h_a	dt/dh	h_a+h_w	k	k_{20}
8:33		0.200	7.523	40.438		3.65	5.72	10.350	210.9		221.250		
8:33	10:02	0.200	7.523	40.438	5340	7.87	1.44	-32.150	210.9	1.01	178.750	7.43E-07	7.54E-07
10:02	10:25	0.200	7.523	40.438	1380	8.80	0.52	-41.400	210.9	0.99	169.500	7.16E-07	7.27E-07
10:25	10:36	0.200	7.523	40.438	660	9.22	0.08	-45.700	210.9	1.05	165.200	7.24E-07	7.35E-07
													7.47E-07

COEFFICIENT OF VERTICAL PERMEABILITY
K_{20} = 7.47 E-07 CM/SEC

REMARKS: Testing Completed 2/19/2021

TESTED BY: **BJS**

COMPUTED BY: **BJS**

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Geotechnics Form No. 17-FW

PERMEABILITY TEST REPORT
ASTM D 5084-10

PROJECT No. **21-1004**

PROJECT **Duck Creek Power Station GMF** LOCATION
CLIENT **Hanson Professional Services, Inc.** SAMPLING DATE **2/4/2021**

SAMPLE DESCRIPTION **Silty Sand (SM), Light Gray to Gray, Clayey, With Sandy Lean Clay Seams and Sand Pockets, Moist**

LIQUID LIMIT PLASTIC LIMIT P.I.

BORING NO. **G-54C** SAMPLE NO. **44-46**

SAMPLE TYPE **ST** DEPTH **44-46 ft.**

SPECIFIC GRAVITY, Gs TEST METHOD **ASTM D 5084-10**

INITIAL WATER CONTENT **12.2%** INITIAL DRY DENSITY **126.1 P.C.F.**

FINAL WATER CONTENT **12.3%** FINAL DRY DENSITY **127.4 P.C.F.**

t_1	t_2	a	L	A	t	head	tail	h_w	h_a	dt/dh	h_a+h_w	k	k_{20}
9:12		0.200	7.752	41.447		7.21	2.54	-23.350	210.9		187.550		
9:12	9:15	0.200	7.752	41.447	180	8.15	1.58	-32.850	210.9	1.02	178.050	5.40E-06	5.48E-06
9:15	9:18	0.200	7.752	41.447	180	9.02	0.69	-41.650	210.9	1.02	169.250	5.27E-06	5.35E-06
9:18	9:20	0.200	7.752	41.447	120	9.58	0.13	-47.250	210.9	1.00	163.650	5.24E-06	5.32E-06
													5.39E-06

COEFFICIENT OF VERTICAL PERMEABILITY
K_{20} = 5.39 E-06 CM/SEC

REMARKS: Testing Completed 2/22/2021

TESTED BY: **BJS**

COMPUTED BY: **BJS**

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PERMEABILITY TEST REPORT
ASTM D 5084-10

PROJECT No. **21-1004**

PROJECT **Duck Creek Power Station GMF** LOCATION
CLIENT **Hanson Professional Services, Inc.** SAMPLING DATE **2/4/2021**

SAMPLE DESCRIPTION **Sandy Lean Clay (CL), Light Gray, Silty, With Fat Clay Seam, Moist**

LIQUID LIMIT PLASTIC LIMIT P.I.

BORING NO. **G-54C** SAMPLE NO. **76-78**

SAMPLE TYPE **ST** DEPTH **76-78 ft.**

SPECIFIC GRAVITY, Gs TEST METHOD **ASTM D 5084-10**

INITIAL WATER CONTENT **12.6%** INITIAL DRY DENSITY **123.2 P.C.F.**

FINAL WATER CONTENT **13.9%** FINAL DRY DENSITY **122.0 P.C.F.**

t_1	t_2	a	L	A	t	head	tail	h_w	h_a	dt/dh	h_a+h_w	k	k_{20}
7:13		0.200	7.660	41.592		5.75	3.85	-9.500	210.9		201.400		
7:13	9:36	0.200	7.660	41.592	8580	6.13	3.48	-13.250	210.9	0.97	197.650	4.03E-08	4.09E-08
9:36	11:26	0.200	7.660	41.592	6600	6.41	3.20	-16.050	210.9	1.00	194.850	3.98E-08	4.04E-08
11:26	11:59	0.200	7.660	41.592	1980	6.50	3.11	-16.950	210.9	1.00	193.950	4.31E-08	4.37E-08
													4.11E-08

COEFFICIENT OF VERTICAL PERMEABILITY
K_{20} = 4.11 E-08 CM/SEC

REMARKS: Testing Completed 2/24/2021

TESTED BY: **BJS**

COMPUTED BY: **BJS**

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Geotechnics Form No. 17-FW

PERMEABILITY TEST REPORT
ASTM D 5084-10

PROJECT No. **21-1004**

PROJECT **Duck Creek Power Station GMF** LOCATION
CLIENT **Hanson Professional Services, Inc.** SAMPLING DATE **2/2/2021**

SAMPLE DESCRIPTION **Silt (ML), Yellow Brown mottled Light Brown/Light Gray, Black Oxidation, Clayey, Moist**

LIQUID LIMIT PLASTIC LIMIT P.I.

BORING NO. **SB-50** SAMPLE NO. **10-12**

SAMPLE TYPE **ST** DEPTH **10-12 ft.**

SPECIFIC GRAVITY, Gs TEST METHOD **ASTM D 5084-10**

INITIAL WATER CONTENT **25.9%** INITIAL DRY DENSITY **98.0 P.C.F.**

FINAL WATER CONTENT **23.4%** FINAL DRY DENSITY **106.1 P.C.F.**

t_1	t_2	a	L	A	t	head	tail	h_w	h_a	dt/dh	h_a+h_w	k	k_{20}
8:44		0.200	7.112	39.443		2.88	6.86	19.900	140.6		160.500		
8:44	10:49	0.200	7.112	39.443	7500	6.52	3.15	-16.850	140.6	1.02	123.750	6.25E-07	6.35E-07
10:49	11:56	0.200	7.112	39.443	4020	8.14	1.52	-33.100	140.6	1.01	107.500	6.31E-07	6.41E-07
11:56	13:09	0.200	7.112	39.443	4380	9.63	0.02	-48.050	140.6	1.01	92.550	6.16E-07	6.26E-07
													6.34E-07

COEFFICIENT OF VERTICAL PERMEABILITY
K_{20} = 6.34 E-07 CM/SEC

REMARKS: Testing Completed 2/15/2021

TESTED BY: **BJS**

COMPUTED BY: **BJS**

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PERMEABILITY TEST REPORT
ASTM D 5084-10

PROJECT No. **21-1004**

PROJECT **Duck Creek Power Station GMF** LOCATION
CLIENT **Hanson Professional Services, Inc.** SAMPLING DATE **2/2/2021**

SAMPLE DESCRIPTION **Lean Clay with Sand (CL), Light Gray/Gray mottled Yellow Brown, Silty, Moist**

LIQUID LIMIT PLASTIC LIMIT P.I.

BORING NO. **SB-50** SAMPLE NO. **22-24**

SAMPLE TYPE **ST** DEPTH **22-24 ft.**

SPECIFIC GRAVITY, Gs TEST METHOD **ASTM D 5084-10**

INITIAL WATER CONTENT **21.8%** INITIAL DRY DENSITY **106.3 P.C.F.**

FINAL WATER CONTENT **21.7%** FINAL DRY DENSITY **106.2 P.C.F.**

t_1	t_2	a	L	A	t	head	tail	h_w	h_a	dt/dh	h_a+h_w	k	k_{20}
9:25		0.200	7.391	41.931		1.68	7.91	31.150	210.9		242.050		
9:25	10:45	0.200	7.391	41.931	4800	3.30	6.23	14.650	210.9	1.04	225.550	2.59E-07	2.63E-07
10:45	12:50	0.200	7.391	41.931	7500	5.58	3.88	-8.500	210.9	1.03	202.400	2.55E-07	2.58E-07
12:50	13:54	0.200	7.391	41.931	3840	6.64	2.80	-19.200	210.9	1.02	191.700	2.49E-07	2.53E-07
													2.59E-07

COEFFICIENT OF VERTICAL PERMEABILITY
K_{20} = 2.59 E-07 CM/SEC

REMARKS: Testing Completed 2/16/2021

TESTED BY: **BJS**

COMPUTED BY: **BJS**

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PERMEABILITY TEST REPORT
ASTM D 5084-10

PROJECT No. **21-1004**

PROJECT **Duck Creek Power Station GMF** LOCATION
CLIENT **Hanson Professional Services, Inc.** SAMPLING DATE **2/3/2021**

SAMPLE DESCRIPTION **Fill: Lean Clay (CL), Light Brown mottled Gray, Silty, Trace Sand, Moist**

LIQUID LIMIT PLASTIC LIMIT P.I.

BORING NO. **SB-62** SAMPLE NO. **12-14**

SAMPLE TYPE **ST** DEPTH **12-14 ft.**

SPECIFIC GRAVITY, Gs TEST METHOD **ASTM D 5084-10**

INITIAL WATER CONTENT **21.1%** INITIAL DRY DENSITY **105.5 P.C.F.**

FINAL WATER CONTENT **24.5%** FINAL DRY DENSITY **102.7 P.C.F.**

t_1	t_2	a	L	A	t	head	tail	h_w	h_a	dt/dh	h_a+h_w	k	k_{20}
15:45		0.200	7.264	42.028		5.07	4.80	-1.350	210.9		209.550		
15:45	16:53	0.200	7.264	42.028	4080	6.01	3.83	-10.900	210.9	1.03	200.000	1.98E-07	2.01E-07
16:53	17:27	0.200	7.264	42.028	2040	6.44	3.40	-15.200	210.9	1.00	195.700	1.84E-07	1.87E-07
17:27	17:53	0.200	7.264	42.028	1560	6.76	3.08	-18.400	210.9	1.00	192.500	1.83E-07	1.85E-07
													1.94E-07

COEFFICIENT OF VERTICAL PERMEABILITY
K_{20} = 1.94 E-07 CM/SEC

REMARKS: Testing Completed 3/1/2021

TESTED BY: **BJS**

COMPUTED BY: **BJS**

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PERMEABILITY TEST REPORT
ASTM D 5084-10

PROJECT No. **21-1004**

PROJECT **Duck Creek Power Station GMF** LOCATION
CLIENT **Hanson Professional Services, Inc.** SAMPLING DATE **2/3/2021**

SAMPLE DESCRIPTION **Lean Clay with Sand (CL), Yellow Brown mottled Reddish Brown and Light Brown, Silty, Moist**

LIQUID LIMIT PLASTIC LIMIT P.I.

BORING NO. **SB-62** SAMPLE NO. **26-28**

SAMPLE TYPE **ST** DEPTH **26-28 ft.**

SPECIFIC GRAVITY, Gs TEST METHOD **ASTM D 5084-10**

INITIAL WATER CONTENT **23.2%** INITIAL DRY DENSITY **105.3 P.C.F.**

FINAL WATER CONTENT **21.5%** FINAL DRY DENSITY **108.1 P.C.F.**

t_1	t_2	a	L	A	t	head	tail	h_w	h_a	dt/dh	h_a+h_w	k	k_{20}
14:11		0.200	7.574	41.689		3.25	6.63	16.900	105.5		122.400		
14:11	14:36	0.200	7.574	41.689	1500	5.33	4.54	-3.950	105.5	1.00	101.550	2.26E-06	2.30E-06
14:36	15:11	0.200	7.574	41.689	2100	7.64	2.24	-27.000	105.5	1.00	78.500	2.23E-06	2.26E-06
15:11	15:28	0.200	7.574	41.689	1020	8.59	1.30	-36.450	105.5	0.99	69.050	2.28E-06	2.32E-06
													2.28E-06

COEFFICIENT OF VERTICAL PERMEABILITY
K_{20} = 2.28 E-06 CM/SEC

REMARKS: Testing Completed 2/25/2021

TESTED BY: **BJS**

COMPUTED BY: **BJS**

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PERMEABILITY TEST REPORT
ASTM D 5084-10

PROJECT No. **21-1004**

PROJECT **Duck Creek Power Station GMF** LOCATION
CLIENT **Hanson Professional Services, Inc.** SAMPLING DATE **2/3/2021**

SAMPLE DESCRIPTION **Sandy Lean Clay (CL), Light Gray, Silty, With Silt Seam, Moist**

LIQUID LIMIT PLASTIC LIMIT P.I.

BORING NO. **SB-62** SAMPLE NO. **38-40**

SAMPLE TYPE **ST** DEPTH **38-40 ft.**

SPECIFIC GRAVITY, Gs TEST METHOD **ASTM D 5084-10**

INITIAL WATER CONTENT **15.6%** INITIAL DRY DENSITY **118.4 P.C.F.**

FINAL WATER CONTENT **16.4%** FINAL DRY DENSITY **116.5 P.C.F.**

t_1	t_2	a	L	A	t	head	tail	h_w	h_a	dt/dh	h_a+h_w	k	k_{20}
15:45		0.200	7.620	41.834		4.33	5.50	5.850	210.9		216.750		
15:45	16:03	0.200	7.620	41.834	1080	5.68	4.14	-7.700	210.9	1.01	203.200	1.09E-06	1.11E-06
16:03	16:26	0.200	7.620	41.834	1380	7.27	2.54	-23.650	210.9	1.01	187.250	1.08E-06	1.10E-06
16:26	16:44	0.200	7.620	41.834	1080	8.41	1.40	-35.050	210.9	1.00	175.850	1.06E-06	1.08E-06
													1.09E-06

COEFFICIENT OF VERTICAL PERMEABILITY
K_{20} = 1.09 E-06 CM/SEC

REMARKS: Testing Completed 2/26/2021

TESTED BY: **BJS**

COMPUTED BY: **BJS**

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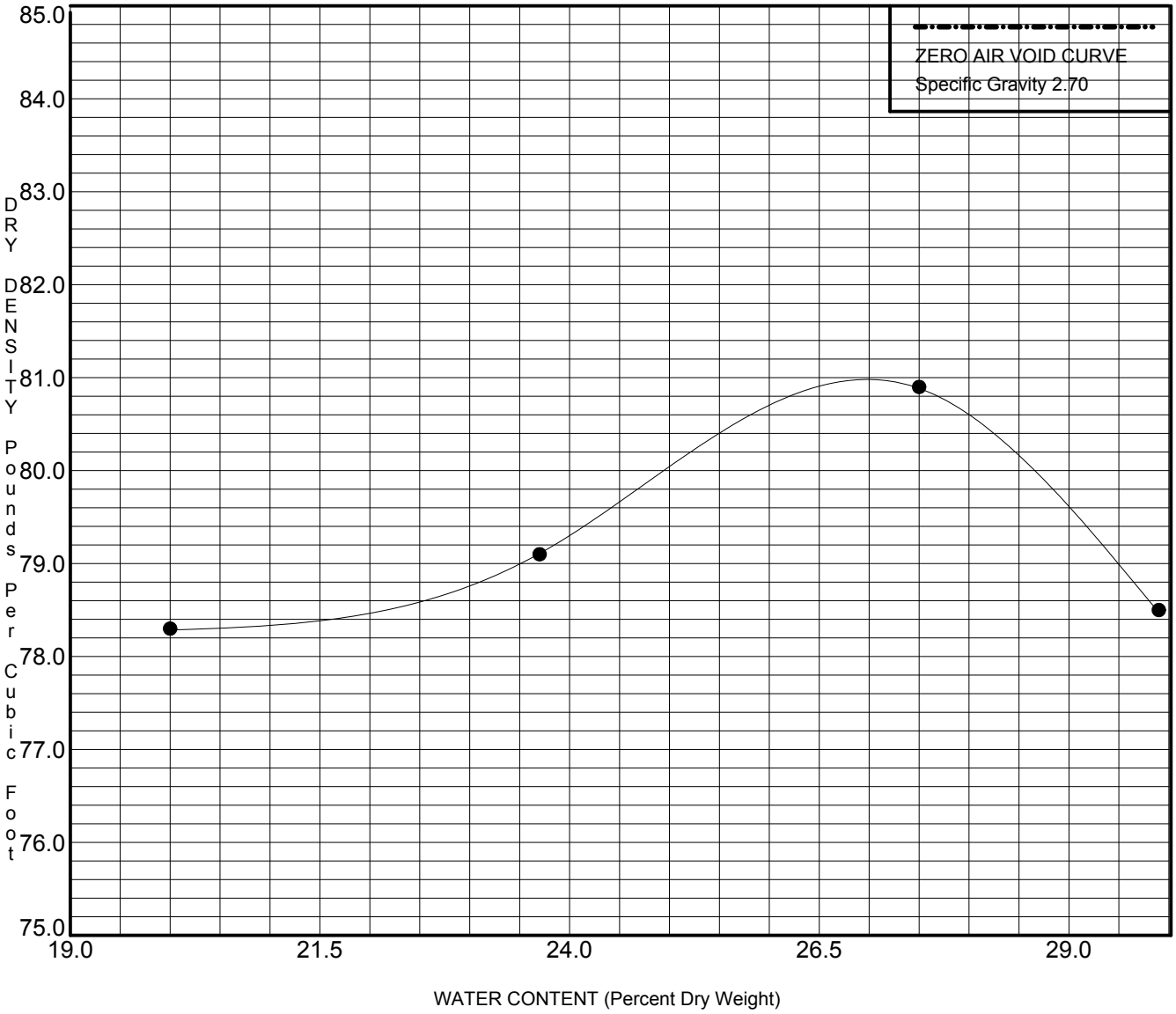


SPECIMEN IDENTIFICATION	CLASSIFICATION
Gypsum	Gypsum

MOISTURE/DENSITY RELATIONSHIP	
Standard ASTM D698/AASHTO T99	
Modified ASTM D1557/AASHTO T180	
Maximum Dry Density (PCF)	**81.0**
Optimum Water Content (%)	**27.0**

NOTES :

PROJECT **Duck Creek Bottom Ash Basins** JOB NO. **21-026**

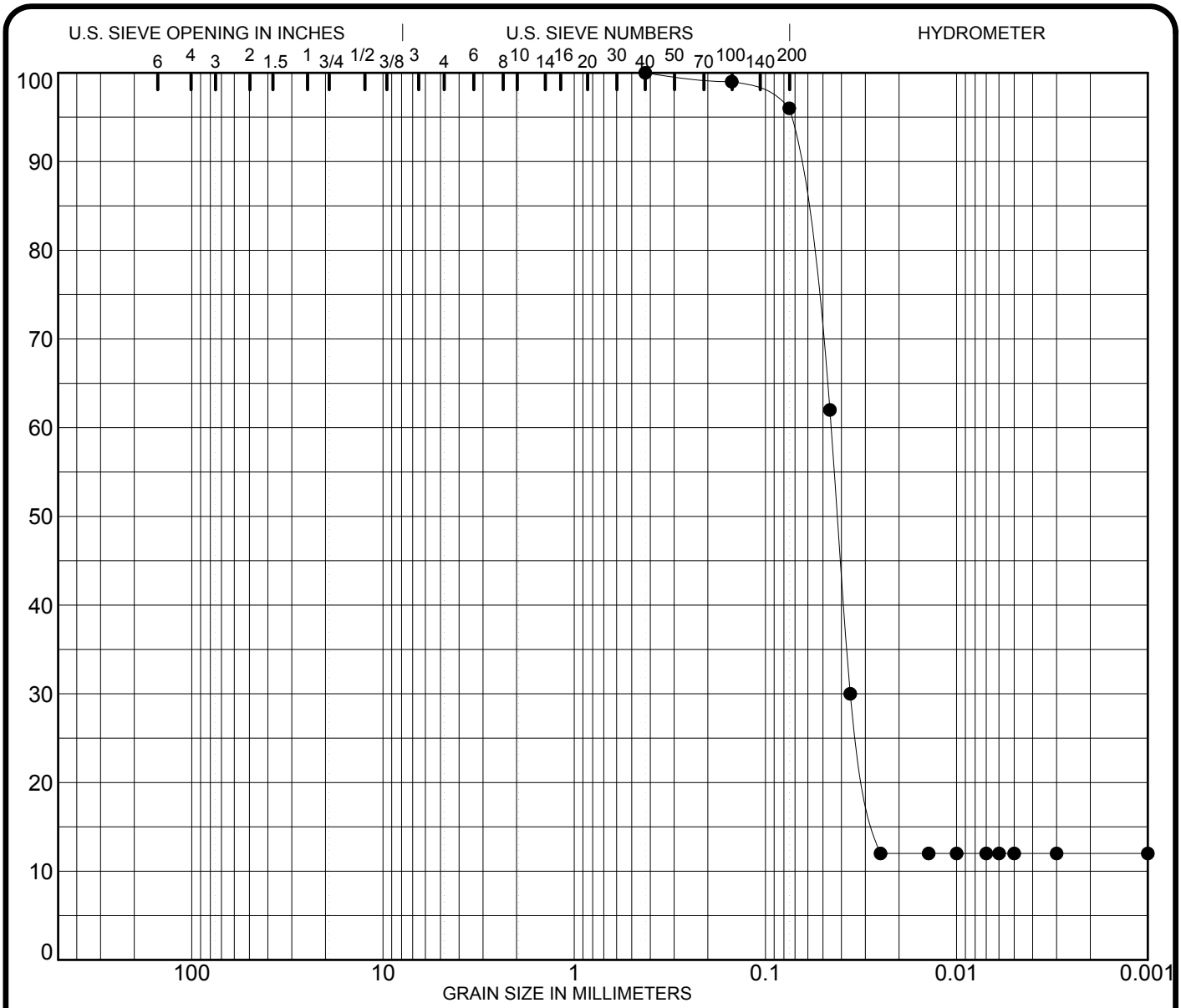
LOCATION **Fulton County, Illinois** DATE **March 18, 2021**

Gypsum

MOISTURE-DENSITY RELATIONSHIP

Ramsey Geotechnical Engineering

Bloomington, IL 61701



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SPECIMEN IDENTIFICATION	SIEVE	% PASS	CLASSIFICATION			
Gypsum	3/8	100.0	Gypsum			
	#4	100.0				
	#8	100.0				
	#10	100.0	%GRAVEL	%SAND	%SILT	%CLAY
NOTES:	# 16	100.0	0	4		
Specific Gravity - 2.31	# 30	100.0				
	# 40	100.0	MC%	γ_{dry} (pcf)	LL	PL	PI
	# 50		32.5				
	# 80					
	# 100	99.0	Density/Moisture Relationship: Standard			
	# 200	96.0	Max PCF	81.0	Opt. WC%	27.0

PROJECT **Duck Creek Bottom Ash Basins - Fulton County, Illinois**

JOB NO. **21-026**

DATE March 18, 2021

Gypsum

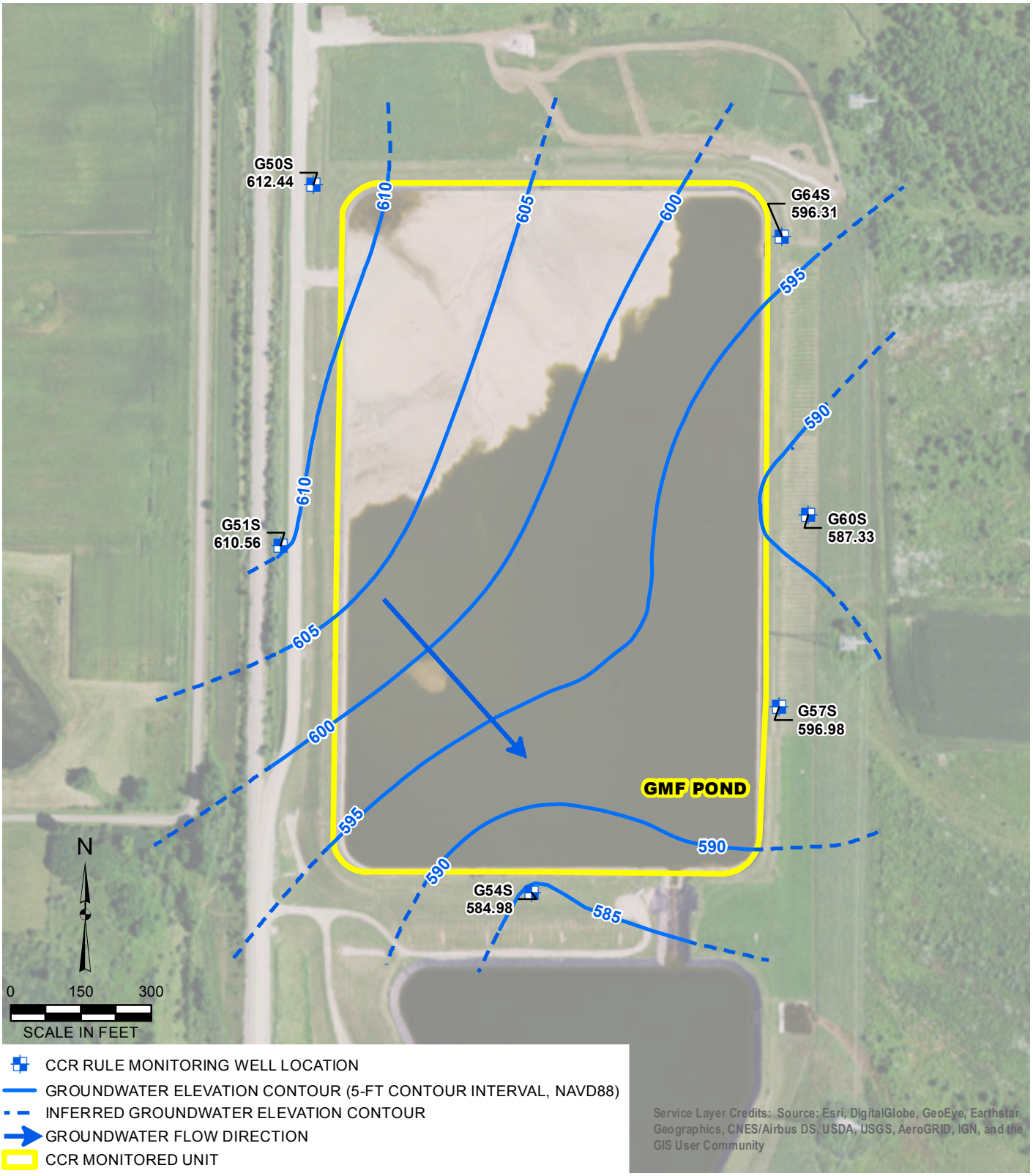
SOIL DATA SHEET

Ramsey Geotechnical Engineering

Bloomington, IL 61701

APPENDIX D
GROUNDWATER CONTOUR MAPS AND ELEVATIONS

GROUNDWATER CONTOUR MAPS



DRAWN BY/DATE:
SDS 1/23/17
REVIEWED BY/DATE:
ANS 1/25/17
APPROVED BY/DATE:
JJW 2/7/17

DUCK CREEK GMF POND (UNIT ID: 203)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 1: DECEMBER 2, 2015

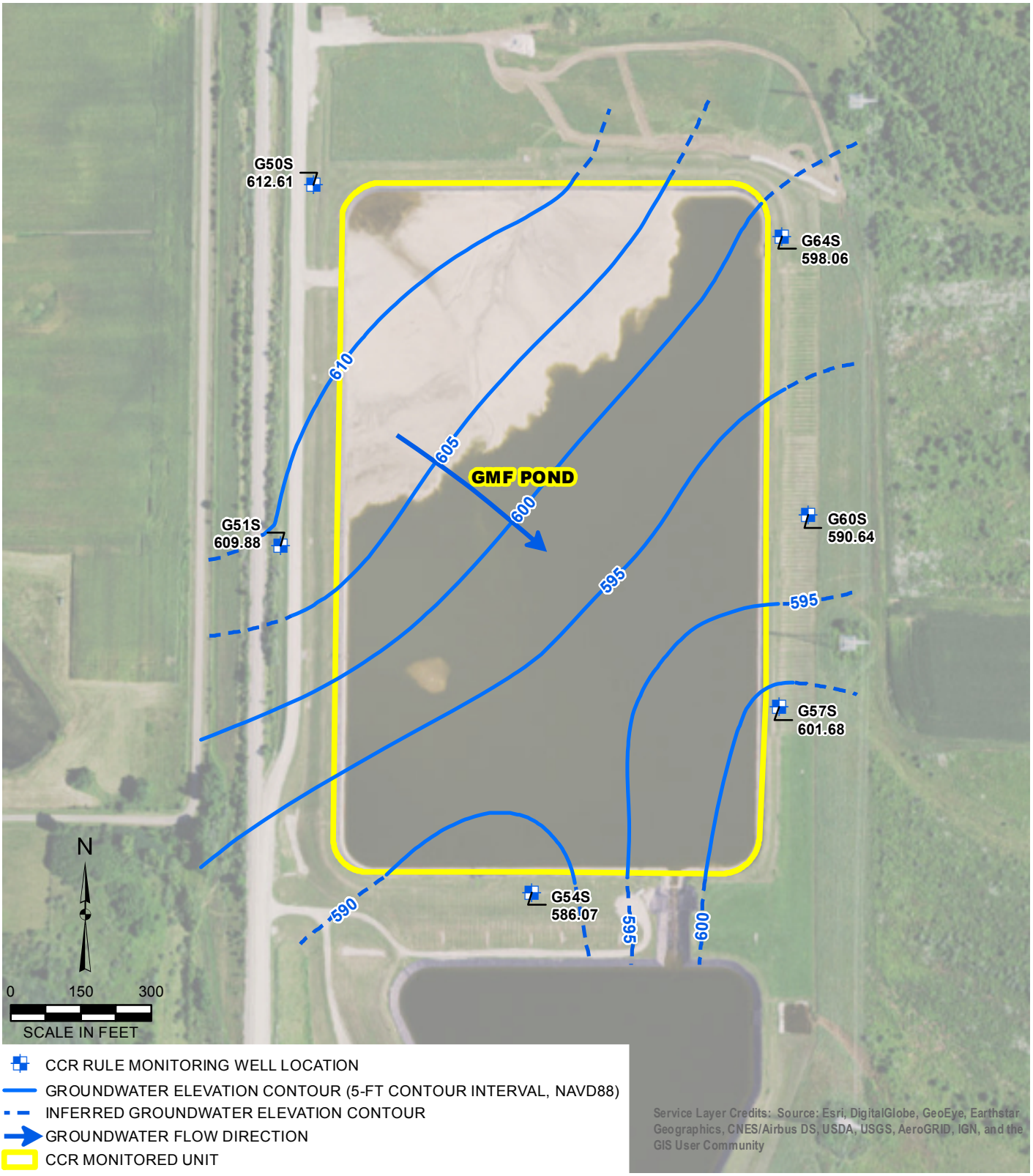
DYNEGY CCR RULE GROUNDWATER MONITORING
DUCK CREEK POWER STATION
CANTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\22\2285\MXD\GW_Contours\Round_01\R1_DuckCreekGMFP_GW_Contours.mxd Author: sstolz Date/Time: 3/2/2017, 2:44:52 PM



DRAWN BY/DATE:
SDS 1/23/17
REVIEWED BY/DATE:
ANS 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

DUCK CREEK GMF POND (UNIT ID: 203)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 2: JANUARY 25, 2016

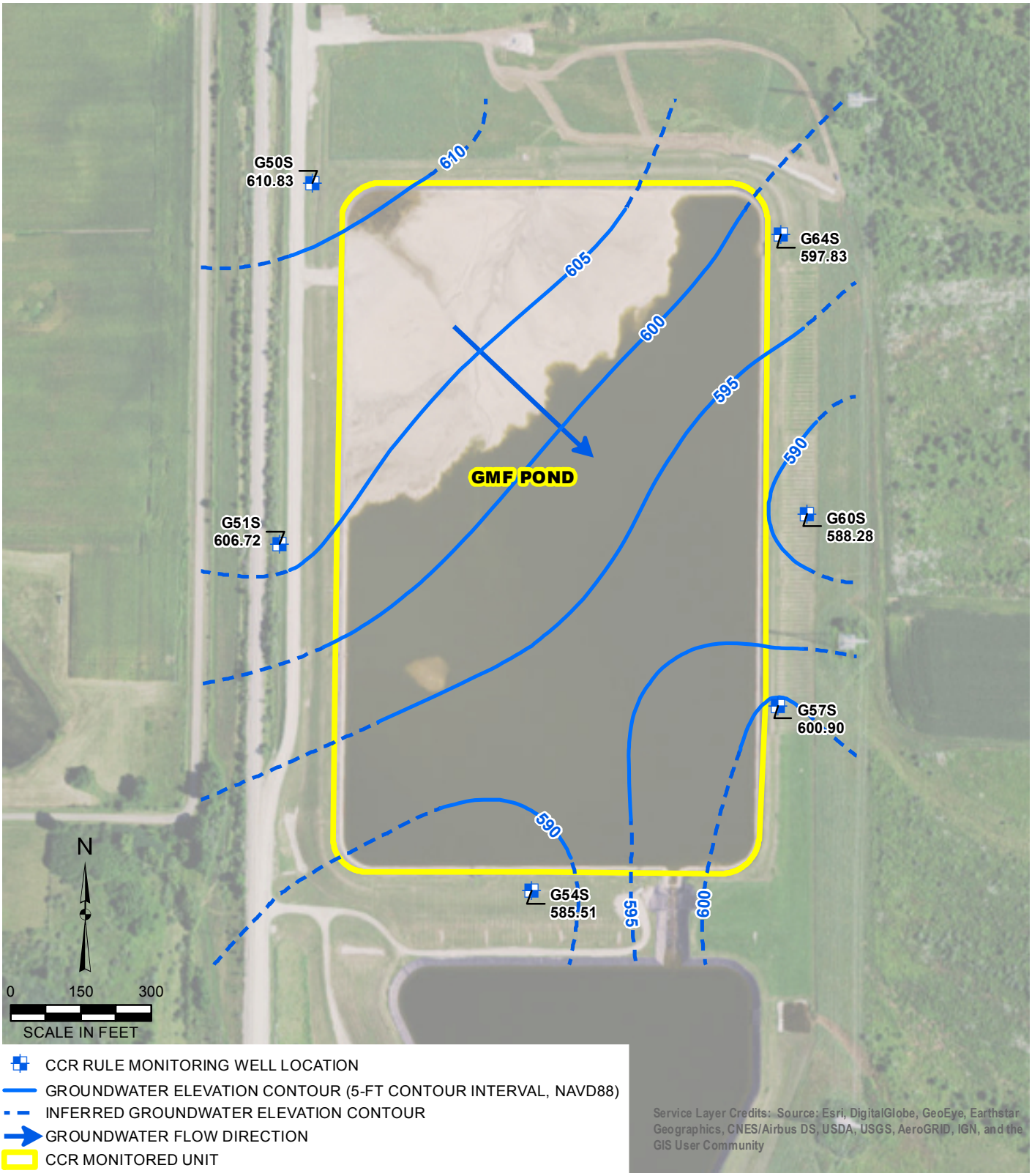
DYNEGY CCR RULE GROUNDWATER MONITORING
DUCK CREEK POWER STATION
CANTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\22\2285\MXD\GW_Contours\Round_02\R2_DuckCreekGMFP_GW_Contours.mxd Author: sstolz Date/Time: 3/2/2017, 3:41:36 PM



DRAWN BY/DATE:
SDS 1/23/17
REVIEWED BY/DATE:
ANS 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

DUCK CREEK GMF POND (UNIT ID: 203)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 3: APRIL 18, 2016

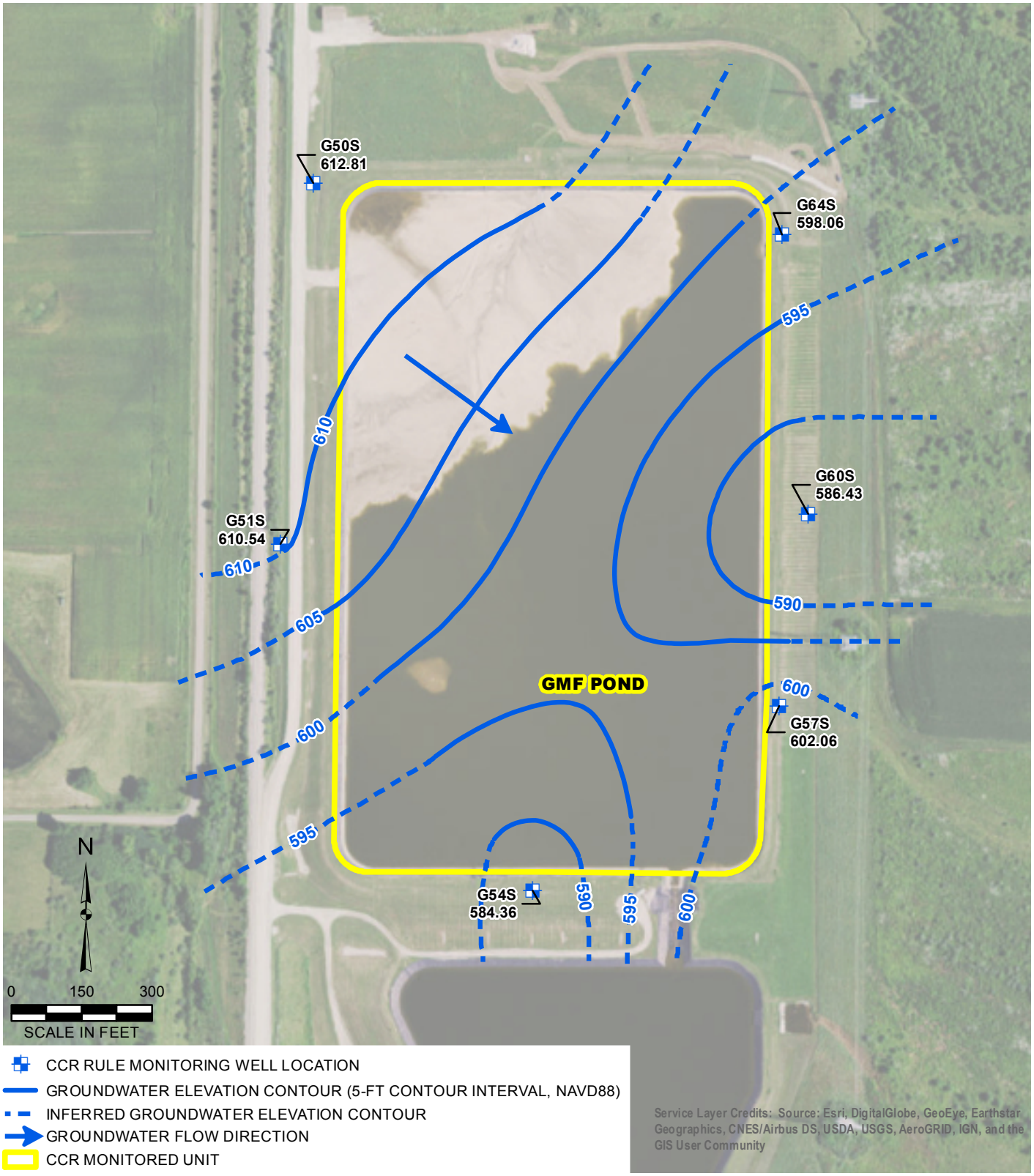
DYNEGY CCR RULE GROUNDWATER MONITORING
DUCK CREEK POWER STATION
CANTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\22\2285\MXD\GW_Contours\Round_03\R3_DuckCreekGMFP_GW_Contours.mxd Author: sstolz Date/Time: 3/3/2017, 11:30:08 AM



DRAWN BY/DATE:
SDS 1/23/17
REVIEWED BY/DATE:
ANS 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

DUCK CREEK GMF POND (UNIT ID: 203)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 4: AUGUST 9, 2016

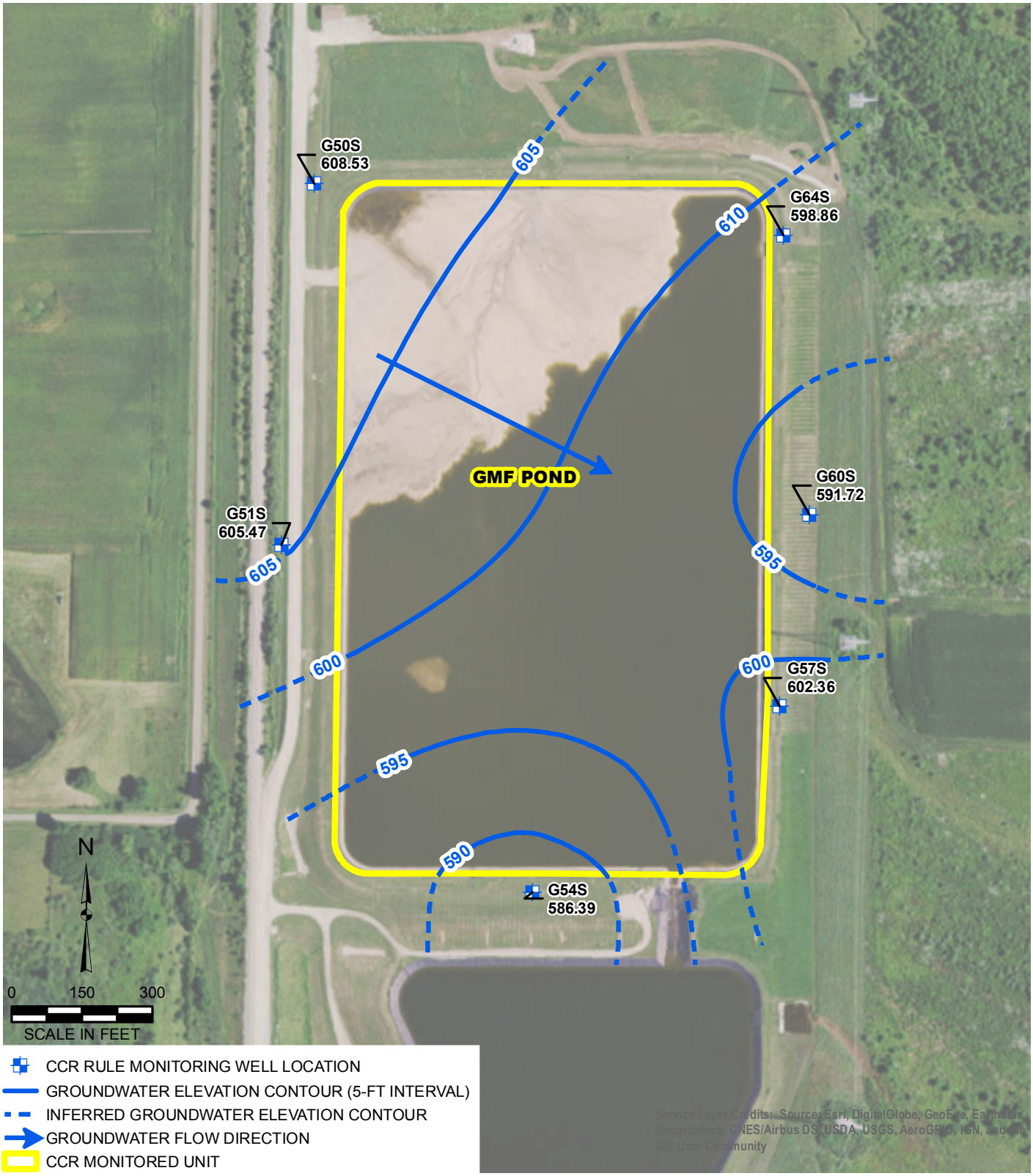
DYNEGY CCR RULE GROUNDWATER MONITORING
DUCK CREEK POWER STATION
CANTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\22\2285\MXD\GW_Contours\Round_04\R4_DuckCreekGMFP_GW_Contours.mxd Author: sstolz Date/Time: 3/3/2017, 1:54:35 PM



DRAWN BY/DATE:
SDS 3/6/17
REVIEWED BY/DATE:
ANS 3/6/17
APPROVED BY/DATE:
JJW 9/1/17

DUCK CREEK GMF POND (UNIT ID: 203)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 5: OCTOBER 14, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
DUCK CREEK POWER STATION
CANTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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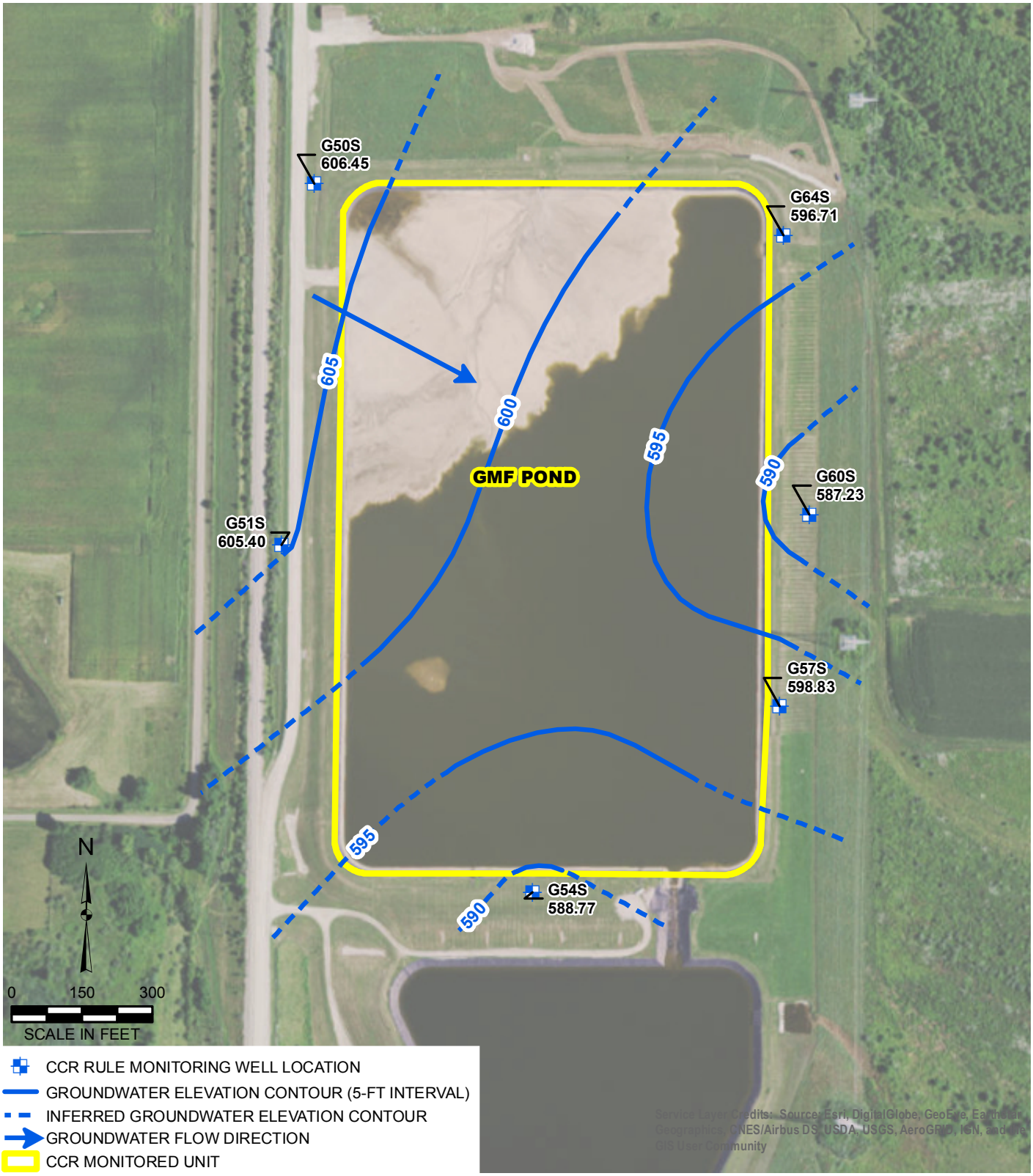

DRAWN BY/DATE:
SDS 3/6/17
REVIEWED BY/DATE:
ANS 3/6/17
APPROVED BY/DATE:
JJW 9/1/17

DUCK CREEK GMF POND (UNIT ID: 203)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 6: JANUARY 9, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
DUCK CREEK POWER STATION
CANTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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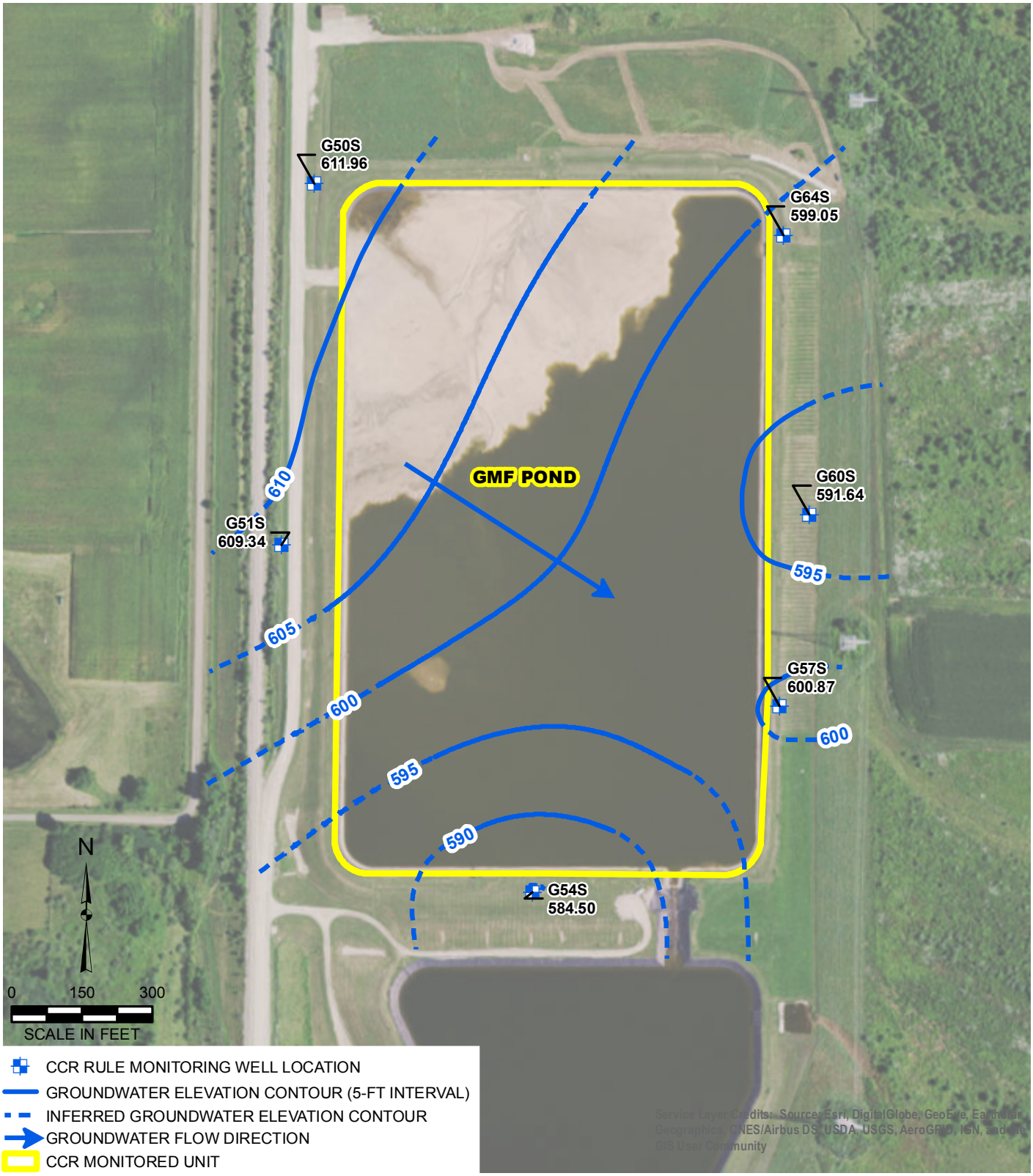

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REVIEWED BY/DATE:
ANS 5/25/17
APPROVED BY/DATE:
JJW 9/1/17

DUCK CREEK GMF POND (UNIT ID: 203)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 7: APRIL 2, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
DUCK CREEK POWER STATION
CANTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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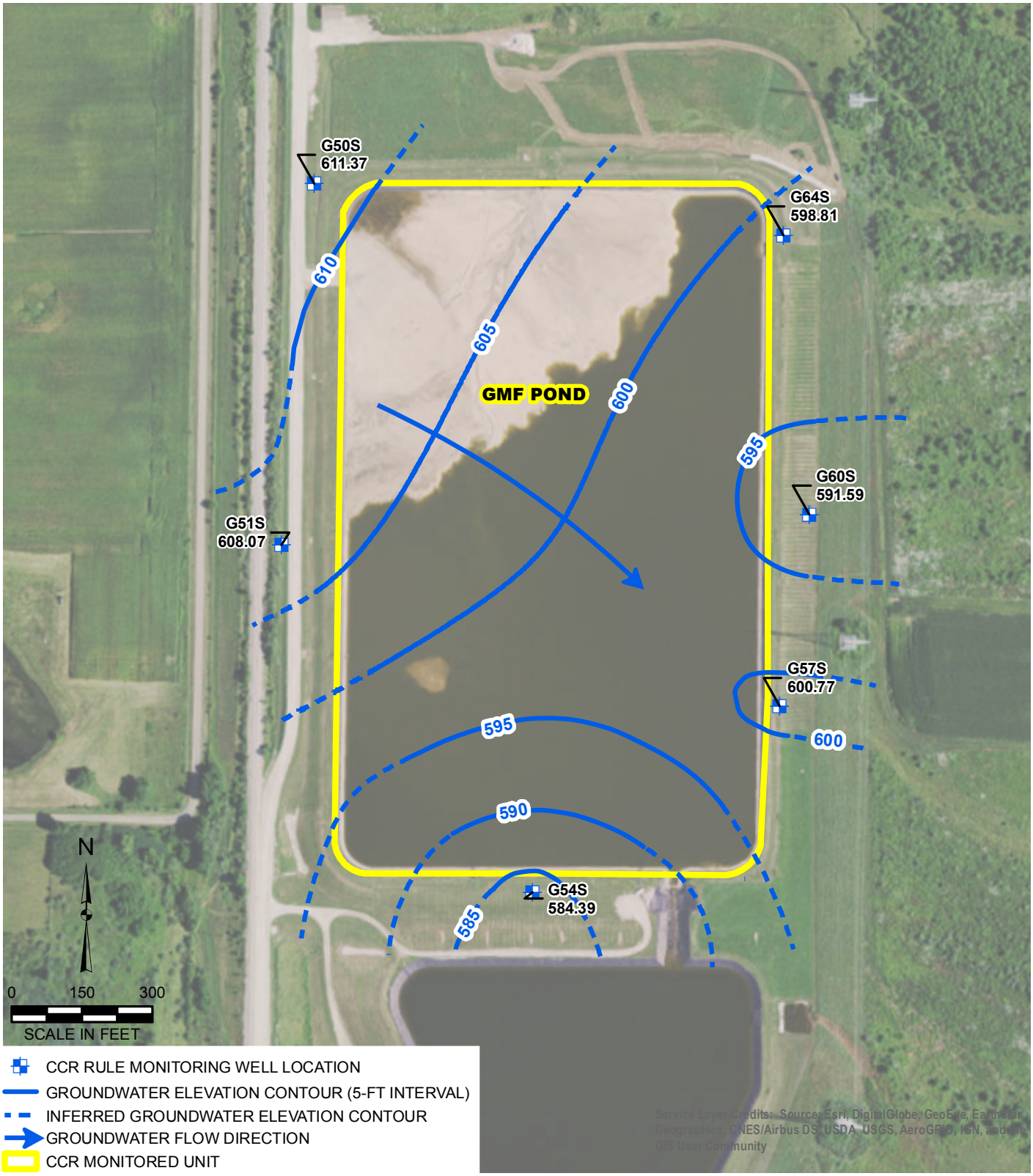

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REVIEWED BY/DATE:
ANS 7/28/17
APPROVED BY/DATE:
JJW 9/1/17

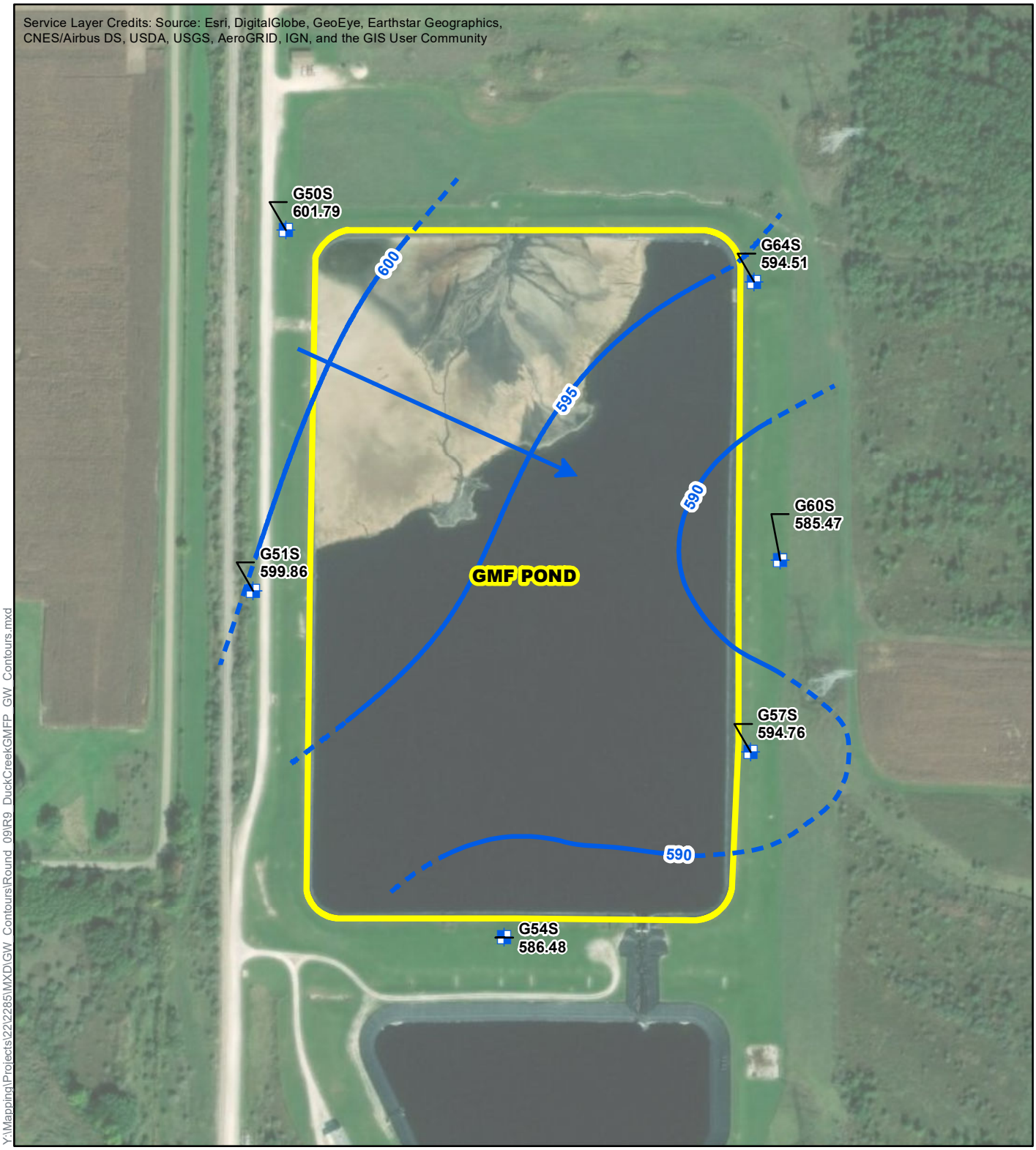
DUCK CREEK GMF POND (UNIT ID: 203)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 8: JUNE 28, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
DUCK CREEK POWER STATION
CANTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

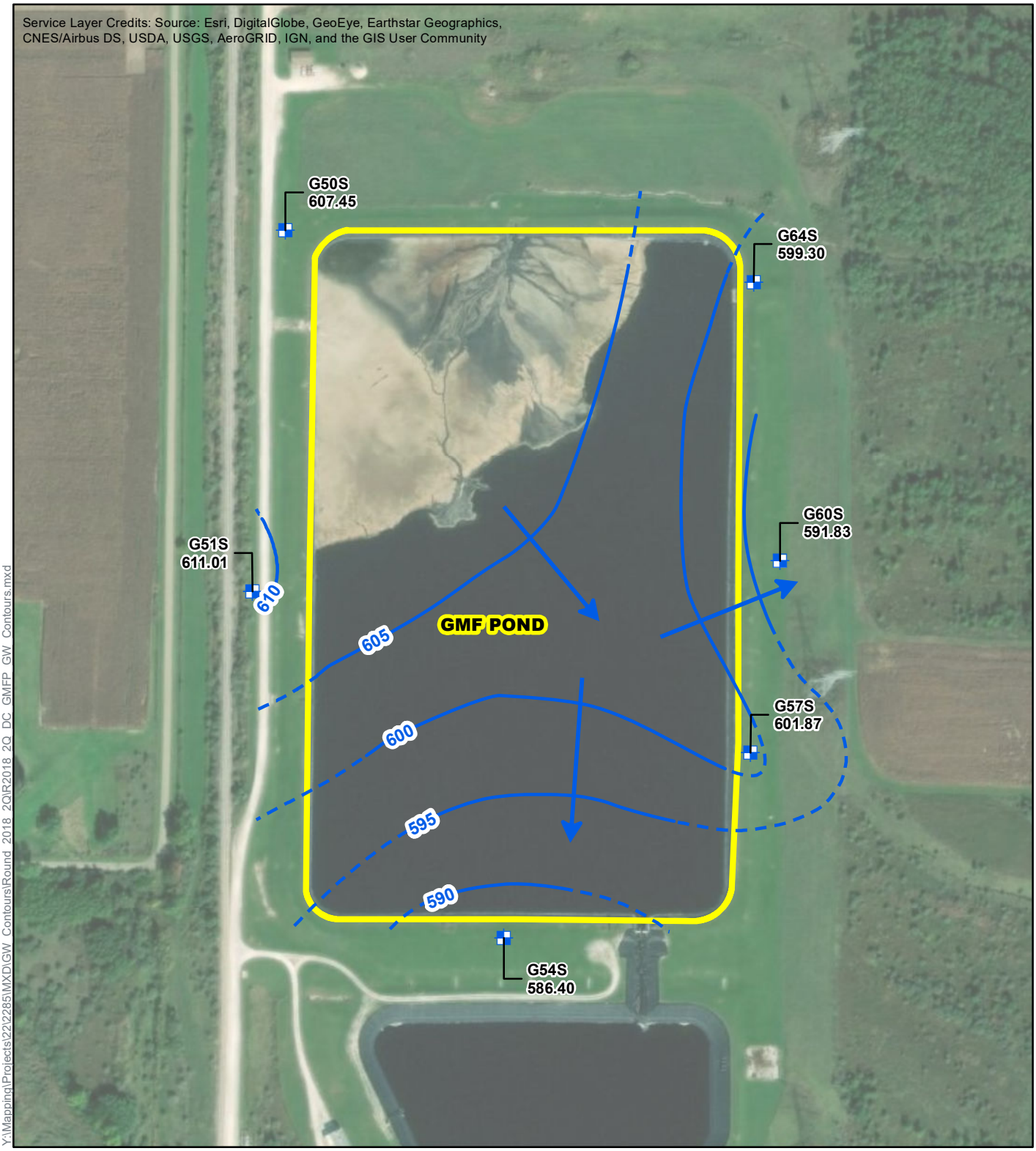
DUCK CREEK GMF POND (UNIT ID: 203)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 8, 2017

CCR RULE GROUNDWATER MONITORING
DUCK CREEK POWER STATION
CANTON, ILLINOIS

0 62.5 125 250
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



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CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

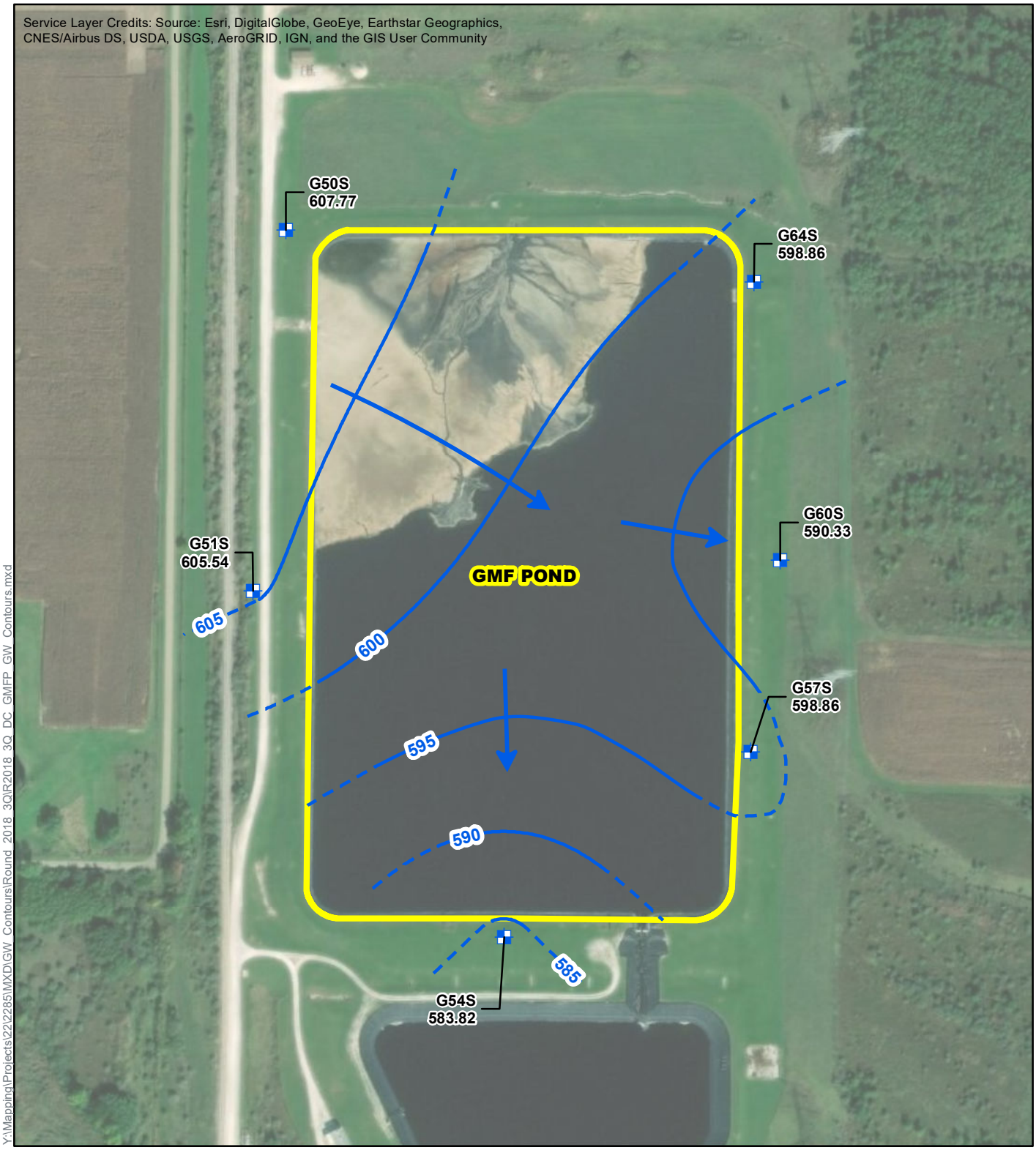
DUCK CREEK GMF POND (UNIT ID: 203)
GROUNDWATER ELEVATION CONTOUR MAP
APRIL 10, 2018

CCR RULE GROUNDWATER MONITORING
DUCK CREEK POWER STATION
CANTON, ILLINOIS

0 62.5 125 250
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



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CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

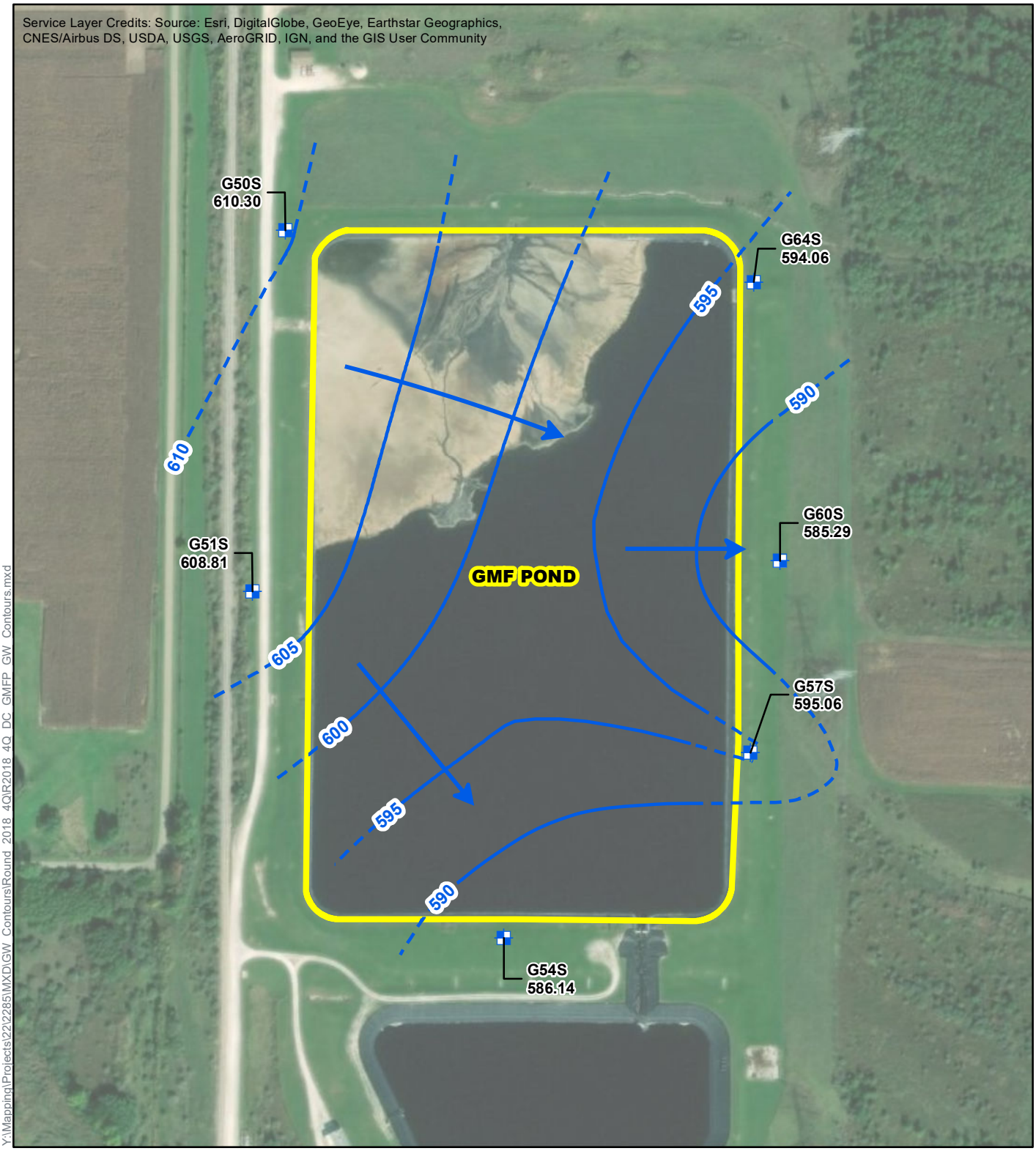
DUCK CREEK GMF POND (UNIT ID: 203)
GROUNDWATER ELEVATION CONTOUR MAP
JULY 2, 2018

CCR RULE GROUNDWATER MONITORING
DUCK CREEK POWER STATION
CANTON, ILLINOIS

0 62.5 125 250
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



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CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

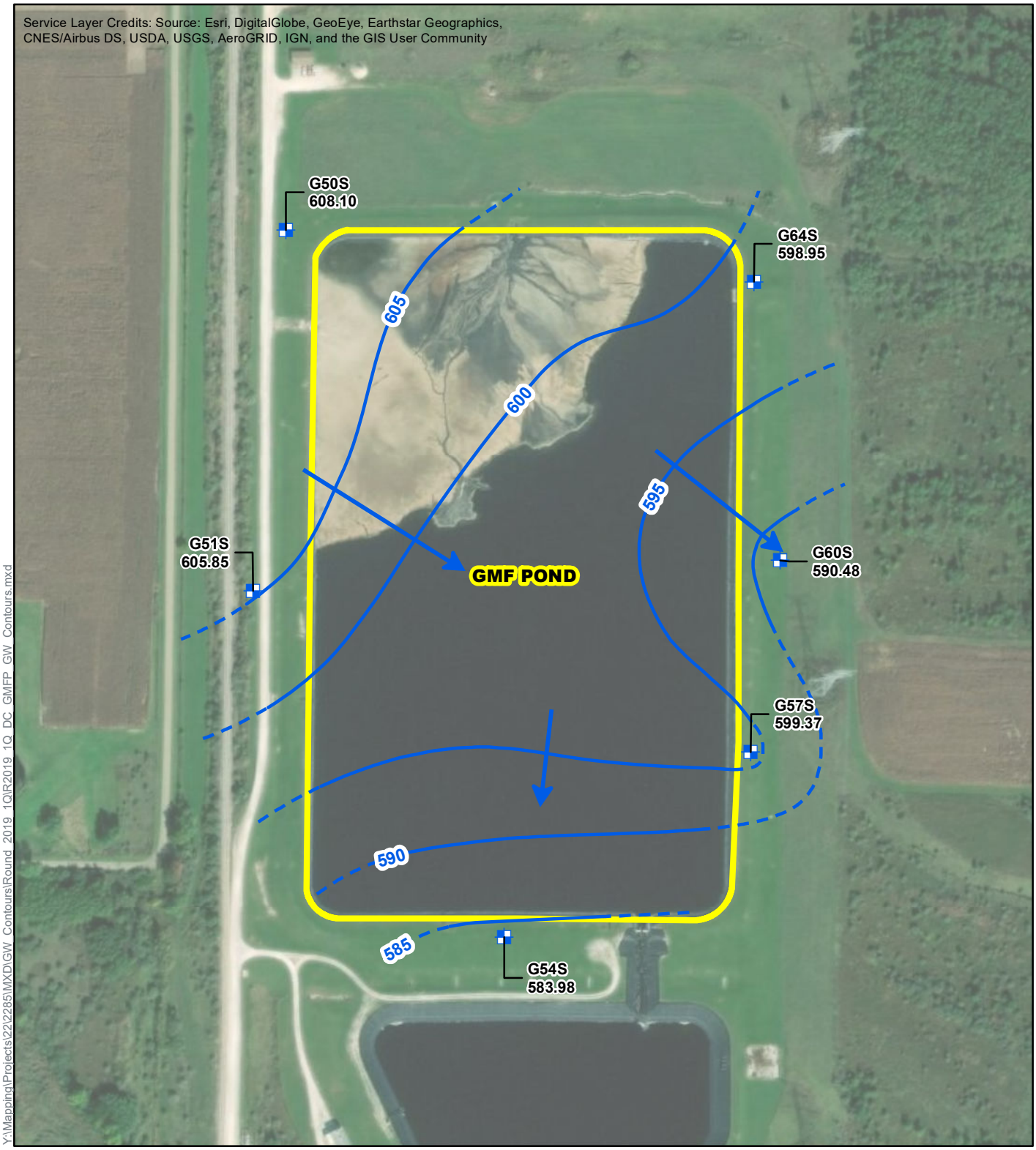
DUCK CREEK GMF POND (UNIT ID: 203)
GROUNDWATER ELEVATION CONTOUR MAP
OCTOBER 2, 2018

CCR RULE GROUNDWATER MONITORING
DUCK CREEK POWER STATION
CANTON, ILLINOIS

0 62.5 125 250
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



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CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

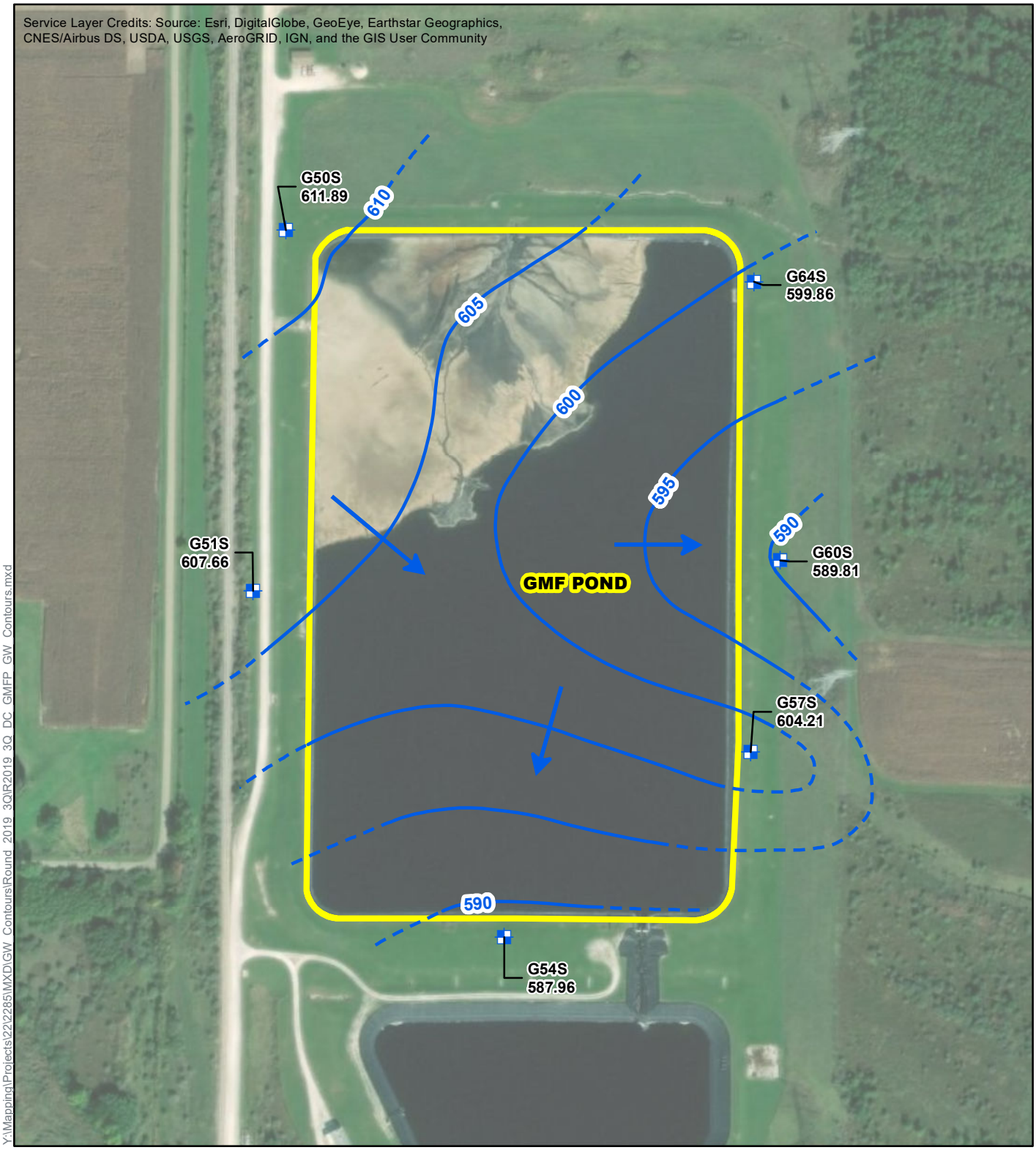
DUCK CREEK GMF POND (UNIT ID: 203)
GROUNDWATER ELEVATION CONTOUR MAP
JANUARY 7, 2019

CCR RULE GROUNDWATER MONITORING
DUCK CREEK POWER STATION
CANTON, ILLINOIS

0 62.5 125 250
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



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CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

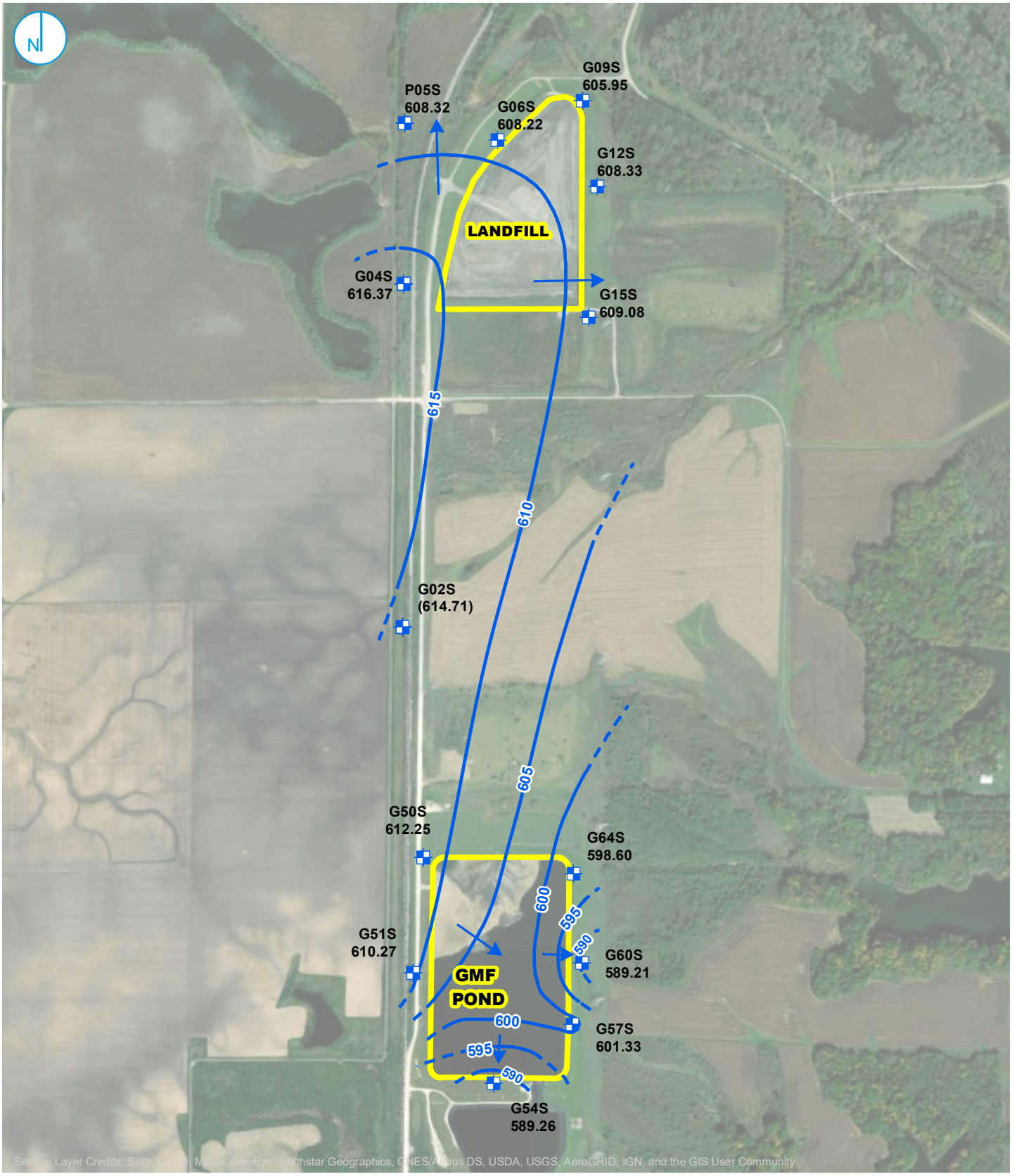
DUCK CREEK GMF POND (UNIT ID: 203)
GROUNDWATER ELEVATION CONTOUR MAP
JULY 1, 2019

CCR RULE GROUNDWATER MONITORING
DUCK CREEK POWER STATION
CANTON, ILLINOIS

0 62.5 125 250
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



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PROJECT: 169000XXXX | DATED: 8/28/2020 | DESIGNER: STOLZSD

- CCR RULE MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED UNIT

0 450 900 Feet

GROUNDWATER ELEVATION CONTOUR MAP
JANUARY 2-3, 2020

DUCK CREEK GMF POND (UNIT ID: 203)
AND LANDFILL (UNIT ID: 204)
VISTRA ENERGY
DUCK CREEK POWER STATION
CANTON, ILLINOIS

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

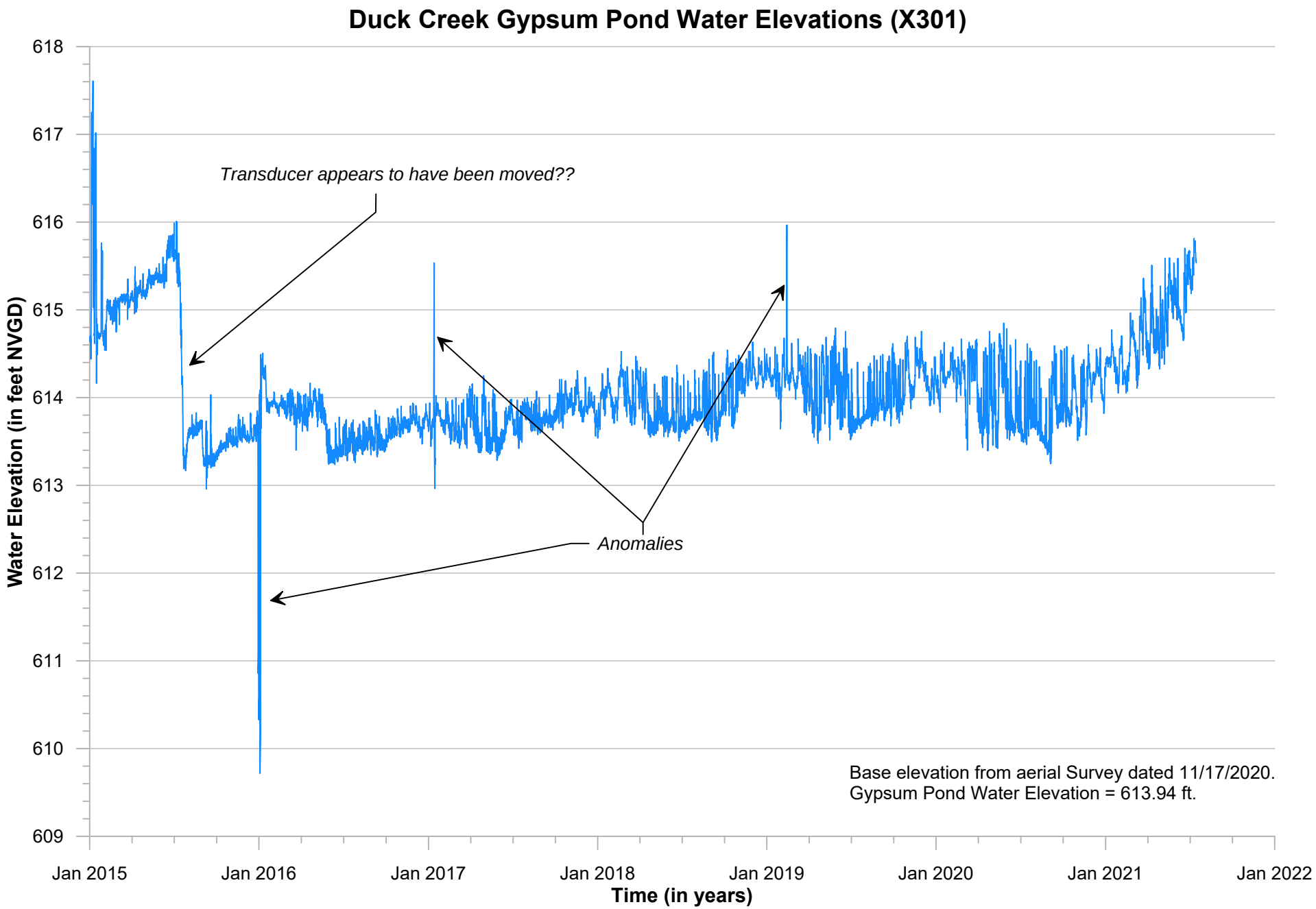

Duck Creek Gypsum Pond Water Elevations (X301)
Water Elevation (in feet NVGD)
618
617
616
615
614
613
612
611
610
609
Transducer appears to have been moved??
Anomalies
Base elevation from aerial Survey dated 11/17/2020.
Gypsum Pond Water Elevation = 613.94 ft.
Jan 2015
Jan 2016
Jan 2017
Jan 2018
Jan 2019
Jan 2020
Jan 2021
Jan 2022
Time (in years)

TABLE D-1. GROUNDWATER ELEVATION RESULTS

TABLE D-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G02L	02/18/2021	613.08
G02L	05/10/2021	616.01
G02L	08/05/2021	613.14
G02S	12/02/2015	615.45
G02S	01/25/2016	615.35
G02S	04/18/2016	611.81
G02S	08/09/2016	612.03
G02S	10/14/2016	611.55
G02S	01/09/2017	612.30
G02S	04/02/2017	614.75
G02S	06/28/2017	614.07
G02S	11/10/2017	606.10
G02S	01/17/2018	610.75
G02S	04/10/2018	614.73
G02S	07/02/2018	612.82
G02S	10/02/2018	609.88
G02S	01/07/2019	613.19
G02S	07/01/2019	611.06
G02S	01/03/2020	614.71
G02S	08/06/2020	610.89
G02S	11/16/2020	607.52
G02S	02/18/2021	612.97
G02S	02/19/2021	613.24
G02S	04/14/2021	614.98
G02S	04/28/2021	613.94
G02S	04/29/2021	614.65
G02S	05/10/2021	615.30
G02S	05/12/2021	614.97
G02S	06/01/2021	613.85
G02S	06/10/2021	613.50
G02S	06/15/2021	613.10
G02S	06/21/2021	613.84
G02S	07/12/2021	614.73
G02S	07/26/2021	613.93
G02S	07/28/2021	613.80
G02S	08/05/2021	613.30
G50L	11/18/2020	606.44
G50L	02/18/2021	611.14
G50L	02/19/2021	611.31
G50L	04/14/2021	614.31
G50L	04/28/2021	612.60
G50L	04/29/2021	612.43
G50L	05/10/2021	613.80
G50L	05/13/2021	613.27
G50L	06/01/2021	612.96

TABLE D-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G50L	06/10/2021	612.33
G50L	06/21/2021	612.48
G50L	07/12/2021	614.79
G50L	07/13/2021	616.06
G50L	07/26/2021	613.07
G50L	07/28/2021	612.78
G50L	08/05/2021	612.25
G50S	12/02/2015	612.44
G50S	01/25/2016	612.61
G50S	04/18/2016	610.83
G50S	08/09/2016	612.81
G50S	10/14/2016	608.53
G50S	01/09/2017	606.45
G50S	04/02/2017	611.96
G50S	06/28/2017	611.37
G50S	11/08/2017	601.79
G50S	04/10/2018	607.45
G50S	07/02/2018	607.77
G50S	10/02/2018	610.30
G50S	01/07/2019	608.10
G50S	07/01/2019	611.89
G50S	01/02/2020	612.25
G50S	08/06/2020	608.32
G50S	11/16/2020	605.58
G50S	11/18/2020	605.85
G50S	02/18/2021	610.30
G50S	02/19/2021	610.30
G50S	04/14/2021	612.98
G50S	04/28/2021	611.54
G50S	04/29/2021	614.22
G50S	05/10/2021	612.71
G50S	05/13/2021	612.15
G50S	06/01/2021	611.87
G50S	06/10/2021	611.15
G50S	06/21/2021	611.57
G50S	07/12/2021	613.25
G50S	07/13/2021	614.03
G50S	07/26/2021	612.06
G50S	07/28/2021	611.81
G50S	08/05/2021	611.21
G51L	11/18/2020	602.35
G51L	02/18/2021	606.81
G51L	02/19/2021	606.96
G51L	04/14/2021	610.50
G51L	04/28/2021	609.12

TABLE D-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G51L	05/10/2021	610.72
G51L	06/01/2021	609.14
G51L	06/10/2021	606.57
G51L	06/21/2021	608.97
G51L	07/12/2021	610.66
G51L	07/26/2021	608.51
G51L	08/05/2021	605.95
G51S	12/02/2015	610.56
G51S	01/25/2016	609.88
G51S	04/18/2016	606.72
G51S	08/09/2016	610.54
G51S	10/14/2016	605.47
G51S	01/09/2017	605.40
G51S	04/02/2017	609.34
G51S	06/28/2017	608.07
G51S	11/08/2017	599.86
G51S	04/10/2018	611.01
G51S	07/02/2018	605.54
G51S	10/02/2018	608.81
G51S	01/07/2019	605.85
G51S	07/01/2019	607.66
G51S	01/02/2020	610.27
G51S	08/06/2020	603.64
G51S	11/16/2020	602.10
G51S	11/18/2020	602.40
G51S	02/18/2021	607.04
G51S	02/19/2021	607.04
G51S	04/14/2021	610.69
G51S	04/28/2021	609.35
G51S	04/29/2021	610.56
G51S	05/10/2021	610.93
G51S	05/13/2021	610.39
G51S	06/01/2021	609.44
G51S	06/10/2021	606.98
G51S	06/15/2021	605.80
G51S	06/21/2021	609.37
G51S	07/12/2021	610.91
G51S	07/26/2021	608.84
G51S	07/27/2021	608.29
G51S	08/05/2021	606.34
G52L	11/18/2020	591.84
G52L	02/18/2021	593.43
G52L	02/19/2021	593.53
G52L	04/14/2021	596.93
G52L	04/28/2021	596.16

TABLE D-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G52L	05/10/2021	596.82
G52L	06/01/2021	597.15
G52L	06/10/2021	596.04
G52L	06/21/2021	595.09
G52L	07/12/2021	597.20
G52L	07/26/2021	596.89
G52L	08/05/2021	595.67
G52S	02/18/2021	589.65
G52S	05/10/2021	596.45
G52S	08/05/2021	589.39
G53L	11/18/2020	605.53
G53L	02/18/2021	607.98
G53L	02/22/2021	608.43
G53L	05/10/2021	613.90
G53L	08/05/2021	612.79
G53S	11/18/2020	603.70
G53S	02/18/2021	606.48
G53S	02/22/2021	606.81
G53S	05/10/2021	610.80
G53S	08/05/2021	610.14
G54C	04/14/2021	581.99
G54C	04/28/2021	581.10
G54C	04/29/2021	580.28
G54C	05/10/2021	580.11
G54C	05/12/2021	580.11
G54C	06/01/2021	581.00
G54C	06/10/2021	580.47
G54C	06/21/2021	579.83
G54C	07/12/2021	582.36
G54C	07/26/2021	581.64
G54C	08/05/2021	578.99
G54L	11/17/2020	592.43
G54L	02/18/2021	591.36
G54L	02/22/2021	591.69
G54L	04/14/2021	591.47
G54L	04/28/2021	591.11
G54L	04/29/2021	591.30
G54L	05/10/2021	591.22
G54L	05/12/2021	591.22
G54L	06/01/2021	591.52
G54L	06/10/2021	591.78
G54L	06/14/2021	591.77
G54L	06/21/2021	592.11
G54L	07/12/2021	592.97
G54L	07/13/2021	594.53

TABLE D-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G54L	07/26/2021	592.50
G54L	07/27/2021	592.51
G54L	08/05/2021	592.79
G54S	12/02/2015	584.98
G54S	01/25/2016	586.07
G54S	04/18/2016	585.51
G54S	08/09/2016	584.36
G54S	10/14/2016	586.39
G54S	01/09/2017	588.77
G54S	04/02/2017	584.50
G54S	06/28/2017	584.39
G54S	11/08/2017	586.48
G54S	01/18/2018	585.43
G54S	04/10/2018	586.40
G54S	07/02/2018	583.82
G54S	10/02/2018	586.14
G54S	01/07/2019	583.98
G54S	07/01/2019	587.96
G54S	01/02/2020	589.26
G54S	08/06/2020	591.39
G54S	11/16/2020	591.47
G54S	11/17/2020	591.31
G54S	02/18/2021	590.52
G54S	02/22/2021	590.52
G54S	04/14/2021	590.44
G54S	04/28/2021	590.52
G54S	05/10/2021	590.53
G54S	06/01/2021	590.80
G54S	06/10/2021	591.07
G54S	06/21/2021	591.23
G54S	07/12/2021	591.76
G54S	07/26/2021	591.98
G54S	08/05/2021	592.55
G55L	11/17/2020	597.65
G55L	02/18/2021	595.73
G55L	02/22/2021	596.28
G55L	05/10/2021	597.38
G55L	08/05/2021	599.54
G55S	11/17/2020	597.42
G55S	02/18/2021	595.68
G55S	02/22/2021	596.14
G55S	05/10/2021	597.41
G55S	08/05/2021	599.57
G56L	11/17/2020	598.87
G56L	02/18/2021	597.50

TABLE D-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G56L	02/22/2021	598.01
G56L	04/14/2021	602.88
G56L	04/28/2021	603.24
G56L	05/10/2021	603.44
G56L	06/01/2021	602.48
G56L	06/10/2021	604.14
G56L	06/21/2021	603.64
G56L	07/12/2021	605.23
G56L	07/26/2021	605.31
G56L	08/05/2021	604.62
G56S	11/17/2020	598.37
G56S	02/18/2021	598.06
G56S	02/22/2021	598.38
G56S	05/10/2021	603.62
G56S	08/05/2021	604.42
G57L	11/17/2020	596.17
G57L	02/18/2021	595.73
G57L	02/22/2021	595.88
G57L	04/14/2021	603.07
G57L	04/28/2021	602.15
G57L	05/10/2021	604.41
G57L	06/01/2021	603.88
G57L	06/10/2021	603.17
G57L	06/21/2021	602.45
G57L	07/12/2021	604.81
G57L	07/26/2021	604.43
G57L	08/05/2021	603.00
G57S	12/02/2015	596.98
G57S	01/25/2016	601.68
G57S	04/18/2016	600.90
G57S	08/09/2016	602.06
G57S	10/14/2016	602.36
G57S	01/09/2017	598.83
G57S	04/02/2017	600.87
G57S	06/28/2017	600.77
G57S	11/08/2017	594.76
G57S	01/18/2018	602.07
G57S	04/10/2018	601.87
G57S	07/02/2018	598.86
G57S	10/02/2018	595.06
G57S	01/07/2019	599.37
G57S	07/01/2019	604.21
G57S	01/02/2020	601.33
G57S	08/06/2020	600.65
G57S	11/16/2020	596.28

TABLE D-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G57S	11/17/2020	596.21
G57S	02/18/2021	596.21
G57S	02/22/2021	596.21
G57S	04/14/2021	601.83
G57S	04/28/2021	601.99
G57S	05/10/2021	602.61
G57S	06/01/2021	603.89
G57S	06/10/2021	603.20
G57S	06/21/2021	602.52
G57S	07/12/2021	604.68
G57S	07/26/2021	604.41
G57S	08/05/2021	603.51
G58L	11/18/2020	591.87
G58L	02/18/2021	591.24
G58L	02/22/2021	591.55
G58L	05/10/2021	597.62
G58L	08/05/2021	598.92
G58S	11/18/2020	591.87
G58S	02/18/2021	591.54
G58S	02/22/2021	592.02
G58S	05/10/2021	597.67
G58S	08/05/2021	598.87
G59L	11/18/2020	590.59
G59L	02/18/2021	588.96
G59L	02/22/2021	589.09
G59L	05/10/2021	599.77
G59L	08/05/2021	601.28
G59S	11/18/2020	587.04
G59S	02/18/2021	586.43
G59S	02/22/2021	586.88
G59S	05/10/2021	588.40
G59S	08/05/2021	598.43
G60L	11/17/2020	593.09
G60L	02/18/2021	593.56
G60L	02/23/2021	594.34
G60L	04/14/2021	606.78
G60L	04/28/2021	603.75
G60L	04/29/2021	604.10
G60L	05/10/2021	606.16
G60L	05/13/2021	605.30
G60L	06/01/2021	605.20
G60L	06/10/2021	603.76
G60L	06/15/2021	602.71
G60L	06/21/2021	603.43
G60L	07/12/2021	609.27

TABLE D-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G60L	07/26/2021	605.97
G60L	07/28/2021	605.54
G60L	08/05/2021	604.40
G60S	12/02/2015	587.33
G60S	01/25/2016	590.64
G60S	04/18/2016	588.28
G60S	08/09/2016	586.43
G60S	10/14/2016	591.72
G60S	01/09/2017	587.23
G60S	04/02/2017	591.64
G60S	06/29/2017	591.59
G60S	11/08/2017	585.47
G60S	01/19/2018	599.93
G60S	04/10/2018	591.83
G60S	07/02/2018	590.33
G60S	10/02/2018	585.29
G60S	01/07/2019	590.48
G60S	07/01/2019	589.81
G60S	01/02/2020	589.21
G60S	08/06/2020	588.88
G60S	11/16/2020	587.66
G60S	11/17/2020	587.47
G60S	02/18/2021	587.35
G60S	02/23/2021	587.35
G60S	04/14/2021	590.16
G60S	04/28/2021	589.76
G60S	05/10/2021	590.34
G60S	06/01/2021	590.54
G60S	06/10/2021	590.02
G60S	06/21/2021	589.48
G60S	07/12/2021	591.02
G60S	07/26/2021	590.71
G60S	08/05/2021	590.05
G61S	11/18/2020	595.85
G61S	02/18/2021	594.19
G61S	02/23/2021	594.48
G61S	05/10/2021	601.73
G61S	08/05/2021	604.46
G62L	11/18/2020	597.59
G62L	02/18/2021	595.63
G62L	02/24/2021	595.51
G62L	05/10/2021	603.44
G62L	08/05/2021	603.85
G63L	11/18/2020	596.38
G63L	02/18/2021	595.23

TABLE D-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G63L	02/24/2021	595.10
G63L	05/10/2021	599.58
G63L	08/05/2021	600.87
G63S	11/18/2020	595.43
G63S	02/18/2021	595.11
G63S	02/24/2021	595.53
G63S	05/10/2021	599.17
G63S	08/05/2021	601.78
G64L	11/18/2020	596.89
G64L	02/18/2021	596.41
G64L	02/25/2021	596.23
G64L	04/14/2021	600.43
G64L	04/28/2021	600.87
G64L	05/10/2021	601.22
G64L	06/01/2021	602.41
G64L	06/10/2021	601.95
G64L	06/21/2021	601.21
G64L	07/12/2021	602.32
G64L	07/26/2021	602.40
G64L	08/05/2021	601.70
G64S	12/02/2015	596.31
G64S	01/25/2016	598.06
G64S	04/18/2016	597.83
G64S	08/09/2016	598.06
G64S	10/14/2016	598.86
G64S	01/09/2017	596.71
G64S	04/02/2017	599.05
G64S	06/29/2017	598.81
G64S	11/08/2017	594.51
G64S	01/19/2018	600.88
G64S	04/10/2018	599.30
G64S	07/02/2018	598.86
G64S	10/02/2018	594.06
G64S	01/07/2019	598.95
G64S	07/01/2019	599.86
G64S	01/02/2020	598.60
G64S	08/06/2020	598.72
G64S	11/16/2020	596.27
G64S	11/18/2020	596.42
G64S	02/18/2021	596.13
G64S	02/24/2021	596.13
G64S	04/14/2021	599.04
G64S	04/28/2021	599.38
G64S	05/10/2021	599.64
G64S	06/01/2021	600.28

TABLE D-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
G64S	06/10/2021	599.97
G64S	06/21/2021	599.51
G64S	07/12/2021	600.50
G64S	07/26/2021	600.60
G64S	08/05/2021	600.04
P60	02/24/2021	591.82
P60	03/24/2021	593.80
P60	05/10/2021	598.86
P60	08/05/2021	601.39
P61	05/10/2021	606.78
P61	08/05/2021	603.86
P62	05/10/2021	602.28
P62	08/05/2021	603.46
P63	05/10/2021	601.64
P63	08/05/2021	601.91
P64	05/10/2021	605.52
P64	08/05/2021	603.10
R61L	11/18/2020	596.19
R61L	02/18/2021	594.59
R61L	02/23/2021	594.27
R61L	05/10/2021	601.43
R61L	08/05/2021	614.47

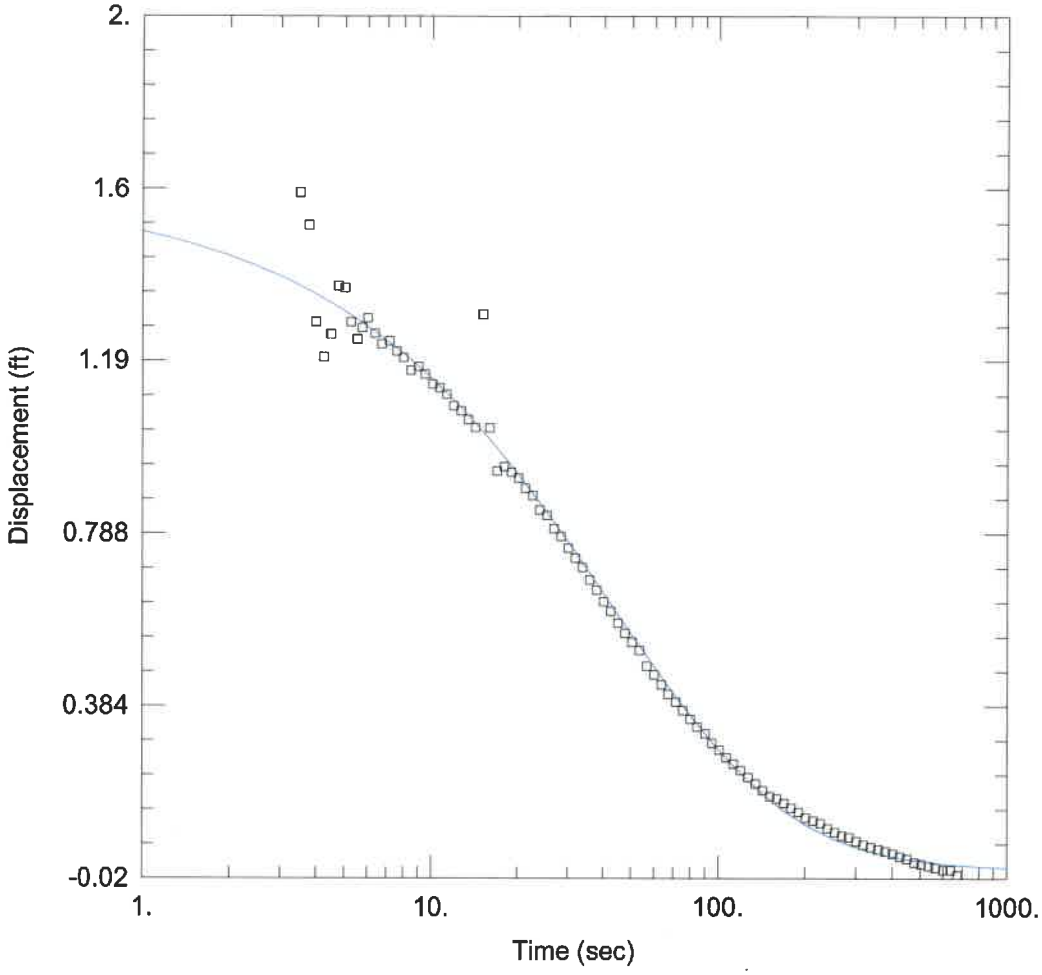
Notes:
ft NAVD88 = feet relative to the North American Vertical Datum 1988, GEOID 12A

generated 10/06/2021, 3:08:25 PM CDT

APPENDIX E
HYDRAULIC CONDUCTIVITY TEST DATA

Slug Test data summary - Duck Creek Gypsum Management Facility

Well ID	Falling Head k (cm/sec)	Specific Storage (1/ft)	FH Solution	Rising Head k (cm/sec)	Specific Storage (1/ft)	RH Solution	Average	Geo. Mean
G50L	2.30E-03	6.00E-03	KGS Model	2.10E-03	5.00E-03	KGS Model	2.20E-03	2.20E-03
G50S	6.50E-05	7.00E-03	KGS Model	1.50E-04	1.40E-05	KGS Model	1.08E-04	9.87E-05
G51L	3.00E-05	1.10E-03	KGS Model	*No test results*			3.00E-05	3.00E-05
G51S	7.20E-05	n/a	Bouwer-Rice	1.10E-04	1.50E-03	KGS Model	9.10E-05	8.90E-05
G53L	1.10E-04	2.90E-04	KGS Model	1.10E-04	1.10E-03	KGS Model	1.10E-04	1.10E-04
G53S	3.80E-03	2.00E-03	KGS Model	3.20E-03	1.00E-03	KGS Model	3.50E-03	3.49E-03
G54C	1.60E-04	n/a	Hvorslev	1.40E-04	n/a	Hvorslev	1.50E-04	1.50E-04
G54L	4.90E-05	n/a	Bouwer-Rice	2.20E-04	n/a	Bouwer-Rice	1.35E-04	1.04E-04
G54S	1.20E-04	n/a	Bouwer-Rice	2.10E-04	n/a	Bouwer-Rice	1.65E-04	1.59E-04
G57S	2.60E-03	7.00E-05	KGS Model	6.80E-04	2.20E-03	KGS Model	1.64E-03	1.33E-03
G60L	2.30E-04	6.00E-02	KGS Model	2.60E-04	3.50E-02	KGS Model	2.45E-04	2.45E-04
G60S	3.90E-03	7.10E-06	KGS Model	3.50E-03	7.00E-05	KGS Model	3.70E-03	3.69E-03
G63S	3.00E-04	2.00E-02	KGS Model	2.90E-04	2.00E-02	KGS Model	2.95E-04	2.95E-04



G50L FALLING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G50L-fh.aqt
Date: 06/02/21 Time: 16:26:20

AQUIFER DATA

Saturated Thickness: 5.04 ft

WELL DATA (G50L)

Initial Displacement: 1.6 ft
Total Well Penetration Depth: 7.64 ft
Casing Radius: 0.08333 ft

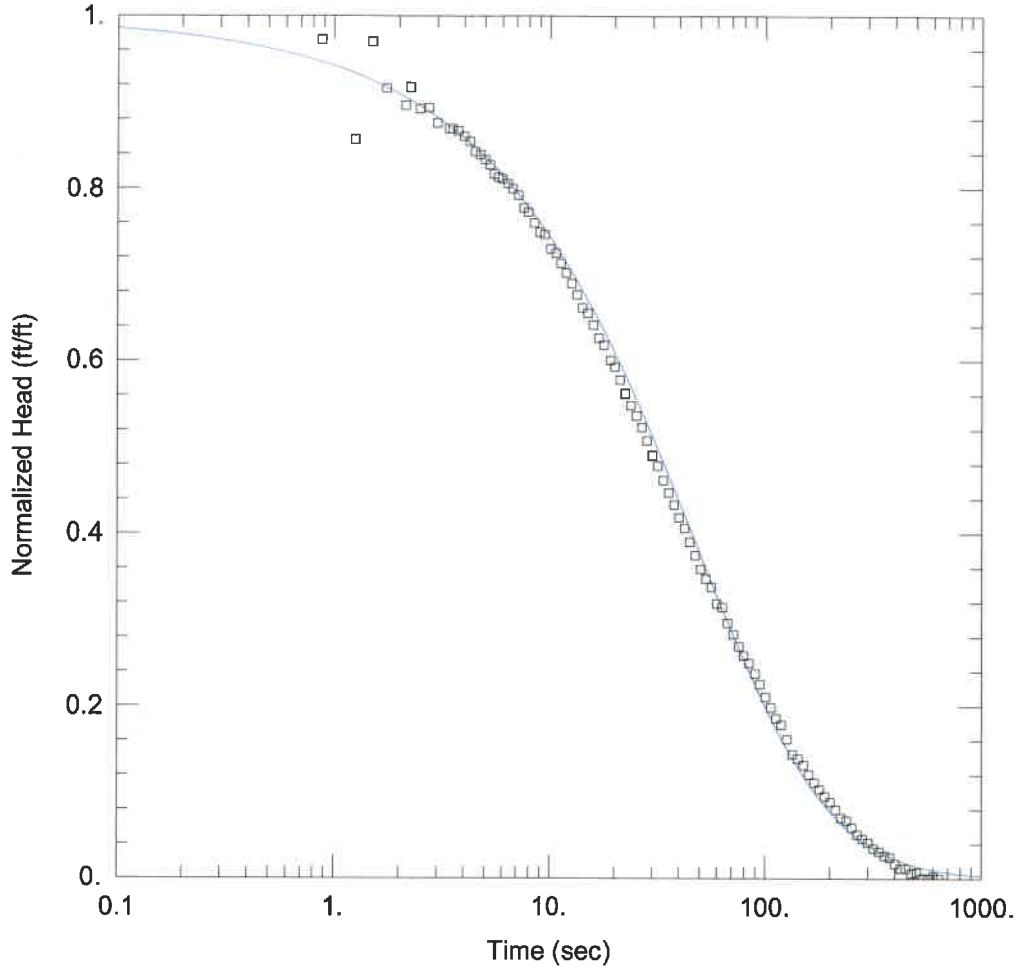
Static Water Column Height: 5.04 ft
Screen Length: 4.71 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.0023 cm/sec
Kz/Kr = 1.

Ss = 0.006 ft^{-1}



G50L RISING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G50L-rh.aqt
Date: 06/02/21 Time: 16:26:22

AQUIFER DATA

Saturated Thickness: 5.04 ft

WELL DATA (G50L)

Initial Displacement: 1.625 ft
Total Well Penetration Depth: 7.64 ft
Casing Radius: 0.08333 ft

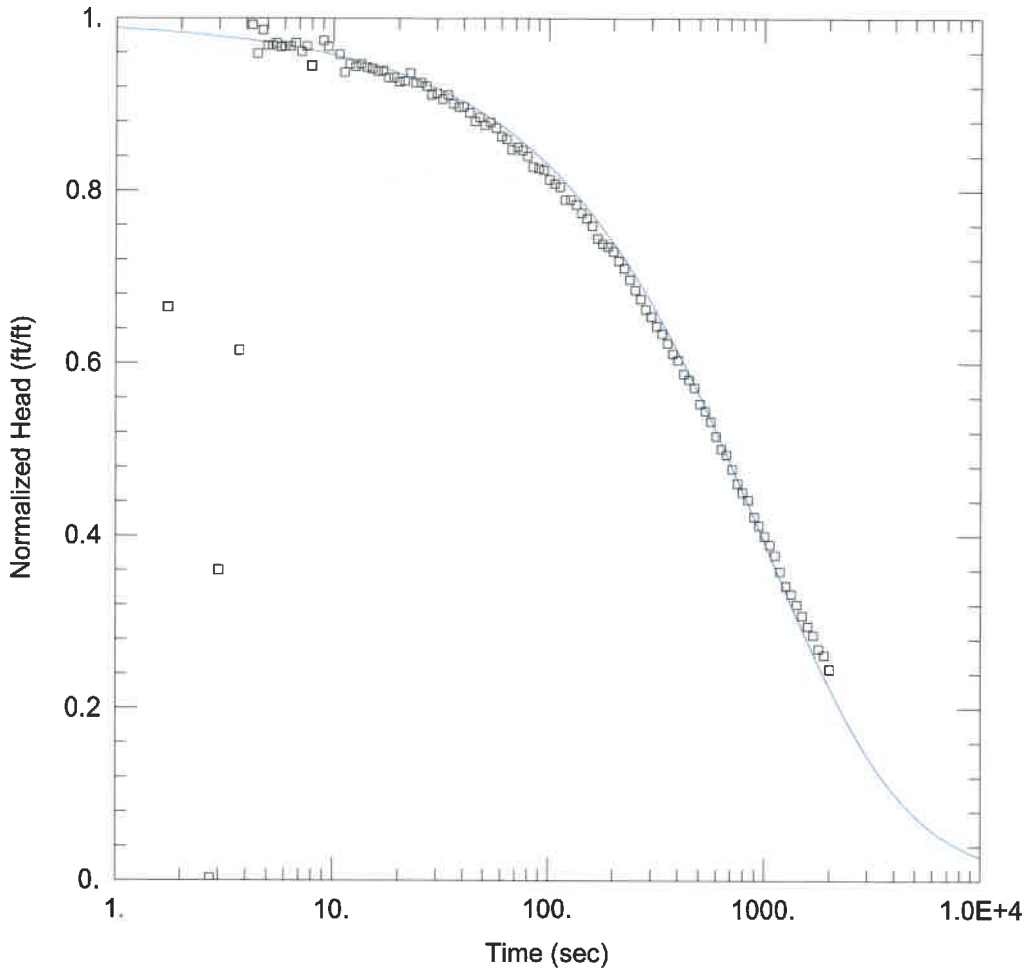
Static Water Column Height: 5.04 ft
Screen Length: 4.71 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.0021 cm/sec
Kz/Kr = 1.

Ss = 0.005 ft^{-1}



G50S FALLING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G50S-fh.aqt
Date: 06/02/21 Time: 16:26:23

PROJECT INFORMATION

Client: Duck Creek Power Statin
Project: 20E0111A
Location: Canton, IL
Test Well: G50S
Test Date: 4 Mar 2021

AQUIFER DATA

Saturated Thickness: 4.3 ft

WELL DATA (G50S)

Initial Displacement: 1.07 ft
Total Well Penetration Depth: 22.57 ft
Casing Radius: 0.08333 ft

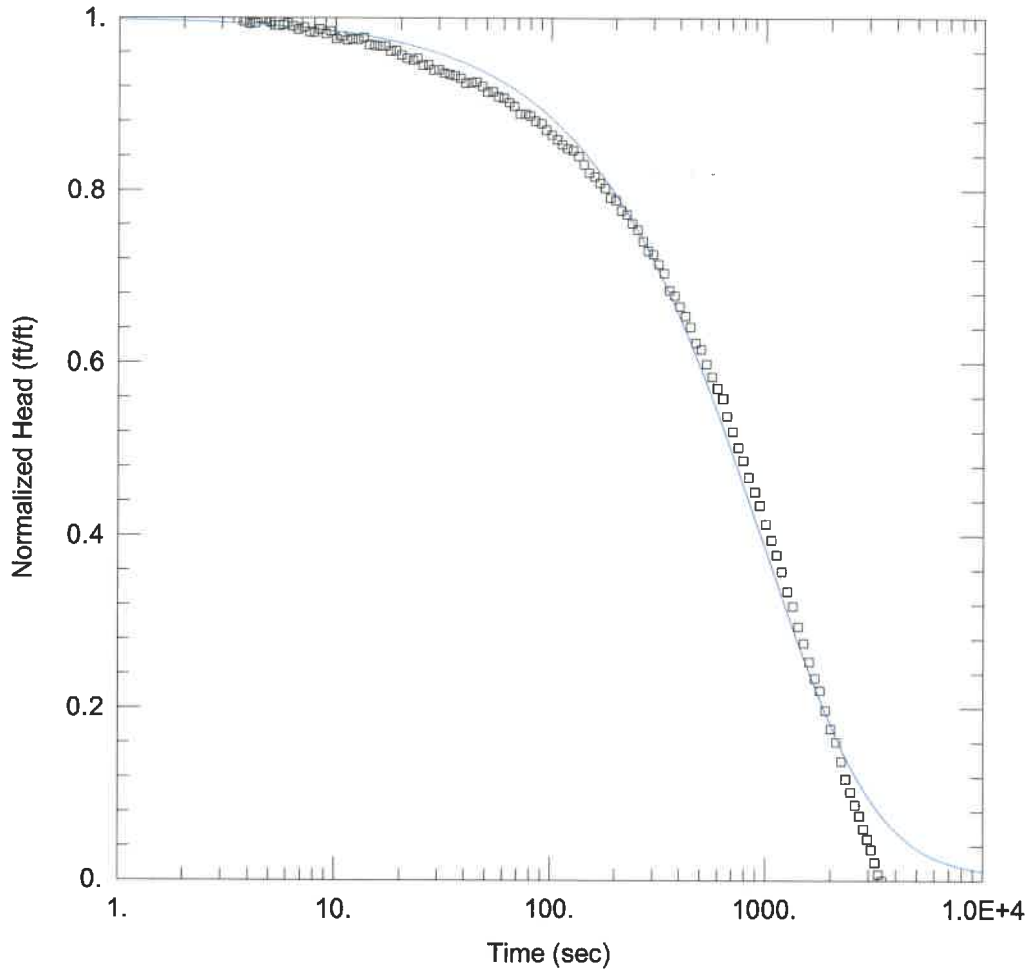
Static Water Column Height: 20.03 ft
Screen Length: 4.71 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 6.5E-5 cm/sec
Kz/Kr = 1.

Ss = 0.007 ft^{-1}



G50S RISING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G50S-rh.aqt
Date: 06/02/21 Time: 16:26:25

AQUIFER DATA

Saturated Thickness: 4.3 ft

WELL DATA (G50S)

Initial Displacement: 1.35 ft
Total Well Penetration Depth: 22.57 ft
Casing Radius: 0.08333 ft

Static Water Column Height: 20.03 ft
Screen Length: 4.71 ft
Well Radius: 0.08333 ft

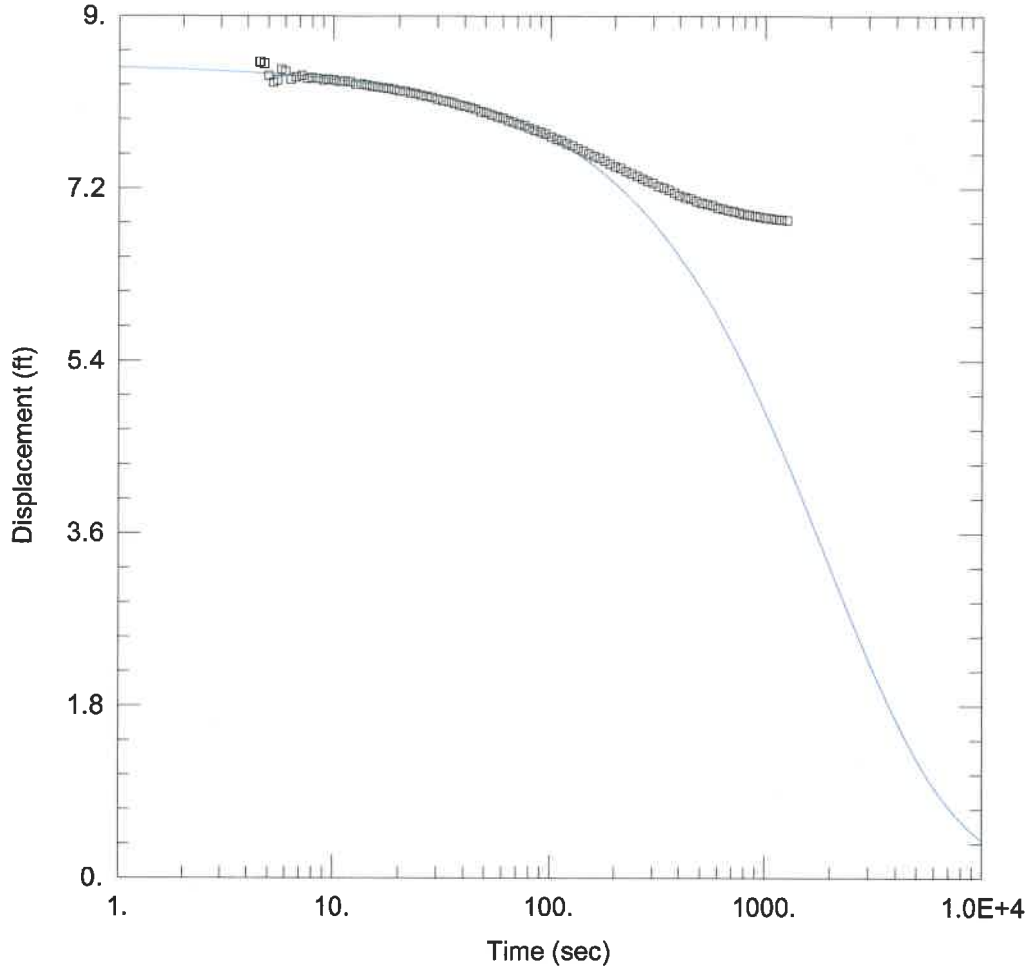
SOLUTION

Aquifer Model: Confined

Kr = 0.00015 cm/sec
Kz/Kr = 1.

Solution Method: KGS Model

Ss = 1.4E-5 ft^{-1}



G51L FALLING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G51L-fh.aqt
Date: 06/02/21 Time: 16:26:26

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G51L
Test Date: 4 Mar 2021

AQUIFER DATA

Saturated Thickness: 8.5 ft

WELL DATA (G51L)

Initial Displacement: 8.5 ft
Total Well Penetration Depth: 14.11 ft
Casing Radius: 0.08333 ft

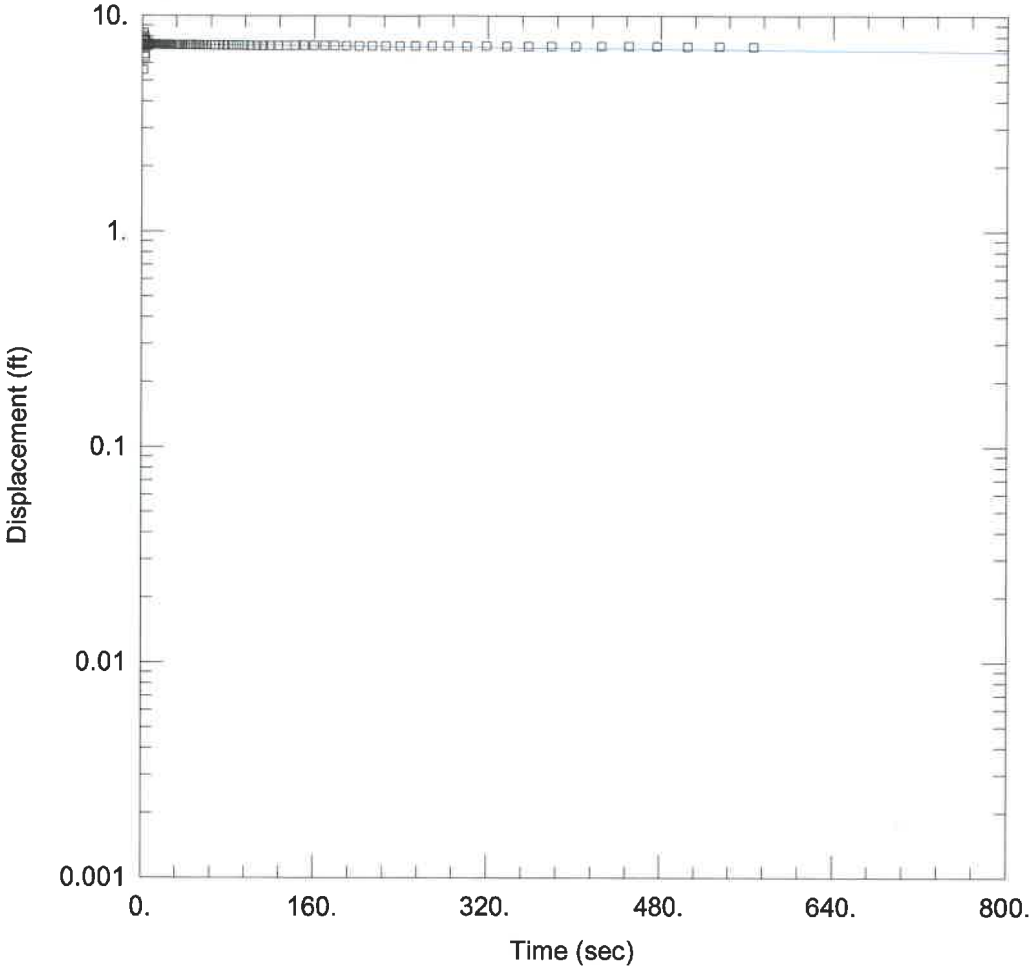
Static Water Column Height: 6.32 ft
Screen Length: 4.79 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 3.0E-5 cm/sec
Kz/Kr = 1.

Ss = 0.0011 ft^{-1}



G51S FALLING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G51S-fh.aqt
Date: 06/02/21 Time: 16:26:27

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G51S
Test Date: 4 Mar 2021

AQUIFER DATA

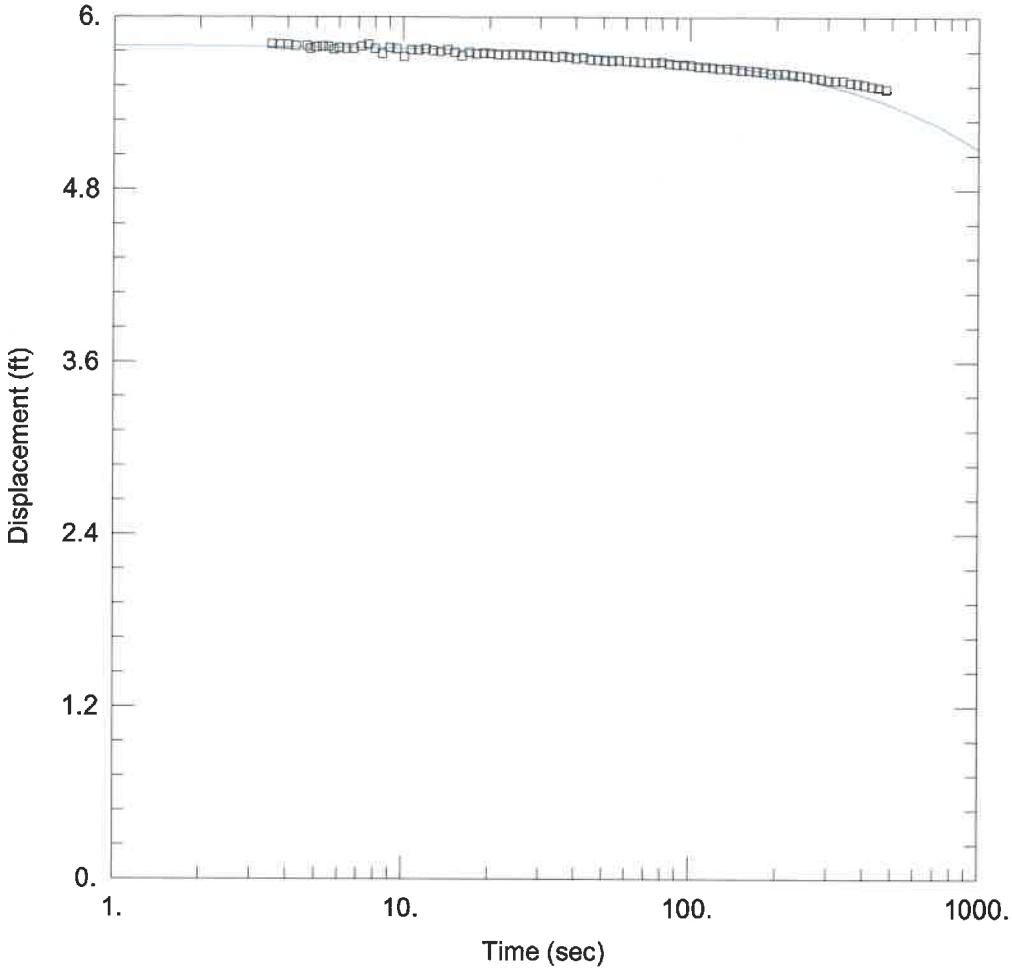
Saturated Thickness: 0.4 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G51S)

Initial Displacement: 7.4 ft
Total Well Penetration Depth: 20.04 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 17.4 ft
Screen Length: 4.78 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 7.2E-5 cm/sec
y0 = 7.35 ft



G51S RISING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G51S-rh.aqt
Date: 06/02/21 Time: 16:26:29

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G51S
Test Date: 4 Mar 2021

AQUIFER DATA

Saturated Thickness: 0.4 ft

WELL DATA (G51S)

Initial Displacement: 5.8 ft
Total Well Penetration Depth: 20.04 ft
Casing Radius: 0.08333 ft

Static Water Column Height: 17.4 ft
Screen Length: 4.78 ft
Well Radius: 0.08333 ft

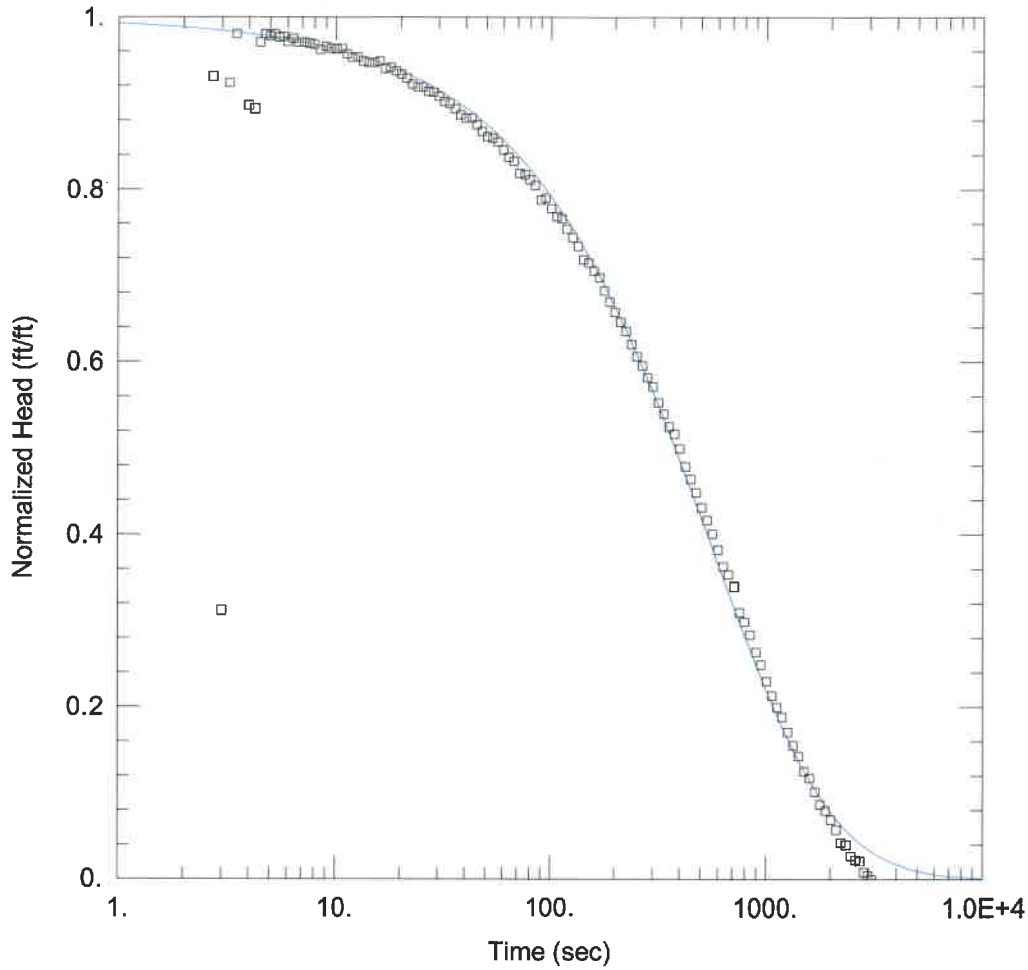
SOLUTION

Aquifer Model: Confined

Kr = 0.00011 cm/sec
Kz/Kr = 1.

Solution Method: KGS Model

Ss = 0.0015 ft^{-1}



G53L FALLING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G53L-fh.aqt
Date: 06/02/21 Time: 16:26:30

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G53L
Test Date: 5 Mar 2021

AQUIFER DATA

Saturated Thickness: 11.48 ft

WELL DATA (G53L)

Initial Displacement: 1.4 ft
Total Well Penetration Depth: 14.33 ft
Casing Radius: 0.08333 ft

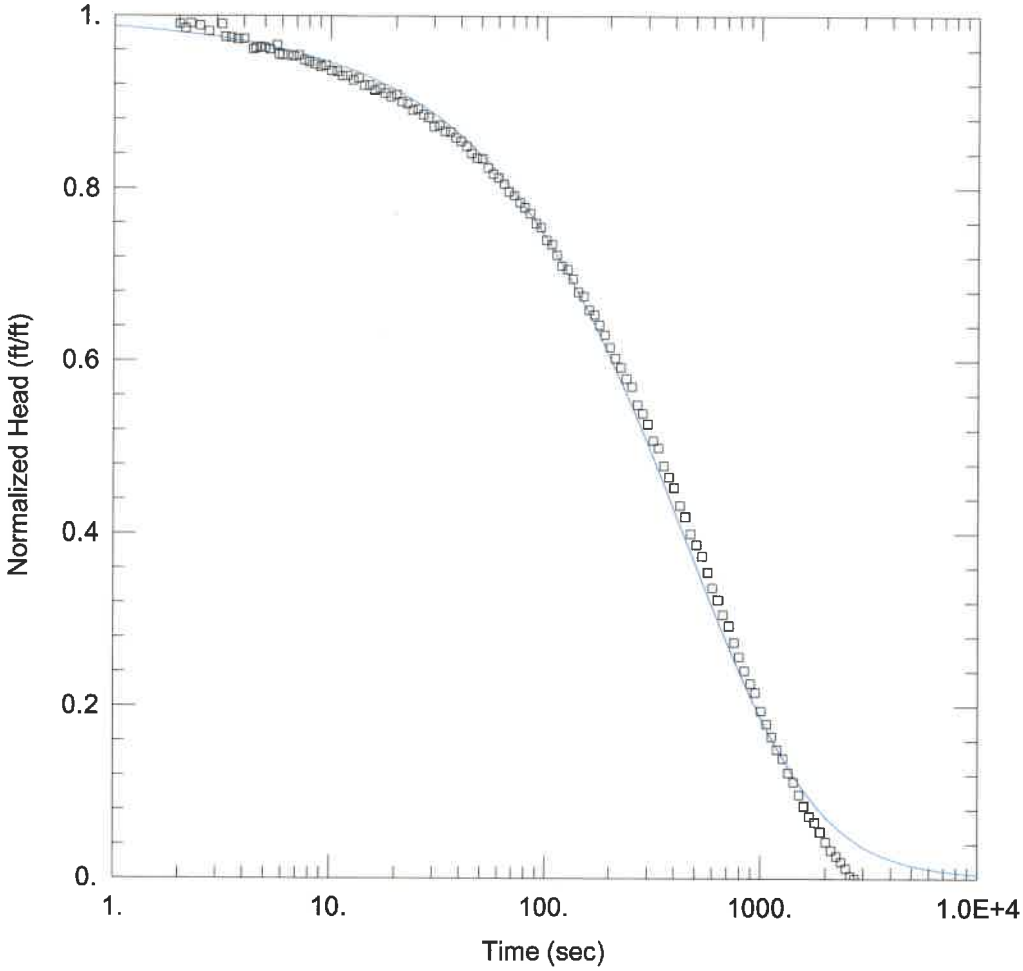
Static Water Column Height: 11.48 ft
Screen Length: 9.35 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.00011 cm/sec
Kz/Kr = 1.

Ss = 0.00029 ft^{-1}



G53L RISING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G53L-rh.aqt
Date: 06/02/21 Time: 16:26:32

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G53L
Test Date: 5 Mar 2021

AQUIFER DATA

Saturated Thickness: 11.48 ft

WELL DATA (G53L)

Initial Displacement: 1.5 ft
Total Well Penetration Depth: 14.33 ft
Casing Radius: 0.08333 ft

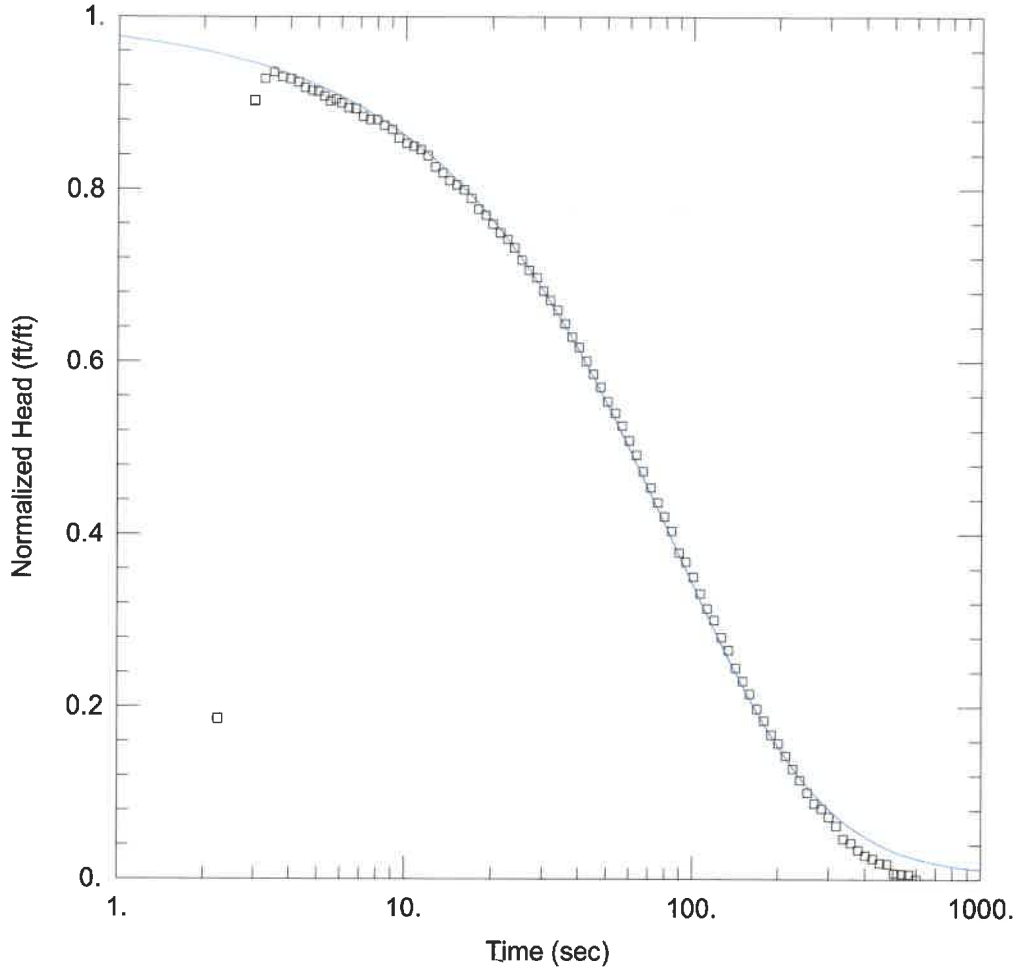
Static Water Column Height: 11.48 ft
Screen Length: 9.35 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.00011 cm/sec
Kz/Kr = 1.

Ss = 0.0011 ft^{-1}



G53S FALLING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G53S-fh.aqt
Date: 06/02/21 Time: 16:26:33

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G53S
Test Date: 5 Mar 2021

AQUIFER DATA

Saturated Thickness: 1.6 ft

WELL DATA (G53S)

Initial Displacement: 1.6 ft
Total Well Penetration Depth: 21.38 ft
Casing Radius: 0.08333 ft

Static Water Column Height: 18.77 ft
Screen Length: 4.49 ft
Well Radius: 0.08333 ft

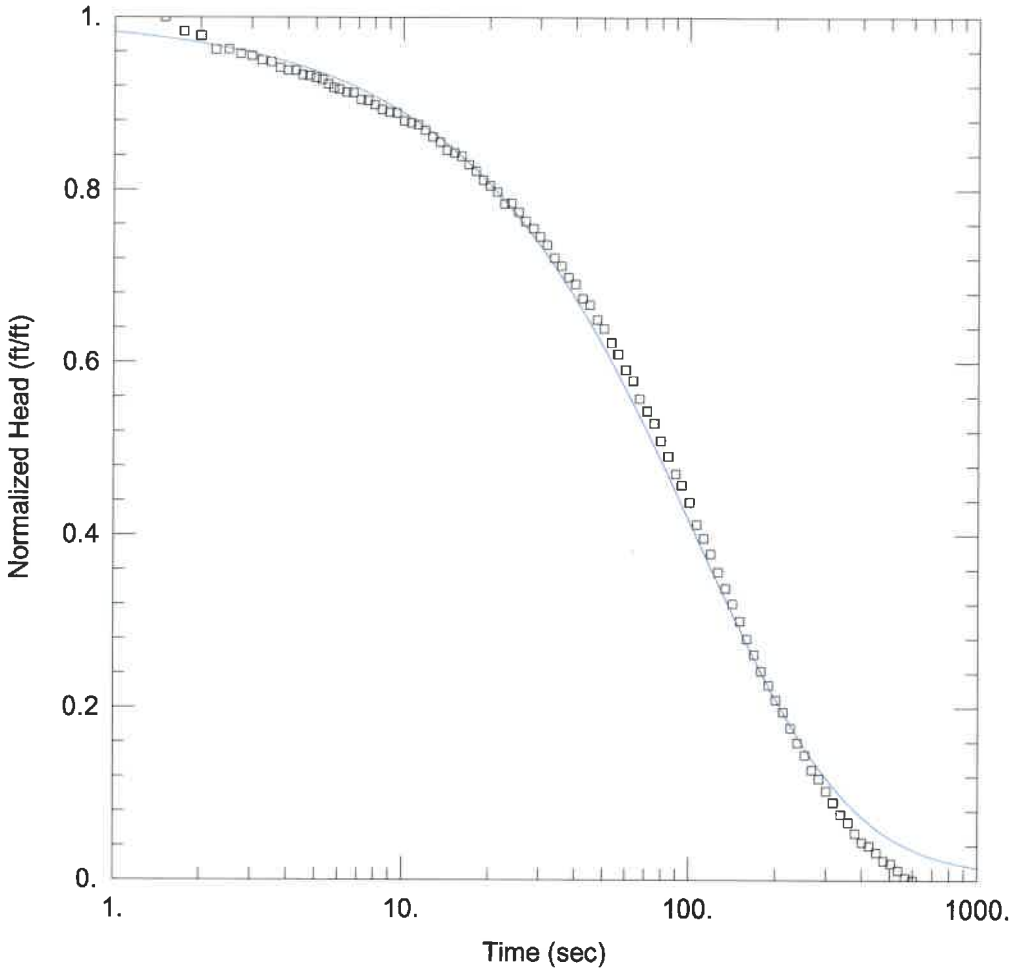
SOLUTION

Aquifer Model: Confined

Kr = 0.0038 cm/sec
Kz/Kr = 1.

Solution Method: KGS Model

Ss = 0.002 ft^{-1}



G53S RISING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G53S-rh.aqt
Date: 06/02/21 Time: 16:26:35

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G53S
Test Date: 5 Mar 2021

AQUIFER DATA

Saturated Thickness: 1.6 ft

WELL DATA (G53S)

Initial Displacement: 1.75 ft
Total Well Penetration Depth: 21.38 ft
Casing Radius: 0.08333 ft

Static Water Column Height: 18.77 ft
Screen Length: 4.49 ft
Well Radius: 0.08333 ft

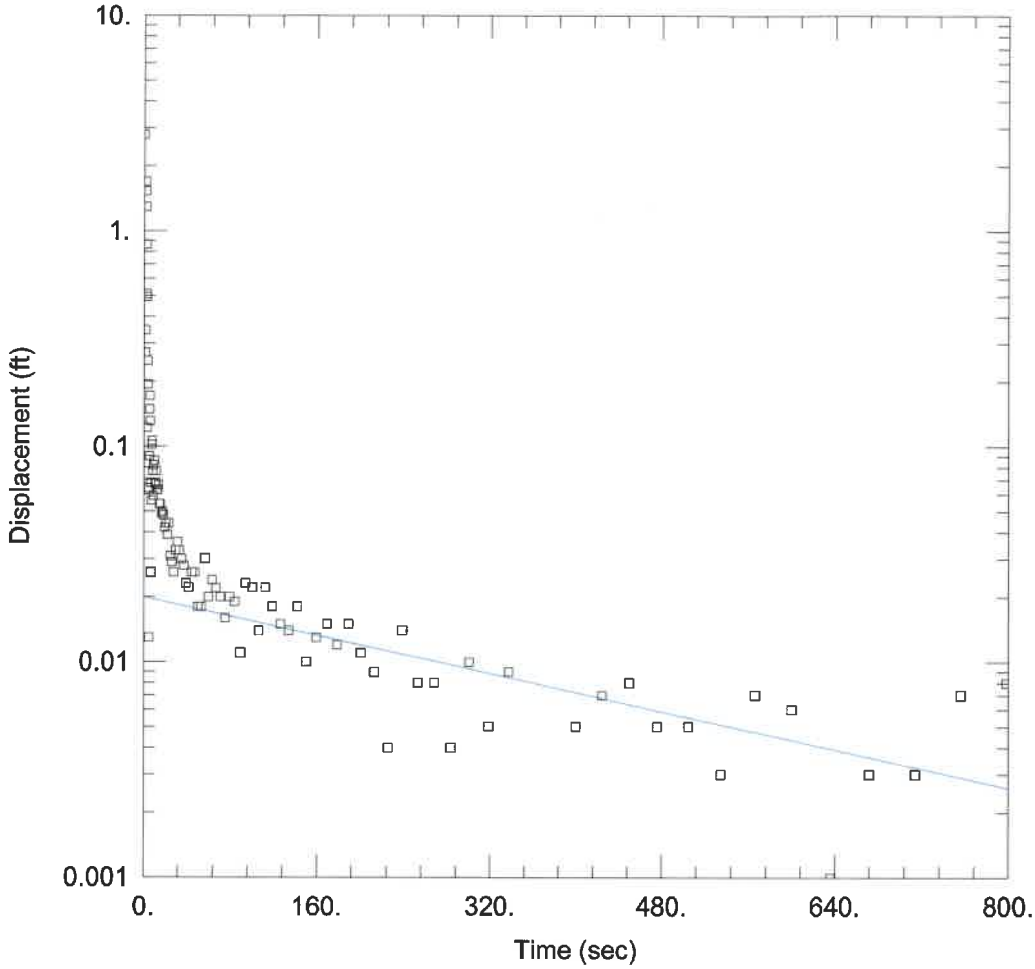
SOLUTION

Aquifer Model: Confined

Kr = 0.0032 cm/sec
Kz/Kr = 1.

Solution Method: KGS Model

Ss = 0.001 ft^{-1}



G54C FALLING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G54C-fh.aqt
Date: 06/02/21 Time: 16:26:36

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G54C
Test Date: 8 Mar 2021

AQUIFER DATA

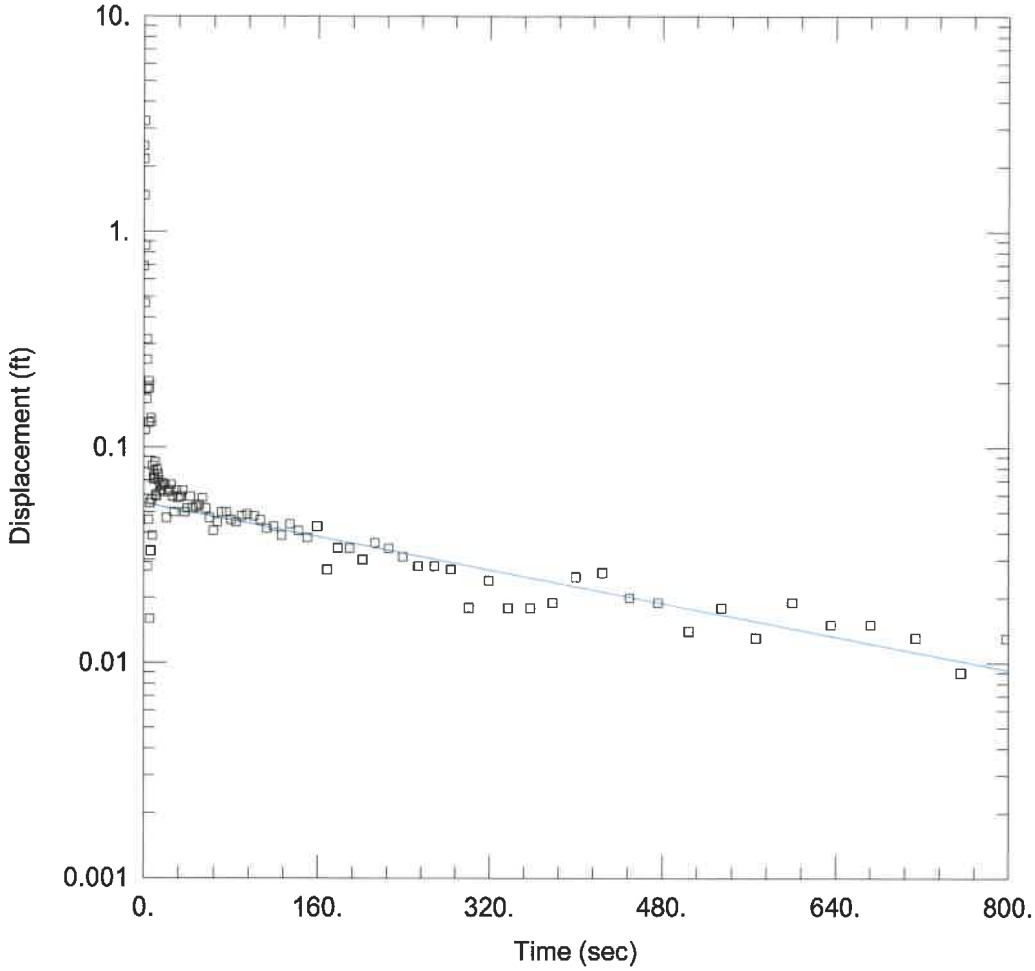
Saturated Thickness: 42.2 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G54C)

Initial Displacement: 2.8 ft
Total Well Penetration Depth: 44.3 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 42.2 ft
Screen Length: 9.07 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev
K = 0.00016 cm/sec
y0 = 0.02 ft



G54C RISING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G54C-rh.aqt
Date: 06/02/21 Time: 16:26:38

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G54C
Test Date: 8 Mar 2021

AQUIFER DATA

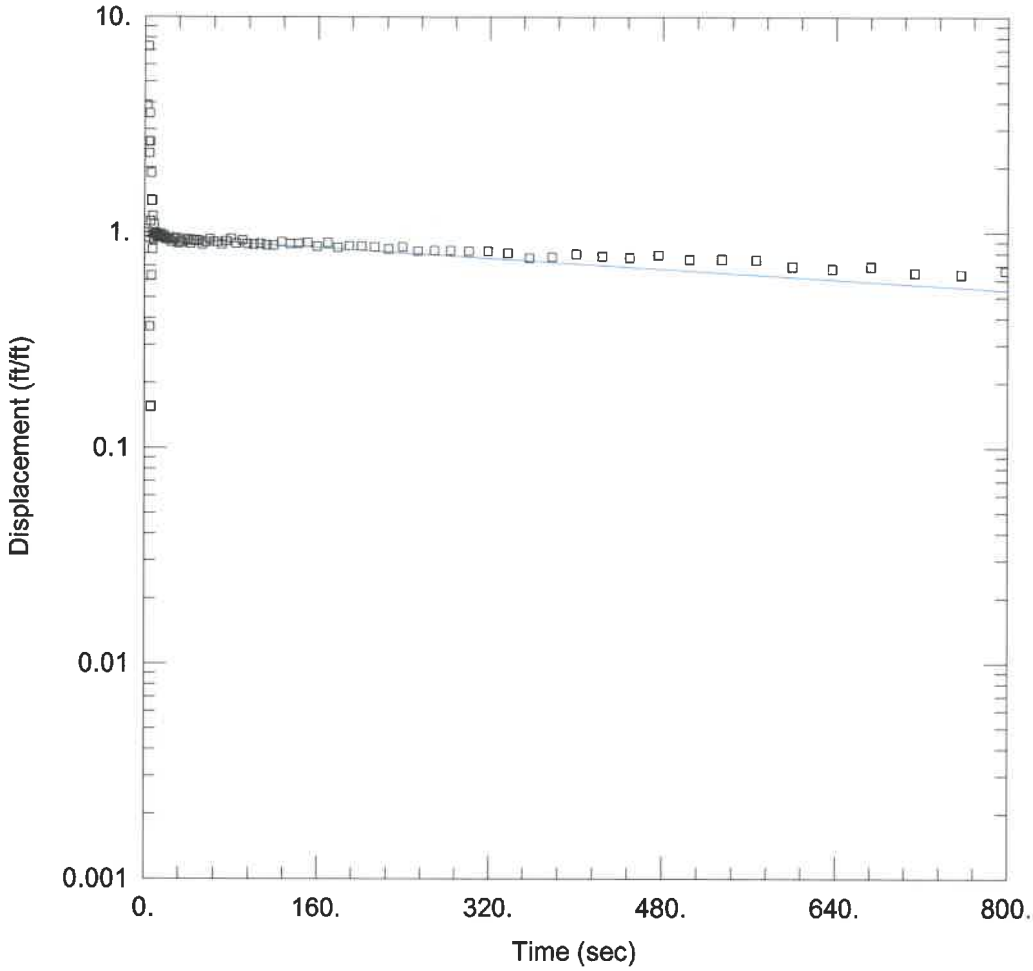
Saturated Thickness: 42.2 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G54C)

Initial Displacement: 2.5 ft
Total Well Penetration Depth: 44.3 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 42.2 ft
Screen Length: 9.07 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev
K = 0.00014 cm/sec
y0 = 0.055 ft



G54L FALLING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G54L-fh.aqt
Date: 06/02/21 Time: 16:27:18

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G54L
Test Date: 8 Mar 2021

AQUIFER DATA

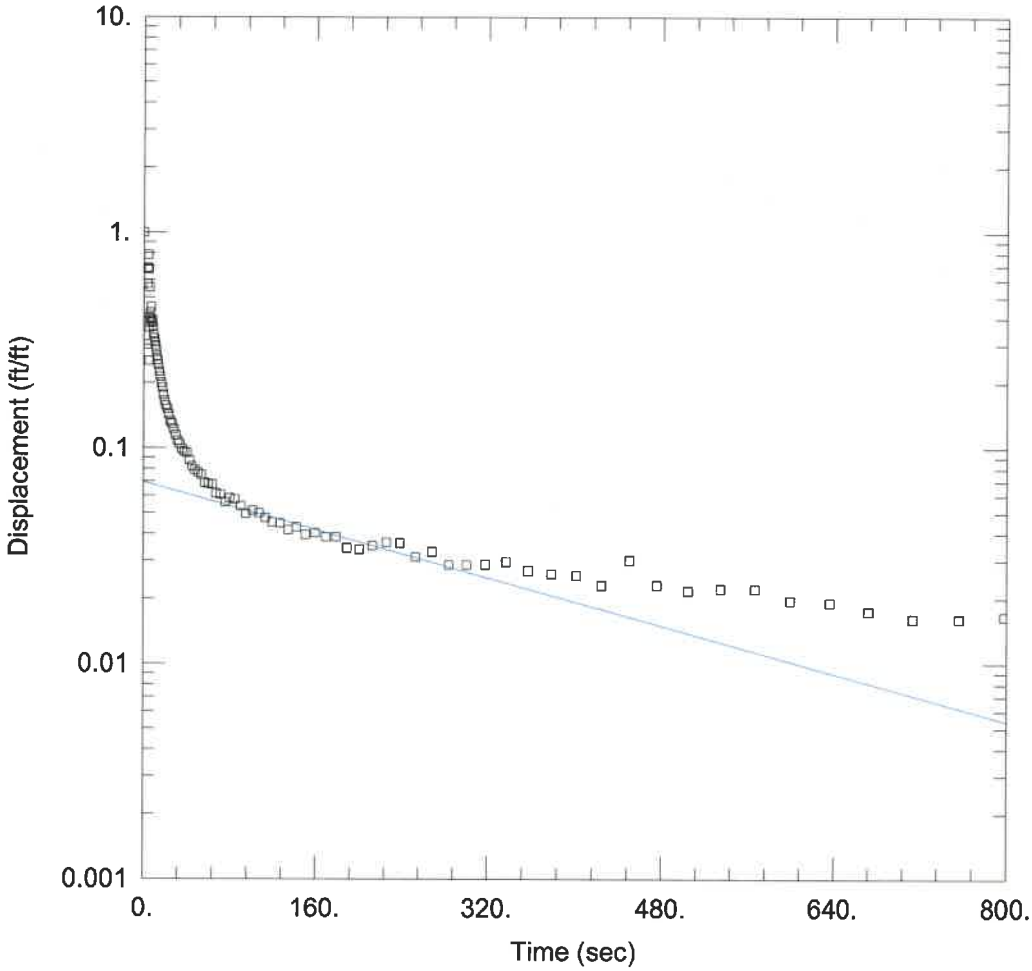
Saturated Thickness: 5.59 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G54L)

Initial Displacement: 0.2 ft
Total Well Penetration Depth: 10.65 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 5.59 ft
Screen Length: 9.43 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 4.9E-5 cm/sec
y0 = 0.19 ft



G54L RISING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G54L-rh.aqt
Date: 06/02/21 Time: 16:27:20

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G54L
Test Date: 8 Mar 2021

AQUIFER DATA

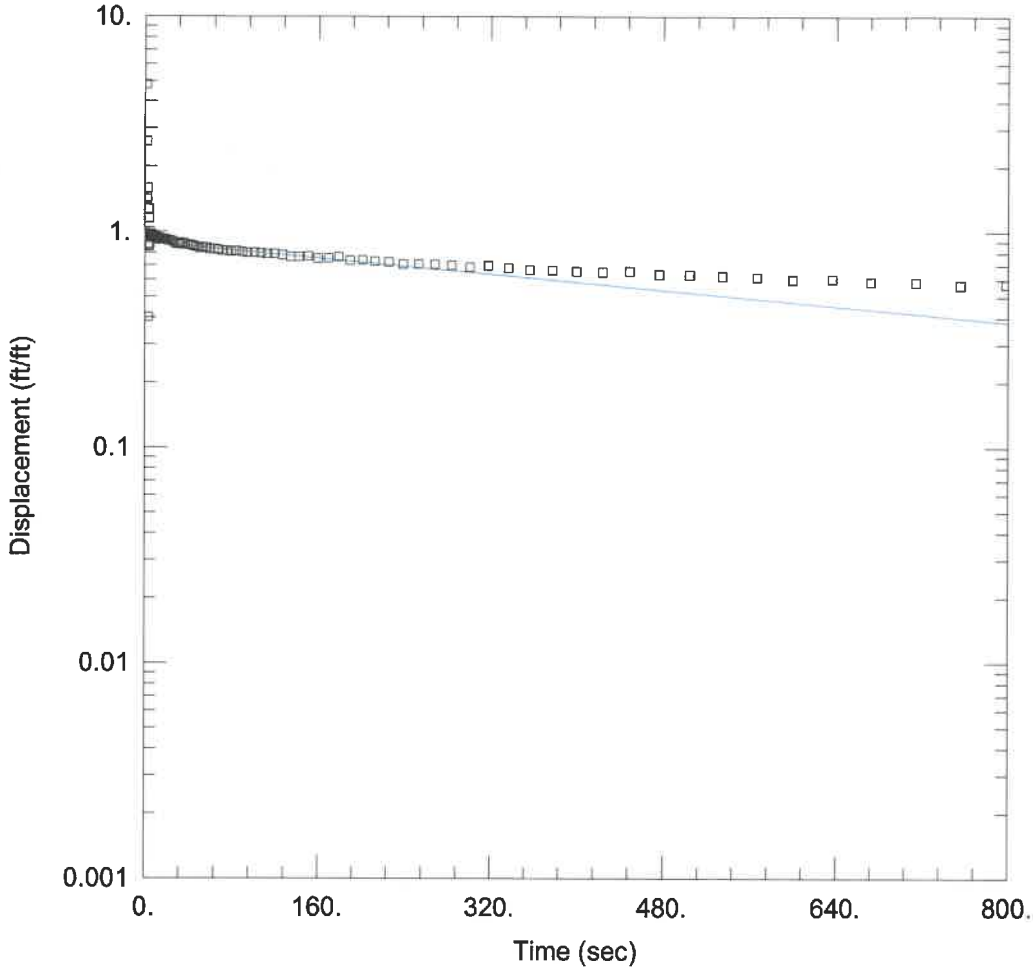
Saturated Thickness: 5.59 ft
Anisotropy Ratio (Kz/Kr): 0.001

WELL DATA (G54L)

Initial Displacement: 2.3 ft
Total Well Penetration Depth: 10.65 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 5.59 ft
Screen Length: 9.43 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00022 cm/sec
y0 = 0.16 ft



G54S FALLING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G54S-fh.aqt
Date: 06/02/21 Time: 16:27:22

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G54S
Test Date: 8 Mar 2021

AQUIFER DATA

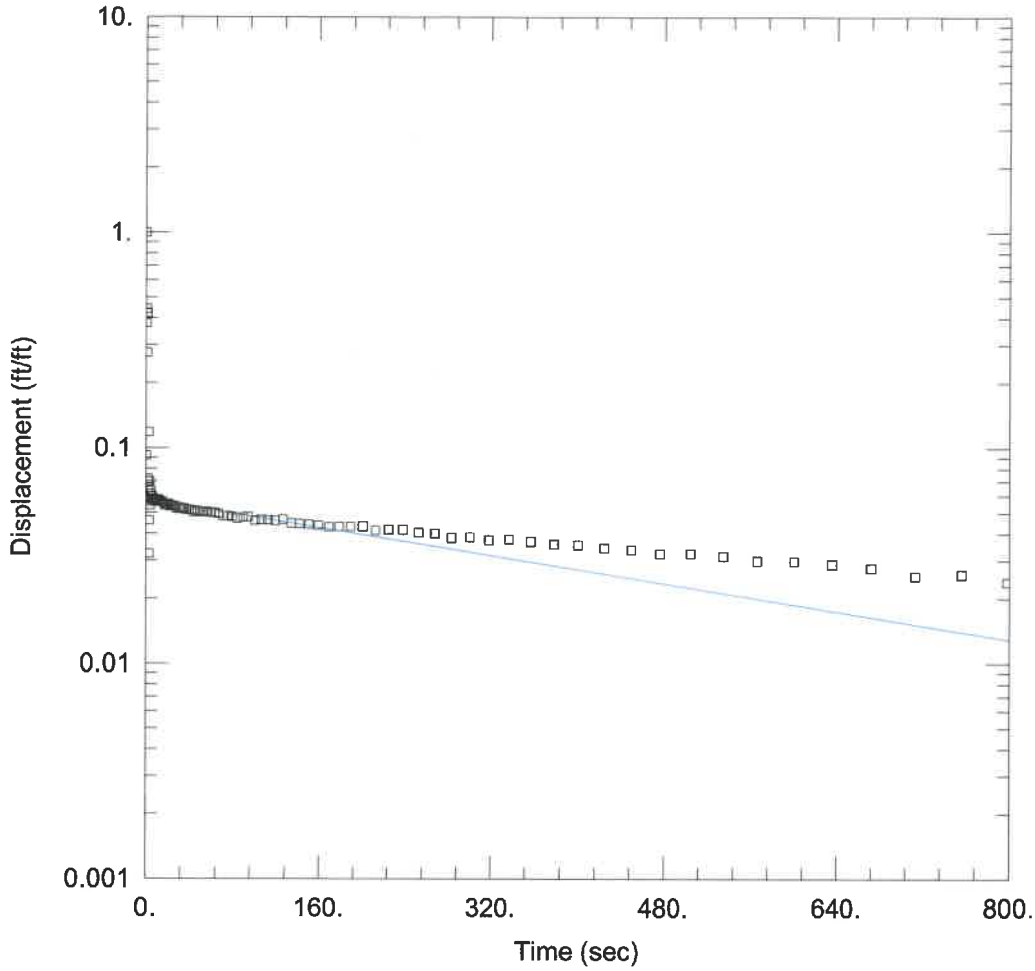
Saturated Thickness: 3.6 ft
Anisotropy Ratio (Kz/Kr): 0.001

WELL DATA (G54S)

Initial Displacement: 0.525 ft
Total Well Penetration Depth: 17.18 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 14.36 ft
Screen Length: 4.47 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.00012 cm/sec
y0 = 0.47 ft



G54S RISING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G54S-rh.aqt
Date: 06/02/21 Time: 16:27:23

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G54S
Test Date: 8 Mar 2021

AQUIFER DATA

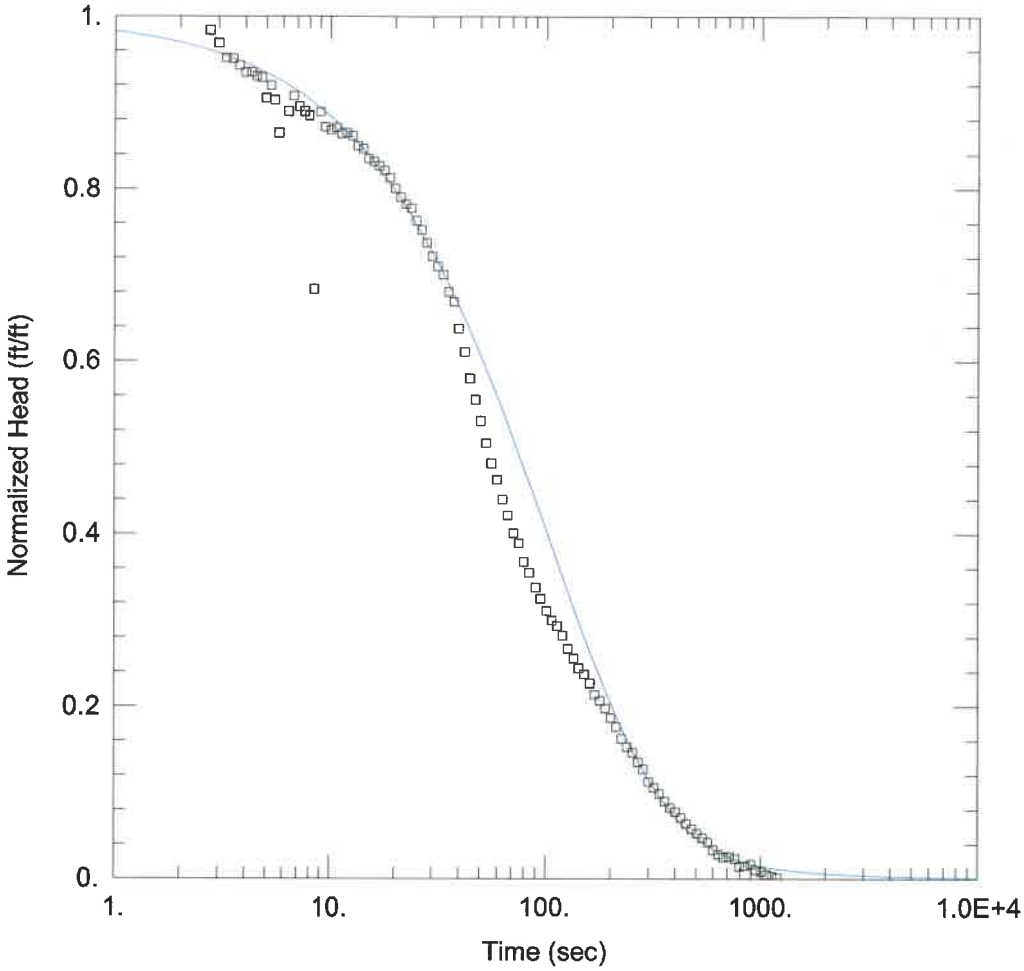
Saturated Thickness: 3.6 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (G54S)

Initial Displacement: 7.8 ft
Total Well Penetration Depth: 17.18 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 14.36 ft
Screen Length: 4.47 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00021 cm/sec
y0 = 0.45 ft



G57S FALLING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G57S-fh.aqt
Date: 06/02/21 Time: 16:27:25

AQUIFER DATA

Saturated Thickness: 1.9 ft

WELL DATA (G57S)

Initial Displacement: 1.55 ft
Total Well Penetration Depth: 10.16 ft
Casing Radius: 0.08333 ft

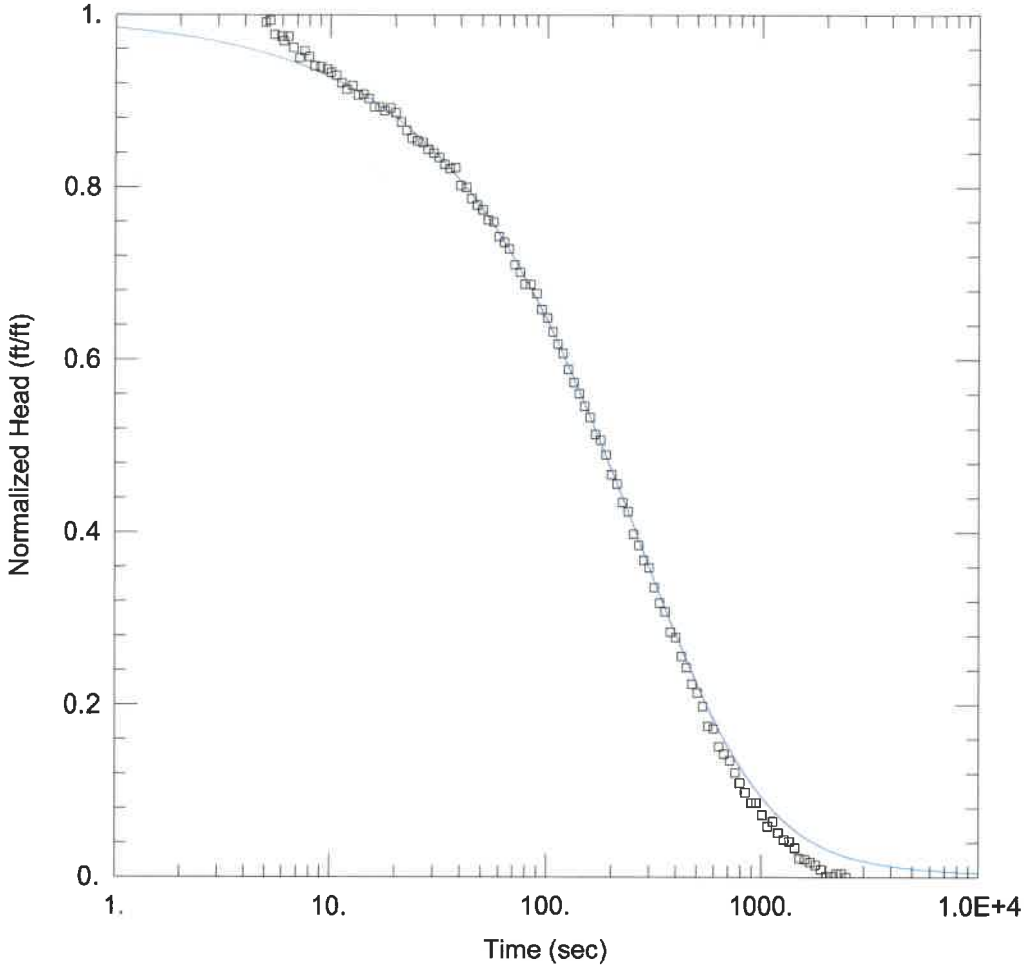
Static Water Column Height: 7.62 ft
Screen Length: 4.53 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0026 cm/sec
Kz/Kr = 1.

Ss = 7.0E-5 ft^{-1}



G57S RISING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G57S-rh.aqt
Date: 06/02/21 Time: 16:27:26

AQUIFER DATA

Saturated Thickness: 1.9 ft

WELL DATA (G57S)

Initial Displacement: 0.925 ft
Total Well Penetration Depth: 10.16 ft
Casing Radius: 0.08333 ft

Static Water Column Height: 7.62 ft
Screen Length: 4.53 ft
Well Radius: 0.08333 ft

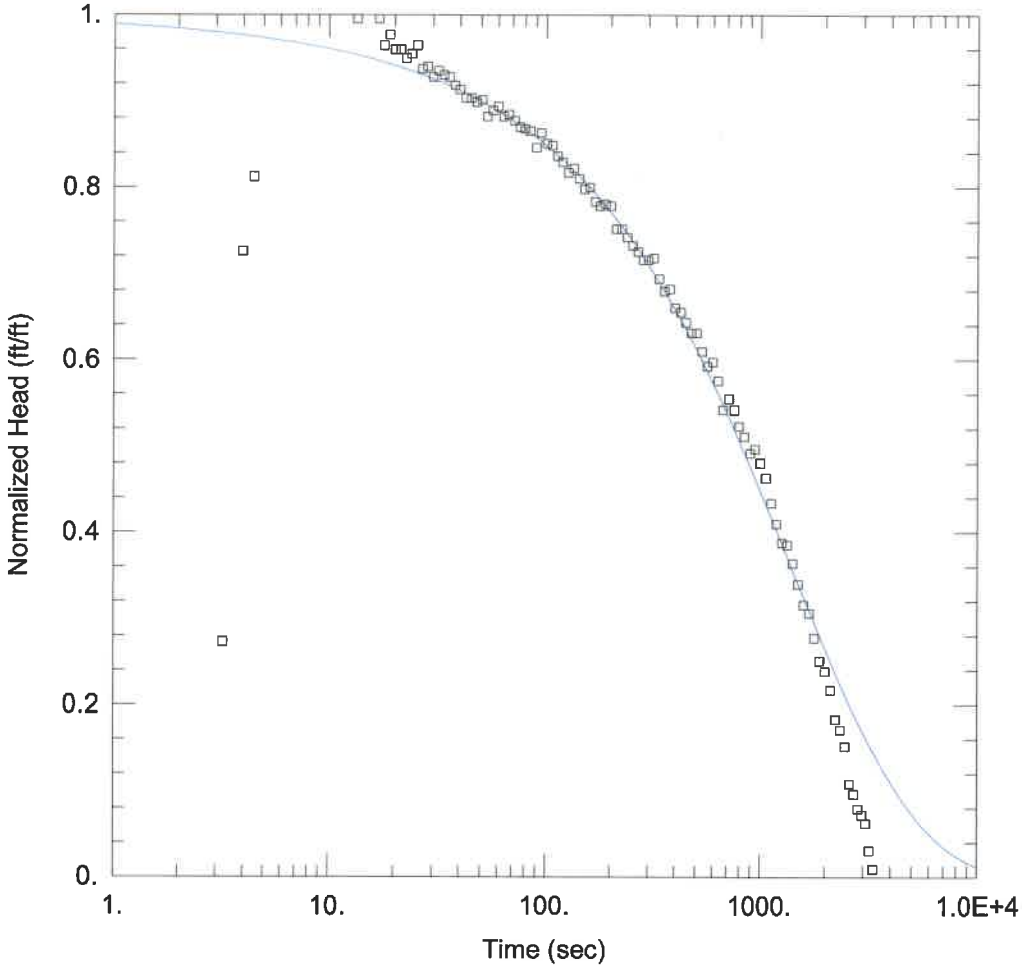
SOLUTION

Aquifer Model: Confined

Solution Method: KGS Model

Kr = 0.00068 cm/sec
Kz/Kr = 0.001

Ss = 0.0022 ft^{-1}



G60L FALLING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G60L-fh.aqt
Date: 06/02/21 Time: 16:27:28

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G60L
Test Date: 5 Mar 2021

AQUIFER DATA

Saturated Thickness: 1.04 ft

WELL DATA (G60L)

Initial Displacement: 0.415 ft
Total Well Penetration Depth: 5.4 ft
Casing Radius: 0.08333 ft

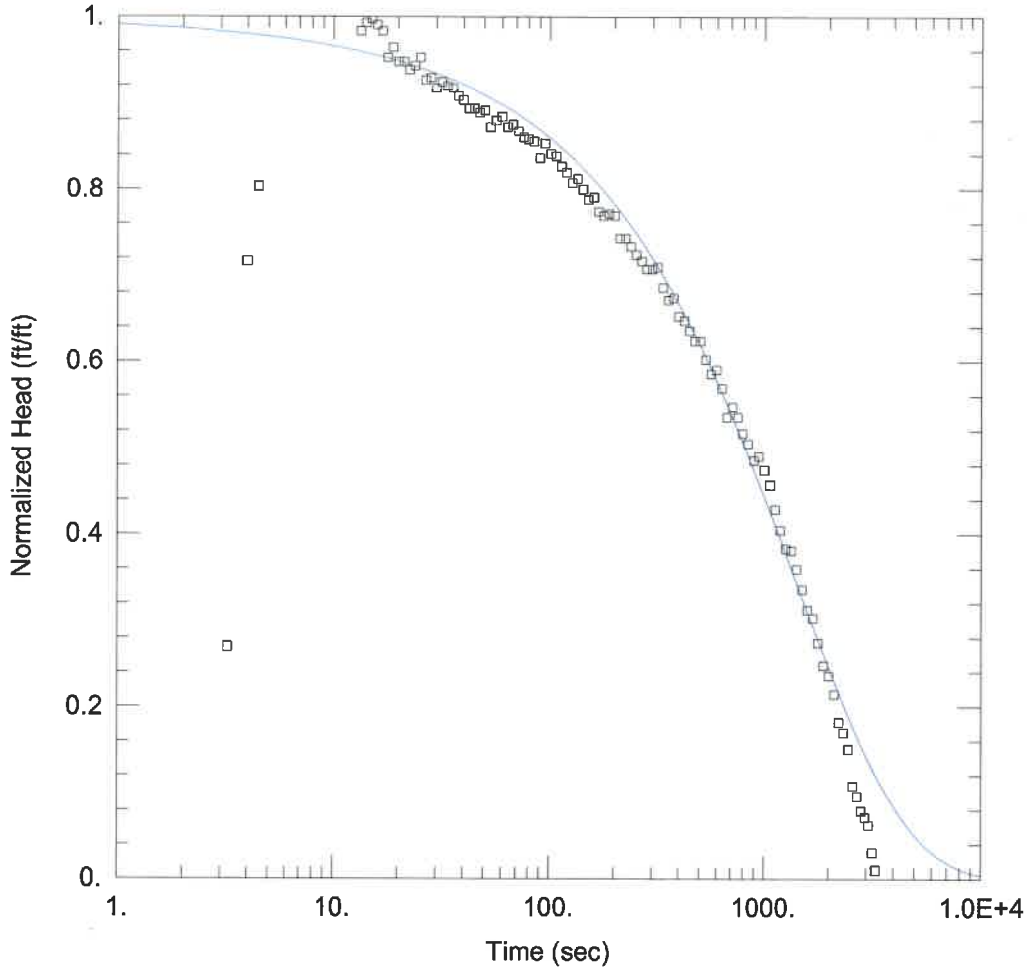
Static Water Column Height: 1.04 ft
Screen Length: 4.74 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.00023 cm/sec
Kz/Kr = 1.

Ss = 0.06 ft^{-1}



G60L RISING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G60L-rh.aqt
Date: 06/02/21 Time: 16:27:30

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G60L
Test Date: 5 Mar 2021

AQUIFER DATA

Saturated Thickness: 1.04 ft

WELL DATA (G60L)

Initial Displacement: 0.42 ft
Total Well Penetration Depth: 5.4 ft
Casing Radius: 0.08333 ft

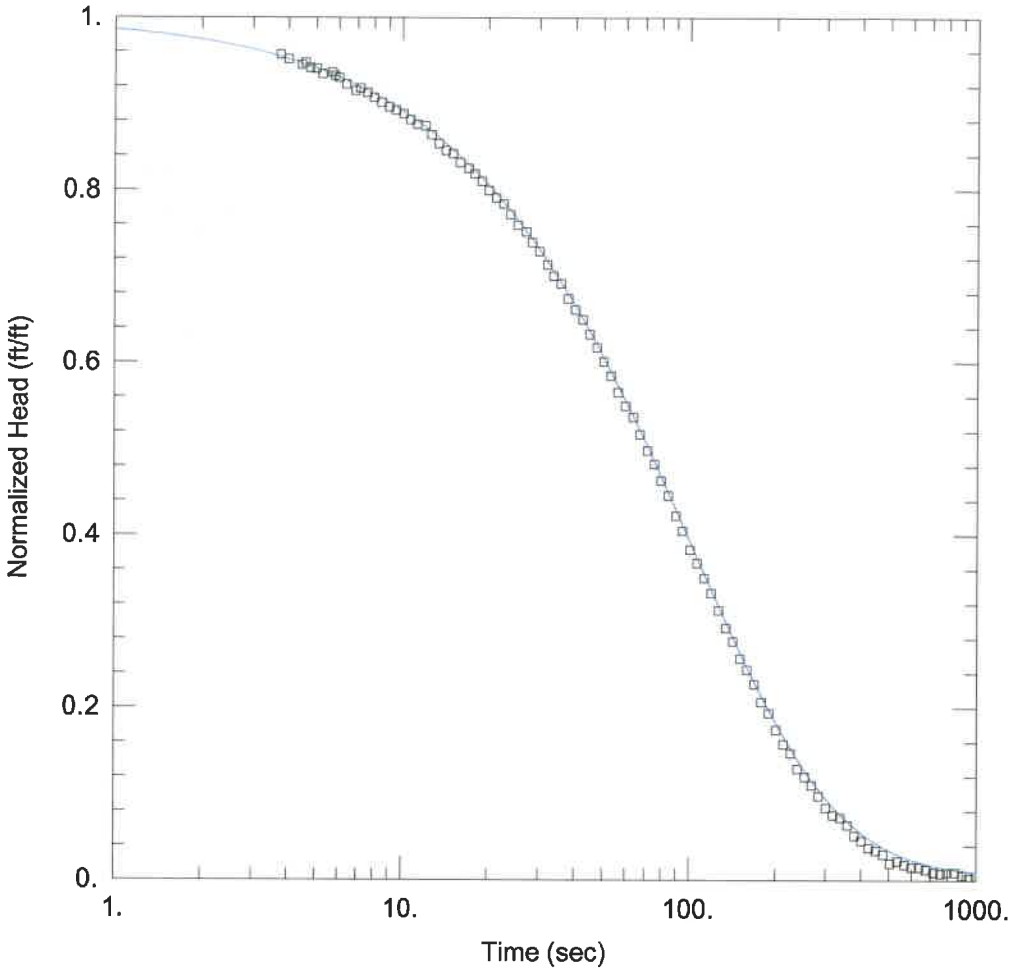
Static Water Column Height: 1.04 ft
Screen Length: 4.74 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.00026 cm/sec
Kz/Kr = 1.

Ss = 0.035 ft^{-1}



G60S FALLING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G60S-fh.aqt
Date: 06/02/21 Time: 16:27:31

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G60S
Test Date: 5 Mar 2021

AQUIFER DATA

Saturated Thickness: 1.9 ft

WELL DATA (G60S)

Initial Displacement: 1.55 ft
Total Well Penetration Depth: 7.23 ft
Casing Radius: 0.08333 ft

Static Water Column Height: 3.91 ft
Screen Length: 3.95 ft
Well Radius: 0.08333 ft

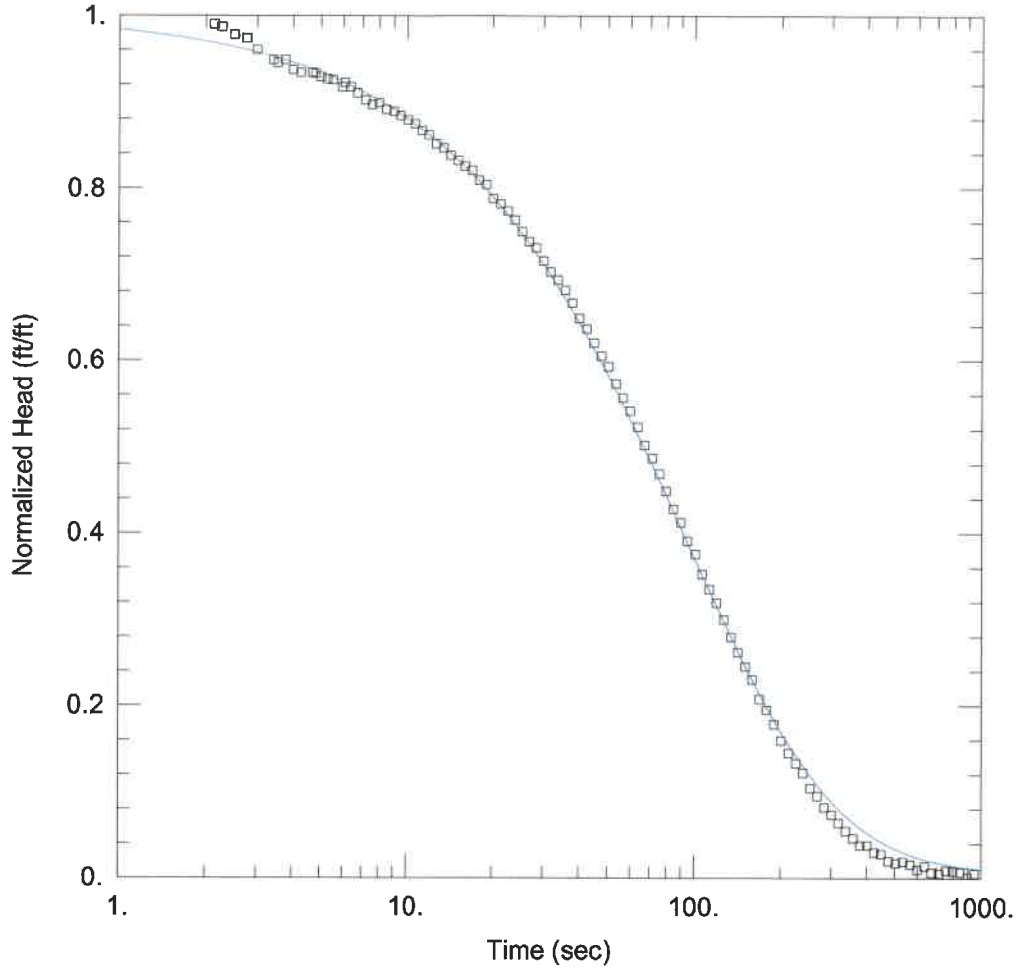
SOLUTION

Aquifer Model: Confined

Kr = 0.0039 cm/sec
Kz/Kr = 1.

Solution Method: KGS Model

Ss = 7.1E-6 ft^{-1}



G60S RISING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G60S-rh.aqt
Date: 06/02/21 Time: 16:27:33

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G60S
Test Date: 5 Mar 2021

AQUIFER DATA

Saturated Thickness: 1.9 ft

WELL DATA (G60S)

Initial Displacement: 1.85 ft
Total Well Penetration Depth: 7.23 ft
Casing Radius: 0.08333 ft

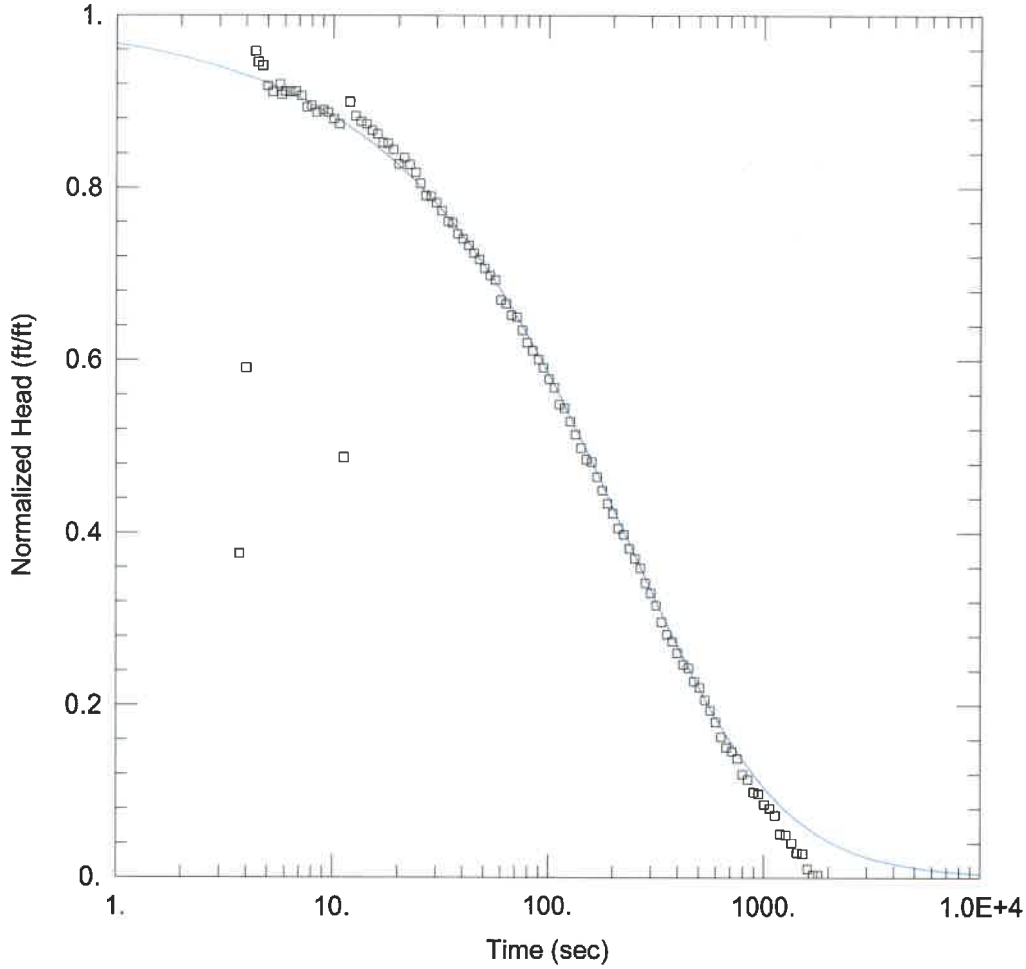
Static Water Column Height: 3.91 ft
Screen Length: 3.95 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0035 cm/sec
Kz/Kr = 1.

Ss = 7.0E-5 ft^{-1}



G63S FALLING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G63S-fh.aqt
Date: 06/02/21 Time: 16:27:35

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G63L
Test Date: 5 May 2021

AQUIFER DATA

Saturated Thickness: 10.8 ft

WELL DATA (G63S)

Initial Displacement: 0.975 ft
Total Well Penetration Depth: 13.54 ft
Casing Radius: 0.08333 ft

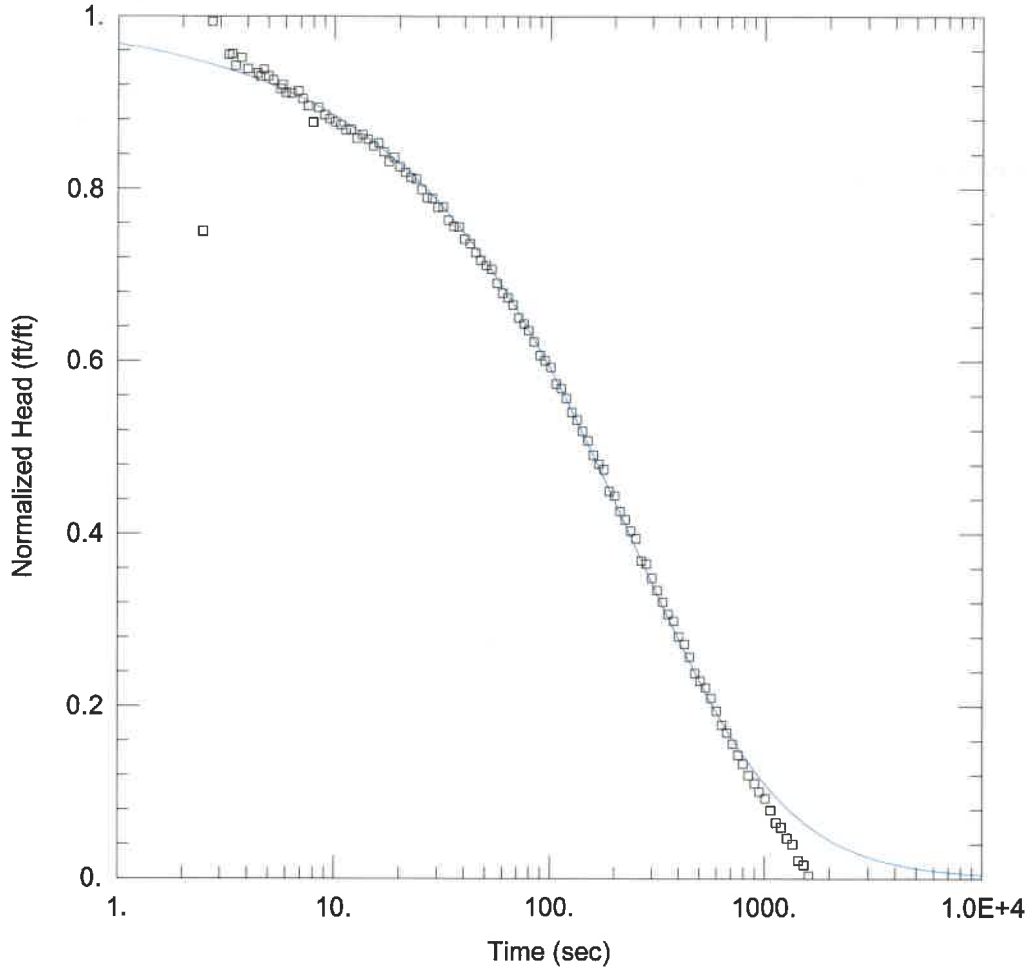
Static Water Column Height: 10.84 ft
Screen Length: 4.49 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.0003 cm/sec
Kz/Kr = 1.

Ss = 0.02 ft^{-1}



G63S RISING HEAD TEST

Data Set: I:\20jobs\20E0111A\Admin\13-Calculations\Slug Tests\Duck Creek\G63S-rh.aqt
Date: 06/02/21 Time: 16:27:37

PROJECT INFORMATION

Client: Duck Creek Power Station
Project: 20E0111A
Location: Canton, IL
Test Well: G63S
Test Date: 5 Mar 2021

AQUIFER DATA

Saturated Thickness: 10.8 ft

WELL DATA (G63S)

Initial Displacement: 1.15 ft
Total Well Penetration Depth: 13.54 ft
Casing Radius: 0.08333 ft

Static Water Column Height: 10.84 ft
Screen Length: 4.49 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.00029 cm/sec
Kz/Kr = 1.

Ss = 0.02 ft^{-1}

APPENDIX F
FEMA FLOOD HAZARD MAP

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or flood plain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or flood plain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

In the State of Illinois, any portion of a stream or watercourse that lies within the **floodway fringe** of a studied (AE) stream may have a state regulated floodway. The FIRM may not depict these state regulated floodways.

Floodways restricted by anthropogenic features such as bridges and culverts are drawn to reflect natural conditions and may not agree with the model computed widths listed in the Floodway Data table in the Flood Insurance Study report.

Multiple **topographic sources** may have been used in the delineation of Special Flood Hazard Areas. See Flood Insurance Study report for details on source resolution and geographic extent.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 15. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services, NOAA, N/NGS12
National Geodetic Survey SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at www.ngs.noaa.gov.

Base map information shown on this FIRM was provided in digital format by the United States Geological Survey. Digital orthoimagery with a spatial resolution of 0.5 meter ground sample distance were photogrammetrically compiled from aerial photography acquired during the leaf-off period of spring 2005.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The Special Flood Hazard Areas and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

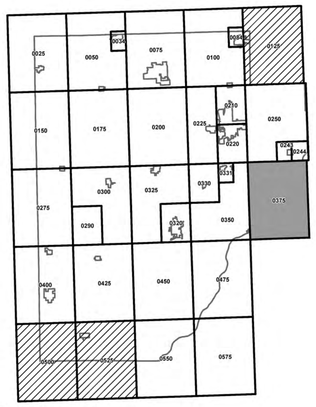
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the Map Service Center (MSC) website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

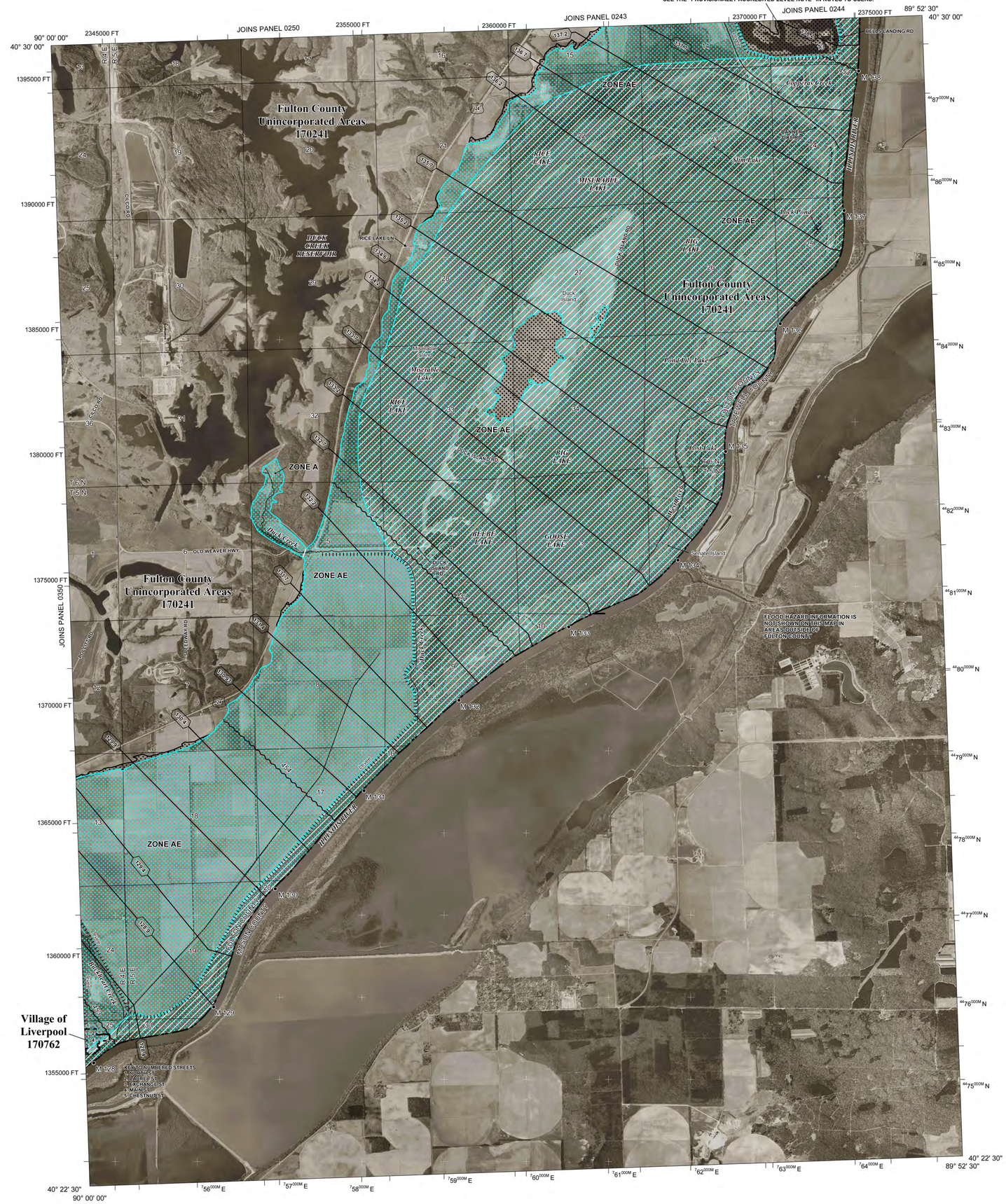
If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

Provisionally Accredited Levee Notes to Users: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations by December 31, 2010. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicate the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA website at http://www.fema.gov/business/nfip/index.shtm.

PANEL INDEX



NOTE: THIS AREA IS SHOWN AS BEING PROTECTED FROM THE 1-PERCENT-ANNUAL-CHANCE OR GREATER FLOOD HAZARD BY A LEVEE SYSTEM THAT HAS BEEN PROVISIONALLY ACCREDITED. OVERTOPPING OR FAILURE OF ANY LEVEE SYSTEM IS POSSIBLE. FOR ADDITIONAL INFORMATION, SEE THE "PROVISIONALLY ACCREDITED LEVEE NOTE" IN NOTES TO USERS.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 - - - - 23	Transect line
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4489000M N	1000-meter Universal Transverse Mercator grid values, zone 15
1565000 FT	5000-foot grid tick: Illinois State Plane West Coordinate System, 3801 zone (FIPSZONE 1202) Transverse Mercator
DX5510X	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
FEBRUARY 4, 2011

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 2000'

1000 0 2000 4000 FEET

600 0 600 1200 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0375E

FIRM
FLOOD INSURANCE RATE MAP
FULTON COUNTY, ILLINOIS
AND INCORPORATED AREAS

PANEL 375 OF 575

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
FULTON COUNTY	170241	0375	E
LIVERPOOL, VILLAGE OF	170762	0375	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
17057C0375E

EFFECTIVE DATE
FEBRUARY 4, 2011

Federal Emergency Management Agency

ATTACHMENT I

Intended for
Illinois Power Resources Generating, LLC

Date
October 25, 2021

Project No.
1940100806-003

GROUNDWATER MONITORING PLAN

GYPSUM MANAGEMENT FACILITY POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

RAMBOLL Bright ideas. Sustainable change.

GROUNDWATER MONITORING PLAN
DUCK CREEK POWER PLANT GYPSUM MANAGEMENT FACILITY POND

Ramboll
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Fifth Floor
Milwaukee, WI 53204
USA

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Project Name	**Duck Creek Power Plant Gypsum Management Facility Pond**
Project No.	**1940100806-003**
Recipient	**Illinois Power Resources Generating, LLC**
Document Type	**Groundwater Monitoring Plan**
Revision	**FINAL**
Date	**October 25, 2021**

Brian G. Hennings, PG
Senior Managing Hydrogeologist

Eric J. Tlachac, PE
Senior Managing Engineer

Nathaniel R. Keller
Senior Hydrogeologist

Chase J. Christenson, PG
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, Duck Creek Power Plant Gypsum Management Facility 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

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, Duck Creek Power Plant Gypsum Management Facility 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

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APPENDICES

Appendix A Statistical Analysis Plan

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
CSM	conceptual site model
DCPP	Duck Creek Power Plant
GMF Pond	Gypsum Management Facility Pond
GMP	Groundwater Monitoring Plan
GWPS	groundwater protection standard
HCR	Hydrogeologic Site Characterization Report
HDPE	high-density polyethylene
ID	identification
IEPA	Illinois Environmental Protection Agency
IPRG	Illinois Power Resources Generating, LLC
mg/L	milligrams per liter
mil	millimeter
msl	mean sea level
NA	not applicable
NAVD88	North American Vertical Datum of 1988
NID	National Inventory of Dams
No.	number
NRT/OBG	Natural Resource Technology, an OBG Company
oz/yd^2	ounces per square yard
Part 845	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
USEPA	United States Environmental Protection Agency
WLO	water level only
WPCP	Water Pollution Control Permit

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 Duck Creek Power Plant (DCPP), operated by Illinois Power Resources Generating, LLC (IPRG). This report will apply specifically to the CCR Unit referred to as the Gypsum Management Facility Pond (GMF Pond) (Vistra identification [ID] number [No.] 203, IEPA ID No. W0578010001-04, and National Inventory of Dams [NID] No. IL50573). 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 GMF Pond at the DCPP.

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 DCPP is located in Fulton County, Illinois, approximately six miles southeast of the town of Canton, Illinois. The GMF Pond is located north of the DCPP within Section 18, Township 6 North, Range 5 East (**Figure 1-1**). Prior to construction of the DCPP and associated facilities, strip mining of coal took place within the current property boundary. Currently, land use adjacent to the DCPP is primarily agriculture, pasture, and forested land with minimal development.

The GMF Pond is a 1,500-foot by 900-foot earthen berm double-lined CCR SI located north of the former DCPP. The GMF Pond decant water discharges to the lined GMF Recycle Pond located to the south of the GMF Pond (**Figure 1-2**). In addition to the GMF Pond, several other CCR units are located on the DCPP property, including the Landfill located due north of the GMF Pond; the closed units Ash Pond No. 1 and Ash Pond No. 2 located south of the GMF Pond; and the Bottom Ash Basin located between the former DCPP and the closed Ash Pond No. 1 and Ash Pond No. 2.

The GMF Pond, also referred to as the gypsum stack/management system, operates under IEPA Water Pollution Control Permit (WPCP) No. 2017-E0-62640, issued in December 2017. It consists of 1,500-foot by 900-foot earthen berm with 3.5:1 side slopes, a maximum elevation of 620 feet above mean sea level, a double geomembrane liner consisting of a 60-millimeter (mil) high-density polyethylene (HPDE) geomembrane liner, 12 inches of clay cushion, 4 ounces per square yard (oz/yd^2) non-woven geotextile filter fabric, 12 inches highly permeable granular drainage (sand), 10 oz/yd^2 non-woven geotextile filter fabric, 60-mil HPDE geomembrane liner, reinforced bentonite mat, 36 inches compacted clay all installed over in-situ foundation soil, and all pipes, pumps, and appurtenances necessary for the storage of approximately 3.6 million tons of gypsum at a maximum elevation of 715 feet above mean sea level with discharge to the Recycle Pond. The GMF Recycle Pond is lined with a 60-mil HDPE geomembrane liner, reinforced bentonite mat, and 36 inches of compacted clay.

Strip mining has occurred in this area since the 1930s. Strip mining in the site vicinity extracted coal from the Springfield (No. 5) coal seam. Mining operations in the area have ceased. Strip mining has completely disrupted the natural stratigraphy down to the Springfield (No. 5) coal unit at some portions of the DCPP property. Previous investigations completed outside of the GMF Pond indicated that bedrock in the area is overlain by mine spoil ranging in thickness from approximately 10 to 75 feet. The mine spoil consists of excavated bedrock (weathered shale, shale fragments, and some coal fines) mixed with the sand, silts and silty clays of the unconsolidated glacial and aeolian deposits. The GMF Pond is located immediately adjacent to and downgradient of several former large surface mining areas.

1.3 Conceptual Model

Significant site investigation has been completed at the DCPP to characterize the geology, hydrogeology, and groundwater quality. Based on extensive investigation and monitoring, the GMF Pond has been well characterized and detailed in the Hydrogeologic Site Characterization Report (HCR; Ramboll, 2021); included in the Operating Permit to which this Plan is attached). A conceptual site model (CSM) has been developed and is discussed below.

The three distinct hydrostratigraphic units summarized below have been identified at the GMF Pond based on stratigraphic relationships and common hydrogeologic characteristics:

- **Uppermost Aquifer:** At the GMF Pond, this unit includes the Peoria/Roxana Loess, the upper Radnor Till, and the shallow sands. These units are hydraulically connected and underlain by a thick till sequence of the Radnor Till (Natural Resource Technology, an OBG Company [NRT/OBG], 2017a). The shallow sands are laterally extensive across the GMF Pond, vary in thickness from less than one to 18 feet, and are generally located at an elevation of 570 to 590 feet above mean sea level (msl). Sand was completely removed where it was encountered during construction of the GMF Pond, putting the base of liner in contact with clay of the lower Radnor Till. Sand outside the GMF Pond footprint remains in place. While the primary migration pathway is the shallow sand of the uppermost aquifer, the groundwater within the overlying Peoria/Roxanna Loess has the potential to be impacted and is considered a potential migration pathway (PMP).
- **Lower Radnor Till/Lower Confining Unit**: Underlying the uppermost aquifer, the lower Radnor Till is approximately 42 to 58 feet thick. Previous hydrogeologic studies indicate discontinuous sand lenses observed within the till are not hydraulically connected to the shallow sand unit (NRT/OBG, 2017a).
- **Bedrock Confining Unit**: The thick and low permeability shaley siltstone, silty shale, and coal beds of the Carbondale Formation, are estimated to have a thickness of approximately 300 to 400 feet.

Groundwater migrates downward through the loess and upper Radnor Till into the shallow sands of the uppermost aquifer. Groundwater flow in the sands is generally in a northwest to southeast direction (**Figure 1-3**). Seasonal variation of groundwater levels at the GMF Pond are present and may fluctuate approximately one to 10 feet. There is no observable seasonal variation of groundwater flow direction at the GMF Pond associated with the elevation changes. Groundwater flows toward the Duck Creek Cooling Pond located approximately 2,100 feet east of the GMF Pond. The surface water elevation of the Duck Creek Cooling Pond is estimated from 562.5 to 565 feet North American Vertical Datum of 1988 (NAVD88). Which is approximately 20 feet lower than downgradient groundwater at the GMF Pond.

Part 845 parameters were monitored in the uppermost aquifer and PMP monitoring wells at the GMF Pond as part of the Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257 monitoring program beginning in 2015. These data were supplemented with sampling of additional locations in 2021. The results indicate that the following parameters were detected at concentrations or measurements greater than the applicable 35 I.A.C. § 845.600 groundwater protection standards (GWPSs) and are considered potential exceedances:

- Antimony, arsenic, cobalt, lead, pH, sulfate, and thallium were detected at least once at concentrations or measurements greater than the GWPS in downgradient uppermost aquifer wells (including PMP wells). Lead, mercury, pH, and thallium were detected at concentrations or measurements greater than the GWPS in upgradient uppermost aquifer wells. Radium 226 and 228 combined was detected once at concentrations greater than the GWPS in the bedrock confining unit well.

Concentration results for the above parameters were compared directly to 35 I.A.C. § 845.600 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 GMF Pond that will comply with Part 845. Monitoring networks and programs that apply to other units are not discussed in this GMP. Those programs will continue to be performed as specified in IEPA approvals. Any future modifications will be proposed and submitted to IEPA for approval in a separate document. The remaining discussion in this document will include only these networks and monitoring programs that are applicable and specific to the GMF Pond, specifically the IEPA WPCP monitoring network, the 40 C.F.R. § 257 monitoring network and the proposed Part 845 monitoring network.

2.1.1 IEPA Monitoring Program

Routine quarterly groundwater monitoring is completed at GMF Pond wells G50L/S, G51L/S, G52L/S, G53L/S, G54L/S, G55L/S, G56L/S, G57L/S, G58L/S, G59L/S, G60L/S, R61L/G61S, G62L, G63L/S, and G64L/S in accordance with the IEPA WPCP No. 2017-E0-62640. This permit also requires sampling G65L/S, G66L/S, G67L/S, G70L, G71L/S, and G72L/R72S at the GMF Recycle Pond. The boring logs, well construction forms, and other related monitoring well forms for the GMF Pond well network are included in Appendix B of the HCR (included in the Operating Permit to which this Plan is attached). The location of all IEPA monitoring wells is illustrated in **Figure 2-1**. Groundwater samples are collected quarterly and annually and are analyzed for the laboratory and field parameters listed in **Table A** below.

Table A. IEPA Groundwater Monitoring Program Parameters

Field Parameters			
pH	Temperature	Specific Conductance	
Groundwater Elevation	Depth to Water (bmp)	Bottom of Well Elevation	
Quarterly Parameters (Dissolved)			
Arsenic	Cadmium	Lead	Sulfate
Boron	Chloride	Manganese	Total Dissolved Solids (TDS)
Annual Parameters (Dissolved)			
Alkalinity, bicarbonate	Chromium	Mercury	Selenium
Alkalinity, carbonate	Cobalt	Nickel	Sodium
Ammonia as Nitrogen	Iron	Nitrate nitrogen	Zinc
Calcium	Magnesium	Potassium	

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

The 40 C.F.R. § 257 well network for the GMF Pond consists of seven monitoring wells installed nearby or adjacent to the GMF Pond in the uppermost aquifer. The GMF Pond 40 C.F.R. § 257 well network consists of three background monitoring wells (G02S, G50S, and G51S) and four compliance monitoring wells (G54S, G57S, G60S, and G64S). 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 B of the HCR (included in the Operating Permit to which this Plan is attached).

Groundwater is being monitored at the GMF Pond in accordance with the Detection Monitoring Program requirements specified in 40 C.F.R. § 257.94. Details on the procedures and techniques used to fulfill the groundwater sampling and analysis program requirements are found in the Sampling and Analysis Plan for the GMF Pond (NRT/OBG, 2017b).

Groundwater samples are collected semiannually and analyzed for the laboratory and field 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]		
pH	Groundwater Elevation	
Appendix III Parameters (Total, except TDS)		
Boron	Chloride	Sulfate
Calcium	Fluoride	TDS

[1]Dissolved oxygen, temperature, specific conductance, oxidation/reduction potential, and turbidity were 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, one additional monitoring well (G54C) was installed between the GMF Pond and the GMF Recycle Pond 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, a porewater sample was collected from a temporary leachate monitoring location (XTPW02) installed within the GMF Pond to characterize the CCR materials.

Prospective Part 845 monitoring wells were sampled for eight rounds from February to August 2021 and the results were assessed for selection of the GMF Pond Part 845 monitoring well network. Groundwater samples were collected and analyzed for 35 I.A.C. § 845.600 parameters as summarized in **Table C** below.

Table C. Part 845 Groundwater Monitoring Program Parameters

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

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

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 GMF Pond. 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 2021, 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 seven wells screened in the uppermost aquifer (G02S, G50S, G51S, G54S, G57S, G60S, and G64S), three wells screened in the PMP (G54L, G60L, and G64L), and one temporary water level only monitoring point (X301) that is located in a riser along the south end of the pond for monitoring the phreatic surface within the GMF Pond. The proposed network is summarized in **Table D** below and displayed on **Figure 2-2**. Ten wells (three background and seven compliance) will be used to monitor groundwater concentrations within the hydrostratigraphic units.

The groundwater samples collected from the ten 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 D** below.

Table D. Proposed Part 845 Monitoring Well Network

Well ID	Monitored Unit	Well Screen Interval (feet bgs)	Well Type[1]
G02S	UA	23.0 – 28.0	Background
G50S	UA	29.2 – 34.0	Background
G51S	UA	24.0 – 28.8	Background
G54L	PMP	27.3 – 36.8	Compliance
G54S	UA	43.5 – 48.0	Compliance
G57S	UA	29.7 – 34.2	Compliance
G60L	PMP	20.1 – 24.9	Compliance
G60S	UA	31.1 – 35.9	Compliance
G64L	PMP	18.1 – 27.5	Compliance
G64S	UA	34.5 – 39.0	Compliance
X301[2,3]	CCR	NA	WLO

[1] Well Type refers to the role of the well in the monitoring network.
[2] Well is to be used for water level data collection only.
[3] Location is temporary pending implementation of impoundment closure per an approved Construction Permit Application.
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

Groundwater at the GMF Pond meets the definition of Class I – Potable Resource Groundwater (35 I.A.C. § 620.210), based on the following criteria:

- Groundwater in the uppermost aquifer extends ten feet or more below the land surface.
- Field hydraulic conductivity tests performed in the unlithified geologic materials that include loess, shallow sand, and intermediate sand at the GMF Pond resulted in an overall (geometric mean) horizontal hydraulic conductivity exceeding the 1×10^{-4} centimeters per second (cm/s) criterion.

However, background (upgradient) groundwater originates from areas north and west of the GMF Pond that have been surface mined and present a significant alternative source for groundwater impacts.

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 GWPSs 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 results of the statistical analysis of background groundwater data (**Table 3-1**) indicate that most background concentrations in the 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 exception being lead, where the background concentration is greater than the 35 I.A.C. § 845.600(a)(1) standard (0.015 milligrams per liter [mg/L] versus 0.0075 mg/L). In this instance, the GWPS will be the background concentration.

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

a future mean (for 50 to 70 percent non-detects) or median (for greater than 70 percent non-detects) will be compared to the GWPS. Consistent with the *Unified Guidance*, the same general statistical method of confidence interval testing against a fixed GWPS is recommended in compliance and corrective action programs. Confidence intervals provide a flexible and statistically accurate method to test how a parameter estimated from a single sample compares to a fixed numerical limit. Confidence intervals explicitly account for variation and uncertainty in the sample data used to construct them.

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

4. GROUNDWATER MONITORING PLAN

The 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 GMF Pond exist: IEPA WPCP monitoring program, the 40 C.F.R. § 257 monitoring program, and the proposed Part 845 monitoring program. These programs will continue to be monitored as specified in IEPA approvals or 40 C.F.R. § 257. Upon approval of the Operating Permit applications (and by extension the GMP) for the GMF Pond, the monitoring program required by IEPA WPCP will be discontinued following approval of a future permit modification submittal and will be replaced by the proposed Part 845 monitoring program. 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 Plan 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 monitoring program was discussed in detail in **Section 2.1.1**. Monitoring wells are sampled on a quarterly and yearly frequency for the parameters required under IEPA WPCP 2017-EO-62640. Well locations and parameters will continue to be monitored as required by the WPCP until IEPA approves the Operating Permit (and by extension the GMP) for the GMF Pond.

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**. Seven wells (three 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 three background monitoring wells (G02S, G50S, and G51S), seven compliance monitoring wells (G54L, G54S, G57S, G60L, G60S, G64L, and G64S), and one temporary water level only monitoring point (X301) to monitor potential impacts from the GMF Pond (**Figure 2-2**). The monitoring wells are screened within the uppermost aquifer (G02S, G50S, G51S, G54S, G57S, G60S, and G64S) and PMP (G54L, G60L, and G64L) along the perimeter of the GMF Pond. Groundwater samples will be collected and analyzed for the laboratory and field parameters in **Table E** below.

Table E. Part 845 Groundwater Monitoring Program Parameters

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

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

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 F. 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 program 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 GMF Pond 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; 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 GMF Pond caused the contamination and the GMF Pond 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, an OBG Company (NRT/OBG), 2017a. *Hydrogeologic Monitoring Plan, Duck Creek GMF Pond – CCR Unit ID 203 and Duck Creek Landfill – CCR Unit ID 204.* October 17, 2017.

Natural Resource Technology, an OBG Company. (NRT/OBG), 2017b. *Sampling and Analysis Plan, Final, Duck Creek GMF Pond, Duck Creek Power Station, Canton, Illinois, Project No. 2285, Revision 0.* October 17, 2017.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021. *Hydrogeologic Site Characterization Report. Gypsum Management Facility Pond. Duck Creek Power Plant*. Canton, 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.

TABLES

TABLE 1-1. PART 845 REQUIREMENTS CHECKLIST

GROUNDWATER MONITORING PLAN

DUCK CREEK POWER PLANT

GMF POND

CANTON, 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 Table 2-1
845.630(a) 845.630(b) 845.630(c)	At least two upgradient wells and four downgradient wells (min. 1 and 3, but requires additional documentation)	Sections 2.2 & 4.1.3 Table 2-1 Figure 2-2
845.630(a) 845.630(b) 845.630(c)	Downgradient Well Density	Figure 2-2
845.630(a)(2)	Downgradient wells at waste boundary	Figure 2-2
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

TABLE 1-1. PART 845 REQUIREMENTS CHECKLIST

GROUNDWATER MONITORING PLAN

DUCK CREEK POWER PLANT

GMF POND

CANTON, 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) and (3)	Staff gauge/ piezometer to monitor head in impoundment	Sections 2.2 & 4.1.3 Figure 2-1 (X301)
NA	Staff gauge/ piezometer to monitor head of neighboring surface water body	NA

[O: CJC 09/17/21; C: LDC 09/20/21]

Notes:

GMP = Groundwater Monitoring Plan

NA = Not Applicable

TABLE 2-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
GROUNDWATER MONITORING PLAN
DUCK CREEK POWER PLANT
GMF POND
CANTON, 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)
G02S	B	UA	09/29/2003	--	621.66	Top of Disk	619.18	23.00	28.00	596.18	591.18	28.00	589.20	5	2	40.512879	-89.991105
G50S	B	UA	03/13/2007	623.65	623.65	Top of Riser	620.83	29.17	33.98	591.66	586.85	34.30	586.50	4.8	2	40.508672	-89.990607
G51S	B	UA	01/28/2008	619.66	619.66	Top of Riser	616.83	24.01	28.79	592.82	588.04	29.16	587.70	4.8	2	40.50656	-89.990864
G54L	C	UA/PMP	02/12/2009	622.95	622.95	Top of Riser	620.18	27.32	36.75	592.86	583.43	37.22	583.00	9.4	2	40.504524	-89.988927
G54S	C	UA	02/12/2009	622.98	622.98	Top of Riser	620.25	43.50	47.97	576.75	572.28	48.41	571.80	4.5	2	40.504525	-89.98894
G57S	C	UA	01/30/2009	622.76	622.76	Top of Riser	620.20	29.65	34.18	590.55	586.02	34.62	582.20	4.5	2	40.505608	-89.987043
G60L	C	UA/PMP	01/17/2008	615.39	615.39	Top of Riser	612.69	20.12	24.91	592.57	587.78	25.28	587.40	4.8	2	40.506745	-89.986816
G60S	C	UA	01/16/2008	615.03	615.03	Top of Riser	612.33	31.12	35.91	581.21	576.42	36.29	574.30	4.8	2	40.506732	-89.986815
G64L	C	UA/PMP	01/22/2009	622.46	622.46	Top of Riser	620.24	18.12	27.48	602.12	592.76	27.95	592.30	9.4	2	40.508378	-89.987007
G64S	C	UA	01/22/2009	623.06	623.06	Top of Riser	620.25	34.50	38.99	585.75	581.26	39.48	580.30	4.5	2	40.508365	-89.987011
X301	WLO	S	--	--	--	--	--	--	--	--	--	--	--	--	--	40.504777	-89.990046

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
ft = foot or feet
HSU = Hydrostratigraphic Unit
PVC = polyvinyl chloride
S = source water
UA = uppermost aquifer
UA/PMP = uppermost aquifer/potential migration pathway

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RAMBOLL

TABLE 3-1. BACKGROUND GROUNDWATER QUALITY AND STANDARDS
GROUNDWATER MONITORING PLAN
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Parameter	Background Concentration	845 Limit	Groundwater Protection Standard	Unit
Antimony, total	0.003	0.006	0.006	mg/L
Arsenic, total	0.0092	0.010	0.010	mg/L
Barium, total	0.28	2.0	2.0	mg/L
Beryllium, total	0.001	0.004	0.004	mg/L
Boron, total	0.21	2	2	mg/L
Cadmium, total	0.001	0.005	0.005	mg/L
Chloride, total	17	200	200	mg/L
Chromium, total	0.0059	0.1	0.1	mg/L
Cobalt, total	0.002	0.006	0.006	mg/L
Fluoride, total	0.498	4.0	4.0	mg/L
Lead, total	0.015	0.0075	0.015	mg/L
Lithium, total	0.02	0.04	0.04	mg/L
Mercury, total	0.00098	0.002	0.002	mg/L
Molybdenum, total	0.0023	0.1	0.1	mg/L
pH (field)	7.4 / 6.6	9.0 / 6.5	9.0 / 6.5	SU
Radium 226 and 228 combined	2	5	5	pCi/L
Selenium, total	0.0012	0.05	0.05	mg/L
Sulfate, total	55	400	400	mg/L
Thallium, total	0.001	0.002	0.002	mg/L
Total Dissolved Solids	483	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
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Parameter	Analytical Method [1]	Number of Samples	Field Duplicates [2]	Field Blanks [3]	Equipment Blanks [3]	MS/MSD [4]	Total	Container Type	Minimum Volume [5]	Preservation (Cool to 4 °C for all samples)	Sample Hold Time from Collection Date
Metals											
Metals [6]	6020, Li - EPA 200.7	10	1	0	0	1	12	plastic	600 mL	HNO_3 to pH<2	6 months
Mercury	7470A or 6020	10	1	0	0	1	12	plastic	400 mL	HNO_3 to pH<2	28 days
Inorganic Parameters											
Fluoride	9214 or EPA 300	10	1	0	0	1	12	plastic	300 mL	Cool to 4 °C	28 days
Chloride	9251 or EPA 300	10	1	0	0	1	12	plastic	100 mL	Cool to 4 °C	28 days
Sulfate	9036 or EPA 300	10	1	0	0	1	12	plastic	50 mL	Cool to 4 °C	28 days
Total Dissolved Solids	SM 2540 C	10	1	0	0	1	12	plastic	200 mL	Cool to 4 °C	7 days
Radium											
Radium 226	9315 or EPA 903	10	0	0	0	0	10	plastic	1000 mL	HNO_3 to pH<2	6 months
Radium 228	9320 or EPA 904	10	0	0	0	0	10	plastic	1000 mL	HNO_3 to pH<2	6 months
Field Parameters											
pH	SM 4500-H+ B	10	NA	NA	NA	NA	10	flow-through cell	NA	none	immediately
Dissolved Oxygen [8]	SM 4500-O/405.1	10	NA	NA	NA	NA	10	flow-through cell	NA	none	immediately
Temperature [8]	SM 2550	10	NA	NA	NA	NA	10	flow-through cell	NA	none	immediately
Oxidation/Reduction Potential [8]	SM 2580 B	10	NA	NA	NA	NA	10	flow-through cell	NA	none	immediately
Specific Conductance [8]	SM 2510 B	10	NA	NA	NA	NA	10	flow-through cell	NA	none	immediately
Turbidity [7]	SM 2130 B	10	NA	NA	NA	NA	10	flow-through cell or hand-held turbidity meter	NA	none	immediately

[O: CJC 09/17/21; C: LDC 09/20/21]

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
GMF = Gypsum Management Facility
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

DUCK CREEK POWER PLANT

GMF POND

CANTON, 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]

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TABLE 4-2. DETECTION AND REPORTING LIMITS FOR PART 845 PARAMETERS

GROUNDWATER MONITORING PLAN

DUCK CREEK POWER PLANT

GMF POND

CANTON, ILLINOIS

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

[O: CJC 09/17/21; C: LDC 09/20/21]

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

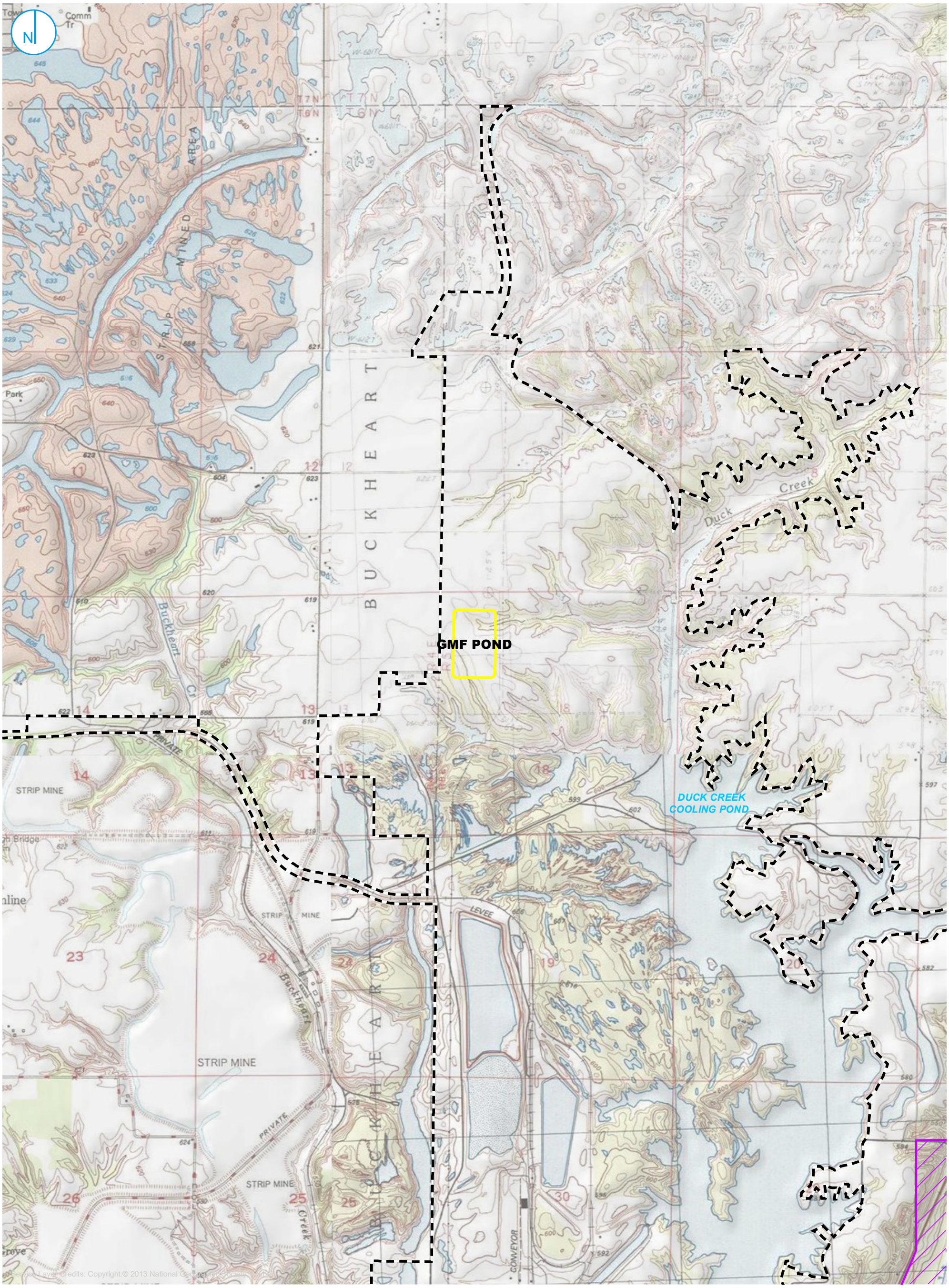
pCi/L = picoCuries per liter

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 (SUBJECT UNIT)
PROPERTY BOUNDARY
RICE LAKE STATE RECREATION AREA

0 1,000 2,000 Feet

SITE LOCATION MAP

FIGURE 1-1

GROUNDWATER MONITORING PLAN
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

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PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
PROPERTY BOUNDARY

0 150 300 Feet

SITE MAP

FIGURE 1-2

GROUNDWATER MONITORING PLAN
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

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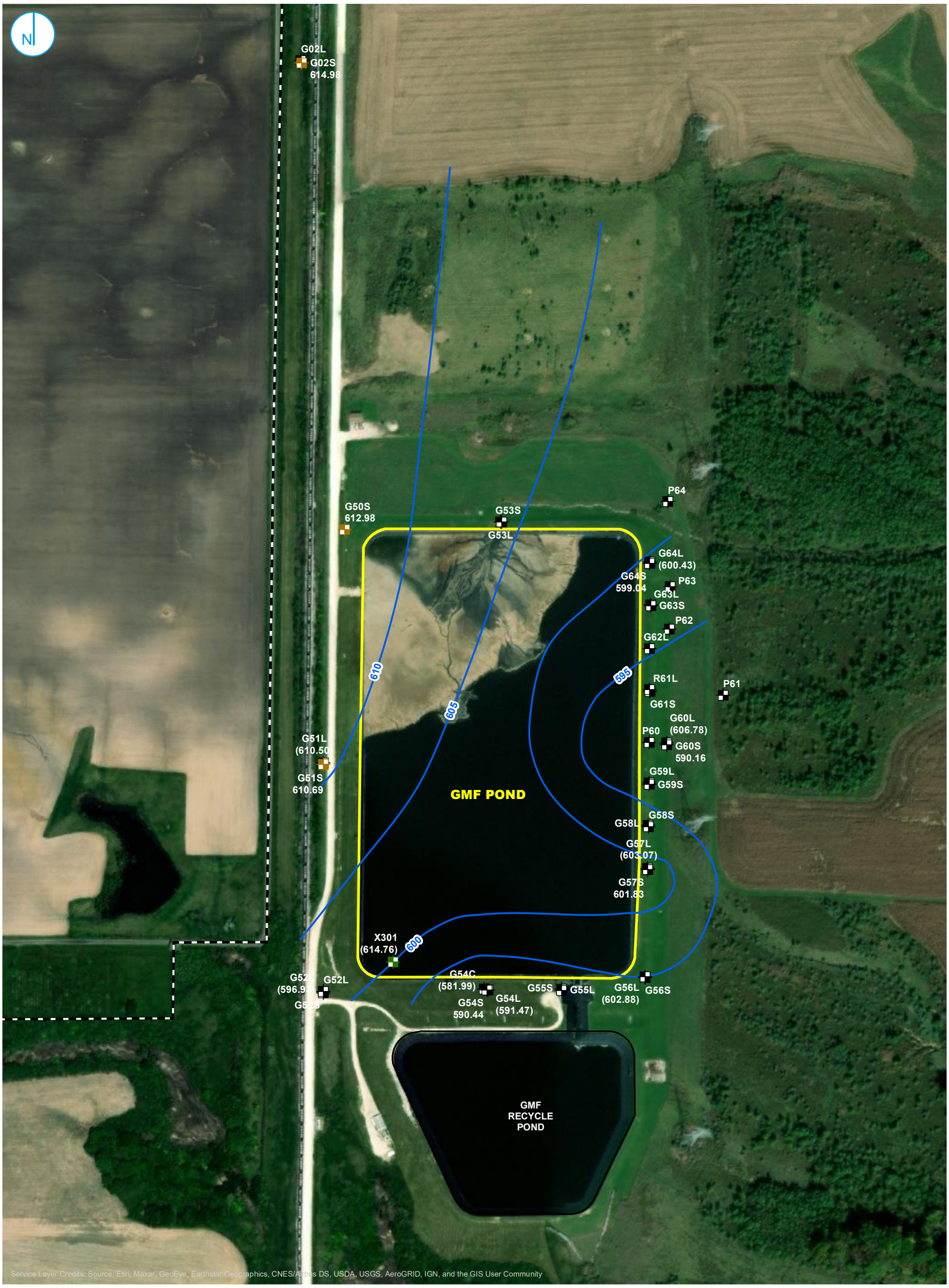

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
PROPERTY BOUNDARY

0 150 300 Feet

UPPERMOST AQUIFER GROUNDWATER ELEVATION CONTOURS APRIL 14, 2021

GROUNDWATER MONITORING PLAN
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

FIGURE 1-3

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MONITORING WELL
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
PROPERTY BOUNDARY

0 150 300 Feet

IEPA MONITORING PROGRAM WELL NETWORK

FIGURE 2-1

GROUNDWATER MONITORING PLAN
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

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BACKGROUND WELL
COMPLIANCE WELL
SOURCE SAMPLE LOCATION
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
PROPERTY BOUNDARY

0 150 300 Feet

PROPOSED PART 845 GROUNDWATER MONITORING WELL NETWORK

GROUNDWATER MONITORING PLAN
GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

FIGURE 2-2

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APPENDIX A
STATISTICAL ANALYSIS PLAN

Prepared for
Illinois Power Resources Generating, LLC

Date
October 25, 2021

Project No.
1940100806-003

STATISTICAL ANALYSIS PLAN

GYPSUM MANAGEMENT FACILITY POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

RAMBOLL Bright ideas. Sustainable change.

STATISTICAL ANALYSIS PLAN
DUCK CREEK POWER PLANT GYPSUM MANAGEMENT FACILITY POND

Project Name	**Duck Creek Power Plant Gypsum Management Facility Pond**
Project No.	**1940100806-003**
Recipient	**Illinois Power Resources Generating, LLC**
Document Type	**Statistical Analysis Plan**
Version	**FINAL**
Date	**October 25, 2021**

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Senior Managing Hydrogeologist

Eric J. Tlachac, PE
Senior Managing Engineer

Rachel A. Banoff, EIT
Project Statistician

LICENSED PROFESSIONAL CERTIFICATIONS

This certification is based on the description of the statistical methods selected to evaluate groundwater as presented in the following Statistical Analysis Plan; Duck Creek Power Plant Gypsum Management Facility 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; Duck Creek Power Plant Gypsum Management Facility 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

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; Duck Creek Power Plant Gypsum Management Facility 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

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; Duck Creek Power Plant Gypsum Management Facility 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

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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 100th percentile is (1–*P*). The number of sample values falling below the *P* x 100th percentile out of a set of n should follow a binomial distribution with parameters n and success probability *P*, where 'success' is defined as the event that a sample measurement is below the *P* x 100th percentile. The probability that the interval formed by a given pair of order statistics will contain the percentile of interest will then be determined by a cumulative binomial distribution *Bin(x;n,p)*, representing the probability of *x* or fewer successes occurring in *n* trials with success probability p. *P* will be set to 0.50 for an interval around the median.

The sample size n will be ordered from least to greatest. Given *P* = 0.50, candidate interval endpoints will be chosen by ordered data values with ranks close to the product of (n+1) x 0.50. If the result of (n+1) x 0.50 is a fraction (for even-numbered sample sizes), the rank values immediately above and below will be selected as possible candidate endpoints. If the result of (n+1) x 0.50 is an integer (for odd-numbered sample sizes), one will be added to and subtracted

from the result to get the upper and lower candidate endpoints. The ranks of the endpoints will be denoted L* and U*. For a one-sided LCL, the confidence level associated with endpoint L* will be computed as:

$$1 - \alpha = Bin(L^* - 1; n, 0.50) = \sum_{x=L^*}^{n} \binom{n}{x} \left(\frac{1}{2}\right)^n$$

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-α) and a point in time (t_0), will be computed as follows:

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

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

$\hat{x}_0$ = 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-α)th percentile, $\hat{x}_j^{[1-\alpha]}$ at each time point (tj).

For background data, the UCL around the Thiel-Sen trend line will be used as the GWPS for the trending constituent. For compliance data, confidence bands around the Thiel-Sen trend line will be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance wells. A GWPS exceedance is confirmed when the LCL based on the trend line first exceeds the GWPS.

3.2 Determination of Statistically Significant Increases over Background

In accordance with 35 I.A.C. §§ 845.610(b)(3)(B) and 845.640(h), individual monitoring event concentrations for each constituent detected in the compliance monitoring wells during compliance monitoring sampling events will be compared to the background concentration as determined by the methods described above. An exceedance of the background concentration for any constituent measured at any compliance monitoring well, or constituent detection if not detected in the background samples, constitutes a Statistically Significant Increase (SSI). An exception to this method is pH, where two-sided (upper and lower) tolerance limits are established from the distribution of the background groundwater quality data. An exceedance of either the UTL or lower tolerance limit (LTL) would constitute an SSI for pH.

4. REFERENCES

Davis, C.B., 1994. *Environmental Regulatory Statistics.* In GP Patil & CR Rao (Eds.) *Handbook of Statistics, Volume 12: Environmental Statistics*, Chapter 26. New York: Elsevier Science B.V.

United States Environmental Protection Agency (USEPA), 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance*. EPA 530-R-09-007. March 2009.

ATTACHMENT J

Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: IEPA Part 845 – Slope Maintenance Documentation for GMF Pond at Duck Creek Power Plant

Illinois Power resources Generating, LLC operates the coal-fired Duck Creek Power Plant (Plant) located in Fulton County, Illinois. The GMF Pond is an inactive surface impoundment storing coal combustion residuals (CCR). The requirements for the Duck Creek GMF Pond are found in 35 Ill. Admin. Code 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

Pursuant to Part 845, Section 845.230(d)(2)(F), the initial operating permit application for existing or inactive CCR surface impoundments that have not completed an Agency approved closure before prior to July 30, 2021, must contain documentation that the CCR surface impoundment, if not incised, will be operated, and maintained with one of the forms of slope protection specified in Section 845.430. This statement addresses the requirements of Part 845, Section 845.430 Slope Maintenance, which states:

> *<u>Section 845.430:</u> The slopes and pertinent surrounding areas of the CCR surface impoundment must be designed, constructed, operated, and maintained with one of the forms of slope protection specified in subsection (a) that meets all the performance standards of subsection (b).*
>
> *<u>Section 845.430(a):</u> Slope protection must consist of one of the following: 1) A vegetative cover consisting of grassy vegetation; 2) An engineered cover consisting of a single form or combination of forms of engineered slope protection measures; or 3) A combination of the forms of cover specified in subsections (a)(1) or (a)(2).*
>
> *<u>Section 845.430(b):</u> Any form of cover for slope protection must meet the following performance standards: 1) The cover must be installed and maintained on the slopes and pertinent surrounding areas of the CCR surface impoundment; 2) The cover must provide protection against surface erosion, wave action, and adverse effects of rapid drawdown; 3) The cover must be maintained to allow for the observation of, and access to, the slopes and pertinent surrounding areas during routine and emergency events; 4) Woody vegetation must be removed from the slopes or pertinent surrounding areas. Any removal of woody vegetation with a diameter greater than 1/2 inch must be directed by a person familiar with the design and operation of the CCR surface impoundment and in consideration of the complexities of removal of a tree or a shrubbery, who must ensure the removal does not create a risk of destabilizing the CCR surface impoundment or otherwise adversely affect the stability and safety of the CCR surface impoundment or*

> *personnel undertaking the removal; and 5) The height of vegetation must not exceed 12 inches.*

Slope protection, consisting of vegetative cover, was installed on the slopes and pertinent surrounding areas of the Duck Creek GMF Pond, and is inspected, maintained and repaired as needed. Based on observations from weekly inspections conducted in accordance with Section 845.540(a), and the 2020 annual inspections conducted by Hanson Professional Services Inc., the vegetative cover is described to be in good working condition with a maximum vegetation height of 12 inches. The owner's Operations and Maintenance Plan (O&M Plan) provides details for maintaining grass and removing woody vegetation and addressing erosion features on the slopes. Based on a review of the documentation described above, the owner is implementing the O&M Plan, including the completion of repairs and maintenance as needed and when issues are identified during weekly and/or annual inspections. The slope maintenance portion of the O&M Plan and the Annual Inspection performed by Hanson in 2020 are included in Attachment J. The surface impoundment slope protection (vegetative cover) installed and maintained on the slopes and pertinent areas around the slopes is depicted in the aerial photograph provided below.

Source: Imagery ©2021 Maxar Technologies, USDA Farm Service Agency, Map data ©2021 (accessed via Google® on 10/20/21)

Excerpt from the Duck Creek Operations and Maintenance Manual

1.1 OPERATION AND MAINTENANCE INSPECTION

"Walk-around" inspections of the dams and appurtenant works are to be made by the dam Operator. During these inspections, a checklist of items to be maintained and items to be observed should be recorded. The checklist provided in Appendix B shall be utilized for these inspections. **If any of the following items are found to be unusual or are cause for concern, Shift Supervisor should be immediately notified.**

Frequency: Weekly. Also, during and after unusual events such as heavy rainfall or after an earthquake.

Inspection Items: During each inspection the following items should be noted.

1. Water Level - Maximum levels because of heavy rainfall should be recorded.

2. Earth Embankment - Walk the crest, side slopes and downstream toe of the dam concentrating on surface erosion, seepage, cracks, settlement, slumps, slides, and animal burrows. These are described as follows:

   - Surface Erosion - Removal of vegetative cover by water action or pedestrian or vehicle usage forming deep ruts or gullies.

   - Seepage - The passage of water through and/or underneath the earth embankment abutment and natural groundline or at the contact between the embankment and outlet works. It can be indicated by cattails or other wet environmental vegetation, erosion, channelization, or slumping on the embankment face.

   - Cracks - Deep cracks usually indicate the movement of the dam and/or the foundation and can be in either the longitudinal (along the length of the dam) or transverse (across the dam) directions. Cracking can be an indicator of the beginning of slumps. Shallow cracks may develop during the summer when the surface soils of the embankment become severely dried and are usually of no concern regarding the safety of the dam.

   - Settlement - Settlement is indicated by depressions or low spots and can be signs of consolidation of the dam or foundation or the loss of material beneath the settlement area.

   - Slumps/Slides - A slow or sudden movement of the earth embankment slope on either face toward the toe of the dam.

- If seepage indicates the presence of soil particles, or if deep cracks, settlement, slumps, or slides are noticed, a qualified engineer should be contacted immediately for consultation.

- Animal Burrows - Animal burrows result in a loss of earth embankment material and can provide seepage paths for water through the embankment.

3. Gypsum Embankment - Walk the crest, side slopes and downstream toe of the dam concentrating on surface erosion, seepage, cracks, settlement, slumps, slides, and animal burrows. The descriptions for these are the same as for earth embankment.

4. Vegetation - Grass should be a thick vigorous growth to stabilize the earth embankment soils and prevent erosion from occurring. Note the height of the grass, if greater than 1-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 ft of the embankment toes or other structures. The gypsum embankment will not be seeded and is not expected to have any vegetation.

5. Gypsum Stack piezometers should be inspected for any damage or loss of function. Damaged piezometers must be promptly repaired or replaced since their function is critical to ensuring stability of the gypsum stack.

6. The water level in each Gypsum Stack piezometer must be measured and recorded. If the water level in any piezometer is above the "critical elevation" as discussed in Section **Error! Reference source not found.**, Ameren should be notified, and the **design engineer should be immediately consulted for guidance on an appropriate course of action**.

7. Gypsum Stack LD/LCRS Drains - The change in location or amount of flow discharging from the Leak Detection/Leachate Collection Recovery System (LD/LCRS) should be recorded. If a significant change has occurred, a qualified engineer should be contacted for consultation.

8. Gypsum Stack Ring Drains - The change in location or amount of flow discharging from the Ring Drains should be recorded. If a significant change has occurred, a qualified engineer should be contacted for consultation.

9. Gypsum Stack Fixed Decant – Check the alignment and supports for the pipe. Record the amount of flow discharging from the pipe and any erosion or scour around the discharge point.

10. Gypsum Stack Perimeter Ditch – The perimeter ditch should have a consistent prismatic shape for the entire length. Inspect the perimeter ditch for evidence of erosion, sediment deposition and irregularity in channel geometry, especially in the vicinity of siphon, decant or ring drain outfall structures. If irregularities are noted, repairs should be scheduled and completed.

11. Stop Logs - Check to make sure that the stop logs in the transfer ditch are undamaged, and, if installed, are operating well, and allowing for the free flow of water over them.

12. Transfer Channel - Check for any debris or other obstructions which may block or restrict the free flow of water. Check for any pools or undulation of the floor of the channel.

13. Recycle Pond Decant - Check for any debris or other obstructions around the Recycle Pond decant which may block or restrict the free flow of water. The emergency dewatering valve should be lubricated. If there is no return water in the pipe, the emergency dewatering valve should be exercised. Record the physical and operating conditions of the system.

14. Recycle Pond Drop Inlet Spillways - Check for any debris or other obstructions around the inlet crest and at the bottom of the drop inlet which may block or restrict the free flow of water. Check for the development of any rusty areas on the concrete, and seepage, cracking, breaking, or spalling of the concrete. Check for settlement or cracking of the crest. Check for any debris in the pipes which may restrict the flow of water. Check for any tears or leaks in the HDPE liner covering the concrete.

15. Recycle Pond Rip Rap Basin - Check for any debris or other obstructions in the riprap basin which may block or restrict the free flow of water. Check to make sure that the rip rap is remaining in a uniform position. Freeze/thaw action or flow over the rip rap may tend to lift or fracture, thus requiring replacement or leveling to maintain the necessary level of protection. NO trees or woody vegetation should be growing through the rip rap.

16. Fences - Check for damage, accumulated debris, operation of gates and locks, and adequacy of locations (this may change with time as people access the area or development occurs in the area).

17. Perimeter - Check the perimeter of the dams for a distance of at least 100 ft beyond the toe for signs of seepage or boils.

18. HDPE Liner – Wherever exposed, the HDPE Liner should be inspected for tears, gouges, protrusions under the liner and abrasion.

Dam Inspection Report

Name of Dam: Duck Creek GMF Gypsum Stack Dam ID No. IL 50573

Permit Number: DS2014020 Class of Dam: III

Location: _____ Section: 18 Township: 6N Range: 5E

Owner: Dynegy Midwest Generation (Name) 309-633-2836 (Telephone Number (Day))

17751 North Cilco Road (Street) 309-633-2836 (Telephone Number (Night))

Canton (City) 61520 (Zip Code) County: Fulton

Type of Dam: Earth embankment with geosynthetic liner

Type of Spillway: Overflow

Date(s) Inspected: 10-Nov-20

Weather When Inspected: Cloudy

Temperature When Inspected: 50 F

Pool Elevation When Inspected: 614.7

Tailwater Elevation When Inspected: NA

LICENSED PROFESSIONAL ENGINEER
JAMES P. KNUTELSKI
062-054206
OF ILLINOIS

12/31/2020

Professional Engineer's Seal

Exp 11/30/21

Inspection Personnel:

Name	Title
James P. Knutelski, P.E.	Geotechnical Engineer
Jason Campbell, P.E.	Dynegy Dam Safety
Daryl Johnson	Dynegy Plant
Paul Mauer	IDNR-OWR

The Department of Nautural Resources is requesting information that is necessary to accomplish the statutory purpose as outlined under the River, Lakes and Streams Act, 615 ILCS 5. Submittal of this information is REQUIRED. Failure to provide the required information could result in the initiation of non-compliance procedures as outlined in Section 3702.160 of the "Rules for Construction and Maintenance of Dams".

CONDITION CODES

NE - No evidence of a problem

GC - Good condition

MM - Item needing minor maintenance and/or repairs within the year, the safety or integrity of the item is not yet imperiled

IM - Item needing immediate maintenance to restore or ensure its safety or integrity

EC - Emergency condition which if not immediately repaired or other appropriate measures taken could lead to failure of the dam

OB - Condition requires regular observation to ensure that the condition does not become worse

NA - Not applicable to this dam

NI - Not inspected - list the reason for non-inspection under deficiencies

EARTH EMBANKMENT

ITEM	CONDITION CODE	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE
Surface Cracks	NE		
Vertical and Horizontal Alignment of Crest	GC		
Unusual Movement or Cracking At or Beyond Toe	NE		
Sloughing or Erosion of Embankment and Abutment Slopes	NE		
Upstream Face Slope Protection	GC		Note: Liner weld at anchor trench on both sides of spillway incomplete in small area approximately 2 inches in length was observed. Not a dam safety issue.
Seepage	NE		
Filter and Filter Drains	NA		

EARTH EMBANKMENT
(Continued)

ITEM	CONDITION CODE	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE
Animal Damage	NE		
Embankment Drainage Ditches	GC		
Vegetative Cover	GC		
Unwanted Vegetation	NE		
Other			
Other			
Other			

PRINCIPAL SPILLWAY

(Continued)

☐ Drop Inlet Spillway X Overflow Spillway Structure ☐ Gated

ITEM	CONDITION CODE	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE
Alignment of Abutment Walls	GC		
Construction Joints	NE		
Filter and Filter Drains	NA		
Trash Racks	NA		
Bridge and Piers	NA		
Differential Settlement	NE		
Outlet Channel	GC		

IF THE SPILLWAY IS GATED FILL OUT THE GATES SECTION

SUMMARY OF MAINTENANCE DONE AND/OR

REPAIRS MADE SINCE THE LAST INSPECTION

DATE OF PRESENT INSPECTION 10-Nov-20

DATE OF LAST INSPECTION 5-Nov-19

1. EARTH EMBANKMENT DAMS
   Mowed.

2. CONCRETE MASONRY DAMS
   NA

3. PRINCIPAL SPILLWAY
   None

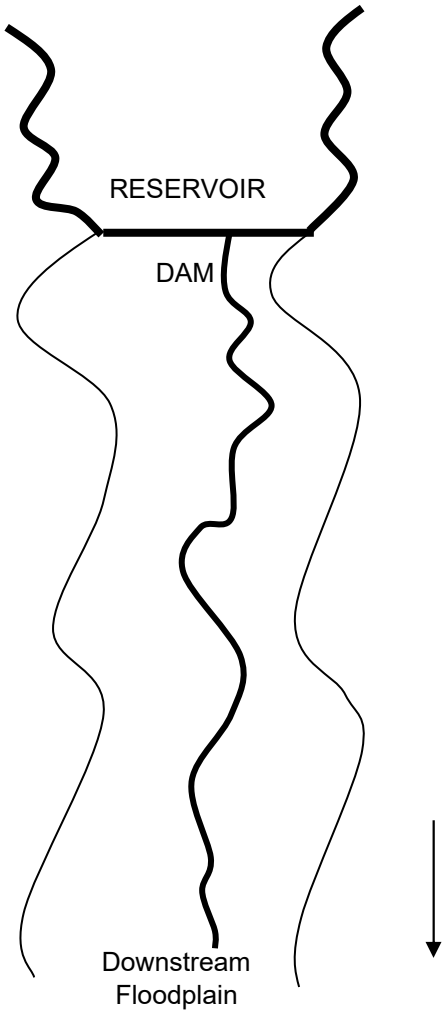
4. OUTLET WORKS
   NA

5. EMERGENCY SPILLWAY
   NA

DOWNSTREAM DEVELOPMENT
APPROXIMATE WIDTH OF AFFECTED FLOODPLAIN _____ MILES

MILES DOWNSTREAM FROM DAM	DOWNSTREAM DEVELOPMENT												Loss of Life Potential			Economic Loss Potential		
	OCCUPIED HOMES	UNOCCUPIED HOMES	AGRICULTURAL BUILDINGS	INDUSTRIAL BUILDINGS	COMMERCIAL BUILDINGS	SCHOOLS	HOSPITALS	ROADS & BRIDGES	DAMS	OVERHEAD UTILITIES	OTHER DEVELOPMENT (Name	OTHER DEVELOPMENT (Name	NONE	1 TO 10	OVER 10	MINIMAL EXPECTED	APPRECIABLE EXPECTED	EXCESSIVE EXPECTED
0 to 1/4	0	0	0	0	0	0	0	0	0	0	0	0	X			X		
1/4 to 1/2																		
1/2 to 3/4																		
3/4 to 1																		
1 to 1-1/4																		
1-1/4 to 1-1/2																		
1-1/2 to 1-3/4																		
1-3/4 to 2																		
OVER 2																		

SKETCH IN DEVELOPMENTS DOWNSTREAM OF THE DAM



The number of homes, buildings, or other items in the floodplain downstream of the dam should be placed in the appropriate row and column to designate their location.

Owner's Maintenance Statement

I, _____, owner of Duck Creek Gypsum Stack

Dam Identification Number IL 50573, in Fulton County,

am maintaining the dam in accordance with the accepted maintenance plan which is part of

Permit Number DS2014020.

_____
Signature

_____
Date

Owner's Operation and Maintenance Plan Statement

I, _____, owner of Duck Creek Gyp. Stack dam,

Dam Identification Number IL 50573, in Fulton County,

have reviewed the operation and maintenance plan including the Emergency Action Plan (EAP),

which is part of, Permit Number DS2014020.

I _____ have enclosed the appropriate revisions or

_____ have determined that no revisions to the plan are necessary.

_____
Signature

_____
Date

The Department of Nautural Resources is requesting information that is necessary to accomplish the statutory purpose as outlined under the River, Lakes and Streams Act, 615 ILCS 5. Submittal of this information is REQUIRED. Failure to provide the required information could result in the initiation of non-compliance procedures as outlined in Section 3702.160 of the "Rules for Construction and Maintenance of Dams".

Pond north side interior

North side

East side crest

East side interior slope

East side exterior

South side

West side exterior

Outlet structure

Outlet channel

ATTACHMENT K

POST-CLOSURE PLAN FOR EXISTING CCR SURFACE IMPOUNDMENT
40 C.F.R. § 257.104 and 35 I.A.C. 845.780
REV 0 – 10/30/2021

SITE INFORMATION

Site Name / Address	Duck Creek Power Plant / 17751 North Cilco Road, Canton, IL 62234		
Owner Name / Address	Illinois Power Generating Company / 6555 Sierra Drive Irving, Texas 75039		
CCR Unit	GMF Pond	Closure Method and Final Cover Type	Close In-Place Geomembrane with Soil and Vegetation Cover

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 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 damage to the geosynthetic components, 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, repairing, or replacing damaged geosynthetic components, replacing and compacting soil cover, repairing drainage channels that have been eroded, filling in depressions with soil, regrading, and reseeding areas of failed vegetation, as necessary. Pursuant to § 257.104(b)(3) and 35 I.A.C. 845.780(b)(3), the groundwater monitoring system will be maintained, and groundwater will be monitored as required by 40 C.F.R. § 257.90 through 40 C.F.R. § 257.98 and 35 I.A.C. 845.600 through 35 I.A.C. 845.680. Monitoring wells will be inspected during each groundwater sampling event. Monitoring wells and associated instrumentation will be maintained so that they perform to the design specifications throughout the life of the monitoring program. Groundwater monitoring frequency will be at least quarterly, except as provided in 40 C.F.R. § 257.94(d), 257.94(c), and 35 I.A.C. 845.650(b)(4).
40 C.F.R. § 257.104(d)(1)(ii) and 35 I.A.C. 845.780(d)(1)(B) – The name, address, telephone number and email address of the person or office to contact about the facility during the post-closure care period.	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 a retired electric generation facility. Planned uses of the property during the post-closure period are currently unknown, except for post-closure care of the CCR unit. Post-closure use of the property will not disturb the integrity of the final cover system or other components of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements of 40 C.F.R. Part § 257, Subpart D and 35 I.A.C. Part 845. Any other disturbance will be conducted following a demonstration that it will not increase the potential threat to human health or the environment, as required by 40 C.F.R. § 257.104(d)(1)(iii) and 35 I.A.C. 845.780 (d)(1)(C). The demonstration will be certified by a qualified professional engineer and submitted to the Illinois Environmental Protection Agency (IEPA). Per 40 C.F.R. § 257.104(d)(1)(iii) notification shall be provided to the State Director that the demonstration has been placed in the operating record and on the owners or operator's publicly accessible internet site. Following closure of the CCR unit, a notation on the deed to the property, or some other instrument that is normally examined during title search, will be recorded in accordance with 40 C.F.R. § 257.102(i) and 35 I.A.C. 845.760(h). The notation will notify potential purchasers of the property that the land has been used as a CCR unit and its use is restricted under the post-closure care requirements in 40 C.F.R. 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 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 Duck Creek GMF 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: Illinois Power Resources Generating, LLC; Duck Creek Power Plant; GMF Pond

I, John R. Hesemann, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the amended/initial written post closure plan, dated October 30, 2021, meets the requirements of 40 C.F.R. § 257.104 and 35 I.A.C. 845.780.

John R. Hesemann

Printed Name

9/28/2021

Date

JOHN ROBERT HESEMANN
062-058523
LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

11/30/2021

ATTACHMENT L

Date: 25 October 2021

Subject: 35 Ill. Admin. Code Part 845 – CCR Liner Design Criteria Demonstration for GMF Pond at Duck Creek Power Plant

Illinois Power Resources Generating, LLC is the owner of the inactive coal-fired Duck Creek Power Plant (Plant) located in Fulton County, Illinois. The GMF Pond is an inactive surface impoundment storing coal combustion residuals (CCR). The requirements for the GMF Pond are found in 35 Ill. Admin. Code (I.A.C.) Part 845 (Part 845).

This liner design criteria demonstration addresses the requirements of Section 845.400 Liner Design Criteria for Existing CCR Surface Impoundments, which states.

Section 845.400 Liner Design Criteria for Existing CCR Surface Impoundments

a) *An existing CCR surface impoundment is considered to be an existing lined surface impoundment if it has been constructed with either a composite liner that meets the requirements of subsection (b) or an alternative composite liner that meets the requirements of subsection (c).*

b) *Composite Liner*

1) *A composite liner must consist of two components: the upper component consisting of, at a minimum, a 30-mil geomembrane liner, and the lower component consisting of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1 x 10−7 centimeters per second (cm/sec). The geomembrane liner components consisting of high-density polyethylene (HDPE) must be at least 60 mil. The geomembrane liner or upper liner component must be installed in direct and uniform contact with the compacted soil or lower liner component.*

2) *The composite liner must be:*

A) *Constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the CCR or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation;*

B) *Constructed of materials that provide appropriate shear resistance of the upper and lower component interface to prevent sliding of the upper component, including on slopes;*

C) *Placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift; and*

D) Installed to cover all surrounding earth likely to be in contact with the CCR or leachate.

c) Alternative Composite Liner

1) An alternative composite liner must consist of two components: the upper component consisting of, at a minimum, a 30-mil geomembrane liner, and a lower component, that is not a geomembrane, with a liquid flow rate no greater than the liquid flow rate of two feet of compacted soil with a hydraulic conductivity of no more than 1 x 10−7 cm/sec. The geomembrane liner components consisting of high-density polyethylene (HDPE) must be at least 60 mil. If the lower component of the alternative liner is compacted soil, the geomembrane liner must be installed in direct and uniform contact with the compacted soil.

2) The liquid flow rate through the lower component of the alternative composite liner must be no greater than the liquid flow rate through two feet of compacted soil with a hydraulic conductivity of 1 x 10−7 cm/sec. The hydraulic conductivity for the two feet of compacted soil used in the comparison must be no greater than 1 x 10−7 cm/sec. The hydraulic conductivity of any alternative to the two feet of compacted soil must be determined using recognized and generally accepted methods.

3) The liquid flow rate comparison must be made using the following equation, which is derived from Darcy's Law for gravity flow through porous media.

$$Q/A = q = k\,((h/t)+1)$$

Where:
Q = flow rate (cubic centimeters/second)
A = Surface area of the liner (squared centimeters)
q = flow rate per unit area (cubic centimeters/ second/squared centimeter)
k = hydraulic conductivity of the liner (centimeters /second)
h = hydraulic head above the liner (centimeters); and
t = thickness of the liner (centimeters)

4) The alternative composite liner must meet the requirements specified in subsection (b).

d) The hydraulic conductivity of the compacted soil must be determined using recognized and generally accepted methods.

e) The owner or operator of an existing CCR surface impoundment that has not completed an Agency approved closure before July 30, 2021 must submit an initial operating permit application under Section 845.230 that demonstrates whether the CCR surface impoundment was constructed with either of the following:

1) *A composite liner that meets the requirements of subsection (b); or*

2) *An alternative composite liner that meets the requirements of subsection (c).*

h) *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer attesting that the CCR surface impoundment meets the requirements of subsection (a) and submit the certification to the Agency in the facility's initial operating permit application.*

A liner evaluation was conducted for the Duck Creek Power Plant GMF Pond in 2016 to evaluate conformance with liner design criteria set forth in 40 C.F.R. § 257.71 and 257.70 (as referenced in 257.71). The evaluation included a review of design drawings, laboratory test data, field test data, construction records and other available information. The evaluation results were documented in the *Liner Evaluation Report – Duck Creek GMF Pond*, prepared by Hanson Professional Services Inc. in October 2016. The report demonstrates that the Duck Creek Power Plant GMF Pond was constructed with an alternative composite liner, as defined in 40 C.F.R. § 257.70(c)(1), that meets the design criteria set forth in 40 C.F.R. § 257.71 and 257.70 (as referenced in 257.71). The report includes a certification from a qualified professional engineer licensed in the State of Illinois stating that the Duck Creek Power Plant GMF Pond meets the applicable requirements set forth in 40 C.F.R. § 257.71 and 257.70.

Because the liner design criteria set forth in Section 845.400 are nearly identical to those presented in 40 C.F.R. § 257.71 and 257.70, the previous liner evaluation report and associated certification demonstrate that the Duck Creek Power Plant GMF Pond meets the design criteria for an alternative composite liner set forth in Section 845.400(c). The previous liner evaluation report and associated certification are provided in Attachment L.

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, based on the information provided in the Duck Creek Power Plant GMF Pond Liner Evaluation Report prepared by Hanson Professional Services Inc., the Duck Creek Power Plant GMF Pond Liner meets the design criteria set forth in 35 I.A.C.845.400(a).

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

Liner Evaluation Report
Duck Creek GMF Pond

Illinois Power Resources Generating, LLC
Duck Creek Power Station
Fulton County, Illinois

October 2016

HANSON
Engineering | Planning | Allied Services

DUCK CREEK GMF POND
ILLINOIS POWER RESOURCES GENERATING, LLC
LICENSED PROFESSIONAL ENGINEER CERTIFICATION

As a Qualified Professional Engineer as defined by 40 CFR 257.53 and being a Professional Engineer licensed in the State of Illinois, I certify that I have personally examined and am familiar with the information in the Duck Creek GMF Pond Liner Evaluation Report and the Duck Creek GMF Pond Liner Documentation Report in the operating record and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete.

As required by 40 CFR 257.71(b), the Duck Creek GMF Pond Liner Evaluation Report and the Duck Creek GMF Pond Liner Documentation Report in the operating record are accurate, and the **Duck Creek GMF Pond** meets the requirements set forth in 40 CFR 257.71(a)(iii) as published on April 17, 2015. As required by 40 CFR 257.70(c)(2), the **Duck Creek GMF Pond** meets the requirements in 40 CFR 257.70(c)(2).

Steven M. Bishoff, P.E.
Hanson Professional Services Inc.
1525 South Sixth Street
Springfield, IL 62703-2886
(217) 788-2450
Registration No. 062-040449

Seal:

Signature: _____

Date: 10-10-2016

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1. Summary

The Duck Creek GMF Pond (GMF Pond) was constructed to retain wet-sluiced gypsum produced in the flue-gas scrubber at the Duck Creek Power Station. Construction of the GMF Pond began in 2007 with excavation of the site. Construction of the liner components began in April 2008 and was completed in February 2009. The GMF Pond encompasses about 30.0 acres within Section 18, Township 6 North, Range 5 East of the Fourth Principal Meridian, just north of the Duck Creek Power Station.

The composite liner system in the GMF Pond was designed to exceed compliance with Illinois Environmental Protection Agency rules for solid waste landfills by having a double HDPE geomembrane. Basic liner system performance criteria is contained in 35 Illinois Administrative Code (IAC) Part 811 as follows:

35 IAC 811.306 Liner Systems

d) Compacted Earth Liner Standards

1) The minimum allowable thickness shall be 1.52 meters (5 feet).

2) The liner shall be compacted to achieve a maximum hydraulic conductivity of $1X10^{-7}$ centimeters per second.

3) The construction and compaction of the liner shall be carried out in accordance with the construction quality assurance procedures of Subpart E so as to reduce void spaces and allow the liner to support the loadings imposed by the waste disposal operation without settling that causes or contributes to the failure of the leachate collection system.

4) The liner shall be constructed from materials whose properties are not affected by contact with the constituents of the leachate expected to be produced.

5) Alternative specifications, using standard construction techniques, for hydraulic conductivity and liner thickness may be utilized under the following conditions:

A) The liner thickness shall be no less than 1.52 meter (5 feet) unless a composite liner consisting of a geomembrane immediately overlying a compacted earth liner is installed. The following minimum standards shall apply for a composite liner:

i) the geomembrane shall be no less than 60 mils in thickness and meet the requirements of subsection (e); and

ii) the compacted earth liner shall be no less than 0.91 meter in thickness (3 feet) and meet the requirements of subsection (d)(2) through (d)(4).

B) The modified liner shall operate in conjunction with a leachate drainage and collection system to achieve equivalent or superior performance to the requirements of this subsection. Equivalent performance shall be evaluated at maximum annual leachate flow conditions.

In accordance with 35 IAC 811.306(d)(5), the GMF Pond was designed and constructed with an alternate liner system composed of the following, from lowest elevation to highest elevation:

- Three (3) feet of compacted clay with a hydraulic conductivity less than $9.8x10^{-7}$ cm/sec (from actual field testing);
- A geosynthetic clay liner (Bentomat SDN); and
- A 60-mil HDPE geomembrane.

In addition to the Part 811 requirements, the Duck Creek GMF Pond has a second 60-mil HDPE geomembrane with an active leachate collection system in the interstitial space between the two geomembranes. From the lowest geomembrane going upward, the additional components are listed below:

- One-foot of drainage sand for the leachate collection system;
- One-foot of cushion soil; and
- A second 60-mil HDPE geomembrane.

The dual liner with interstitial leachate collection system was designed to limit leachate head on the bottom geomembrane to 12 inches or less.

In April 2015, the United States Environmental Protection Agency published rules at 40 CFR Part 257, Subpart D, regulating the disposal of coal combustion residuals (CCR) in landfills and surface impoundments located in association with electrical utilities utilizing coal as the primary fuel source. Liner system performance criteria for existing CCR surface impoundments is contained in 40 CFR Part 257, Subpart D, as follows:

257.71 Liner design criteria for existing CCR surface impoundments.

(a)(1) No later than October 17, 2016, the owner or operator of an existing CCR surface impoundment must document whether or not such unit was constructed with any one of the following:

(i) A liner consisting of a minimum of two feet of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec;

(ii) A composite liner that meets the requirements of §257.70(b); or

(iii) An alternative composite liner that meets the requirements of §257.70(c).

(2) The hydraulic conductivity of the compacted soil must be determined using recognized and generally accepted methods.

(3) An existing CCR surface impoundment is considered to be an existing unlined CCR surface impoundment if either:

(i) The owner or operator of the CCR unit determines that the CCR unit is not constructed with a liner that meets the requirements of paragraphs (a)(1)(i), (ii), or (iii) of this section; or

(ii) The owner or operator of the CCR unit fails to document whether the CCR unit was constructed with a liner that meets the requirements of paragraphs (a)(1)(i), (ii), or (iii) of this section.

(4) All existing unlined CCR surface impoundments are subject to the requirements of §257.101(a).

(b) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer attesting that the documentation as to whether a CCR unit meets the requirements of paragraph (a) of this section is accurate.

(c) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in §257.105(f), the notification requirements specified in §257.106(f), and the Internet requirements specified in §257.107(f).

As referenced in 40 CFR 257.71(a)(1)(ii) and (iii), 40 CFR 257.70(b) and (c) -- Design criteria for new CCR landfills and any lateral expansion of a CCR landfill -- provide:

(b) A composite liner must consist of two components; the upper component consisting of, at a minimum, a 30-mil geomembrane liner (GM), and the lower component consisting of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} centimeters per second (cm/sec). GM components consisting of high density polyethylene (HDPE) must be at least 60-mil thick. The GM or upper liner component must be installed in direct and uniform contact with the compacted soil or lower liner component. The composite liner must be:

(1) Constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the CCR or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation;

(2) Constructed of materials that provide appropriate shear resistance of the upper and lower component interface to prevent sliding of the upper component including on slopes;

(3) Placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift; and

(4) Installed to cover all surrounding earth likely to be in contact with the CCR or leachate.

(c) If the owner or operator elects to install an alternative composite liner, all of the following requirements must be met:

(1) An alternative composite liner must consist of two components; the upper component consisting of, at a minimum, a 30-mil GM, and a lower component, that is not a geomembrane, with a liquid flow rate no greater than the liquid flow rate of two feet of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec. GM components consisting of high density polyethylene (HDPE) must be at least 60-mil thick. If the lower component of the alternative liner is compacted soil, the GM must be installed in direct and uniform contact with the compacted soil.

(2) The owner or operator must obtain certification from a qualified professional engineer that the liquid flow rate through the lower component of the alternative composite liner is no greater than the liquid flow rate through two feet of compacted soil with a hydraulic conductivity of 1×10^{-7} cm/sec. The hydraulic conductivity for the two feet of compacted soil used in the comparison shall be no greater than 1×10^{-7} cm/sec. The hydraulic conductivity of any alternative to the two feet of compacted soil must be determined using recognized and generally accepted methods. The liquid flow rate comparison must be made using Equation 1 of this section, which is derived from Darcy's Law for gravity flow through porous media.

(Eq. 1) $$\frac{Q}{A} = q = k\left(\frac{h}{t} + 1\right)$$

Where,
Q = flow rate (cubic centimeters/second);
A = surface area of the liner (squared centimeters);
q = flow rate per unit area (cubic centimeters/second/squared centimeter);
k = hydraulic conductivity of the liner (centimeters/second);
h = hydraulic head above the liner (centimeters); and t = thickness of the liner (centimeters).

> *(3) The alternative composite liner must meet the requirements specified in paragraphs (b)(1) through (4) of this section.*

In accordance with 40 CFR 257.70(b)(1) above, the composite liner in the Duck Creek GMF Pond was constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the CCR or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation. This information is located in Section 4 and Section 5 of the Duck Creek GMF Pond Liner Documentation Report located in the operating record.

In accordance with 40 CFR 257.70(b)(2) above, the composite liner in the Duck Creek GMF Pond was constructed of materials that provide appropriate shear resistance of the upper and lower component interface to prevent sliding of the upper component, including on slopes. This information is located in Section 4 of the Duck Creek GMF Pond Liner Documentation Report located in the operating record.

In accordance with 40 CFR 257.70(b)(3) above, the composite liner in the Duck Creek GMF Pond was placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift. This information is located in Section 4 of the Duck Creek GMF Pond Liner Documentation Report located in the operating record.

In accordance with 40 CFR 257.70(b)(4) above, the composite liner in the Duck Creek GMF Pond was installed to cover all surrounding earth likely to be in contact with the CCR or leachate. This information is located in the "Geosynthetics Quality Assurance Report, Gypsum Stack, AERG (Ameren) Duck Creek Power Station, Canton, Fulton County, Illinois. Feezor Engineering, Inc. (March 2009, Revised July 2009)" in the Duck Creek GMF Pond Liner Documentation Report located in the operating record.

The purpose of this report is to document that the existing composite liner in the Duck Creek GMF Pond meets the minimum requirements of 40 CFR 257.71(a)(1)(iii), i.e., an alternative composite liner that meets the requirements of § 257.70(c).

Briefly, in comparison:

35 IAC 811.306(d)(5)(A) requires a compacted clay liner of at least three (3) feet in thickness with a hydraulic conductivity of less than $1x10^{-7}$ cm/sec, overlain by a geomembrane of no less than 60-mils in thickness.

In addition, the Duck Creek GMF Pond has a second 60-mil HDPE geomembrane overlying an interstitial leachate collection system.

40 CFR 257.71(a)(1)(iii) requires that an alternative composite liner meet the requirements of 40 CFR 257.70(c), which requires (A) a lower component, that is not a geomembrane, with a liquid flow rate no greater than the liquid flow rate of two feet of compacted soil with a hydraulic conductivity of no more than $1x10^{-7}$ cm/sec; and (B) an upper component consisting of, at a minimum, a 30-mil geomembrane. If the geomembrane is composed of high-density polyethylene (HDPE), the geomembrane must be a minimum of 60-mils in thickness.

The soil liner comparison in 40 CFR 257.70(c)(2) is based on an assumed water driving head. In the ideal case, there should be no driving head as the overlying geomembrane would prevent downward migration of water. However, for practical purposes, the driving head is the water head on the overlying geomembrane. For the GMF Pond as-built case, the driving head is limited to 12-inches by the interstitial leachate collection system. For the comparison case, the double geomembrane liner would not exist, and the maximum driving head would be approximately 33.7 feet (the elevation difference between the lowest portion of the clay liner and the overlying pond surface).

The 40 CFR 257.70(c)(2) demonstration calculations comparing these two scenarios are contained in the Duck Creek GMF Pond Liner Documentation Report located in the operating record.

In summary, the lower component of the minimum alternative composite liner required by 40 CFR 257.70(c) has a flow rate per unit area of 1.785×10^{-6} cm/sec. The geosynthetic clay liner (GCL) in the GMF Pond has a flow rate per unit area of 4.9×10^{-8} cm/sec, and the as-built clay liner for the GMF Pond has a flow rate per unit area of 1.307×10^{-6} cm/sec. Consequently, each of the two components of the as-built liner of the GMF Pond exceeds the performance standard set by 40 CFR 257.70(c)(2) for the lower component of an alternative composite liner.

The major components of the construction and Construction Quality Assurance (CQA) of the GMF Pond liner are discussed in the sections below.

2. Foundation Preparation

Foundation preparation consisted of removing the soil to foundation grade in the bottom of the GMF Pond, construction of the perimeter berm containing the GMF Pond, and surveying and certifying the foundation surface.

Foundation preparation in 2008 consisted of removing excess soil above foundation grade, construction of the perimeter berm containing the GMF Pond, and surveying and certifying the subgrade surface prior to construction of the test soil liner and the full scale soil liner.

The construction contractor began removing soil material to foundation grade and stockpiling the cut material for later reuse as liner material. Unsuitable sand material was removed from several locations and these areas were backfilled with suitable foundation soils. The foundation surface was proof rolled and visually observed and any unsuitable soils were reworked or removed and replaced.

Foundation backfill lifts were compacted with a Cat 815 sheepsfoot compactor and tested for compaction using a Troxler nuclear moisture/density gauge at a minimum rate of one test per 10,000 yd^3 (minimum one test per compacted lift). Fill was placed in approximately 8-inch lifts and compacted to at least 95% Standard Proctor maximum dry density with moisture contents of -2% to +2% of optimum. Nuclear moisture/density and Standard Proctor test results are included in Appendix E in the Duck Creek GMF Pond Liner Documentation Report located in the operating record.

Finished foundation grades were verified by survey and certified, and CQA certifications of completion were provided by the CQA Officer (Appendices K and L in the Duck Creek GMF Pond Liner Documentation Report located in the operating record).

3. Berm Construction

The perimeter berm was constructed with structural fill excavated and hauled directly from within the GMF Pond and other borrow areas within the facility. Nuclear moisture/density gauge testing was performed during berm construction at a minimum rate of one test per 10,000 yd^3 (and a minimum one test per compacted lift). Fill was placed in approximately 8-inch lifts and compacted with a Cat 815 or 825 sheepsfoot compactor to at least 95% Standard Proctor maximum dry density with moisture contents of -2% to +2% of optimum. Areas that showed deficiencies in compaction or moisture content were reworked or removed, and then compacted with a Cat 815 or 825 sheepsfoot compactor and tested for moisture/density. Nuclear moisture/density and Standard Proctor test results are included in Appendix E of the Duck Creek GMF Pond Liner Documentation Report located in the operating record.

After berm construction was completed, eight Shelby tube samples were collected from the berm, and a soil sample from each tube was tested to determine in-place hydraulic conductivity (or permeability). In-place berm hydraulic conductivities ranged from 2.2×10^{-8} cm/sec to 1.0×10^{-7} cm/sec. Permeability test results and a drawing showing Shelby tube sample locations are included in Appendix E-3 of the Duck Creek GMF Pond Liner Documentation Report located in the operating record.

4. Test Soil Liner

Prior to construction of the full scale soil liner, two test soil liners were constructed using two different borrow sources. Test Soil Liner No. 1 was constructed in the southeast corner of the GMF Pond footprint. Test Soil Liner No. 2 was constructed to the northeast of the GMF Pond at a location outside the footprint, on higher ground, to avoid flooding from heavy rainfalls being experienced at the project site. The purpose of the test soil liners was to verify that the material and methods of construction proposed for the full scale soil liner would provide the quality of construction required by the design.

The borrow materials for Test Soil Liner No. 1 were the natural glacial till materials taken from the lower ±5 feet of GMF Pond excavation footprint. The borrow materials for Test Soil Liner No. 2 were obtained from the natural glacial till materials taken from the upper excavation levels in the GMF Pond footprint.

Pursuant to the CQA Plan, the test soil liners were sampled and tested for physical properties utilizing both laboratory and field testing. Required were at least five (5) two-stage field tests to determine both vertical and horizontal hydraulic conductivity and at least two (2) undisturbed Shelby tube samples tested in the laboratory for vertical hydraulic conductivity to determine if there was a statistical correlation with the field tests.

4.1 Test Soil Liner No. 1

4.1.1 Prequalification of Borrow Materials

While no prequalification testing was required by the regulations, a program of laboratory testing was carried out on typical samples of the glacial till materials used for the construction of Test Soil Liner No. 1. Tables 4.1 and 4.2 summarize the primary borrow material properties determined from the testing (Appendix F-1 of the Duck Creek GMF Pond Liner Documentation Report located in the operating record).

Table 4.1 Properties of Borrow Materials for Test Soil Liner No. 1

Sample Location	Percent of Fines	Liquid Limit	Plasticity Index	Maximum Dry Density (MDD)	Optimum Moisture Content (OMC)
GMF Pond Southeast Floor	70.9%	22%	5%	122.4 pcf	11.0%
GMF Pond Northwest Floor	68.4%	23%	7%	122.9 pcf	11.6%

Table 4.2 Results of Constant Head Permeability Tests on Borrow Materials

Sample Location	Dry Density	Moisture Content	Permeability Result
GMF Pond Southeast Floor	95% of MDD 95% of MDD	OMC 3% Wet of OMC	2.1×10^{-6} cm/sec 9.6×10^{-8} cm/sec
GMF Pond Northwest Floor	95% of MDD 95% of MDD	OMC 3% Wet of OMC	9.1×10^{-7} cm/sec 3.8×10^{-8} cm/sec

The measured percentages of fines and permeability values confirmed that the material was suitable to achieve the required design hydraulic conductivity. Based on these results, the field compaction criteria for the soil liner were set as follows:

Dry Density $\geq$ 95% MDD
Moisture Content = 0% to 5% Wet of OMC

4.1.2 Construction

The construction of Test Soil Liner No. 1 was initiated on May 1, 2008. The test soil liner was built in five lifts of approximately 8-inches and compacted with a Cat 815 sheepsfoot compactor.

Nuclear moisture/density gauge testing was performed at a minimum rate of one test per acre per lift or one test per 1,000 yd^3 to 95% Standard Proctor MDD with moisture contents of optimum to +5%. Nuclear moisture/density test results and a drawing showing the testing locations are included in Appendix F-3 of the Duck Creek GMF Pond Liner Documentation Report located in the operating record. The Standard Proctor test reports are included in Appendix F-4 of the Duck Creek GMF Pond Liner Documentation Report located in the operating record.

On June 17, 2008, Test Soil Liner No. 1 was completed after it was smooth drum rolled and then covered with plastic sheeting to prevent moisture loss.

4.1.3 Sampling and Testing Programs for Test Soil Liner

Pursuant to the CQA Plan, the test soil liner was sampled and tested for physical properties utilizing both laboratory and field testing. Required were at least five (5) two-stage field tests to determine the hydraulic conductivity (both vertical and horizontal hydraulic conductivity were calculated), and at least two (2) undisturbed Shelby tube samples tested in the laboratory for vertical hydraulic conductivity to determine a statistical correlation with the field tests.

4.1.3.1 Laboratory Testing

Three (3) Shelby tube samples (ST-01 thru ST-03) were collected from the original Test Soil Liner No. 1 on May 28, 2008. On June 18, 2008, three (3) additional Shelby tube samples (ST-04 thru ST-06) were collected from the test soil liner following repairs from flooding. A sample from each tube was tested for particle size analysis, Atterberg limits, and/or hydraulic conductivity. Table 4.3 summarizes the results of the testing (Appendix F-5 of the Duck Creek GMF Pond Liner Documentation Report located in the operating record contains laboratory test reports and Shelby tube sampling locations).

Table 4.3 Results of Laboratory Testing Program for Test Soil Liner No. 1

Sample No.	Percent of Fines	Liquid Limit	Plasticity Index	Hydraulic Conductivity, k_v	Lift
ST-01-5	67.7%	22%	7%	2.5×10^{-7} cm/sec	2
ST-02-2	71.8%	23%	7%	1.7×10^{-7} cm/sec	4/5
ST-03-3	65.0%	21%	5%	8.7×10^{-8} cm/sec	3/4
ST-04-5				3.0×10^{-7} cm/sec	2
ST-05-3				1.7×10^{-7} cm/sec	4
ST-06-2				2.1×10^{-7} cm/sec	4/5

4.1.3.2 Field Testing

Six (6) two-stage (Boutwell) field permeability tests were conducted on Test Soil Liner No. 1. The tests were carried out to measure the limiting values of field saturated hydraulic conductivity. The first stage of the test measures the maximum possible value for the vertical component of permeability (k_v) and the second stage measures the maximum possible value for the horizontal component of permeability (k_h). One test installation malfunctioned during testing and was abandoned. Table 4.4 summarizes the results of the testing.

Table 4.4 Results of Field Testing Program for Test Soil Liner No. 1

Date of Installation	Test No.	Stage 1 Permeability, k_v	Stage 2 Permeability, k_h
July 18 and 19, 2008	1	9.77×10^{-8} cm/sec	6.23×10^{-8} cm/sec
July 18 and 19, 2008	2	2.20×10^{-7} cm/sec	1.54×10^{-7} cm/sec
July 18 and 19, 2008	3	3.17×10^{-6} cm/sec	9.53×10^{-7} cm/sec
July 18 and 19, 2008	4	Abandoned	Abandoned
July 18 and 19, 2008	5	1.84×10^{-7} cm/sec	5.17×10^{-7} cm/sec
July 18 and 19, 2008	6	9.71×10^{-8} cm/sec	1.30×10^{-7} cm/sec

4.2 Test Soil Liner No. 2

4.2.1 Prequalification of Borrow Materials

Prequalification testing of the borrow materials for the gypsum stack soil liner was not a requirement of the CQA Plan. However, Shelby tube samples collected from the test soil liner were tested for particle size analysis, Atterberg limits, and hydraulic conductivity.

4.2.2 Construction

The construction of Test Soil Liner No. 2 was initiated on July 28, 2008. The test soil liner was built in five approximately 8-inch lifts and compacted with a Cat 815 sheepsfoot compactor.

Nuclear moisture/density gauge testing was performed at a minimum rate of one per acre per lift or one per 1,000 yd^3 to 95% Standard Proctor MDD with moisture contents of optimum to +5%. Nuclear moisture/density test results and a drawing showing the testing locations are included in Appendix F-3 of the Duck Creek GMF Pond Liner Documentation Report located in the operating record. The Standard Proctor test reports are included in Appendix F-4 of the Duck Creek GMF Pond Liner Documentation Report located in the operating record.

On August 1, 2008, Test Soil Liner No. 2 was completed after it was smooth drum rolled and then covered with plastic sheeting.

4.2.3 Sampling and Testing Programs for Test Soil Liner

Pursuant to the CQA Plan, the test soil liner was sampled and tested for physical properties utilizing both laboratory and field testing. Required were at least five (5) two-stage field tests to determine the hydraulic conductivity (both vertical and horizontal hydraulic conductivity were calculated), and at least two (2) undisturbed Shelby tube samples tested in the laboratory for vertical hydraulic conductivity to determine a statistical correlation with the field tests.

4.2.3.1 Laboratory Testing

Three (3) Shelby tube samples were collected from the test liner. A sample from each tube was tested for particle size analysis, Atterberg limits, and hydraulic conductivity. Table 4.5 summarizes the results of the testing (Appendix F-5 of the Duck Creek GMF Pond Liner Documentation Report located in the operating record contains laboratory test reports and Shelby tube sampling locations).

Table 4.5 Results of Laboratory Testing Program for Test Soil Liner No. 2

Sample No.	Percent of Fines	Liquid Limit	Plasticity Index	Hydraulic Conductivity, k_v	Lift
ST-08-1	95.7%	34%	14%	1.1×10^{-7} cm/sec	3/4
ST-09-2	97.5%	38%	18%	1.3×10^{-8} cm/sec	4
ST-10-3	95.0%	36%	17%	1.3×10^{-8} cm/sec	3

4.2.3.2 Field Testing

Five (5) two-stage (Boutwell) field permeability tests were conducted on Test Soil Liner No. 2. The tests were carried out to measure the limiting values of field saturated hydraulic conductivity. The first stage of the test measures the maximum possible value for the vertical component of permeability (k_v) and the second stage measures the maximum possible value for the horizontal component of permeability (k_h). A complete report of the field testing and data is included in the "Geosynthetics Quality Assurance Report, Gypsum Stack, AERG (Ameren) Duck Creek Power Station, Canton, Fulton County, Illinois. Feezor Engineering, Inc. (March 2009, Revised July 2009)" included in the Duck Creek GMF Pond Liner Documentation Report located in the operating record.

Table 4.6 summarizes the results of the testing.

Table 4.6 Results of Field Testing Program for Test Soil Liner No. 2

Date of Installation	Test No.	Stage 1 Permeability, k_v	Stage 2 Permeability, k_h
August 4 and 5, 2008	1	5.87×10^{-8} cm/sec	2.79×10^{-6} cm/sec
August 4 and 5, 2008	2	3.92×10^{-8} cm/sec	9.79×10^{-9} cm/sec
August 4 and 5, 2008	3	1.44×10^{-7} cm/sec	3.09×10^{-8} cm/sec
August 4 and 5, 2008	4	5.53×10^{-7} cm/sec	5.28×10^{-7} cm/sec
August 4 and 5, 2008	5	3.59×10^{-6} cm/sec	4.29×10^{-7} cm/sec

4.3 CQA Certification of Test Soil Liners

Based on the laboratory and field test results, the CQA Officer certified the construction of the test soil liners and that construction of the full scale soil liner could begin using the same soils and procedures used to construct the test liners.

5. Full Scale Soil Liner Construction

Soil materials excavated from the GMF Pond and from the north clay liner soil stockpile were used to construct the 3-ft thick soil liner within the GMF Pond. The soil was placed in approximately 8-inch lifts and compacted with a Cat 815 sheepsfoot compactor. Material placement commenced at the north end of the GMF Pond and proceeded to the south. Nuclear moisture/density gauge testing was performed at a minimum rate of one test per acre per lift or one test per 1,000 yd^3. As-placed densities met at least 95% Standard Proctor MDD with moisture contents of optimum to +5%. Nuclear moisture/density and Standard Proctor test results are included in Appendix G in the Duck Creek GMF Pond Liner Documentation Report located in the operating record.

Eighteen (18) Shelby tube samples were collected from the soil liner at various stages of construction. The hydraulic conductivity of the compacted soil liner was sampled and laboratory tested in accordance with ASTM D5084. A sample from each tube was tested to determine hydraulic conductivity. The sample intervals included at least one permeability test from each of the five liner construction lifts. The hydraulic conductivity results ranged from 8.6×10^{-9} cm/sec to 9.8×10^{-7} cm/sec. Permeability test results and a drawing showing Shelby tube sample locations are included in Appendix G-3 in the Duck Creek GMF Pond Liner Documentation Report located in the operating record.

Base grades and completed liner elevations were surveyed to ensure construction to the design grades and to verify minimum soil liner thickness. Record drawings and certified survey data are included in Appendices K and L, respectively, in the Duck Creek GMF Pond Liner Documentation Report located in the operating record. After the soil liner was smooth drum rolled, CQA certifications of its construction and grades were provided by the CQA Officer prior to installation of the GCL and 60-mil HDPE geomembrane liner.

6. GCL Installation

The GCL panels were placed on the rolled surface of the compacted soil liner. Panels were placed on the slopes with the long edge of the panel parallel to the direction of drainage. Panels on the floor were oriented in a manner to make installation as efficient as possible. GCL seams were constructed by overlapping their adjacent edges, generally 6 to 12 inches. The GCL panels included a proprietary groove along the longitudinal seams to ensure a proper seal. Seams at the end of panels were shingled in the direction of the grade and granular bentonite was applied to seams at end-of-rolls and at repairs at a rate of ¼ pound per lineal foot.

A third party engineering firm monitored the installation of all geosynthetic materials and assembled the manufacturing quality control (MQC) data, manufacturing quality assurance (MQA) testing data, installer subgrade acceptance, panel placement information, laboratory CQA test data from destruct samples, and field CQA test data for seam welding integrity. All of this data is included in the "Geosynthetics Quality Assurance Report, Gypsum Stack, AERG (Ameren) Duck Creek Power Station, Canton, Fulton County, Illinois. Feezor Engineering, Inc. (March 2009, Revised July 2009)" in the Duck Creek GMF Pond Liner Documentation Report located in the operating record.

7. Lower HDPE Geomembrane Liner Installation

Prior to installation of the lower 60-mil textured HDPE geomembrane liner on the floor and side slopes of the GMF Pond, the surface of the full scale soil liner was accepted by the geomembrane installer. In addition, the installation of the GCL was accepted by the geomembrane installer. Installation of the lower geomembrane liner began on September 27, 2008, and placement continued through November 5, 2008. Textured geomembrane liner was used on the GMF Pond floor and side slopes.

The lower HDPE geomembrane was placed immediately over the GCL. On the side slopes, the HDPE geomembrane was laid parallel to the slope and the tie-in weld with the bottom geomembrane was welded a minimum of 5 feet past the toe of the slope. Adjacent panels were overlapped approximately 4-6 inches and were shingled in the direction of the drainage.

Production seaming of the geomembrane panels was made using a dual hot wedge fusion welder. This device creates an air channel between two fused seams that can later be tested with pressurized air to assure there is no leakage. Destruct sample sites and repairs were welded with extrusion welds which were checked for leaks with a vacuum box. All seams were sampled at a rate of one destruct sample for every 500 feet of seam and tested for strength parameters in the laboratory.

8. Upper HDPE Geomembrane Liner Installation

Following installation of the lower 60-mil textured HDPE geomembrane liner, a 10-oz. non-woven geotextile was placed on top of the geomembrane. Twelve inches of drainage media was then installed on the 10-oz. geotextile. Leachate collection pipes and appropriate leachate collection sumps were installed within this drainage layer. The drainage layer was then covered with a 4-oz. non-woven geotextile, one-foot of cushion soil, and a second 60-mil HDPE geomembrane. The second geomembrane was installed utilizing the same practices as the lower geomembrane.

A third party engineering firm monitored the installation of all geosynthetic materials and assembled the manufacturing quality control (MQC) data, manufacturing quality assurance (MQA) testing data, installer subgrade acceptance, panel placement information, laboratory CQA test data from destruct samples, and field CQA test data for seam welding integrity. All of this data is included in the "Geosynthetics Quality Assurance Report, Gypsum Stack, AERG (Ameren) Duck Creek Power Station, Canton, Fulton County, Illinois. Feezor Engineering, Inc. (March 2009, Revised July 2009)" in the Duck Creek GMF Pond Liner Documentation Report located in the operating record.

ATTACHMENT M

HISTORY OF POTENTIAL EXCEEDANCES

This presentation of the History of Potential Exceedances, and any corrective action taken to remediate groundwater, is provided to meet the requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.230(d)(2)(M) for the Duck Creek Power Plant GMF Pond, Illinois Environmental Protection Agency (IEPA) ID No. W0578010001-04.

Note

Groundwater concentrations from 2015 to 2021 presented in the Hydrogeologic Site Characterization Report (HCR) Table 4-1, and evaluated and summarized in the following tables, are considered potential exceedances because the methodology used to determine them is proposed in the Statistical Analysis Plan (Appendix A to Groundwater Monitoring Plan [GMP]), which has not been reviewed or approved by IEPA at the time of submittal of the 35 I.A.C. § 845 Operating Permit application.

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

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

Background Concentrations

Background monitoring wells identified in the GMP include G02S, G50S, and G51S.

For monitoring wells that have been historically monitored in accordance with Title 40, Code of Federal Regulations, Part 257, Subpart D (Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments), background concentrations calculated from sampling events in 2015-2017 were compared to the standards identified in 35 I.A.C. § 845.600(a)(1). For constituents with calculated background concentrations in 2015-2017 greater than the standards in 35 I.A.C. § 845.600(a)(1), those calculated background concentrations were used as Groundwater Protection Standards (GWPSs) for comparing to statistical calculation results for each compliance well to determine potential exceedances. Compliance well statistical calculations consider concentrations from all sampling events in 2015-2021.

For all other monitoring wells, either newly constructed in 2021 or existing wells not monitored under Title 40, Code of Federal Regulations, Part 257, Subpart D, background concentrations calculated from the eight sampling events required by 35 I.A.C. § 845.650(b)(1)(A), to be collected within 180 days from April 21, 2021, were compared to the standards identified in 35 I.A.C. § 845.600(a)(1). For constituents with calculated background concentrations greater than the standards in 35 I.A.C. § 845.600(a)(1), those calculated background concentrations were used as GWPSs. Compliance well statistical calculations from that same time period were compared to the GWPSs to determine potential exceedances.

Corrective Action

No corrective actions have been taken to remediate the groundwater.

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
G51L	PMP	845	pH (field)	SU	02/19/2021 - 02/19/2021	Most recent sample	6.8	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G52L	PMP	845	pH (field)	SU	02/19/2021 - 02/19/2021	Most recent sample	6.4	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G53L	PMP	845	pH (field)	SU	02/22/2021 - 02/22/2021	Most recent sample	6.8	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G53S	UA	845	pH (field)	SU	02/22/2021 - 02/22/2021	Most recent sample	6.8	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G54C	BR	845	Antimony, total	mg/L	04/14/2021 - 06/01/2021	All ND - Last	0.003	0.006	0.003	0.006	Standard
G54C	BR	845	Arsenic, total	mg/L	04/14/2021 - 06/01/2021	CI around mean	0.000774	0.010	0.0092	0.01	Standard
G54C	BR	845	Barium, total	mg/L	04/14/2021 - 06/01/2021	CI around mean	0.31	2.0	0.28	2	Standard
G54C	BR	845	Beryllium, total	mg/L	04/14/2021 - 06/01/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
G54C	BR	845	Boron, total	mg/L	04/14/2021 - 06/01/2021	CI around mean	-0.0552	2.0	0.21	2	Standard
G54C	BR	845	Cadmium,total	mg/L	04/14/2021 - 06/01/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
G54C	BR	845	Chloride, total	mg/L	04/14/2021 - 06/01/2021	CI around mean	1.4	200	17	200	Standard
G54C	BR	845	Chromium, total	mg/L	04/14/2021 - 06/01/2021	CI around median	0	0.10	0.0059	0.1	Standard
G54C	BR	845	Cobalt, total	mg/L	04/14/2021 - 06/01/2021	CI around median	0	0.006	0.002	0.006	Standard
G54C	BR	845	Fluoride, total	mg/L	04/14/2021 - 06/01/2021	CI around mean	0.34	4.0	0.50	4	Standard
G54C	BR	845	Lead, total	mg/L	04/14/2021 - 06/01/2021	Future median	0.001	0.015	0.015	0.0075	Background
G54C	BR	845	Lithium, total	mg/L	04/14/2021 - 06/01/2021	All ND - Last	0.020	0.040	0.020	0.04	Standard
G54C	BR	845	Mercury, total	mg/L	04/14/2021 - 06/01/2021	All ND - Last	0.0002	0.002	0.00098	0.002	Standard
G54C	BR	845	Molybdenum, total	mg/L	04/14/2021 - 06/01/2021	CI around mean	0.024	0.10	0.0023	0.1	Standard
G54C	BR	845	pH (field)	SU	04/14/2021 - 06/01/2021	CI around mean	7.1	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G54C	BR	845	Radium-226 + Radium 228, tot	pCi/L	04/14/2021 - 06/14/2021	CI around mean	-2.06	5.0	2.0	5	Standard
G54C	BR	845	Selenium, total	mg/L	04/14/2021 - 06/01/2021	CI around median	0	0.050	0.0012	0.05	Standard
G54C	BR	845	Sulfate, total	mg/L	04/14/2021 - 06/01/2021	CI around mean	39	400	55	400	Standard
G54C	BR	845	Thallium, total	mg/L	04/14/2021 - 06/01/2021	All ND - Last	0.001	0.002	0.001	0.002	Standard
G54C	BR	845	Total Dissolved Solids	mg/L	04/14/2021 - 06/01/2021	CI around mean	616	1200	483	1200	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
G54L	PMP	845	Antimony, total	mg/L	04/14/2021 - 07/27/2021	All ND - Last	0.003	0.006	0.003	0.006	Standard
G54L	PMP	845	Arsenic, total	mg/L	04/14/2021 - 07/27/2021	CI around mean	0.00259	0.010	0.0092	0.01	Standard
G54L	PMP	845	Barium, total	mg/L	04/14/2021 - 07/27/2021	CI around mean	0.14	2.0	0.28	2	Standard
G54L	PMP	845	Beryllium, total	mg/L	04/14/2021 - 07/27/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
G54L	PMP	845	Boron, total	mg/L	04/14/2021 - 07/27/2021	CI around mean	0.020	2.0	0.21	2	Standard
G54L	PMP	845	Cadmium,total	mg/L	04/14/2021 - 07/27/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
G54L	PMP	845	Chloride, total	mg/L	04/14/2021 - 07/27/2021	CI around median	5.2	200	17	200	Standard
G54L	PMP	845	Chromium, total	mg/L	04/14/2021 - 07/27/2021	CI around median	0.004	0.10	0.0059	0.1	Standard
G54L	PMP	845	Cobalt, total	mg/L	04/14/2021 - 07/27/2021	CI around mean	0.00178	0.006	0.002	0.006	Standard
G54L	PMP	845	Fluoride, total	mg/L	04/14/2021 - 07/27/2021	CI around median	0.25	4.0	0.50	4	Standard
G54L	PMP	845	Lead, total	mg/L	04/14/2021 - 07/27/2021	All ND - Last	0.001	0.015	0.015	0.0075	Background
G54L	PMP	845	Lithium, total	mg/L	04/14/2021 - 07/27/2021	All ND - Last	0.020	0.040	0.020	0.04	Standard
G54L	PMP	845	Mercury, total	mg/L	04/14/2021 - 07/27/2021	CI around median	0.0002	0.002	0.00098	0.002	Standard
G54L	PMP	845	Molybdenum, total	mg/L	04/14/2021 - 07/27/2021	CI around mean	0.000575	0.10	0.0023	0.1	Standard
G54L	PMP	845	pH (field)	SU	02/22/2021 - 07/27/2021	CI around mean	6.5	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G54L	PMP	845	Radium-226 + Radium 228, tot	pCi/L	04/14/2021 - 07/27/2021	CI around mean	0.25	5.0	2.0	5	Standard
G54L	PMP	845	Selenium, total	mg/L	04/14/2021 - 07/27/2021	All ND - Last	0.001	0.050	0.0012	0.05	Standard
G54L	PMP	845	Sulfate, total	mg/L	04/14/2021 - 07/27/2021	CI around mean	54	400	55	400	Standard
G54L	PMP	845	Thallium, total	mg/L	04/14/2021 - 07/27/2021	All ND - Last	0.001	0.002	0.001	0.002	Standard
G54L	PMP	845	Total Dissolved Solids	mg/L	04/14/2021 - 07/27/2021	CI around mean	631	1200	483	1200	Standard
G54S	UA	257	Antimony, total	mg/L	12/04/2015 - 06/28/2017	All ND - Last	0.003	0.006	0.003	0.006	Standard
G54S	UA	257	Arsenic, total	mg/L	01/30/2015 - 06/28/2017	CI around geomean	0.00107	0.010	0.00959	0.01	Standard
G54S	UA	257	Barium, total	mg/L	12/04/2015 - 06/28/2017	CI around mean	0.21	2.0	0.32	2	Standard
G54S	UA	257	Beryllium, total	mg/L	12/04/2015 - 06/28/2017	All ND - Last	0.001	0.004	0.0013	0.004	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
G54S	UA	257	Boron, total	mg/L	01/30/2015 - 02/22/2021	CI around mean	0.032	2.0	0.059	2	Standard
G54S	UA	257	Cadmium,total	mg/L	12/04/2015 - 06/28/2017	All ND - Last	0.001	0.005	0.001	0.005	Standard
G54S	UA	257	Chloride, total	mg/L	01/30/2015 - 02/22/2021	CI around median	2.2	200	22	200	Standard
G54S	UA	257	Chromium, total	mg/L	12/04/2015 - 06/28/2017	All ND - Last	0.004	0.10	0.0058	0.1	Standard
G54S	UA	257	Cobalt, total	mg/L	12/04/2015 - 06/28/2017	All ND - Last	0.002	0.006	0.002	0.006	Standard
G54S	UA	257	Fluoride, total	mg/L	12/04/2015 - 02/22/2021	CI around median	0.25	4.0	0.56	4	Standard
G54S	UA	257	Lead, total	mg/L	01/30/2015 - 06/28/2017	All ND - Last	0.001	0.0075	0.002	0.0075	Standard
G54S	UA	257	Lithium, total	mg/L	12/04/2015 - 06/28/2017	CI around median	0.010	0.040	0.010	0.04	Standard
G54S	UA	257	Mercury, total	mg/L	12/04/2015 - 06/28/2017	Future median	0.0002	0.0024	0.0024	0.002	Background
G54S	UA	257	Molybdenum, total	mg/L	12/04/2015 - 06/28/2017	CI around mean	0.00161	0.10	0.0042	0.1	Standard
G54S	UA	257	pH (field)	SU	01/30/2015 - 06/21/2021	CI around mean	6.9	6.5/9.0	6.5/7.5	6.5/9	Standard/Standard
G54S	UA	257	Radium-226 + Radium 228, tot	pCi/L	12/04/2015 - 06/28/2017	CI around mean	0.52	5.0	2.0	5	Standard
G54S	UA	257	Selenium, total	mg/L	12/04/2015 - 06/28/2017	All ND - Last	0.001	0.050	0.0014	0.05	Standard
G54S	UA	257	Sulfate, total	mg/L	01/30/2015 - 02/22/2021	CI around median	42	400	97	400	Standard
G54S	UA	257	Thallium, total	mg/L	12/04/2015 - 06/28/2017	All ND - Last	0.001	0.0028	0.0028	0.002	Background
G54S	UA	257	Total Dissolved Solids	mg/L	12/04/2015 - 06/21/2021	CI around mean	492	1200	499	1200	Standard
G55L	PMP	845	pH (field)	SU	02/22/2021 - 02/22/2021	Most recent sample	6.7	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G55S	UA	845	pH (field)	SU	02/22/2021 - 02/22/2021	Most recent sample	6.8	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G56L	PMP	845	pH (field)	SU	02/22/2021 - 02/22/2021	Most recent sample	6.6	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G56S	UA	845	pH (field)	SU	02/22/2021 - 02/22/2021	Most recent sample	6.6	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G57L	PMP	845	pH (field)	SU	02/22/2021 - 02/22/2021	Most recent sample	6.8	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G57S	UA	257	Antimony, total	mg/L	12/04/2015 - 06/28/2017	CI around median	0.003	0.006	0.003	0.006	Standard
G57S	UA	257	Arsenic, total	mg/L	02/04/2015 - 06/28/2017	CI around median	0.001	0.010	0.00959	0.01	Standard
G57S	UA	257	Barium, total	mg/L	12/04/2015 - 06/28/2017	CI around median	0.13	2.0	0.32	2	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
G57S	UA	257	Beryllium, total	mg/L	12/04/2015 - 06/28/2017	CI around median	0.001	0.004	0.0013	0.004	Standard
G57S	UA	257	Boron, total	mg/L	02/04/2015 - 02/22/2021	CI around median	0.010	2.0	0.059	2	Standard
G57S	UA	257	Cadmium,total	mg/L	12/04/2015 - 06/28/2017	CI around median	0.001	0.005	0.001	0.005	Standard
G57S	UA	257	Chloride, total	mg/L	02/04/2015 - 02/22/2021	CI around median	18	200	22	200	Standard
G57S	UA	257	Chromium, total	mg/L	12/04/2015 - 06/28/2017	All ND - Last	0.004	0.10	0.0058	0.1	Standard
G57S	UA	257	Cobalt, total	mg/L	12/04/2015 - 06/28/2017	All ND - Last	0.002	0.006	0.002	0.006	Standard
G57S	UA	257	Fluoride, total	mg/L	12/04/2015 - 02/22/2021	CI around mean	0.26	4.0	0.56	4	Standard
G57S	UA	257	Lead, total	mg/L	02/04/2015 - 06/28/2017	CI around median	0.001	0.0075	0.002	0.0075	Standard
G57S	UA	257	Lithium, total	mg/L	12/04/2015 - 06/28/2017	All ND - Last	0.010	0.040	0.010	0.04	Standard
G57S	UA	257	Mercury, total	mg/L	12/04/2015 - 06/28/2017	All ND - Last	0.0002	0.0024	0.0024	0.002	Background
G57S	UA	257	Molybdenum, total	mg/L	12/04/2015 - 06/28/2017	CI around median	0.001	0.10	0.0042	0.1	Standard
G57S	UA	257	pH (field)	SU	02/04/2015 - 02/22/2021	CI around mean	7.0	6.5/9.0	6.5/7.5	6.5/9	Standard/Standard
G57S	UA	257	Radium-226 + Radium 228, tot	pCi/L	12/04/2015 - 06/28/2017	CI around mean	0.025	5.0	2.0	5	Standard
G57S	UA	257	Selenium, total	mg/L	12/04/2015 - 06/28/2017	All ND - Last	0.001	0.050	0.0014	0.05	Standard
G57S	UA	257	Sulfate, total	mg/L	02/04/2015 - 02/22/2021	CI around geomean	53	400	97	400	Standard
G57S	UA	257	Thallium, total	mg/L	12/04/2015 - 06/28/2017	Future median	0.001	0.0028	0.0028	0.002	Background
G57S	UA	257	Total Dissolved Solids	mg/L	12/04/2015 - 02/22/2021	CI around mean	492	1200	499	1200	Standard
G58L	PMP	845	pH (field)	SU	02/22/2021 - 02/22/2021	Most recent sample	6.8	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G58S	UA	845	pH (field)	SU	02/22/2021 - 02/22/2021	Most recent sample	6.6	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G59L	PMP	845	pH (field)	SU	02/22/2021 - 02/22/2021	Most recent sample	6.7	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G59S	UA	845	pH (field)	SU	02/22/2021 - 02/22/2021	Most recent sample	6.8	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G60L	PMP	845	Antimony, total	mg/L	04/14/2021 - 07/28/2021	All ND - Last	0.003	0.006	0.003	0.006	Standard
G60L	PMP	845	Arsenic, total	mg/L	04/14/2021 - 07/28/2021	All ND - Last	0.001	0.010	0.0092	0.01	Standard
G60L	PMP	845	Barium, total	mg/L	04/14/2021 - 07/28/2021	CI around mean	0.014	2.0	0.28	2	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
G60L	PMP	845	Beryllium, total	mg/L	04/14/2021 - 07/28/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
G60L	PMP	845	Boron, total	mg/L	04/14/2021 - 07/28/2021	CI around geomean	0.021	2.0	0.21	2	Standard
G60L	PMP	845	Cadmium,total	mg/L	04/14/2021 - 07/28/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
G60L	PMP	845	Chloride, total	mg/L	04/14/2021 - 07/28/2021	CI around mean	16	200	17	200	Standard
G60L	PMP	845	Chromium, total	mg/L	04/14/2021 - 07/28/2021	All ND - Last	0.004	0.10	0.0059	0.1	Standard
G60L	PMP	845	Cobalt, total	mg/L	04/14/2021 - 07/28/2021	CI around mean	0.00164	0.006	0.002	0.006	Standard
G60L	PMP	845	Fluoride, total	mg/L	04/14/2021 - 07/28/2021	All ND - Last	0.25	4.0	0.50	4	Standard
G60L	PMP	845	Lead, total	mg/L	04/14/2021 - 07/28/2021	All ND - Last	0.001	0.015	0.015	0.0075	Background
G60L	PMP	845	Lithium, total	mg/L	04/14/2021 - 07/28/2021	All ND - Last	0.020	0.040	0.020	0.04	Standard
G60L	PMP	845	Mercury, total	mg/L	04/14/2021 - 07/28/2021	All ND - Last	0.0002	0.002	0.00098	0.002	Standard
G60L	PMP	845	Molybdenum, total	mg/L	04/14/2021 - 07/28/2021	All ND - Last	0.001	0.10	0.0023	0.1	Standard
G60L	PMP	845	pH (field)	SU	02/23/2021 - 07/28/2021	CI around mean	6.1	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G60L	PMP	845	Radium-226 + Radium 228, tot	pCi/L	04/14/2021 - 07/28/2021	CI around mean	-0.0854	5.0	2.0	5	Standard
G60L	PMP	845	Selenium, total	mg/L	04/14/2021 - 07/28/2021	All ND - Last	0.001	0.050	0.0012	0.05	Standard
G60L	PMP	845	Sulfate, total	mg/L	04/14/2021 - 07/28/2021	CI around median	125	400	55	400	Standard
G60L	PMP	845	Thallium, total	mg/L	04/14/2021 - 07/28/2021	All ND - Last	0.001	0.002	0.001	0.002	Standard
G60L	PMP	845	Total Dissolved Solids	mg/L	04/14/2021 - 07/28/2021	CI around mean	538	1200	483	1200	Standard
G60S	UA	257	Antimony, total	mg/L	12/04/2015 - 06/29/2017	All ND - Last	0.003	0.006	0.003	0.006	Standard
G60S	UA	257	Arsenic, total	mg/L	02/04/2015 - 06/29/2017	CI around geomean	0.00136	0.010	0.00959	0.01	Standard
G60S	UA	257	Barium, total	mg/L	12/04/2015 - 06/29/2017	CI around mean	0.12	2.0	0.32	2	Standard
G60S	UA	257	Beryllium, total	mg/L	12/04/2015 - 06/29/2017	All ND - Last	0.001	0.004	0.0013	0.004	Standard
G60S	UA	257	Boron, total	mg/L	02/04/2015 - 02/23/2021	CI around mean	0.016	2.0	0.059	2	Standard
G60S	UA	257	Cadmium,total	mg/L	12/04/2015 - 06/29/2017	All ND - Last	0.001	0.005	0.001	0.005	Standard
G60S	UA	257	Chloride, total	mg/L	02/04/2015 - 02/23/2021	CI around geomean	8.9	200	22	200	Standard

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DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
G60S	UA	257	Chromium, total	mg/L	12/04/2015 - 06/29/2017	CI around median	0.004	0.10	0.0058	0.1	Standard
G60S	UA	257	Cobalt, total	mg/L	12/04/2015 - 06/29/2017	CI around median	0.002	0.006	0.002	0.006	Standard
G60S	UA	257	Fluoride, total	mg/L	12/04/2015 - 02/23/2021	CI around mean	0.27	4.0	0.56	4	Standard
G60S	UA	257	Lead, total	mg/L	02/04/2015 - 06/29/2017	CB around linear reg	-0.0104	0.0075	0.002	0.0075	Standard
G60S	UA	257	Lithium, total	mg/L	12/04/2015 - 06/29/2017	CI around median	0.010	0.040	0.010	0.04	Standard
G60S	UA	257	Mercury, total	mg/L	12/04/2015 - 06/29/2017	All ND - Last	0.0002	0.0024	0.0024	0.002	Background
G60S	UA	257	Molybdenum, total	mg/L	12/04/2015 - 06/29/2017	CI around median	0.001	0.10	0.0042	0.1	Standard
G60S	UA	257	pH (field)	SU	02/04/2015 - 02/23/2021	CI around mean	6.7	6.5/9.0	6.5/7.5	6.5/9	Standard/Standard
G60S	UA	257	Radium-226 + Radium 228, tot	pCi/L	12/04/2015 - 06/29/2017	CI around mean	0.66	5.0	2.0	5	Standard
G60S	UA	257	Selenium, total	mg/L	12/04/2015 - 06/29/2017	CI around median	0.001	0.050	0.0014	0.05	Standard
G60S	UA	257	Sulfate, total	mg/L	02/04/2015 - 02/23/2021	CB around linear reg	94	400	97	400	Standard
G60S	UA	257	Thallium, total	mg/L	12/04/2015 - 06/29/2017	All ND - Last	0.001	0.0028	0.0028	0.002	Background
G60S	UA	257	Total Dissolved Solids	mg/L	12/04/2015 - 02/23/2021	CI around mean	534	1200	499	1200	Standard
G61S	UA	845	pH (field)	SU	02/23/2021 - 02/23/2021	Most recent sample	6.5	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G62L	PMP	845	pH (field)	SU	02/24/2021 - 02/24/2021	Most recent sample	6.7	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G63L	PMP	845	pH (field)	SU	02/24/2021 - 02/24/2021	Most recent sample	6.7	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G63S	UA	845	pH (field)	SU	02/24/2021 - 02/24/2021	Most recent sample	7.0	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G64L	PMP	845	pH (field)	SU	02/25/2021 - 02/25/2021	Most recent sample	7.0	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G64S	UA	257	Antimony, total	mg/L	12/04/2015 - 06/29/2017	CI around median	0.003	0.006	0.003	0.006	Standard
G64S	UA	257	Arsenic, total	mg/L	02/04/2015 - 06/29/2017	CI around geomean	0.00251	0.010	0.00959	0.01	Standard
G64S	UA	257	Barium, total	mg/L	12/04/2015 - 06/29/2017	CI around mean	0.17	2.0	0.32	2	Standard
G64S	UA	257	Beryllium, total	mg/L	12/04/2015 - 06/29/2017	All ND - Last	0.001	0.004	0.0013	0.004	Standard
G64S	UA	257	Boron, total	mg/L	02/04/2015 - 02/24/2021	CI around mean	0.017	2.0	0.059	2	Standard
G64S	UA	257	Cadmium,total	mg/L	12/04/2015 - 06/29/2017	All ND - Last	0.001	0.005	0.001	0.005	Standard

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GMF POND
CANTON, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
G64S	UA	257	Chloride, total	mg/L	02/04/2015 - 02/24/2021	CB around linear reg	3.1	200	22	200	Standard
G64S	UA	257	Chromium, total	mg/L	12/04/2015 - 06/29/2017	CI around median	0.004	0.10	0.0058	0.1	Standard
G64S	UA	257	Cobalt, total	mg/L	12/04/2015 - 06/29/2017	All ND - Last	0.002	0.006	0.002	0.006	Standard
G64S	UA	257	Fluoride, total	mg/L	12/04/2015 - 02/24/2021	CI around median	0.30	4.0	0.56	4	Standard
G64S	UA	257	Lead, total	mg/L	02/04/2015 - 06/29/2017	CI around mean	0.00131	0.0075	0.002	0.0075	Standard
G64S	UA	257	Lithium, total	mg/L	12/04/2015 - 06/29/2017	All ND - Last	0.010	0.040	0.010	0.04	Standard
G64S	UA	257	Mercury, total	mg/L	12/04/2015 - 06/29/2017	All ND - Last	0.0002	0.0024	0.0024	0.002	Background
G64S	UA	257	Molybdenum, total	mg/L	12/04/2015 - 06/29/2017	CI around mean	0.00152	0.10	0.0042	0.1	Standard
G64S	UA	257	pH (field)	SU	02/04/2015 - 06/21/2021	CI around mean	6.9	6.5/9.0	6.5/7.5	6.5/9	Standard/Standard
G64S	UA	257	Radium-226 + Radium 228, tot	pCi/L	12/04/2015 - 06/29/2017	CI around mean	0.63	5.0	2.0	5	Standard
G64S	UA	257	Selenium, total	mg/L	12/04/2015 - 06/29/2017	CI around median	0.001	0.050	0.0014	0.05	Standard
G64S	UA	257	Sulfate, total	mg/L	02/04/2015 - 02/24/2021	CI around median	25	400	97	400	Standard
G64S	UA	257	Thallium, total	mg/L	12/04/2015 - 06/29/2017	All ND - Last	0.001	0.0028	0.0028	0.002	Background
G64S	UA	257	Total Dissolved Solids	mg/L	12/04/2015 - 06/21/2021	CI around mean	416	1200	499	1200	Standard
P60	PMP	845	Arsenic, total	mg/L	03/24/2021 - 03/24/2021	Most recent sample	0.020	0.010	0.0092	0.01	Standard
P60	PMP	845	Boron, total	mg/L	03/24/2021 - 03/24/2021	Most recent sample	0.056	2.0	0.21	2	Standard
P60	PMP	845	Cadmium,total	mg/L	03/24/2021 - 03/24/2021	Most recent sample	0.001	0.005	0.001	0.005	Standard
P60	PMP	845	Chloride, total	mg/L	03/24/2021 - 03/24/2021	Most recent sample	32	200	17	200	Standard
P60	PMP	845	Lead, total	mg/L	03/24/2021 - 03/24/2021	Most recent sample	0.036	0.015	0.015	0.0075	Background
P60	PMP	845	pH (field)	SU	02/24/2021 - 03/24/2021	Most recent sample	6.6	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
P60	PMP	845	Sulfate, total	mg/L	03/24/2021 - 03/24/2021	Most recent sample	53	400	55	400	Standard
R61L	PMP	845	pH (field)	SU	02/23/2021 - 02/23/2021	Most recent sample	6.6	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Notes:
Potential exceedance of GWPS
HSU = hydrostratigraphic unit:
BR = Bedrock
PMP = Potential Migration Pathway
UA = Uppermost Aquifer
Program = regulatory program data were collected under:
257 = 40 C.F.R. Part 257 Subpart D (Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments)
845 = 35 I.A.C. Part 845 (Sampling events completed to assess well locations for inclusion in the Part 845 monitoring well network)
mg/L = milligrams per liter
pCi/L = picoCuries per liter
SU = standard units
Sample Count = number of samples from Sampled Date Range used to calculate the Statistical Result
Statistical Calculation = method used to calculate the statistical result:
All ND - Last = All results were below the reporting limit, and the last determined reporting limit is shown
CB around linear reg = Confidence band around linear regression
CI around geomean = Confidence interval around the geometric mean
CI around mean = Confidence interval around the mean
CI around median = Confidence interval around the median
Future median = Median of the three most recent samples
Most recent sample = Result for the most recently collected sample used due to insufficient data
Statistical Result = calculated in accordance with Statistical Analysis Plan using constituent concentrations observed at monitoring well during all sampling events within the specified date range
For pH, the values presented are the lower / upper limits
GWPS = Groundwater Protection Standard
GWPS Source:
Standard = standard specified in 35 I.A.C. § 845.600(a)(1)
Background = background concentration (see cover page for additional information)

TABLE 2. SUMMARY OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
DUCK CREEK POWER PLANT
GMF POND
CANTON, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
G52L	PMP	845	pH (field)	SU	02/19/2021 - 02/19/2021	Most recent sample	6.4	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
G60L	PMP	845	pH (field)	SU	02/23/2021 - 07/28/2021	CI around mean	6.1	6.5/9.0	6.6/7.4	6.5/9	Standard/Standard
P60	PMP	845	Arsenic, total	mg/L	03/24/2021 - 03/24/2021	Most recent sample	0.020	0.010	0.0092	0.01	Standard
P60	PMP	845	Lead, total	mg/L	03/24/2021 - 03/24/2021	Most recent sample	0.036	0.015	0.015	0.0075	Background

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

ATTACHMENT N

Certification of Financial Assurance Requirements

On June 17, 2021, Illinois Power Resources Generating, LLC provided financial assurance in the form of performance bonds to the Illinois Environmental Protection Agency in the amount of $20,670,871 for Ash Pond 1, Ash Pond 2, the Bottom Ash Basin, and the GMF Pond at the Duck Creek Power Plant.[1]

I, Matthew A. Goering, Senior Vice President of Illinois Power Resources Generating, LLC, do hereby certify to the best of my knowledge for the above referenced CCR Units that the financial assurance instruments satisfy the requirements of 35 I.A.C. Part 845, Subpart I.

Matthew A. Goering
Senior Vice President
Illinois Power Resources Generating, LLC

[1] In the operating permit applications, the Ash Pond 1 is referred to as the Ash Pond No. 1, and the Ash Pond 2 is referred to as the Ash Pond No. 2.

ATTACHMENT O

Stantec Consulting Services Inc.
1859 Bowles Avenue Suite 250, Fenton MO 63026-1944

October 12, 2016
File: let_002_175666013_certification
Revision 0

Initial Hazard Potential Classification Assessment
EPA Final CCR Rule
GMF Pond
Duck Creek Power Station
Fulton County, Illinois

1.0 PURPOSE

This report documents Stantec's certification of the initial hazard potential classification assessment for the Duck Creek Power Station GMF Pond.

40 CFR 257.73(a)(2) requires the owner or operator of an existing CCR surface impoundment to conduct an initial hazard potential classification assessment and document the hazard potential classification, and the basis for the classification, of the CCR unit as either a high hazard potential CCR surface impoundment, a significant hazard potential CCR surface impoundment, or a low hazard potential CCR surface impoundment.

2.0 FINDINGS

A visual analysis was performed to evaluate potential hazards associated with a failure of the GMF Pond perimeter containment dike. Failure scenarios were considered along the perimeter dike. Breach scenarios were evaluated for potential downstream impacts to structures, infrastructure, frequently occupied facilities/areas, and waterways. Potential for impacts was evaluated by determining probable breach flow paths using available elevation data and imagery of the impoundment along with the nearby area.

The analysis indicates that a breach of the north, east, and south embankments have potential to impact structures on the Duck Creek Power Station property prior to flowing into the Duck Creek Cooling Pond. A breach of the west embankment would likely impact North Bethel Cemetery Road and the railroad to/from the power station prior to flowing into the Duck Creek Cooling Pond. North Bethel Cemetery Road is intermittently used and the at-risk populations are considered transient. In accordance with Federal guidelines, loss of life is not considered probable for scenarios where persons are only temporarily in the potential inundation area. It was concluded that a breach failure of the GMF Pond containment dike will not result in probable loss of human life. However, it is anticipated that a breach failure of the containment dike will release stored CCR materials into downstream areas and waterways causing environmental damage.

40 CFR 257.53 defines a "significant hazard potential CCR surface impoundment" as a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

Based on the results of the analysis summarized above, the GMF Pond was assigned a Significant hazard potential classification per 40 CFR 257.53.

3.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Matthew Hoy, being a Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that;

1. the information contained in this report and the underlying data in the operating record was prepared in accordance with the accepted practice of engineering and is accurate as of the date of my signature below; and

2. the initial hazard potential classification assessment for the Duck Creek Power Station GMF Pond was conducted in accordance with the requirements specified in 40 CFR 257.73.

SIGNATURE _____ DATE 10/12/2016

ADDRESS: Stantec Consulting Services Inc.
1859 Bowles Avenue Suite 250
Fenton MO 63026-1944

TELEPHONE: (636) 343-3880

LICENSED PROFESSIONAL ENGINEER
MATTHEW A. HOY
062-063141
STATE OF ILLINOIS

ATTACHMENT P

AECOM

Submitted to
Illinois Power Resources
Generating, LLC
17751 North Cilco Road
Canton, IL 61520

Submitted by
AECOM
1001 Highlands Plaza Drive West
Suite 300
St. Louis, MO 63110

October 2016

CCR Rule Report: Initial Structural Stability Assessment

For

GMF Pond

At Duck Creek Power Station

1 Introduction

This Coal Combustion Residual (CCR) Rule Report documents that the Gypsum Management Facility (GMF) Pond at the Illinois Power Resources Generating, LLC Duck Creek Power Station meets the structural stability assessment requirements specified in 40 Code of Federal Regulations (CFR) §257.73(d). The GMF Pond is located near Canton, Illinois in Fulton County, approximately 2.5 miles north of the Duck Creek Power Station. The GMF Pond serves as the wet impoundment basin for gypsum produced by the wet scrubber system at the Duck Creek Power Station.

The GMF Pond is an existing CCR surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that an initial structural stability assessment for an existing CCR surface impoundment be completed by October 17, 2016. In general, the initial structural stability assessment must document that the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial structural stability assessment was conducted in accordance with the requirements of 40 CFR § 257.73(d). The owner or operator must prepare a periodic structural stability assessment every five years.

2 Initial Structural Stability Assessment

40 CFR §257.73(d)(1)
The owner or operator of the CCR unit must conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with [the standards in (d)(1)(i)-(vii)].

An initial structural stability assessment has been performed to document that the design, construction, operation and maintenance of the GMF Pond is consistent with recognized and generally accepted good engineering practices and meets the standards in §257.73(d)(1)(i)-(vii). The results of the structural stability assessment are discussed in the following sections. Based on the assessment and its results, the design, construction, operation, and maintenance of the GMF Pond were found to be consistent with recognized and generally accepted good engineering practices and meets the standards in 257.73(d)(1)(i)-(vii).

2.1 Foundations and Abutments (§257.73(d)(1)(i))

CCR unit designed, constructed, operated, and maintained with stable foundations and abutments.

The stability of the foundations was evaluated using soil data from field investigations and reviewing design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM. Additionally, slope stability analyses were performed to evaluate slip surfaces passing through the foundations. The GMF Pond is a ring dike structure and does not have abutments.

The foundation consists of medium stiff to very stiff soil, which indicates stable foundations. Slope stability analyses exceed the criteria listed in §257.73(e)(1) for slip surfaces passing through the foundation. The slope stability analyses are discussed in the *CCR Rule Report: Initial Safety Factor Assessment for GMF Pond at Duck Creek Power Station* (October 2016). A review of operational and maintenance procedures as well as current and past performance of the dikes has determined appropriate processes are in place for continued operational performance.

Based on the conditions observed by AECOM, the GMF Pond was designed and constructed with stable foundations. Operational and maintenance procedures are in place to address any issues related to the stability of foundations; therefore, the GMF Pond meets the requirements in §257.73(d)(1)(i).

2.2 Slope Protection (§257.73(d)(1)(ii))

CCR unit designed, constructed, operated, and maintained with adequate slope protection to protect against surface erosion, wave action and adverse effects of sudden drawdown.

The adequacy of slope protection was evaluated by reviewing design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM.

Based on this evaluation, adequate slope protection was designed and constructed at the GMF Pond. No evidence of significant areas of erosion or wave action were observed. The interior slopes are protected with a geomembrane liner that underlies the entire GMF Pond and extends up the interior slopes, and the exterior slopes are protected with vegetation. The geomembrane liner on the interior slopes isolates the embankment soils from surface erosion or wave action. Operational and maintenance procedures to repair the vegetation

(exterior slopes) and liner (interior slopes) as needed are appropriate to protect against surface erosion or wave action. Given the presence of a liner that serves to prevent saturation of the dike's soils below the normal pool, sudden drawdown, as well as the corresponding adverse effects, is not applicable to the GMF Pond. Therefore, the GMF Pond meets the requirements in §257.73(d)(1)(ii).

2.3 Dike Compaction (§257.73(d)(1)(iii))

CCR unit designed, constructed, operated, and maintained with dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit.

The density of the dike materials was evaluated using soil data from field investigations and reviewing design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM. Additionally, slope stability analyses were performed to evaluate slip surfaces passing through the dike over the range of expected loading conditions as defined within §257.73(e)(1).

Based on this evaluation, the dike consists of stiff to very stiff material, which is indicative of mechanically compacted dikes. Slope stability analyses exceed the criteria listed in §257.73(e)(1) for slip surfaces passing through the dike. The slope stability analyses are discussed in the *CCR Rule Report: Initial Safety Factor Assessment for GMF Pond at Duck Creek Power Station* (October 2016); therefore, the original design and construction of the GMF Pond included sufficient dike compaction. Operational and maintenance procedures are in place to identify and mitigate deficiencies in order to maintain sufficient compaction of the dikes to withstand the range of loading conditions. Therefore, the GMF Pond meets the requirements in §257.73(d)(1)(iii).

2.4 Vegetated Slopes (§257.73(d)(1)(iv))[1]

CCR unit designed, constructed, operated, and maintained with vegetated slopes of dikes and surrounding areas, except for slopes which have an alternate form or forms of slope protection.

The adequacy of slope vegetation was evaluated by reviewing design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM.

Based on this evaluation, the vegetation on the exterior slopes is adequate as no substantial bare or overgrown areas were observed. Exposed geomembrane liners on the interior slopes are used as an alternate form of slope protection, which is adequate as significant tears or defects were not observed. Therefore, the original design and construction of the GMF Pond included adequate vegetation of the dikes and surrounding areas. Adequate operational and maintenance procedures are in place to regularly manage vegetation growth, including mowing and seeding any bare areas, as evidenced by the conditions observed by AECOM. Therefore, the GMF Pond meets the requirements in §257.73(d)(1)(iv).

[1] As modified by court order issued June 14, 2016, Utility Solid Waste Activities Group v. EPA, D.C. Cir. No. 15-1219 (order granting remand and vacatur of specific regulatory provisions).

2.5 Spillways (§257.73(d)(1)(v))

CCR unit designed, constructed, operated, and maintained with a single spillway or a combination of spillways configured as specified in [paragraph (A) and (B)]:

(A) All spillways must be either:

(1) of non-erodible construction and designed to carry sustained flows; or

(2) earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected.

(B) The combined capacity of all spillways must adequately manage flow during and following the peak discharge from a:

(1) Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or

(2) 1000-year flood for a significant hazard potential CCR surface impoundment; or

(3) 100-year flood for a low hazard potential CCR surface impoundment.

The spillway was evaluated using design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM. Additionally, hydrologic and hydraulic analyses were completed to evaluate the capacity of the spillway relative to inflow estimated for the 1,000-year flood event for the significant hazard potential GMF Pond. The hazard potential classification assessment was performed by Stantec in 2016 in accordance with §257.73(a)(2).

The spillway is lined with a geomembrane, which is a non-erodible material. The ability of the spillway design to carry sustained flows, as well as the capacity of the spillway, was evaluated using hydrologic and hydraulic analysis performed per §257.82(a). The analysis found that the spillway can adequately manage flow during peak discharge resulting from the 1,000-year storm event without overtopping of the embankments. The hydrologic and hydraulic analyses are discussed in the *CCR Rule Report: Initial Inflow Design Flood Control System Plan for GMF Pond at Duck Creek Power Station* (October 2016). This also means that the design of the spillway is adequate to carry sustained flows. Operational and maintenance procedures are in place to repair any tears in the spillway liner and remove debris or other obstructions from the spillway, as evidenced by the conditions observed by AECOM. As a result, these procedures are appropriate for maintaining the spillway. Therefore, the GMF Pond meets the requirements in §257.73(d)(1)(v).

2.6 Stability and Structural Integrity of Hydraulic Structures (§257.73(d)(1)(vi))

CCR unit designed, constructed, operated, and maintained with hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure.

Based on an evaluation of design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM, no hydraulic structures are present that underlie the base or pass through the dike of the GMF Pond. Therefore, the §257.73(d)(1)(vi) requirements are not applicable to the GMF Pond.

2.7 Downstream Slope Inundation/Stability (§257.73(d)(1)(vii))

CCR unit designed, constructed, operated, and maintained with, for CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

The structural stability of the downstream slopes of the GMF Pond was evaluated by comparing the location of the GMF Pond relative to adjacent water bodies using published United States Geological Survey (USGS) topographic maps, aerial imagery, and conditions observed in the field by AECOM.

Based on this evaluation, water bodies adjacent to the downstream slopes of the GMF Pond are not present. Water bodies within the vicinity of the GMF Pond include the Duck Creek Cooling Pond and several small unnamed ponds. These water bodies are located several hundred feet or more beyond the GMF Pond

downstream slopes. The adjacent GMF Pond is a non-CCR surface impoundment and is not a river, stream, or lake. Therefore, adjacent water bodies that can inundate the downstream slopes of the GMF Pond are not present.

Based on this evaluation, the requirements in §257.73(d)(1)(vii) are not applicable to the GMF Pond, as inundation of the downstream slopes is not expected to occur.

3 Certification Statement

CCR Unit: Illinois Power Resources Generating, LLC; Duck Creek Power Station; GMF Pond

I, Victor A. Modeer, 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 CCR Rule Report, and the underlying data in the operating record, has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the initial structural stability assessment dated October 13, 2016 was conducted in accordance with the requirements of 40 CFR § 257.73(d).

VICTOR A. MODEER JR.
Printed Name

10/13/16
Date

VICTOR ALBERT MODEER JR.
062-043112
REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS
11/30/17

About AECOM

AECOM (NYSE: ACM) is a global provider of professional technical and management support services to a broad range of markets, including transportation, facilities, environmental, energy, water and government. With nearly 100,000 employees around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation, and collaborative technical excellence in delivering solutions that enhance and sustain the world's built, natural, and social environments. A Fortune 500 company, AECOM serves clients in more than 100 countries and has annual revenue in excess of $19 billion.

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ATTACHMENT Q

AECOM

Submitted to
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Generating, LLC
17751 North Cilco Road
Canton, IL 61520

Submitted by
AECOM
1001 Highlands Plaza Drive West
Suite 300
St. Louis, MO 63110

October 2016

CCR Rule Report: Initial Safety Factor Assessment

For

GMF Pond

At Duck Creek Power Station

1 Introduction

This Coal Combustion Residual (CCR) Rule Report documents that the Gypsum Management Facility (GMF) Pond at the Illinois Power Resources Generating, LLC Duck Creek Power Station meets the safety factor assessment requirements specified in 40 Code of Federal Regulations (CFR) §257.73(e). The GMF Pond is located near Canton, Illinois in Fulton County, approximately 2.5 miles north of the Duck Creek Power Station. The GMF Pond serves as the wet impoundment basin for gypsum produced by the wet scrubber system at the Duck Creek Power Station.

The GMF Pond is an existing CCR surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that the initial safety factor assessment for an existing CCR surface impoundment be completed by October 17, 2016.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial safety factor assessment meets the requirements of 40 CFR § 257.73(e). The owner or operator must prepare a safety factor assessment every five years.

2 Initial Safety Factor Assessment

40 CFR §257.73(e)(1)
The owner or operator must conduct initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in (e)(1)(i) through (iv) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations.

(i) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.
(ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.
(iii) The calculated seismic factor of safety must equal or exceed 1.00.
(iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

A geotechnical investigation program and stability analyses were performed to evaluate the design, performance, and condition of the earthen dikes of the GMF Pond. The exploration consisted of hollow-stem auger borings and laboratory program including strength and index testing. Data collected from the geotechnical investigation, available design drawings, construction records, inspection reports, previous engineering investigations, and other pertinent historic documents were utilized to perform the safety factor assessment and geotechnical analyses.

In general, the subsurface conditions at the GMF Pond consist of stiff to very stiff embankment fill (clay) intermittently overlying medium stiff to stiff loess (clay), which in turn overlies medium stiff to very stiff glacial till (clay) with trace sand and gravel. Phreatic water is within the foundation of the GMF Pond.

A representative cross section was analyzed using limit equilibrium slope stability analysis software to evaluate stability of the perimeter dike system and foundations. The cross section was located at the maximum embankment height for the GMF Pond. Due to the relatively short height of the GMF Pond embankments and uniform slope orientations, subsurface stratigraphy, and phreatic conditions, a single cross section at the maximum embankment height is sufficient to represent the critical cross section. The cross section was evaluated for each of the loading conditions stipulated in §257.73(e)(1).

A liquefaction susceptibly evaluation did not find soils susceptible to liquefaction within the GMF Pond dikes. As a result, the Soils Susceptible to Liquefaction loading condition (§257.73(e)(1)(iv)) is not applicable to the GMF Pond at the Duck Creek Power Station.

Results of the Initial Safety Factor Assessment, for the critical cross-section, are listed in **Table 1**.

Table 1 – Summary of Initial Safety Factor Assessments

Loading Conditions	§257.73(e)(1) Subsection	Minimum Factor of Safety	Calculated Factor of Safety
Maximum Storage Pool Loading	(i)	1.50	4.27
Maximum Surcharge Pool Loading	(ii)	1.40	4.26
Seismic	(iii)	1.00	2.37
Soils Susceptible to Liquefaction	(iv)	1.20	Not Applicable

Based on this evaluation, the GMF Pond meets the requirements in §257.73(e)(1).

3 Certification Statement

CCR Unit: Illinois Power Resources Generating, LLC; Duck Creek Power Station; GMF Pond

I, Victor A. Modeer, 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 CCR Rule Report, and the underlying data in the operating record, has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the initial safety factor assessment dated October 13, 2016 meets the requirements of 40 CFR §257.73(e).

VICTOR A MODEER JR.
Printed Name

10/13/16
Date

VICTOR ALBERT MODEER JR.
062-043118
REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS
11/30/17

About AECOM

AECOM (NYSE: ACM) is a global provider of professional technical and management support services to a broad range of markets, including transportation, facilities, environmental, energy, water and government. With nearly 100,000 employees around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation, and collaborative technical excellence in delivering solutions that enhance and sustain the world's built, natural, and social environments. A Fortune 500 company, AECOM serves clients in more than 100 countries and has annual revenue in excess of $19 billion.

More information on AECOM and its services can be found at www.aecom.com.

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ATTACHMENT R

AECOM

Submitted to
Illinois Power Resources
Generating, LLC
17751 North Cilco Road
Canton, IL 61520

Submitted by
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St. Louis, MO 63110

October 2016

CCR Rule Report: Initial Inflow Design Flood Control System Plan

For

GMF Pond

At Duck Creek Power Station

1 Introduction

This Coal Combustion Residual (CCR) Rule Report documents that the initial inflow design flood control system plan for Gypsum Management Facility (GMF) Pond at the Illinois Power Resources Generating, LLC Duck Creek Power Station meets the requirements specified in 40 Code of Federal Regulations (CFR) §257.82. The GMF Pond is located near Canton, Illinois in Fulton County, approximately 2.5 miles north of the Duck Creek Power Station. The GMF Pond serves as the wet impoundment basin for gypsum produced by the wet scrubber system at the Duck Creek Power Station.

The GMF Pond is an existing CCR surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that the initial inflow design flood control system plan for an existing CCR surface impoundment be prepared by October 17, 2016. The plan must document how the inflow design flood control system has been designed and constructed to meet the requirements of 40 CFR §257.82 and be supported by appropriate engineering calculations.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the inflow design flood control system meets the requirements of 40 CFR §257.82. The owner or operator must prepare an inflow design flood control system plan every five years.

2 Initial Inflow Design Flood Control System Plan

40 CFR §257.82
(a) The owner or operator of an existing … CCR surface impoundment … must design, construct, operate, and maintain an inflow design flood control system as specified in paragraphs (a)(1) and (2) of this section.

(1) The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood specified in paragraph (a)(3) of this section.

(2) The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood specified in paragraph (a)(3) of this section.

(3) The inflow design flood is:

(i) For a high hazard potential CCR surface impoundment, …, the probable maximum flood;

(ii) For a significant hazard potential CCR surface impoundment, …, the 1,000-year flood;

(iii) For a low hazard potential CCR surface impoundment, …, the 100-year flood; or

(iv) For an incised CCR surface impoundment, the 25-year flood.

(b) Discharge from the CCR unit must be handled in accordance with the surface water requirements under §257.3-3.

Analyses completed for the initial inflow design flood control system plan of the GMF Pond are described in the following subsections. Data and analysis results in the following subsections are based on spillway design information shown on design drawings, construction information, topographic surveys, information about operational and maintenance procedures provided by Illinois Power Resources Generating, LLC, and field measurements collected by AECOM. The analysis approach and results of the hydrologic and hydraulic analyses are presented in the following subsections.

The GMF Pond 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).

2.1 Initial Inflow Design Flood Control Systems (§257.82(a))

An initial inflow design flood control system plan, supported by a hydraulic and hydrologic analysis, was developed for the GMF Pond by evaluating the effects of a 24-hour duration design storm for the 1,000-year Inflow Design Flood (IDF) using a hydrologic HydroCAD (Version 8.5) computer model and a starting water surface elevation of 616.0 feet. The computer model evaluated the GMF Pond's ability to collect and control the 1,000-year IDF under existing operational and maintenance procedures. Rainfall data for the 1,000-year IDF was obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14. The NOAA Atlas 14 rainfall depth is 9.37 inches.

The HydroCAD model results for the GMF Pond indicate that the CCR unit has sufficient storage capacity and spillway structures to adequately manage (1) flow into the CCR unit during and following the peak discharge of the 1,000-year IDF and (2) flow from the CCR unit to collect and control the peak discharge resulting from the 1,000-year IDF. The peak water surcharge elevation is 618.3 feet during the IDF, and the minimum crest elevation of the GMF Pond dike is 620.0 feet. Therefore, overtopping is not expected.

Based on this evaluation, the GMF Pond meets the requirements in §257.82(a).

2.2 Discharge from the CCR Unit (§257.82(b))

40 CFR §257.82(b) provides that the discharge from the CCR unit must be handled in accordance with the surface water requirements under 40 CFR §257.3-3, which states the following:

(a) For purposes of section 4004(a) of the Act, a facility shall not cause a discharge of pollutants into waters of the United States that is in violation of the requirements of the National Pollutant Discharge Elimination System (NPDES) under section 402 of the Clean Water Act, as amended.

(b) For purposes of section 4004(a) of the Act, a facility shall not cause a discharge of dredged material or fill material to waters of the United States that is in violation of the requirements under section 404 of the Clean Water Act, as amended.

(c) A facility or practice shall not cause non-point source pollution of waters of the United States that violates applicable legal requirements implementing an areawide or Statewide water quality management plan that has been approved by the Administrator under section 208 of the Clean Water Act, as amended.

(d) Definitions of the terms Discharge of dredged material, Point source, Pollutant, Waters of the United States, and Wetlands can be found in the Clean Water Act, as amended, 33 U.S.C. 1251 et seq., and implementing regulations, specifically 33 CFR part 323 (42 FR 37122, July 19, 1977).

The handling of discharge was evaluated by reviewing design drawings, operational and maintenance procedures, conditions observed in the field by AECOM, and the inflow design flood control system plan developed per §257.82(a).

Based on this evaluation, the GMF Pond does not discharge into waters of the United States. Water from the GMF Pond is recycled for use in plant operations. Hydraulic and hydrologic analyses performed as part of the initial inflow design flood control system plan found the GMF Pond adequately manages outflow during the 1,000-year IDF, as overtopping of the GMF Pond embankments is not expected.

Therefore, discharge to waters of the United States is not expected during normal or IDF conditions, and the GMF Pond meets the requirements in §257.82(b).

3 Certification Statement

CCR Unit: Illinois Power Resources Generating, LLC; Duck Creek Power Station; GMF Pond

I, Victor A. Modeer, 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 CCR Rule Report, and the underlying data in the operating record, has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the initial inflow design flood control system plan dated October 13, 2016 meets the requirements of 40 CFR §257.82.

VICTOR A MODEER SR.
Printed Name

10/13/16
Date

VICTOR ALBERT MODEER JR.
062-043112
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

11/30/17

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ATTACHMENT S

PART 845 SAFETY AND HEALTH PLAN

DUCK CREEK POWER PLANT
GMF POND AND BOTTOM ASH BASIN

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ACRONYMS & ABBREVIATIONS

%	Percent
§	Section
35 I.A.C.	Title 35 of the Illinois Administrative Code
29 C.F.R.	Title 29 of the Code of Federal Regulations
ACGIH	American Conference of Governmental Industrial Hygienists
BAB	Bottom Ash Basin
CCR	Coal Combustion Residual
DCPP	Duck Creek Power Plant
GMFP	Gypsum Management Facility Pond
HAZWOPER	Hazardous Waste Operations and Emergency Response
ID	identification
IDLH	Immediately Dangerous to Life and Health
IEPA	Illinois Environmental Protection Agency
IPRG	Illinois Power Resources Generating, LLC
kV	kilovolt
NID	National Inventory of Dams
NIOSH	National Institute for Occupational Safety and Health
No.	number
OSHA	Occupational Safety and Health Administration
Part 845	35 I.A.C. Part 845: Residuals in Surface Impoundments
PEL	Permissible Exposure Level
PFAS	Per- and polyfluoroalkyl substances
PFD	Personal Flotation Device
PNOR	particulates not otherwise recognized
POC	Point of Contact
PPE	personal protective equipment
ppm	parts per million
SDS	Safety Data Sheet
Site	GMFP and BAB
STEL	Short Term Exposure Limit
TLV	Threshold Limit Value
TWA	time-weighted averages
USCG	United States Coast Guard

REVISION SUMMARY

Revision Date	**Description of Changes** (Section title or number – description)	**Responsible Party** (individual name or title, company / agency name, document reference and date)

PREFACE

Illinois Power Resources Generating, LLC (IPRG) has prepared this Safety and Health Plan in accordance with requirements set forth in Title 35 of the Illinois Administrative Code (35 I.A.C.) Part 845: Residuals in Surface Impoundments (Part 845), Section (§) 845.530. IRPG assessed health and safety hazards of its coal combustion residual (CCR) surface impoundments to develop and update this Safety and Health Plan.

This document describes the minimum anticipated protective measures necessary for worker health and safety at Duck Creek Power Plant (DCPP) Gypsum Management Facility Pond (GMFP; Vistra identification [ID] number [No.] 203, Illinois Environmental Protection Agency [IEPA] ID No. W0578010001-04, National Inventory of Dams [NID] No. IL50573) and Bottom Ash Basin (BAB; Vistra ID No. 205, IEPA ID No. W0578010001-03, NID No. IL50716), collectively referred to as the Site. Employees of IPRG, contract workers, and third-party contractors must read and comply with the contents of this document. The contents of this document are not intended to cover all situations that may arise nor to waive any provisions specified in Federal, State, and local regulations or site owner / contractor health and safety requirements.

Third-party contractors are accountable for the health and safety of their employees. Third-party contractors are required to prepare a Safety and Health Plan that meets the minimum requirements herein. However, no requirements or provisions within this plan shall be construed as an assumption of IPRG of their legal responsibilities as an employer.

This Safety and Health Plan will be reviewed and updated annually, at a minimum. The Safety and Health Plan will also be updated if facility operations change, or a new hazard is identified.

1. INTRODUCTION

This Safety and Health Plan has been developed to outline the requirements to be met by employees of IPRG, contract workers, and third-party contractors while performing any activity to construct, operate, or close the CCR Units at the Site. This Safety and Health Plan has been developed to meet the requirements of 35 I.A.C. § 845.530 and describes the responsibilities, training requirements, protective equipment, and safety procedures necessary to minimize the risk of injury, fires, explosion, chemical spills, material damage incidents, and near misses related to CCR activities. This Safety and Health Plan incorporates by reference the Occupational Safety and Health Administration (OSHA) regulations contained in Title 29 of the Code of Federal Regulations (29 C.F.R.) § 1910 and 29 C.F.R. § 1926.

The requirements and guidelines in this Safety and Health Plan are based on a review of available information and data, and an evaluation of identified on-site hazards. This Safety and Health Plan will be reviewed with persons assigned to work at the Site and will be available on-site.

1.1 Site Description/History

The DCPP is a retired coal-fired power plant located in Section 30 of Township 6 North, Range 5 East, in Fulton County, Illinois and approximately 6 miles southeast of the town of Canton. The BAB is located immediately northeast of the power plant facility in Section 30, 31. The GMFP is located to the north in Section 18, east of Bethel Cemetery Road, and approximately 2 miles southeast of Canton, Illinois (Appendix A).

1.2 Facility Personnel

The following table outlines key facility personnel with respect to facility operations and health and safety.

Name	Position	Phone Number
Brandon Potter	Point-of-Contact (POC) /Plant Manager	618-210-3418
Security Guard	Security Guard	713-542-0619
Daryl Johnson	Environmental Manager	309-229-6088
Matt Ballance	Engineering Manager	618-343-7739 (office) 618-792-7274 (mobile)
Jason Campbell	Dam Safety Manager	271-753-8904 (Springfield) 217-622-3491 (mobile)
Stu Cravens	Senior Technical Expert	217-390-1503 (mobile)
Vic Modeer	Engineering Manager	618-541-0878
Charles Koudelka	Plant Closure Director	903-235-8633

1.3 Responsibilities

The following persons have responsibilities associated with communicating and implementing the Safety and Health Plan for the Site.

1.3.1 IPRG Point of Contact

The IPRG Point of Contact (POC) is a management-level person who is requiring employees, contract workers, or third-party contractors to enter the Site. The IPRG POC is responsible to communicate Safety and Health Plan information and requirements to employees, contract workers, and third-party contractors, and oversee work performed at the Site to the extent necessary to confirm implementation of Safety and Health Plan requirements.

1.3.2 IPRG Employees

IPRG employees are directly hired by IPRG. They are required to implement and/or follow Safety and Health Plan requirements as applicable to their work and exercise their "stop work authority" if safety requirements are unclear or unanticipated site conditions or hazards are observed.

1.3.3 Contract Workers

Contract workers are those hired by IPRG through an agency firm. Similar to IPRG employees, contract workers are required to implement and/or follow Safety and Health Plan requirements as applicable to their work and exercise their "stop work authority" if safety requirements are unclear or unanticipated site conditions or hazards are observed.

1.3.4 Third-Party Contractor Employees

Third-party contractor employees work for firms under contract to IPRG. Third-party contractors include prime contractors and all of their lower tier subcontractors. Similar to IPRG employees, third-party contractors are required to implement Safety and Health Plan requirements as applicable to their work and exercise their "stop work authority" if safety requirements are unclear or unanticipated site conditions or hazards are observed.

1.3.5 Third-Party Contractor Safety Competent Person

Third-party contractors will be required to designate a Safety Competent Person. The Safety Competent Person must be in a management position (*e.g.,* superintendent, foreman, etc.) with OSHA 30-hour construction safety certification who may perform other duties, unless IPRG requires a dedicated Safety Competent Person. A Safety Competent Person must be on site at all times when the subcontractor has employees performing work for IPRG and must possess a sound working knowledge of pertinent OSHA regulations, this Safety and Health Plan, and other applicable safety requirements related to the scope of work. Third-party contractors must also designate a backup Safety Competent Person that possesses the same authority and training. The competent person will ensure timely correction of safety deficiencies identified by IPRG. The Safety Competent Person is responsible to ensure Safety and Health Plan requirements have been communicated to lower-tier subcontractors and enforce Safety and Health Plan requirements.

2. SITE ACCESS & CONTROL

This section outlines requirements for ensuring that only authorized personnel and visitors are permitted at the Site.

2.1 Facility Security

Elements of site control include restricting access to the CCR Units to persons until they have met the training requirements outlined in this Safety and Health Plan and have been authorized to do so by DCPP POC or their representative.

All IPRG employees, contract workers, and third-party contractors must sign in and out with the security guard.

Upon arrival to the Site, all IPRG employees, contract workers, and third-party contractors must check in/out at Security. A COVID-19 screening must also be completed per Section 3.8.

2.2 Third-Party Contractor Management

Prior to working at the Site, all third-party prime contractors must maintain an active registration with ISNetworld and maintain a grade of A or B. Lower tier subcontractors are currently not required to be registered in ISNetworld, but this requirement may change at the discretion of IPRG.

2.3 Third-Party Contractor Safety and Health Plan

Prior to being authorized to conduct work at the Site, third-party contractors must develop and submit a Safety and Health Plan. The third-party contractor's Safety and Health Plan must be specific to the scope of work that they will be performing at the Site. The third-party contractor's Safety and Health Plan must meet or exceed all the requirements in this Safety and Health Plan, other IPRG requirements, and applicable regulations. All lower tier subcontractors of third-party contractors must meet the requirements in this Safety and Health Plan as well as the requirements outlined in the Safety and Health Plan of the third-party with whom they are contracted.

2.4 Authorized Personnel

At a minimum, authorized personnel who will be granted unescorted access to the project include IPRG employees, contract workers, and third-party contractors that meet the following:

- Reviewed this Safety and Health Plan and other applicable safety planning documentation
- Have completed all the training, medical surveillance, and drug screen and background investigation requirements as outlined in Section 3 of this Safety and Health Plan.

2.5 Visitors

Visitors must be escorted by Authorized Personnel through the Site if they have not reviewed this Safety and Health Plan or completed the training requirements outlined in Section 3 of this Safety and Health Plan. Visitors may not undertake any activity to construct, operate, or close a CCR surface impoundment.

2.6 Communication

Communication between workers and emergency services must be maintained at all times. Cellular service is consistently available and can be relied upon to summon emergency services.

3. TRAINING & MEDICAL REQUIREMENTS

Project personnel must be properly trained for the type of work being performed and in accordance with 35 I.A.C. § 845.530, 29 C.F.R. § 1926 and 29 C.F.R. § 1910, and IPRG policies. Additionally, personnel working in areas regulated by the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standards (29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65) must have current medical surveillance. All employees, contractors, and third-party contractors must complete the following prior to beginning any activity to construct, operate or close the CCR Units at the Site.

3.1 HAZWOPER Training

35 I.A.C. § 845.530(c)(2)(E) requires that all employees, contract workers, and third-party contractors be trained in accordance with 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65. The following training will be completed as required by job function:

- **OSHA 40-Hour Training** per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65, for those personnel who are expected to have extensive contact with contaminated materials and/or may be required to wear a respirator.
- **OSHA 24-Hour Training** per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65, for those personnel who are expected to have minimal contact with contaminated materials and will NOT be required to wear a respirator.
- **OSHA 8-hour Supervisor Training** per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65, for Site Supervisors, Foremen, Superintendents, and others who will be directing and managing site activities.
- **OSHA 8-hour Refresher** per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65, completed within 12 months of initial 40-hour or 24-hour training and annually thereafter.

The following matrix outlines HAZWOPER training requirements based on typical job functions at the Site. It is not intended to be all inclusive, new job functions must be evaluated per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65.

Training	Job Function
OSHA 40-hour	Ash handlers
OSHA 24-hour	Personnel not required to handle CCR materials
OSHA 8-hour Supervisor Training	Third-Party Contractor Safety Competent Persons
OSHA 8-hour refresher	All personnel

3.2 OSHA Construction Outreach Training

35 I.A.C. § 845.530(c)(2)(E) requires that all employees, contract workers, and third-party contractors complete an OSHA 10-hour or 30-hour construction safety training. These trainings will be completed as follows:

- All employees, contract workers, and third-party contract employees: OSHA 10-hour or 30-hour construction outreach training.
- Supervisors, superintendents, foreman and safety professionals: OSHA 30-hour construction outreach training.

3.3 Safety and Health Plan Review

Pursuant to 35 I.A.C. § 845.530(d)(e), before beginning any activity at the Site, and annually thereafter, all IPRG employees, contract workers, and third-party contractors must review the content of this HASP. After reviewing this Safety and Health Plan all personnel will understand the following:

- Procedures for using, inspecting, repairing, and replacing facility emergency and monitoring equipment
- Communications or alarm systems outlined in Section 6
- Response to fires and explosions outlined in Section 6
- Response to a spill or release of CCR
- Information about chemical hazards and hazardous materials outlined in Section 5
- The use of engineering controls, administrative controls, and personal protective equipment (PPE) outlined in Section 4

All personnel will acknowledge this HASP by signing the *Safety and Health Plan Acknowledgment Form (Appendix B).*

3.4 Emergency and Monitoring Equipment Training

All IPRG employees, contract workers, and third-party contractors must be aware of how to respond to alarms and other emergencies as outlined in Section 6 of this plan. Individuals may only use facility emergency and monitoring equipment if they have been trained in their use and authorized to do so by the designated POC. Additionally, a written release may need to be completed as required by Vistra Corporate Procedure FFA-POL-0006.

Individual IPRG employees and contract workers may be responsible for using, inspecting, repairing and replacing facility emergency monitoring equipment. These individuals will be trained in accordance with the Authorized Gas Testing training (or equivalent) or other procedures identified by IPRG. These individuals will review and adhere to the manufacturer's instructions, where applicable.

Third-party contractors are responsible for inspecting, repairing, and replacing any owned emergency (*i.e.*, fire extinguishers) and monitoring equipment (*i.e.*, air monitoring equipment). Third-party contractors will maintain procedures for using, inspecting, repairing, and replacing owned emergency and monitoring equipment that is consistent with the manufacturer's requirements. Third-party contractor employees who are responsible for this equipment will be trained in procedures for using, inspecting, and repairing owned equipment by their employer.

3.5 Hazard Communication

All employees, contract workers, and third-party contractors must be trained in chemical hazards (if any) associated with their work in accordance with 29 C.F.R. § 1910.1200. Work tasks performed at the Site may include exposure to compounds identified in the Hazard Communication section of this Safety and Health Plan and is included as part of the Safety and Health Plan Review outlined in Section 3.3.

3.6 Medical Surveillance

All employees, contract workers, and third-party contractors engaged in operations specified in 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65 and meet one of the criteria outlined in 29 C.F.R. § 1910.120(f)(2) and 29 C.F.R. § 1926.65(f)(2) must participate in a medical surveillance program that is administered by their employer. The criteria for participating in a medical surveillance program are:

- All employees who are or may be exposed to hazardous substances at or above the established permissible exposure limit, without regard to the use of respirators, for 30 days or more a year;
- All employees who wear a respirator for 30 days or more a year; or
- All employees who are injured, become ill or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation.

The medical surveillance program must result in documentation that an individual is cleared to work on sites covered by 29 C.F.R. § 1910.120 and 20 C.F.R. § 1926.65 and is medically fit to wear a respirator when applicable.

3.7 Drug Screen and Background Investigations

IPRG requires that contract worker agencies and third-party contractors are responsible for ensuring that all personnel have completed and passed a drug and alcohol test and background investigation prior to on-site work as described in Appendix C.

3.8 COVID-19 Site Entry Guidelines

All personnel entering Vistra work sites shall review and adhere to the site entry guidelines provided in Appendix D.

3.9 Document Management

IPRG will maintain employee and contract employee training and medical surveillance records in the Maintenance Office. Third-party contractors are responsible for maintaining training and medical surveillance documentation for their employees. Third-party contractors will produce documentation upon IPRG request.

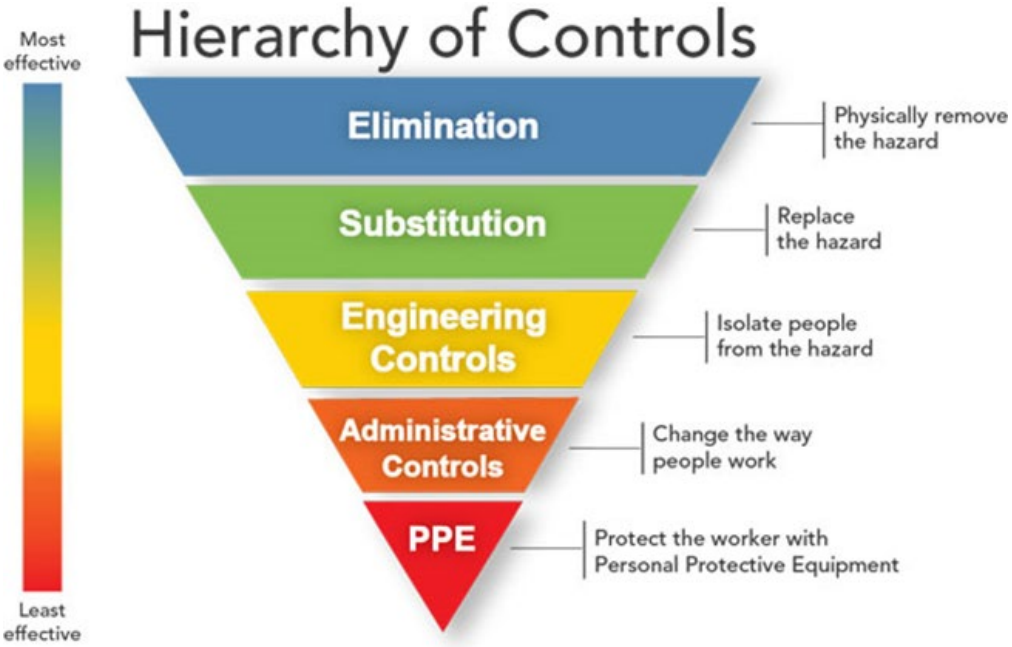
3.10 Industrial Hygiene Sampling Records

Upon receipt of exposure sampling results IPRG and third-party contractors must distribute exposure sampling results to employees within 15 business days unless otherwise required by applicable regulation. All personnel exposure sampling results and records must be maintained by the employee’s company for at least 30 years following termination of employment.

4. HAZARD & CONTROLS

The following section outlines general controls for the hazards and controls. Third-party contractors are still responsible for developing a Safety and Health Plan that incorporates requirements of this Safety and Health Plan, other safety requirements for the DCPP, as well as the third-party contractor's safety policies and procedures. Safety and Health Plans developed by third-party contractors must be specific to the site and the anticipated work means and methods. Safety and Health Plans that consist of only standard operating procedures or are not otherwise specific to the work performed at the Site will not be accepted by IPRG.

IPRG requires that a hierarchy of controls be considered when performing work at the GMFP or BAB. Implement controls that favor elimination, substitution, and engineering over the use of administrative controls and PPE when feasible. See the figure below for additional guidance (courtesy of the National Institute for Occupational Safety and Health [NIOSH]).



4.1 Ash/Unstable Surfaces

Prior to working in or on an ash pond, third-party contractors must notify the security guard and the POC. Work in or on an ash pond may not begin until the facility POC has approved the work and all personnel have signed in with the security guard. Upon completion of the work, third-party contractors must notify the POC and security guard that they have left the Site.

When working on ash ponds or unstable surfaces the following requirements must be implemented where applicable and feasible. The following table summarizes safety controls for work performed in ash ponds and on unstable surfaces and are aligned to the hierarchy of controls:

Elimination	Substitution	Engineering	Administrative	PPE
Change the work task or work methods so that work on ash ponds is no longer required	Use the lightest available tracked equipment to reduce ground pressure	Use crane mats or other cribbing to support heavy equipment on ash ponds	Traverse compacted paths that have previously been used by heavy equipment	Use a restraint (tethering) system to prevent falls or slips into unstable ash pond surfaces or surface water that represents a drowning hazard

Elimination	Substitution	Engineering	Administrative	PPE
			If an unstable condition exists, complete a Next Level Up Pre-Job Brief prior to accessing the ash pond.	
			Approach the ash pond from the most stable direction	
			Inspect travel paths for recent terrain shifts, particularly following heavy rains or rapid dewatering	
			Working alone on ash ponds is prohibited without pre-approval from the POC.	
			When a drowning hazard exists, implement requirements for working on/near water as outlined in Section 4.4.	
			Implement an emergency response plan with trained responders for falls into (or engulfment by) ash	

4.2 Ash Inhalation/Airborne Exposure

Ash that becomes airborne due to site activities or environmental conditions may result in an exposure to its components as outlined in Section 5.1. IPRG and third-party contractors are responsible for ensuring their respective employees' and contract workers' exposures are below occupational exposure limits. Upon request, third-party contractors must demonstrate to IPRG that exposure control methods are adequate. The following table summarizes airborne exposure controls and is aligned to the hierarchy of controls:

Elimination	Substitution	Engineering	Administrative	PPE
Change the work task or work methods so that work on ash ponds is no longer required	Substitute manual work methods for those that can be completed from the cab of a vehicle	Continually wet work areas to reduce the amount of ash that becomes airborne Equip vehicles and heavy equipment cabs with filters. Clean and change filters as required	Conduct air monitoring or exposure sampling to confirm that airborne exposure is below regulatory limits	If exposure levels are above the PEL, equip employees with respirators appropriate to the level of exposure

4.3 Stuck Vehicles/Equipment

If a vehicle or piece of equipment becomes stuck, a third-party towing or wrecking company who is trained in vehicle extraction must be retained and the IPRG POC will be notified. Bob's and Swise Towing (309-647-1633) is an approved extraction company that may be used to remove stuck vehicles. Third-party contractors may extract their own vehicle if they have an approved extraction plan, and a competent person is on site to implement the extraction. The extraction plan shall be included as part of the third-party contractor's reviewed and approved Safety and Health Plan. The above notifications are still required.

The hazards presented by stuck vehicles/equipment must not be underestimated. While the weight of the stuck equipment can be calculated, it's impossible to precisely calculate the other forces that are pulling against the towing vehicle which requires special training and experience to properly size towing equipment and select towing techniques. This is especially true for "complex" or high-hazard extractions involving equipment stuck at axle depth (or beyond) or sloped surfaces or any area where extraction activities could trigger shifts in the ground surface. No chains shall be used to remove stuck vehicles/equipment.

The following table summarizes safety controls related to stuck vehicles and equipment and are aligned to the hierarchy of controls:

Elimination	Substitution	Engineering	Administrative	PPE
Change the work task or work methods so that work on ash ponds is no longer required	Use the lightest available tracked equipment to reduce ground pressure Substitute tracked equipment for wheeled equipment	Use crane mats or other cribbing to support heavy equipment on ash ponds Lighten the load – Remove materials from stuck vehicles or equipment prior to extraction if possible	Only persons trained in vehicle extraction are permitted to remove stuck vehicles/equipment A professional towing/wrecking service is required Prepare for spills (damage to fuel or hydraulic systems)	All persons involved in removing stuck equipment must wear PPE that includes hard hat, safety boots, safety glasses, high visibility vests, and cut resistant gloves

4.4 Working Near/Over Water

All employees, contract workers, and third-party contractors must wear a United States Coast Guard (USCG) approved personal floatation device (PFD), when within 6 feet of water, over water, and/or wading in water where the danger of drowning exists. The PFD must be properly

secured to the wearer, free of all defects including rips, tears, stress, and fading, and be kept clean and free of excessive dirt and oil.

If the possibility of falling into water has been eliminated through the use of guardrails, fall restraint, or other method, the use of a PFD is no longer required.

When performing work on water from a vessel, at least one lifesaving rescue vessel (*e.g.,* a skiff) shall be immediately available at locations where employees are working over, in, on, or adjacent to water where the danger of drowning exists. However, if the water is so shallow that rescuers could simply walk/run into the water body without endangering themselves and/or others or the work was being conducted very close to shore (*e.g.,* the length of the skiff from shore would be greater than the working distance from shore and/or the skiff would foul on the bottom), a skiff would not be required.

The following table summarizes the requirements for working over/near water where a drowning hazard exists and are aligned to the hierarchy of controls:

Elimination	Substitution	Engineering	Administrative	PPE
Change the work task or work methods so that work near a drowning hazard is no longer required		Install guardrails that separate work areas from the drowning hazard	All work to be performed by at least two people where each is equipped with proper safety gear and capable of summoning emergency rescue	All personnel are required to wear suitable PFDs
		Utilize equipment (crowd-control barricades, safety fence, etc.) that will keep personnel at least 6 feet from a drowning hazard	When working on water use of a rescue skiff as outlined above	
			Use of a ring buoy with 90 feet of braided polycarbonate (or equivalent) line	
			Ring buoys must be positioned within 100 feet of work (maximum of 200 feet spacing)	

4.5 Heavy Equipment

All heavy equipment operators must be competent and authorized to operate each piece of heavy equipment. Forklift and telehandler (*e.g.,* Lull, JLG) operators must have a license or certificate that indicates they have passed a written test and "road" test for the equipment they will be operating within the last 3 years. Third-party contractors will provide proof of qualification upon request of IPRG.

Persons working around heavy equipment must implement the “25 Foot Rule.” The 25 Foot Rule requires that persons get the operator’s attention and permission prior to approaching closer than 25 feet to heavy equipment. Persons must walk quickly through blind spots. Loitering in heavy equipment blind spots (especially to the rear) must be avoided.

Temporary fuel storage tanks will be labelled as to their content and be protected from collision by Site vehicles using solid barricades including balusters, chain link fence, or equivalent. Spill kit (55-gallon sorbent capacity contained in an overpack) and one 20-pound Type ABC fire extinguisher will be located within 45 feet of fueling areas. Tanks will be rated for above ground use and will be double walled or have secondary containment in case of a leak. Tanks and dispensing hose will be bonded and grounded. On-site filling of fuel storage tanks will be completed with trucks that have automatic over-flow shutoffs. These trucks will be properly bonded to the storage tank and meet all of the other storage tank requirements. Temporary secondary containment must be provided in the refueling area that includes the storage tank and dispensing hoses.

Elimination	Substitution	Engineering	Administrative	PPE
		Heavy equipment (and vehicles) must be equipped with backup alarms, horns, roll-over protection (when feasible)	Operators must be competent and authorized	Operators must use seatbelts when equipped
		Vehicles and heavy equipment operated at night must have headlights, tail lamps, and reflectors	Forklift operators must have a current license or certificate (within 3 years)	High visibility vests are required when working around heavy equipment
			All vehicles and equipment must be turned off when not in use	
			Operators must inspect equipment daily prior to use	
			Persons working near heavy equipment must follow the "25 Foot Rule" and avoid lingering in blind spots as outlined above	
			Always obey site speed limits – 15 mph unless otherwise posted	

4.6 Overhead Powerlines

All overhead powerlines must be assumed to be energized until confirmed otherwise. The minimum clearance distance for equipment working near energized power lines must be in accordance with the table found in 29 C.F.R. § 1926.1408(h).

The following table summarizes safety controls for work near energized power lines:

Elimination	Substitution	Engineering	Administrative	PPE
Plan to work away from powerlines	Use heavy equipment with shorter booms/attachments to avoid coming close to power lines	Contact the utility owner to deenergize the line	Install signs to warn personnel of overhead powerlines	
		Contact the utility owner to install insulated sleeves over energized lines	Install a non-conductive distance marker to delineate minimum clearance	
			Use a dedicated spotter to ensure equipment does not enter minimum clearance distances	

4.7 Severe Weather

Severe weather conditions include but are not limited to high winds, electrical storms, heavy rain, and tornados can cause hazardous conditions at CCR surface impoundments. The primary control for severe weather is monitoring weather reports prior to beginning work and as work occurs throughout the day.

Monitor lightning using a commercially available mobile application if cellular service is available. When lightning is observed within 10 miles of the CCR surface impoundment, or a storm is imminent, take shelter in the nearest solid structure or fully enclosed vehicle. If possible, secure all tools, materials, and equipment prior to the storm arriving. Work may resume 30 minutes after the last lightning strike is observed within 10 miles. The following locations are acceptable shelter locations near the CCR Units:

- GMF Pump House at the landfill area
- Dumper House at the Coal Yard
- New Stack base

Do not conduct work on a CCR surface impoundment when there is a risk for tornados in the area. If on a CCR surface impoundment and a tornado forms, seek the nearest substantial shelter. The closest tornado shelters are the same as the severe weather shelter locations; shelter locations will be reviewed during the Site Orientation Training. If no shelter is available, attempt to evacuate to a shelter using a vehicle. If a tornado forms and you are not in a shelter, take one of the following actions:

- Stay in a vehicle with the seat belt on, keep your head below the windows and cover it with your hands
- If there is an area which is noticeably lower than the work area, lie in that area and cover your head with your hands.

The following table summarizes safety controls related to severe weather:

Elimination	Substitution	Engineering	Administrative	PPE
Plan outdoor tasks on days with low potential for severe weather.			Prior to beginning outdoor work monitor the day's weather.	

Elimination	Substitution	Engineering	Administrative	PPE
			Periodically monitor weather throughout the day. Use a weather app which issues alerts for severe weather and lightning, assuming cell service is available	
			Utilize a weather radio if cellular service is inconsistent	
			Stop all outdoor work and seek shelter when lightning is observed	

4.8 Heat Stress

Heat stress can be a significant hazard, especially for workers wearing protective clothing. Depending on the ambient conditions and the work being performed, heat stress can occur very rapidly, within as little as 15 minutes. Employees, contract workers, and third-party contractors will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim, and in the prevention of heat stress incidents.

Workers will be encouraged to immediately report any heat-related problems that they experience or observe in fellow workers. Any worker exhibiting signs of heat stress and exhaustion should be made to rest in a cool location and drink plenty of water. Emergency help by a medical professional is required immediately for anyone exhibiting symptoms of heat stroke, such as red, dry skin, confusion, delirium, or unconsciousness. Heat stroke is a life-threatening condition that must be treated immediately by competent medical authority.

4.8.1 Heat Stress Prevention

To prevent heat stress, IPRG employees, contract workers, and third-party contractors will implement heat stress prevention measures as outlined in OSHA's Heat Index (below). A summary of these precautions is described below.

Heat Index	Risk Level	Protective Measures
Less than 91°F	Lower (Caution)	Basic heat safety and planning
91°F to 103°F	Moderate	Implement precautions and heighten awareness
103°F to 115°F	High	Additional precautions to protect workers
Greater than 115°F	Very High to Extreme	Triggers even more aggressive protective measures

Know the Symptoms: Some symptoms associated with heat stress are: Employees should be aware of these symptoms with themselves and with their co-workers:

- Elevated heart rate, lack of concentration, difficulty focusing on a task, fatigue
- Irritability and/or sickness
- Cramps, rash, headache
- Loss of desire to drink water
- Fainting
- Skin clammy, moist, and pale (severe heat exhaustion)
- Skin extremely dry and red (heat stroke)

Acclimatize: When high heat stress conditions arise, employees should be exposed to the heat for short work periods followed by longer periods of work. Acclimatization usually takes five (5) days and should be provided for all new employees and employees returning from an absence of two (2) weeks or more. Contact Corporate Health and Safety for proper procedures.

Hydration & Pace of Work: Make sure all employees intake plenty of water throughout the work day (sometimes as much as a quart per worker per hour) and let employees know where the drinking water is located. Adjust your work pace and expectations on how much work can be done during periods of high heat stress. Workers cannot do as much during periods of high heat stress compared with similar periods of low heat stress. After acclimatization, workers may be able to resume a more "normal" work pace as long as fluid intake is adequate.

Work/Rest Periods: If possible, heavy work should be scheduled during the cooler parts of the day (*i.e.,* early morning) and rest periods should be taken in cool areas for longer periods.

Personal Protective Equipment (PPE): Employees using PPE (*i.e.*, Tyvek® suits or other equipment which may retain heat) can be more susceptible to heat stress due to the fact that heat/sweat often cannot escape the suits and/or the equipment. Persons wearing PPE that contributes to heat stress require more hydration, longer rest periods, or a reduced pace of work. Also, more careful monitoring of each person's health status is required by co-workers and management.

The following table summarizes safety controls for heat related illnesses:

Elimination	Substitution	Engineering	Administrative	PPE
Perform outdoor, strenuous, tasks at cooler times of day/year	Use mechanized equipment in place of manual labor	Install fans or air conditioning units in the work area	Train all personnel to know the signs of heat stress/stroke and how to prevent it	Implement the use of cooling vests or other similar PPE
		Install a canopy to provide shade to work areas	Allow workers to acclimatize to the work environment	
		Provide cool, shaded break areas	Adjust work pace to allow for the effects of heat	
			Implement work/rest periods	

4.9 Cold Stress

The four environmental conditions that cause cold-related stress are low temperatures, high/cool winds (wind chill), dampness, and cold water. One, or any combination of these factors, can cause cold-related hazards. Cold stress, including frostbite and hypothermia, can result in severe health effects. Employees, contract employees, and third-party contractors will be instructed in the identification of a cold stress victim, the first-aid treatment procedures for the victim and in the prevention of heat stress incidents.

A dangerous situation of rapid heat loss may arise for any individual exposed to high winds and cold temperatures. Major risk factors for cold-related stresses include:

- Wearing inadequate or wet clothing thus increasing the effects of cold on the body.
- Taking certain drugs or medications such as alcohol, nicotine, caffeine, and medication thus inhibiting the body's response to the cold and/or impairing judgment.
- Having a cold or certain disease, such as diabetes, heart, vascular and thyroid problems, and thereby increasing susceptibility to the winter elements.
- Lower body-fat composition or other physiological differences. Statistics show that men experience far greater death rates due to cold exposure than women, potentially attributable to participation in risk-taking activities, lower body-fat composition and/or other physiological differences.
- Becoming exhausted or immobilized, especially due to injury or entrapment, thus speeding up the effects of cold weather.

The following table provides the resulting equivalent chill temperature to exposed skin because of increasing wind speeds at decreasing actual temperatures. Personnel shall be aware of predicted weather conditions before beginning site work and stay apprised of changes.

TABLE 2. Cooling Power or Wind on Exposed Flesh Expressed as Equivalent Temperature (under calm conditions)*

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	−10	−20	−30	−40	−50	−60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	−10	−20	−30	−40	−50	−60
5	48	37	27	16	6	−5	−15	−26	−36	−47	−57	−68
10	40	28	16	4	−9	−24	−33	−46	−58	−70	−83	−95
15	36	22	9	−5	−18	−32	−45	−58	−72	−85	−99	−112
20	32	18	4	−10	−25	−39	−53	−67	−82	−96	−110	−121
25	30	16	0	−15	−29	−44	−59	−74	−88	−104	−118	−133
30	28	13	−2	−18	−33	−48	−63	−79	−94	−109	−125	−140
35	27	11	−4	−20	−35	−51	−67	−82	−98	−113	−129	−145
40	26	10	−6	−21	−37	−53	−69	−85	−100	−116	−132	−148
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER In < hr with dry skin. Maximum danger of false sense of security				INCREASING DANGER Danger from freezing of exposed flesh within one minute.				GREAT DANGER Flesh may freeze within 30 seconds.			
	Trenchfoot and immersion foot may occur at any point on this chart.											

*Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.
Equivalent chilll temperature requiring dry clothing to maintain core body tempearture above 36°C (96.8°F) per cold stress TLV

The following table summarizes safety controls for preventing cold stress:

Elimination	Substitution	Engineering	Administrative	PPE
Perform work during warm parts of the day or warmer parts of the year		Install heaters in enclosed work areas	Train all personnel on the symptoms of cold stress and how to prevent it	All personnel must wear multiple layers of clothing
		Provide a warm break area	Implement work/rest schedule	Utilize hand/foot warmers when required

An additional hazard in cold weather conditions is the increased risk for slips from the accumulation of ice and snow in general work areas, ruts where water is accumulated, and heavy equipment. The following table outlines controls that may be used for preventing slips:

Elimination	Substitution	Engineering	Administrative	PPE
Perform work during warm parts of the day or in areas free of accumulated areas		Clear snow in work areas		Use traction control devices (*i.e.,* YakTrax) on work boots to provide additional traction.
		Apply salt/sand to icy areas		
		Use equipment to access work areas		

4.10 Biological Hazards

The following are biological hazards that may be present at the Site.

4.10.1 Ticks (Lyme Disease) & Mites

Although Lyme disease has been detected throughout the continental United States, it is prevalent primarily in certain areas in New England, the Mid-Atlantic and the northern Midwest

states. Although Lyme disease is the most common tickborne illness, other tickborne illnesses include southern tick-associated rash illness, Rocky Mountain spotted fever, ehrlichiosis, and tularemia. More information on Lyme disease and other tickborne illnesses can be found from the CDC.

Prevention

- Standard field gear (work boots, socks, and light-colored coveralls) provides good protection against tick bites, particularly if the joints are taped. However, even when wearing field gear, the following precautions shall be taken when working in areas that might be infested with ticks:
  - Wear long pants and long-sleeved shirts that fit tightly at the ankles and wrists, tape cuffs if necessary
  - Wear light colored clothing so ticks can be easily spotted
  - Per- and polyfluoroalkyl substances (PFAS)-free tick repellents (DEET and Permethrin) must be used when walking in all overgrown areas. DEET (≥25 percent [%]) must be applied to skin while permethrin must be applied to clothes and allowed to dry. Spray outer clothing, particularly your pant legs and socks, BUT NOT YOUR SKIN, with an insect repellent that contains permethrin. For heavily infested tick areas, wear spun polypropylene coveralls that have been sprayed with permethrin.
  - Inspect clothing frequently
  - Inspect head and body thoroughly when you return from the field, particularly on your lower legs and areas covered with hair
  - When walking in wooded areas, wear a hard hat, and avoid contact with bushes, tall grass, or brush as much as possible

Removal

- Remove any ticks by tugging with tweezers or special tick removal tools
- Do not squeeze or crush the tick
- DO NOT use matches, a lit cigarette, nail polish, or any other type of chemical to "coax" the tick out

Treatment

- Disinfect the area with alcohol or a similar antiseptic after removal.
- Notify the Safety Competent Person of the embedded tick.
- For several days to several weeks after removal of the tick, look for the signs of the onset of Lyme disease, such as a rash.
- No further treatment is necessary for ticks embedded <48 hours.
- If other signs or symptoms of Lyme are observed (fever/chills, aches, and pains), then notify the Safety Competent Person and seek medical attention.

The following table summarizes safety controls to reduce the hazards associated with ticks and mites.

Elimination	Substitution	Engineering	Administrative	PPE
Use mechanical equipment to remove overgrown vegetation		Remove overgrowth and excessive vegetation from walkways and work areas (provide safe access)	Train personnel on tick and mite prevention. Areas of vegetation overgrowth and/or debris piles should be considered "high risk" areas	Wear light-colored long sleeved shirt tucked into pants. Tuck pant legs into socks
			Perform frequent tick checks in the field and a thorough tick check after completing work activities	Apply Permethrin to clothes and DEET (20% or more) to exposed skin
			Call licensed pesticide contractors to remove infestations of bees, wasps, fire ants, etc.	

4.10.2 Insect Bites/Stings

Stinging/biting insects at the Site include spiders, wasps, and bees. Contact with these insects may result in project personnel experiencing adverse health effects that range from being mildly uncomfortable to being life-threatening. Therefore, insects present a serious hazard to project personnel, and extreme caution must be exercised whenever Site and weather conditions increase the risk of encountering stinging insects. Some of the factors related to stinging insects that increase the degree of risk associated with accidental contact are as follows:

- The nests for these insects are frequently found in remote wooded or grassy areas or equipment staging areas where equipment has not been moved recently.
- Some people are hypersensitive to the toxins injected by a sting, and when stung, experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock. Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth, and respiratory passages.
- The hypersensitivity needed to cause anaphylactic shock, can in some people accumulate over time and exposure, therefore even if someone has been stung previously and not experienced an allergic reaction, there is no guarantee that they will not have an allergic reaction if they are stung again
- Spider bites generally only cause localized reactions such as swelling, pain, and redness. However, bites from a Black Widow or Brown Recluse, or if you are allergic to spiders, can cause symptoms that are more serious.
- ***If a worker knows that they are hypersensitive to bee, wasp, or hornet stings, or other insects, they must inform the Safety Competent Person prior to site work. Persons who have been prescribed epi-pens by their physician must have an epi-pen on the Site.***
- Inspect any clothing or PPE that has been left for a period of time prior to putting it on. Shake out the clothing and inspect the inside of safety shoes/boots prior to putting them on
- Nests in active work areas must be eradicated. Small nests may be handled by Site personnel using consumer-type insecticide. A pest control contractor should be hired to handle large or difficult to reach nests.

The following table outlines safety controls to reduce the risk of hazards associated with stinging/biting insects.

Elimination	Substitution	Engineering	Administrative	PPE
Use mechanical equipment to remove overgrown vegetation		Remove overgrowth and excessive vegetation from walkways and work areas (provide safe access)	Train personnel on stinging/biting insect prevention. Areas of vegetation overgrowth and/or debris piles should be considered "high risk" areas	Wear light-colored long sleeved shirt tucked into pants. Tuck pant legs into socks
		Eradicate nests in the work area as outlined above.	Instruct personnel to inspect/shake out clothing and work boots that have been left for a period of time.	Apply Permethrin to clothes and DEET (20% or more) to exposed skin – NOTE this will not repel bees/wasps
			Instruct employees who are hypersensitive to insect bites/stings to carry their epi-pen while on site	

4.10.3 Venomous Snakes

There are four species of venomous snakes in Illinois, they are:

- Copperhead
- Cottonmouth Water Moccasin
- Timber rattlesnake
- Eastern Massasauga

Generally, these snakes are found in the southern one-third of the state, with the Cottonmouth Water Moccasin found mostly in the southernmost portions of Illinois. Snakes are generally found in tall grass, wood piles, or other covered areas. Snakes are generally not aggressive towards humans, but if they are encountered avoid the snake and do not provoke it. If bitten by a snake that may be venomous seek medical treatment.

The following table outlines safety controls to reduce the hazard associated with venomous snakes.

Elimination	Substitution	Engineering	Administrative	PPE
Use mechanical equipment to remove overgrown vegetation		Remove debris piles, overgrowth and excessive vegetation from walkways and work areas (provide safe access)	Train personnel on the identification of venomous snakes. Areas of vegetation overgrowth and/or debris piles should be considered "high risk" areas	If working in area with snakes cannot be avoided, wear snake chaps
			Instruct personnel to not disturb snakes if they identify one in their work area	

Elimination	Substitution	Engineering	Administrative	PPE
			Use caution when moving staged tools or materials into which snakes may have moved	

4.10.4 Poisonous Plants and Plant Hazards

Poison ivy and poison oak may be present at the Site. Poison ivy thrives in all types of light and usually grows in the form of a trailing vine; however, it can also grow as a bush and can attain heights of 10 feet or more. Poison ivy has pointed leaves that grow in clusters of three. Poison oak resembles poison ivy except that the poison oak leaves are more rounded rather than jagged like poison ivy, and the underside of poison oak leaves are covered with hair.

The skin reaction associated with contacting these plants is caused by the body's allergic reaction to toxins contained in oils produced by the plant. Becoming contaminated with the oils does not require contact with just the leaves. Contamination can be achieved through contact with other parts of the plant such as the branches, stems or berries, or contact with contaminated items such as tools and clothing. The allergic reaction associated with exposure to these plants will generally cause the following signs and symptoms:

Symptoms

- Blistering at the site of contact, usually occurring within 12 to 48 hours after contact and in many cases, persons experience almost immediate irritation.
- Reddening, swelling, itching, and burning at the site of contact.
- Pain, if the reaction is severe.
- Conjunctivitis, asthma, and other allergic reactions if the person is extremely sensitive to the poisonous plant toxin.

Prevention

- The best treatment appears to be removal of the irritating oil before it has had time to cause inflammation by wiping exposed skin with rubbing alcohol followed by washing with soap and water.
- A visual Site inspection and identification of the plants should be completed prior to starting work so that all individuals are aware of the potential exposure. Avoid contact with any poisonous plants on the Site, and keep a steady watch to identify, report, and mark poisonous plants found on the Site.
- Avoid contact with, and wash daily, contaminated tools, equipment, and clothing.
- Barrier creams (Ivy Block®) and orally administered desensitization may prove effective and should be tried to find the best preventive solution.
- Keeping the skin covered as much as possible (*i.e.*, long pants and long-sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure. PFAS-free spun polypropylene coveralls or Tyvek® may be worn to prevent contact of skin and clothes with poison ivy.

The following table outlines safety controls to mitigate the hazards associated with poisonous plants.

Elimination	Substitution	Engineering	Administrative	PPE
Use mechanical equipment to remove overgrown vegetation		Remove overgrowth and excessive vegetation from walkways and work areas (provide safe access)	Train personnel on the identification of poisonous plants	Wear pants and long sleeves when working in overgrown areas
			Instruct personnel to avoid areas where poisonous plants have been identified	Consider the use of a coverall when working in areas where these plants are present, especially for hypersensitive employees.
			Provide isopropyl alcohol along with soap and water to remove oils from skin, tools, and equipment.	

4.11 Working Alone

As outlined in Section 4.1, working alone while on an ash pond must be pre-approved by the POC. Working alone is prohibited for tasks deemed to be high risk by IPRG including, but not limited to, handling highly hazardous chemicals (sulfuric acid), work over/near water, excavation and trenching, hot work (grinding, welding and torch cutting), and elevated work that requires personal fall arrest. Third-party contractors are responsible for identifying potential high-risk tasks in their Safety and Health Plan and requiring that a buddy system be implemented while high risk work is performed. The buddy must be located in a safe area but may perform other tasks that do not prevent observing the person performing high risk work. Working alone may occur on and around other parts of the Site when there is no drowning hazard or risk of severe injury due to high-risk work.

Elimination	Substitution	Engineering	Administrative	PPE
	Modify work methods by substituting lower hazard methods for high hazard methods	Varies depending on the hazard, but for example, could include installing guardrails (temporary or permanent) which mitigates a fall hazard reducing the risk to levels where working alone may be permitted	Prohibit working alone on ash ponds and for other high hazard tasks without prior approval from the POC	
			Implement a buddy system whenever feasible (required for high hazard work)	

Elimination	Substitution	Engineering	Administrative	PPE
			Implement a worker check-in, emergency alerting, and monitoring system	

5. HAZARD COMMUNICATION

As required by 35 I.A.C. § 845.530, the OSHA HAZWOPER standards (29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65) and OSHA Hazard Communication Standard, site personnel, subcontractors, and visitors must be informed of chemical hazards associated with their work area. The information in this section is based on:

- Recommendations in the most recent "NIOSH Pocket Guide to Chemical Hazards" by the Department of Health and Human Services, Centers for Disease Control and Prevention, and the NIOSH Pocket Guide.
- Requirements set forth in the OSHA regulations from as defined in Chapter 17 of 29 C.F.R. § 1910.1200(c) for all hazards not otherwise classified.

5.1 Coal Combustion Residuals

Primary exposure to CCR is through inhalation and skin contact. CCR is typically a fine, black, grey, or tan particulate. CCR is comprised of several components. The following table outlines the components of the CCR. The exact percentage of each component will vary based on the type of ash and location at the surface impoundment.

Chemical	Percentage	PEL	IDLH	ACGIH TLV	Symptoms of Exposure & Health Effects
Crystalline Silica	20-60% (total)	0.05 mg/m^3 (respirable)	25 mg/m^3 (respirable)	0.025 mg/m^3 (respirable)	Cough, dyspnoea (breathing difficulty), wheezing; decreased pulmonary function, progressive respiratory symptoms (silicosis); irritation eyes; [potential occupational carcinogen]
Iron oxide	1-10%	5 mg/m^3	2500 mg/m^3	5 mg/m^3	Benign pneumoconiosis with X-ray shadows indistinguishable from fibrotic pneumoconiosis (siderosis)
Calcium oxide	10-30%	5 mg/m^3	25 mg/m^3	2 mg/m^3	irritation eyes, skin, upper respiratory tract; ulcer, perforation nasal septum; pneumonitis; dermatitis
Titanium dioxide	<3%	15 mg/m^3	ND	10 mg/m^3	Lung fibrosis; [potential occupational carcinogen]
Aluminosilicates	10-60%	15 mg/m^3 (PNOR)	ND	10 mg/m^3 (PNOR)	irritation eyes, skin, throat, upper respiratory system
Magnesium oxide	2-10%				
Magnesium dioxide	<2%				
Phosphorous pentoxide	≤2%				
Sodium oxide	1-10%				
Potassium oxide	≤1%				
Bromide salt	<0.1%				

Footnotes:

All values are 8-hour time-weighted averages (TWAs) unless otherwise indicated.

- PEL: Permissible Exposure Limit, the concentration an employee may be exposed to for an 8-hour work day for a 40-hour work week for which nearly all employees may be repeatedly exposed without adverse health effects.
- IDLH: IMMEDIATELY Dangerous to Life and Health, contaminant concentration which present the possibility for severe health consequences if exposed to the IDLH concentration without the appropriate personal protective equipment (PPE).
- ACGIH TLV: American Conference of Governmental Industrial Hygienists Threshold Limit Value
- mg/m^3 = milligrams per cubic meter of air
- PNOR: Particulates Not Otherwise Regulated
- ND: Not Determined

5.2 Safety Data Sheets

Pursuant to 35 I.A.C. § 845.530(b)(3), IPRG will provide Safety Data Sheets (SDSs) to all employees, contract workers, and third-party contractors for the CCR located at the Site. Third-party contractors will provide SDSs to the Environmental Manager prior to bringing a material on site. SDSs are provided in Appendix E.

5.3 Signage

The absence of any of the following signage does not mean that a potential hazard does not exist. Signage will be posted by IPRG, but employees, contract workers, and third-party contractors must remain vigilant for changing site conditions.

To aid in hazard communication and pursuant to 35 I.A.C. § 845.530(f), IPRG will post the following signs at the Site:

- Signs identifying the hazards of CCR, including dust inhalation when handling CCR.
- Signs identifying unstable CCR areas that make the operation of heavy equipment hazardous.
- Signs identifying the necessary safety measures and necessary precautions, including the proper use of PPE.

The following signs may also be posted at the CCR units to aid in hazard communication:

- Overhead electrical lines that may be struck by heavy equipment of vehicles will have signs warning drivers of their presence.

6. EMERGENCY RESPONSE PLAN

This emergency response section details actions to be taken in the event of site emergencies. This section is consistent with the DCPP Emergency Response Plan. All personnel on site must be familiar with emergency signals and the content of this section.

6.1 Emergency Phone Numbers & Notifications

Emergency Number	
Site Address	**Emergency Phone Number**
17751 North Cilco Rd Canton, IL 61520	911
	Security Guard: 713-542-0619

Medical Treatment	
Local Hospital	**Phone Number**
Graham Hospital 410 East Elm St Canton, IL	309-647-4088

Incident Notifications		
Title	**Name**	**Contact Number**
Security Guard		712-542-0619
POC	Brandon Potter	618-210-3418

6.2 Evacuation Signal

Upon receiving notification to evacuate, all personnel will leave the work area and proceed to the muster point.

6.3 Muster Point

The muster point for the Site is located at the Security Office by the Main Entrance (Appendix A). The following locations are acceptable severe weather shelter locations near the CCR Units:

- GMF Pump House at the land fill area
- Dumper House at the Coal Yard
- New Stack base

6.4 Calls for Emergency Support

In the case of an emergency, site personnel will call **911** followed by notifying the security guard (713-542-0619). The security guard will coordinate the arrival of on-site emergency personnel. The individual calling for emergency support will briefly explain the nature of the emergency and site conditions as follows:

- Indicate his/her name
- Location of emergency
- Description of emergency conditions that may require special rescue equipment, such as confined spaces, excavations, and elevated work platforms
- Potential chemical hazards and recommended PPE

6.5 Fire & Explosion Response Plan

Trained site personnel may respond to incipient stage fires using a 20-pound Type ABC dry chemical fire extinguisher or hose. An incipient stage fire is a fire which is in the initial or beginning stage and which can be controlled or extinguished by portable fire extinguishers, Class

II standpipe or small hose systems without the need for protective clothing or breathing apparatus. Personnel shall only attempt to extinguish the fire if it is safe to do so.

A fire that CANNOT be readily extinguished with a fire extinguisher will require evacuation of the work area personnel to Muster Point areas per this Safety and Health Plan. If personal injuries result from any fire or explosion, the procedures outlined in the Personal Injury Response Plan will also be followed.

All fires or explosions must be reported to the contacts outlined in Section 6.1 of this Safety and Health Plan.

6.6 Injury Response Plan

Treatment for minor injuries will be provided on site using available first aid supplies and personnel trained in first aid. All third-party contractors must have at least one individual on site who is trained in first aid, CPR, and AED use. Third-party contractors must provide their own first aid kits and AED. For minor injuries that are not life-threatening but require further medical attention, employees should be treated by occupational physicians at occupational clinics whenever possible. Treatment of minor injuries by emergency room or personal physicians should be avoided. When injured workers are released back to work with restrictions, all subcontractors are expected to accommodate those restrictions.

Emergency medical incidents include puncture wounds to the head, chest, and abdomen, serious head and spinal cord injuries, and loss of consciousness must be treated at the hospital emergency room listed in Section 6.1 of this Safety and Health Plan.

All injuries must be reported to the contacts outlined in Section 6.1 of this Safety and Health Plan.

6.7 Spill Response Plan

In general, IPRG employees, contract workers, and third-party contractors are trained and equipped to handle small spills associated with their work. Third-party contractors must include an approved spill response plan in their Safety and Health Plan. Site personnel will generally respond to spills as follows:

- Stop the leak immediately if it can be done without directly contacting the leaking material.
- Remove or stop all ignition sources (hot work, generators, etc.) that are within 25 feet of any part of the spill.
- On-site personnel should immediately secure the area to prevent unauthorized entry into the spill area.
- Although not likely given the anticipated types of spills, site personnel must immediately initiate evacuation if a spill may cause an explosion, death, or serious injury.
- Site personnel may only respond to incipient stage fires regardless if such fires are associated with a spill.
- PPE for spills to open areas generally requires Modified Level D PPE (poly-coat Tyvek®, nitrile gloves, and boot covers or boot decontamination). Over-boots or boot covers may also be used if persons cleaning the spill would have to walk on spilled materials. Latex gloves are not acceptable and will degrade with exposure to petroleum products.
- Contact the Environmental Manager upon containing the spill.

6.8 CCR Spill or Release Response Plan

Response to minor or incidental spills of CCR will be managed as outlined in the General Spill Response Plan. An incidental release is a release of a hazardous substance which does not pose a significant safety or health hazard to employees in the immediate vicinity or to the employee cleaning it up, nor does it have the potential to become an emergency within a short time frame. Incidental releases are limited in quantity, exposure potential, or toxicity and present minor

safety or health hazards to employees in the immediate work area or those assigned to clean them up. An incidental spill may be safely cleaned up by employees who are familiar with CCR. Response to major releases of CCR will be in accordance with the DCPP Emergency Action Plan, which can be found on the Luminant CCR website at https://www.luminant.com/ccr/.

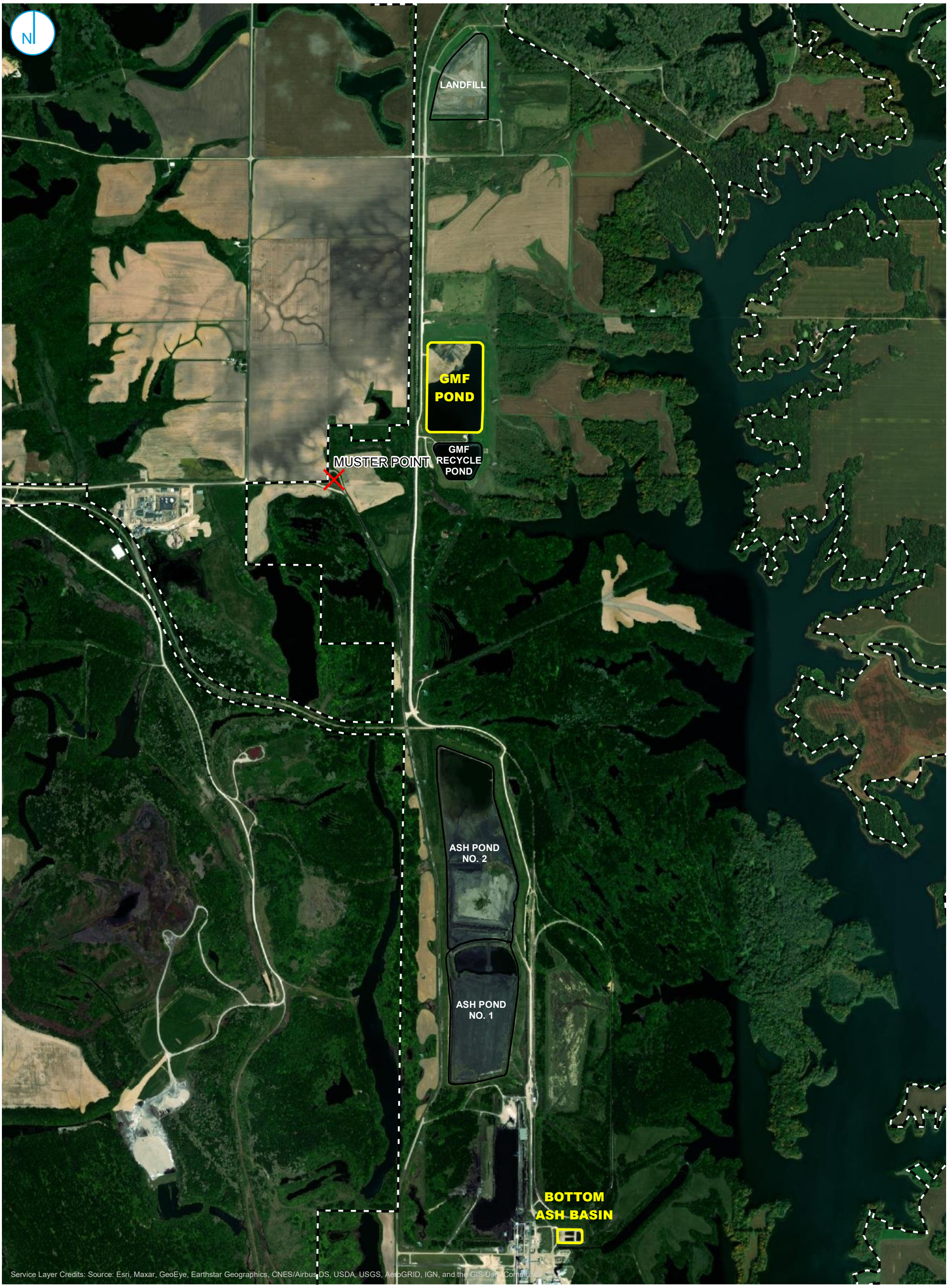
6.9 Ash Pond Rescue

Ash ponds may be unstable and represent an engulfment hazard if persons and equipment traverse the surface, berms, or other unstable areas. Special training is required on behalf of emergency responders to retrieve persons and equipment who become trapped in unstable ash. **Untrained persons must not enter unstable areas** in an attempt to conduct rescue because of the significant potential that they will also become victims. Call 911 and the Guard Shack emergency number and state that an "ash pond rescue" is required. The Guard Shack will notify the designated service to perform the ash pond rescue. On-site personnel should remain on stand-by to support the ash pond rescue team as necessary.

6.10 Incident Reporting

All incidents must be reported to the contacts outlined in Section 6.1 of this Safety and Health Plan. An Incident Report must be completed for all injuries, illnesses, spills, fire, explosion, or property damage. The absence of an injury does not preclude the need to complete an Incident Report as such incidents will be classified as "near miss" or "other." It will include, but is not limited to, the nature of the problem, time, location, and corrective actions taken to prevent recurrence.

APPENDIX A
SITE MAP



PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
PROPERTY BOUNDARY

0 750 1,500 Feet

SITE MAP

APPENDIX A

PART 845 SAFETY AND HEALTH PLAN
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

APPENDIX B
SAFETY AND HEALTH PLAN ACKNOWLEDGMENT FORM

SAFETY AND HEALTH PLAN ACKNOWLEDGEMENT FORM

I HEREBY CERTIFY THAT I HAVE READ AND UNDERSTOOD ALL HEALTH AND SAFETY PROCEDURES AS STATED HEREIN:

Name and Affiliation (printed)	**Signature**	**Date**

APPENDIX C
DRUG SCREEN POLICIES AND SUPPLEMENTAL TERMS

Drug and Background Investigations

Contractor is solely responsible for ensuring that all members of Contractor Project Team have completed and passed all drug and alcohol tests and background investigations required under this Attachment and under Contractor's own programs before assigning such personnel to perform Work. Contractor is also solely responsible for ensuring that such testing and investigations are performed in accordance with all applicable laws.

1. Required Investigations. Except as otherwise required by applicable law, Required Investigations shall consist of all of the following:

   1.1 a 7-panel drug screening;

   1.2 a background investigation that includes a criminal records check in all counties where the applicable person has resided for at least the last seven (7) years;

   1.3 a third-party verification of previous employment and the highest education level completed by the applicable person;

   1.4 a check of the National Sex Offender Registry and Terrorist Watch List (Denied Parties); and

   1.5 a check of Motor Vehicles Record (if work to be performed by the applicable person requires driving as part of the defined duties).

2. Notices to Tested Persons Regarding Background Checks. All background checks will be conducted in compliance with applicable provisions of the Fair Credit Reporting Act.
3. Forms and Testing Organization for Drug Tests. Except for those positions subject to Department of Transportation ("DOT") drug and alcohol testing regulations, all drug testing shall be performed using the Universal Toxicology four part "Non-DOT" Chain of Custody and Request Form with white and blue top page, and shall be conducted by an independent third-party organization.

4. Pass/Fail Standards – Background Checks. A person shall be deemed to have failed the applicable background check if:

   4.1 information is reported through the background check process indicating that such person has failed to disclose or misrepresented information requested at any time about such a person's criminal background history; or

   4.2 such person has ever committed any felony constituting a violent crime, crime against a person, sexual offense or fraud; or

   4.3 such person has committed any other felony, or has been incarcerated for a felony, within ten (10) years prior to the date of such background check (i.e., for these felonies there must be a ten (10) year lapse in time from the later of the commission and the end of any period of incarceration); or

   4.4 such person has committed any misdemeanor that:

      4.4.1 involves violence that is sexually related; or

4.4.2 consists of a DUI that is the second (or more) DUI in the last two (2) years prior to the date of the background check; or

4.4.3 consists of a theft-related offense; provided that there can be no more than one theft by check and it must have been for an amount less that $100; or

4.4.4 consists of any drug-related misdemeanor committed at any time within forty-eight (48) months prior to the date of the background check.

4.4 For purposes of both felonies and misdemeanors, a person is deemed to have committed the applicable offense if he/she is convicted or enters a plea of guilty or nolo contendere for such offense (to include, without limitation, sentences of probation and deferred adjudication).

5. Pass/Fail Standards – Drug Tests. A person shall be deemed to have failed the applicable drug test if any of the following maximum cut-off levels are exceeded, unless there is a legitimate medical explanation for the presence of a tested substance at or above the applicable cut-off level:

5.1 Amphetamines 500ng/mL

5.2 Barbiturates 150ng/mL

5.3 Benzodiazepines 150ng/mL

5.4 Cocaine 150ng/mL

5.5 Marijuana 150ng/mL

5.6 Opiates 2000ng/mL

5.7 Phencyclidine 25ng/mL

For any positions subject to DOT drug and alcohol testing requirements, testing shall be conducted according to the applicable DOT panel and cutoff levels.

6. Other Requirements.

6.1 Background checks and drug tests will be paid for by Contractor without reimbursement by Company.

6.2 Contractor will keep background checks and drug test records while the applicable persons are working pursuant to this Agreement and for three (3) years thereafter.

6.3 Upon request, Contractor will provide a certification to Company that no person required hereunder to pass a background check or drug test has failed such investigation or test. Contractor will not provide the specific results of the background check or drug test of any individual to Company.

6.4 If any person required under this Agreement to pass a background check or drug test fails such check or test, Contractor will not report the specific results of such check or test to Company and will not allow such individual to perform any Work for Company. Although such person may not be assigned to perform any Work for Company, nothing in this Attachment requires Contractor to take any other action with respect to such person's employment with Contractor.

Supplemental Terms for Onsite Services

1. SAFETY

1.1 Contractor agrees that any safety-related assistance or initiatives undertaken by Company will not relieve Contractor while on Company Property from responsibility for the implementation of, and compliance with, safe working practices, as developed from their own experience, or as imposed by law or regulation, and will not in any way, affect the responsibilities resting with Contractor under the provisions of any agreement to which these policies are attached and to meet all safety requirements as specified by the Occupational Safety & Health Administration (OSHA), the Mine Safety Health Administration (MSHA), including the "Mining Contractor Safety Reference Handbook" located at http://www.vistraenergy.com/wp-content/uploads/2016/12/Contractors-Safety-Handbook_Final-MC-08262016.pdf, the Department of Transportation (DOT) and any other applicable state or federal safety and health laws or regulations.

1.2 In the event that a material safety data sheet, warning label, or other documentation concerning the use of hazardous chemicals at any property owned or controlled by Company or any of its affiliates (collectively, "Company Properties"), applies to any materials or equipment provided by Contractor as an aspect of the Work, such documentation will be provided by Contractor to Company prior to the commencement of any such Work.

1.3 Contractor will report to Company all accidents involving personal injuries (including death) and damage to property occurring directly or indirectly as a result of the Work performed by Contractor hereunder immediately, but in no event, no later than 24 hours after the occurrence of any such accident. Any accident or incident occurring directly or indirectly as a result of the Work which Contractor must report to a regulatory agency (e.g. OSHA, MSHA, TCEQ) must also be reported to Company immediately following notification to the regulatory agency.

2. SECURITY

2.1 It will be the affirmative duty of Contractor to ensure that Contractor Group assists in carrying out all security measures, to include reporting all information or knowledge of matters adversely affecting security to Company's designated security personnel.

2.2 Company reserves the right to exclude any of Contractor's employees from any Company Property by denial of access, suspension or revocation of access authorization, preemptory expulsion, or by any other means, without notice or cause. Former Company employees, and any of Contractor's employees who previously have been excluded from any Company Property, may be brought onto Company property or facilities only if prior approval from Company is obtained. If Contractor terminates a member of Contractor Group performing Work on Company's premises, Contractor shall inform Company immediately, but in no event, no later than twenty-four (24) hours after such employee is terminated in order for Company to remove access to Company Property for such employee.

2.3 Company measures may also include investigations, whether by Company or law enforcement officials. Contractor agrees to cooperate in such investigations and understands that Company

reserves the right to require anyone in Contractor Group to authorize appropriate agencies to release his or her criminal records to Contractor as a condition of either initial or continued permission for access to any Company Property. Investigations may include searches of Contractor Group. Such searches may include searches of facilities assigned to Contractor Group, search of all Company Property areas and property at such Company Property areas, searches of including, but not limited to, offices, lockers, desks, lunch boxes, packages and motor vehicles (regardless of ownership). Without limiting the foregoing, Contractor acknowledges and agrees that all members of Contractor Group, to the extent that Company reasonably determines that such members require security badge access prior to entering onto any Company Property, shall be required to comply with Company's standard security badge requirements, including without limitation a background check to be performed by Company.

3. ISNETWORLD

3.1 Contractor agrees to maintain at Contractor's expense a subscription with ISNetworld (www.ISNetworld.com), Company's safety compliance program or any replacement program therefor, as directed by Company, for the Term of the Agreement. Contractor shall also furnish ISNetworld with any information requested by ISNetworld relating to ISNetworld's evaluation of the Contractor's safety program and practices. As a minimum, requested documents will be related to safety, health, and insurance (i.e., regulatory required training, certifications, safety plans, safe and secure workplace practices, insurance certificates, etc.), OSHA and MSHA injury rates and Experience Modification Rate (EMR).

3.2 Contractor has and during the performance of this Agreement shall continue to report full, complete and accurate information to ISNetworld concerning Contractor's employees.

4. MATERIALS, EQUIPMENT AND LABOR. Contractor will be solely responsible for the proper storage, transportation and disposal of any product or waste, other than sandblasting waste, used or generated in connection with the Work in accordance with all applicable Environmental Laws. Contractor will dispose of all waste materials, other than sandblasting waste, at an off-site disposal facility approved for such waste materials pursuant to applicable Environmental Laws and will complete and sign all waste manifests as the generator of such waste. Company will be responsible for the storage, transportation and disposal of any sandblasting waste generated during the performance of the Work.

5. CONDITIONS AFFECTING WORK

5.1 Contractor will investigate and acquaint itself with the conditions affecting the Work, including but not limited to those related to the transportation, disposal, handling and storage of materials and waste; availability of labor, water, electric power and roads; the uncertainties of weather, river stages or similar physical conditions at the site; the conformation and condition of the ground; and the character of equipment and facilities needed preliminary to and during prosecution of the Work. Contractor has satisfied itself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered. Contractor's failure to acquaint itself with any conditions affecting the Work or any available related information will not relieve it from responsibility for properly estimating the difficulty or cost of successfully performing the Work.

5.2 Contractor assumes full responsibility for investigating conditions and determining the existence and magnitude of any hazards to the physical well-being of property of Contractor, the employees, agents, and servants of Contractor, or any other person or entity who is or may become involved in

the performance of Work, and any and all other persons in the vicinity of the Work. Contractor will advise all of the above-specified persons or entities of any hazards relating to Work, and will ensure that those persons or entities are advised of and fully understand the nature of the hazards and safety precautions that can be taken to eliminate or minimize dangers relating to the hazards.

5.3 Contractor will provide information to Company regarding hazardous chemicals and/or consumable products that contain constituents listed in 40 CFR 372.65 used at any Company Property. Contractor will report the amount of such material carried on and off the site, the amount actually used and the manner of use. Contractor will provide the maximum quantity of the material stored on site at any one time and if a waste material was collected, where it was disposed of (location name and address). Contractor will provide information on the amount of material used for the previous calendar year by the first of February.

5.4 Contractor will use its best efforts to ensure that the Work is performed so as to minimize any adverse impact upon natural resources and the environment and will use best industry practices in this regard at all times.

5.5 Contractor acknowledges and agrees that all members of Contractor Group performing Work at any Company Generation or Mining Property are required to view Company's "Contractor/Visitor Safety Orientation" video (in the case of Company Generation property), when applicable, and to read and adhere to Company's "Contractor/Visitor Safety Booklet" (in the case of Company Mining property) prior to performing any Work at any Company Generation or Mining Property.

5.6 Contractor will immediately notify Company as soon as Contractor has reason to believe that Contactor, or any employee or other person performing the Work, is not or may not be performing the Work in compliance with applicable Environmental Laws. Contractor will provide Company with written notice to Company of such actual or potential non-compliance within three (3) days following the discovery thereof. Contractor will take immediate steps to ensure compliance with all applicable Environmental Laws and will, if directed by Company, cease all Work until authorized by Company to resume the Work.

5.7 Contractor will report to Company all accidents involving personal injuries (including death) and damage to property occurring directly or indirectly as a result of the Work performed by Contractor hereunder immediately, but in no event, no later than 24 hours after the occurrence of any such accident. Any accident or incident occurring directly or indirectly as a result of the Work which Contractor must report to a regulatory agency (e.g. OSHA, MSHA, TCEQ) must also be reported to Company immediately following notification to the regulatory agency.

6. WORK SITE PERMITS AND LICENSES

6.1 Subject to the following two paragraphs, Contractor will obtain, prior to the commencement of the Work, and provide to Company upon request, all permits, licenses and governmental authorizations, at its sole expense, required for the performance of the Work. Contractor will be solely responsible for maintaining compliance with such permits, licenses and governmental authorizations.

6.2 In the event that a storm water discharge permit is required for the performance of the Work, (i) Contractor will be responsible for filing a Notice of Intent with respect to the Work, in addition to any Notice of Intent that Company may be required to file, and (ii) Contractor will coordinate with

Company in the preparation and execution of a Storm Water Pollution Prevention Plan for the Work Site.

6.3 In the event that the performance of the Work involves the handling or abatement of asbestos-containing materials, Contractor will coordinate with Company in the preparation and filing of all required notification forms.

7. ACCESS. Should Contractor desire access to the Work Site over any land not controlled by Company, it will, at its sole expense, obtain all proper permits or written permission necessary for that access.

8. COMPANY FACILITIES. Contractor will not use Company's sanitary facilities, changehouses, shops, parks, storage buildings, tools, equipment or other facilities unless so directed by Company. Contractor will not discharge, without Company's prior written authorization, any product or waste used or generated in connection with the Work through any (i) Company-permitted outfall, (ii) Company-owned or operated pollution control equipment, or (iii) storm or sanitary sewer located at or in the vicinity of the Work Site. Any request for authorization to discharge will include, at a minimum, either a copy of the Material Safety Data Sheet for the product or a written description of the waste, including a list of the constituents of the waste and the relative concentrations thereof.

9. ENVIRONMENTAL

9.1 In the event that Contractor discovers during the performance of the Work any substance at the Work Site that is not the subject of the Work or has not otherwise been identified by Company for Contractor, which substance Contractor has reason to believe is or may be a Hazardous Substance that (i) has been or may be released or spilled into the soil, surface water, or groundwater or in a building or structure, or (ii) consists of asbestos-containing materials, lead-based paint, batteries, thermostats, lighting equipment, or equipment containing polychlorinated biphenyls, Contractor will immediately stop Work and notify Company of the discovery. Contractor will not resume the Work until receiving authorization from Company to do so.

9.2 The term "Hazardous Substance" means any product, waste, emission or substance defined, listed or designated as a hazardous or toxic substance, hazardous waste, hazardous material or pollutant by or pursuant to any Environmental Law and includes, but is not limited to, any petroleum-based product, substance or waste, including any additives associated therewith, pesticides, fertilizers, solvents, polychlorinated biphenyls, mercury, lead, lead-based paint, asbestos-containing material or explosives.

9.3 Contractor will immediately notify Company in the event of a spill or release of any material which Contractor knows or has reason to believe is a Hazardous Substance, whether onto the ground, into any body of water, a storm or sanitary sewer, or the air, or anywhere on property owned or controlled by Company, including within any building or structure. Contractor will be solely responsible, as may be required by applicable Environmental Laws, for, in consultation with Company, (i) notifying the appropriate governmental agencies of such spill or release caused or permitted by the acts or omissions of Contractor and (ii) for the cleanup and remediation of such spill or release.

10. PROTECTION OF HIGHWAYS AND RAILROADS. Contractor will make suitable arrangements with governmental authorities and railroads for the construction of all structures, whether underneath or over roads, railroads or rights-of-way to protect the public from accident or delay. Contractor will repair, at its

own expense, to the satisfaction of the governmental authorities or other owners, all roads, railroads and bridges that may be damaged by, or given undue wear due to the Work.

11. CLEANING UP

11.1 Contractor will at all times keep the Work Site free of waste materials or rubbish caused by the Work. After completing the Work, Contractor will remove all its waste materials, rubbish, tools, supplies, equipment and surplus materials from and about the Work Site.

11.2 If Contractor fails to keep the Work Site clean or to clean up after completing the Work, Company may do so and charge all costs of cleaning up to Contractor. Those costs may be deducted from the final payment to Contractor.

12. **COLLATERAL WORK.** Company and other contractors may be working at the Work Site. Company reserves the right to coordinate the performance of Contractor's Work with the work of others. Contractor will cooperate with and will not delay, impede or otherwise impair the work of others. Company does not guarantee Contractor continuous uninterrupted access to the Work Site, but will provide such access as good construction practices will allow, considering the other activities in the area.

13. **ALCOHOLIC BEVERAGES, DRUGS AND WEAPONS.** Contractor will inform all members of Contractor Group who may be involved in the performance of any Work of the following Company rules relating to alcoholic beverages, drugs and weapons, with which all personnel are expected to comply:

13.1 Bringing, attempting to bring, possessing, using or being under the influence of intoxicants, drugs, or narcotics while on any Company Property, including but not limited to parking areas, is prohibited. Possessing alcoholic beverages in sealed containers is permitted, however, in designated parking areas.

13.2 Prescription or over-the-counter medications that could affect the performance of safety-sensitive work are allowed on Company Property only if they have been previously cleared by Contractor. Contractor must confirm that the medication and dosage do not impair an individual's ability to perform safety-sensitive work before clearing the individual to perform such work while under the influence of the medication.

13.3 Bringing, attempting to bring, possessing or using firearms, whether classified as legal or illegal, while on any Company Property, including but not limited to buildings, parking areas, recreation facilities, equipment and vehicles, is prohibited, unless otherwise required by applicable law. Use or possession of firearms for specific situations is permitted if approved by function or higher level management of Company.

13.4 Off-the-job involvement with intoxicants, illegal drugs, or illegal narcotics that adversely affects Company's business, to include impairing the individual's ability to perform his job or the public trust in the safe operation of Company, is prohibited.

13.5 Any conduct on any Company Property which is in violation of any state or federal law or regulation is considered a violation of these rules and a breach of any agreement to which these policies are attached.

13.6 In order to enforce these rules, all individuals with access to any Company Property as well as the vehicles, offices, lockers and any personal belongings of such individuals on any Company Property are subject to search by Company and its agents, to include security representatives appointed or employed by Company. Individuals may be required to take a blood, urinalysis or Breathalyzer test, or submit to other recognized investigatory tests or procedures as are deemed appropriate or necessary by Company in the investigation of a violation of these rules.

14. TITLE AND RIGHT. Nothing in the Agreement will vest Contractor with any right of property in materials used after they have been attached to or incorporated into the Work, nor materials for which Contractor has received full or partial payment. All those materials, upon being so attached, incorporated or paid for, will become the property of Company. Any gravel, sand, stone, minerals, timber or other materials excavated, uncovered, developed or obtained in the Work, or on any land belonging to Company may be used, in the performance of the Work, provided such materials meet the requirements of this Agreement. Any objects or natural materials or animals excavated or exposed that may have historical significance or constitute a threatened or endangered species must be brought to the attention of Company.

15. PROTECTION AGAINST LIENS AND ENCUMBRANCES

15.1 Contractor will not at any time permit any lien, attachment or other encumbrance ("Encumbrance") by any person or persons whosoever or by reason of any claim or demand against Contractor to be placed or remain on the property of Company, including, but not limited to, the Work Site upon which Work is being performed or equipment and materials that are being furnished. To prevent an Encumbrance from being placed on the property of Company, Contractor will furnish during the progress of any Work, as requested from time to time, verified statements showing Contractor's total outstanding indebtedness in connection with the Work.

15.2 If Contractor allows any indebtedness to accrue to subcontractors or others and fails to pay or discharge that indebtedness within five (5) days after demand, then Company may withhold any money due Contractor until that indebtedness is paid or pay the indebtedness and apply that amount against the money due Contractor.

15.3 If Contractor allows any Encumbrances, whether valid or invalid to be placed on the property of Company, any and all claims or demands for payment to Contractor will be denied by Company until the Encumbrance is removed. If the Encumbrance is not removed immediately, Company may pay that claim or demand and deduct the amount paid, together with all related expenses, including attorneys' fees, from any further payment due Contractor, or at Company's election, Contractor will, upon demand, reimburse Company for the amount paid and all related expenses. Any payment made in good faith by Company will be binding on Contractor.

16. TERMINATION FOR DEFAULT

16.1 If a petition in bankruptcy should be filed by Contractor, or if Contractor should make a general assignment for the benefit of creditors, or if a receiver should be appointed due to the insolvency of Contractor, or if Contractor should refuse or fail to supply enough properly skilled workmen or proper equipment, materials or services or should fail to make prompt payment to subcontractors, or to pay promptly for materials or labor, or disregard laws, ordinances or the instruction of Company's Contract Coordinator, or if Contractor should refuse or fail to abide by the SOW Construction Schedule or otherwise violate any provisions of the Agreement or SOW, then Company, upon a

determination by Company's Contract Coordinator that sufficient cause exists to justify such action, may, without prejudice to any other right or remedy available to it after giving Contractor seven (7) days' written notice, terminate the Agreement or the SOW and take possession of the Work Site. In the event of such a termination, Company may use all or part of Contractor's equipment and materials and may finish the Work by whatever method Company may deem expedient. In such event, Contractor will not be entitled to receive any further payment hereunder until the Work is finished. If the unpaid balance of the SOW fees will exceed the expense of finishing the Work, including compensation of Company's Contract Coordinator, other Company personnel, third party engineering companies, or other contractors for additional services, such excess will be paid to Contractor. If the expense of finishing the Work will exceed such unpaid balance, Contractor will pay the difference to Company within fifteen (15) days of receiving an invoice for same. The expenses incurred by Company herein, and the damage incurred through Contractor's default, will be determined by Company's Contract Coordinator, in its sole discretion, and such determination will be binding as between the parties.

16.2 In the event of a termination under the provisions of this Section 3, Contractor will transfer and assign to Company, in accordance with Company's instructions, all Work, all construction records, reports, permits, data and information, other materials (including all Company-supplied materials), supplies, Work in progress and other goods for which Contractor is entitled to receive reimbursement hereunder, and any and all plans, drawings, sketches, specifications, and information in connection with the Work, and will take such action as may be necessary to secure Company, at Company's sole election, the rights of Contractor under any or all orders and subcontracts made in connection with the Work.

16.3 In the event that Company so directs or authorizes, Contractor will sell at a price approved by Company, or retain at a mutually agreeable price, any such materials, supplies, Work in progress, or other goods as referred to in the preceding paragraph. In any event, Company will receive any and all records, plans, drawings, data, permits, specifications, sketches, reports, or other information relating to the Work. The proceeds of any such sale or the agreed price will be paid or credited to Company in such manner as Company may direct so as to reduce the amount payable by Company under this Section 3.

APPENDIX D
COVID-19 SITE ENTRY GUIDELINES

COVID-19 Vistra Site Entry Guidelines – *Effective: June 17, 2021*
These guidelines are applicable to ALL PERSONNEL entering Vistra work sites.

To enter a Vistra work site, each person must answer the following three questions with a "no" answer *and* pass the required temperature testing *unless* they display their Vistra vaccination sticker on their employee badge or hardhat:

Site Entry Questions:

1. In the past 10 days, have you tested positive for COVID-19 or are you currently waiting on test results?

2. In the past 10 days, have you been within six feet of someone, where masks were not worn, who:
    a. has tested positive for COVID-19,
    b. is known to be waiting on test results for COVID-19, or
    c. is under a quarantine order?

3. In the past 10 days, have you or someone who has been within six feet of you where masks were not worn had:
    a. flu-like symptoms,
    b. a deep, dry cough,
    c. recent shortness of breath or difficulty breathing,
    d. new loss of taste or smell, and/or
    e. fever of 100 degrees or above?

Temperature Testing:

You must register a temperature between 96- and 100-degrees Fahrenheit as described in the temperature procedures. (see next page for testing procedures)

- If your temperature is below 96 degrees, retest with a different device.
- If your temperature is 100-degrees Fahrenheit or above, retest on another device preferably an ear thermometer, if your temperature still registers 100-degrees Fahrenheit or above you may not enter the site.

Clearance to enter the site:

- If you have answered **"no"** to all three questions ***and*** passed the temperature test, you may enter the site.
- ***If you have an approved Vistra vaccination sticker, you are cleared to enter the site without the temperature test or answering COVID screening questions.***
- If you passed the temperature test ***and*** answered "Yes" to any of the questions, but have been cleared through VistraTravelerSafety (HR clearance) to enter the Vistra work site for that instance of exposure, testing, or symptoms, you may enter the site.

Anyone *not* cleared to enter the work site must immediately leave the work site and notify their supervisor who will notify HR at VistraTravelerSafety@vistracorp.com for next steps.

Any symptomatic employee, unvaccinated employee exposed to COVID-19 or any employee tested for COVID-19 as described above must be cleared through VistraTravelerSafety prior to returning to work.

Required Temperature Testing Procedures:

All persons entering the site without a Vistra vaccination sticker, who have cleared all questions above, will also submit to temperature testing or self-administer a temperature test as required by the facility management. If a self-administered test is required, then a member of the management team or their designee will witness the testing; however, where that is not practicable, each person must attest that they are only entering the site premises because they have passed the screening questions and temperature test required for entry. Also:

a. Hats may cause false high temperatures and should not be worn for five minutes immediately preceding a forehead temperature test.
b. Each person is responsible for ensuring all self-testing materials and areas touched during testing are sanitized.
c. All personnel should maintain a **distance of at least six feet** from other people during this process or wear required masks.

Temperature Testing Requirements:

1. **All persons entering the site without a Vistra vaccination sticker must register a temperature between 96- and 100-degrees Fahrenheit. Any such person who has a temperature not within that range or who triggers an alarm on a thermal camera** must **retest with a different device**, preferably an **ear thermometer**, if available. If the second test registers a temperature of 100 degrees or above:
    a. That person **may not enter** the Vistra work site and must notify their supervisor, who will notify HR at VistraTravelerSafety@vistracorp.com for next steps.
    b. If there is significant inconsistency between the two tests, repeat another temperature test and use the two closest readings.
2. **Anyone who registers a temperature between 96- and 100-degrees Fahrenheit** may proceed to their work site.
    - **If temperature is below 96 degrees, wait a few minutes and retest with a different device.**

Control rooms and communal areas:

All persons entering the site without a Vistra vaccination sticker should maintain at least six-feet distance from other people as much as possible and should wear face coverings when six-feet distance is not feasible. No one should gather in communal areas (including the temperature-testing area) without a Vistra vaccination sticker. Only operators are allowed in control rooms without plant manager approval.

Vistra Vaccination Sticker protocols:

All persons with a valid Vistra vaccination sticker do not have to socially distance or wear masks while at the site. They will also not be required to quarantine as a part of COVID-19 exposures unless exhibiting COVID-19 symptoms. To be eligible for these protocols, each person must have their approved Vistra vaccination sticker easily visible at all times while at work. If someone who has applied for a Vistra vaccination sticker believes they have specific health conditions that may affect the ability to have a full immune response to the vaccination, please consult your health provider prior to working without a mask.

Any symptomatic employee, unvaccinated employee exposed to COVID-19 or any employee tested for COVID-19 as described above must be cleared through VistraTravelerSafety prior to returning to work.

APPENDIX E
SAFETY DATA SHEETS

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*
Bromide salt (calcium)	*7789-41-5*	*See Footnote 3*	*Toxic to Reproduction Category 2*

[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.*

[3]*Analytical data are not available to demonstrate that the concentration of bromide salt is <0.1%; therefore, a GHS classification of Toxic to Reproduction Category 2 has been assigned.*

Section 4
First Aid Measures

4.1 Description of First Aid Measures

Inhalation:	If product is inhaled and irritation of the nose or coughing occurs, remove person to fresh air. Get medical advice/attention if respiratory symptoms persist.
Skin Contact:	If skin exposure occurs, wash with soap and water.
Eye Contact:	If product gets into the eye, rinse copiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical attention/advice if irritation occurs or persists.
Ingestion:	No specific first aid measures are required.

4.2 Most Important Health Effects, Both Acute and Delayed

Acute Effects: Direct exposure may cause respiratory irritation, eye irritation and skin irritation. The product dust can dry and irritate the skin and cause dermatitis and can irritate eyes and skin through mechanical abrasion.

Chronic Effects: Chronic exposure may cause lung damage from repeated exposure. Prolonged inhalation of respirable crystalline silica above certain concentrations may cause lung diseases, including silicosis and lung cancer. Repeated exposure to dusts containing inorganic bromide salts may affect fertility and/or result in effects to the unborn child.

4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed

Seek first aid or call a doctor or Poison Control Center if contact with eyes occurs and irritation remains after rinsing. Get medical advice if inhalation occurs and respiratory symptoms persist.

Section 5
Firefighting Measures

5.1 Extinguishing Media

Suitable Extinguishing Media:	Product is not flammable. Use extinguishing media appropriate for surrounding fire.
Unsuitable Extinguishing Media:	Not applicable, the product is not flammable.

5.2 Special Hazards Arising from the Substance or Mixture

Hazardous Combustion Products:	None known.

5.3 Advice for Firefighters

Special Protective Equipment and Precautions for Firefighters:	As with any fire, wear self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear.

Section 6
Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

Personal precautions/Protective Equipment:	See Section 8.2.2 Individual Protective Measures. For concentrations exceeding Occupational Exposure Levels (OELs), use a self-contained breathing apparatus (SCBA).
Emergency procedures:	Use scooping, water spraying/flushing/misting or ventilated vacuum cleaning systems to clean up spills. Do not use pressurized air.

6.2 Environmental Precautions

Environmental precautions:	Prevent contamination of drains or waterways and dispose according to local and national regulations.

6.3 Methods and Material for Containment and Cleaning Up

Methods and materials for containment and cleaning up:	Do not use brooms or compressed air to clean surfaces. Use dust collection vacuum and extraction systems. Large spills of dry product should be removed by a vacuum system. Dampened material should be removed by mechanical means and recycled or disposed of according to local and national regulations.

See Sections 8 and 13 for additional information on exposure controls and disposal.

Section 7
Handling and Storage

7.1 Precautions for Safe Handling

Practice good housekeeping. Use adequate exhaust ventilation, dust collection and/or water mist to maintain airborne dust concentrations below permissible exposure limits (note: respirable crystalline silica dust may be in the air without a visible dust cloud).

Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain and test ventilation and dust collection equipment. In cases of insufficient ventilation, wear a NIOSH approved respirator for silica dust when handling or disposing dust from this product. Avoid contact with skin and eyes. Wash or vacuum clothing that has become dusty. Avoid eating, smoking, or drinking while handling the material.

7.2 Conditions for Safe Storage, Including any Incompatibilities

Minimize dust produced during loading and unloading.

Section 8
Exposure Controls/Personal Protection

8.1 Control Parameters

OCCUPATIONAL EXPOSURE LIMITS					
SUBSTANCE		**OSHA PEL TWA (mg/m^3)**	**NIOSH REL TWA (mg/m^3)**	**ACGIH TLV TWA (mg/m^3)**	**CA - OSHA PEL (mg/m^3)**
Calcium oxide		5	2	2	2
Particulates Not Otherwise Regulated	Total	15	15	10	10
	Respirable	5	5	3	5
Respirable Crystalline Silica	Respirable	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. Inorganic bromide salts have been shown to have adverse effects on reproductive parameters in some animal studies.
STOT-SE	CCPs when present as a nuisance dust may result in respiratory irritation.
STOT-RE	In a 180-day inhalation study with fly ash dust, no effects were observed at the highest dose tested. NOEC = 4.2 mg/m^3; it is not possible to assess the level at which toxicologically significant effects may occur. Repeated inhalation exposures to high levels of respirable crystalline silica may result in lung damage (i.e., silicosis).
Aspiration Hazard	Not applicable based product form.

Section 12
Ecological Information

12.1 Toxicity

Fly Ash (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.

Safety Data Sheet

Section 1
Identification of the Substance and of the Supplier

1.1 Product Identifier

Product Name/Identification:	ASTM Class C Fly Ash
Synonyms:	Coal Fly Ash, Pozzolan
Formula:	UVCB Substance

1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advices Against

Relevant Identified Uses:	Component of wallboard, concrete, roofing material, bricks, cement kiln feed.
Uses Advised Against:	None known.

1.3 Details of the Supplier of the SDS

Manufacturer/Supplier:	Dynegy, Inc.
Street Address:	601 Travis Street, Suite 1400
City, State and Zip Code:	Houston, TX 77002
Customer Service Telephone:	800-633-4704

Section 2
Hazards Identification

2.1 Classification of the Substance

GHS Classification(s) according to OSHA Hazard Communication Standard (29 CFR 1910.1200):

- Eye Irritant, Category 2A
- STOT-SE, Category 3 (Respiratory Irritation)
- Carcinogen, Category 1A
- STOT-RE, Category 1 (Lungs)
- Toxic to Reproduction, Category 2

2.2 Label Elements

Labelling according to 29 CFR 1910.1200 Appendices A, B and C*	
Hazard Pictogram(s):	
Signal word:	**DANGER**
Hazard Statement(s):	*Causes serious eye irritation.* *May cause damage to lungs after repeated/prolonged exposure via inhalation.* *May cause respiratory irritation.* *May cause cancer of the lung.* *Suspected of damaging fertility or the unborn child.*
Precautionary Statement(s):	*Obtain special instructions before use.* *Do not handle until all safety precautions have been read and understood.* *Avoid breathing dust.* *Wear protective gloves/protective clothing/eye protection/face protection.* *Wash thoroughly after handling.* *Do not eat drink or smoke when using this product.* *Use outdoors or in a well-ventilated area.* *If exposed or concerned: Get medical advice/attention.* *Store in a secure area.* *Dispose of product in accordance with local/national regulations.*

** Fly ash and other coal combustion products (CCPs) are UVCB substances (unknown or variable composition or biological). Various CCPs, noted as ashes/ash residuals; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Waste solids, ashes under TSCA are defined as: "The residuum from the burning of a combination of carbonaceous materials. The following elements may be present as oxides: aluminum, calcium, iron, magnesium, nickel, phosphorus, potassium, silicon, sulfur, titanium, and vanadium." Ashes including fly ash and fluidized bed combustion ash are identified by CAS number 68131-74-8. The exact composition of the ash is dependent on the fuel source and flue additives composed of many constituents. The*

classification of the final substance is dependent on the presence of specific identified oxides as well as other trace elements.

2.3 Other Hazards

Listed Carcinogens:

-Respirable Crystalline Silica

IARC: [Yes] **NTP:** [Yes] **OSHA:** [Yes] **Other:** **(ACGIH)** [Yes]

Section 3
Composition/Information on Ingredients

Substance	*CAS No.*	*Percentage (%)*	*GHS Classification*
Crystalline Silica	*14808-60-7*	*30 - 60%*	*Repeat Dose STOT, Category 1* *Carcinogen, Category 1A*
Silica, crystalline respirable (RCS)	*14808-60-7*	*See Footnote 1*	*Repeat Dose STOT, Category 1* *Carcinogen, Category 1A*
Aluminosilicates	*71243-67-9* *1327-36-2*	*30 - 60%*	*Single Exposure STOT, Category 3*
Iron oxide	*1309-37-1*	*1 - 10%*	*Not Classified*
Calcium oxide (CaO)	*1305-78-8*	*20 - 30%*	*Skin Irritant, Category 2* *Eye Irritant, Category 1* *Single Exposure STOT, Category 3*
Magnesium oxide	*1309-48-4*	*2 - 10%*	*Not Classified*
Phosphorus pentoxide (P_2O_5)	*1314-56-3*	*≤2%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Sodium oxide	*1313-59-3*	*1-8%*	*Not Classified*
Potassium oxide (K_2O)	*12136-45-7*	*≤1%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Titanium dioxide (TiO_2)	*13463-67-7*	*<3%*	*Not Classified*
Bromide salt (calcium)	*7789-41-5*	*See Footnote 2*	*Toxic to Reproduction, Category 2*

Footnote 1: The percentage of respirable crystalline silica has not been determined. Therefore, a GHS classification of Carcinogen, Category 1A has been assigned.

Footnote 2: Analytical data are not available to demonstrate that the concentration of bromide salt is <0.1%; therefore, a GHS classification of Toxic to Reproduction, Category 2 has been assigned.

Section 4
First Aid Measures

4.1 Description of First Aid Measures

Inhalation:	If product is inhaled and irritation of the nose or coughing occurs, remove person to fresh air. Get medical advice/attention if respiratory symptoms persist.
Skin Contact:	If skin exposure occurs, wash with soap and water.
Eye Contact:	If product gets into the eye, rinse copiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical attention/advice if irritation occurs or persists.
Ingestion:	No specific first aid measures are required.

4.2 Most Important Health Effects, Both Acute and Delayed

Acute Effects: Direct exposure may cause respiratory irritation, eye irritation and skin irritation. The product dust can dry and irritate the skin and cause dermatitis and can irritate eyes and skin through mechanical abrasion.

Chronic Effects: Chronic exposure may cause lung damage from repeated exposure. Prolonged inhalation of respirable crystalline silica above certain concentrations may cause lung diseases, including silicosis and lung cancer. Repeated exposure to dusts containing inorganic bromide salts may affect fertility and/or result in effects to the unborn child.

4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed

Seek first aid or call a doctor or Poison Control Center if contact with eyes occurs and irritation remains after rinsing. Get medical advice if inhalation occurs and respiratory symptoms persist.

Section 5
Firefighting Measures

5.1 Extinguishing Media

Suitable Extinguishing Media:	Product is not flammable. Use extinguishing media appropriate for surrounding fire.
Unsuitable Extinguishing Media:	Not applicable, the product is not flammable.

5.2 Special Hazards Arising from the Substance or Mixture

Hazardous Combustion Products:	None known.

5.3 Advice for Firefighters

Special Protective Equipment and Precautions for Firefighters:	As with any fire, wear self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear.

Section 6
Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

Personal precautions/Protective Equipment:	See Section 8.2.2 Individual Protective Measures. For concentrations exceeding Occupational Exposure Levels (OELs), use a self-contained breathing apparatus (SCBA).
Emergency procedures:	Use scooping, water spraying/flushing/misting or ventilated vacuum cleaning systems to clean up spills. Do not use pressurized air.

6.2 Environmental Precautions

Environmental precautions:	Prevent contamination of drains or waterways and dispose according to local and national regulations.

6.3 Methods and Material for Containment and Cleaning Up

Methods and materials for containment and cleaning up:	Do not use brooms or compressed air to clean surfaces. Use dust collection vacuum and extraction systems. Large spills of dry product should be removed by a vacuum system. Dampened material should be removed by mechanical means and recycled or disposed of according to local and national regulations.

See Sections 8 and 13 for additional information on exposure controls and disposal.

Section 7
Handling and Storage

7.1 Precautions for Safe Handling

Practice good housekeeping. Use adequate exhaust ventilation, dust collection and/or water mist to maintain airborne dust concentrations below permissible exposure limits (note: respirable crystalline silica dust may be in the air without a visible dust cloud).

Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain and test ventilation and dust collection equipment. In cases of insufficient ventilation, wear a NIOSH approved respirator for silica dust when handling or disposing dust from this product. Avoid contact with skin and eyes. Wash or vacuum clothing that has become dusty. Avoid eating, smoking, or drinking while handling the material.

7.2 Conditions for Safe Storage, Including any Incompatibilities

Minimize dust produced during loading and unloading.

Section 8
Exposure Controls/Personal Protection

8.1 Control Parameters

OCCUPATIONAL EXPOSURE LIMITS					
SUBSTANCE		**OSHA PEL TWA (mg/m^3)**	**NIOSH REL TWA (mg/m^3)**	**ACGIH TLV TWA (mg/m^3)**	**CA - OSHA PEL (mg/m^3)**
Calcium oxide		5	2	2	2
Particulates Not Otherwise Regulated	Total	15	15	10	10
	Respirable	5	5	3	5
Respirable Crystalline Silica	Respirable Crystalline Silica	0.05	0.05	0.025	0.05
Titanium dioxide	Total	15	2.4 (fine) 0.3 (ultrafine)	10	10
Manganese dioxide (as manganese compounds)	Total	5 (Ceiling)	1 3 (STEL)	0.1	0.2
	Respirable	-	-	0.02	-

8.2 Exposure Controls

8.2.1 Engineering Controls

Provide ventilation to maintain the ambient workplace atmosphere below the occupational exposure limit(s). Use general and local exhaust ventilation and dust collection systems as necessary to minimize exposure.

8.2.2 Personal Protective Equipment (PPE)

Respiratory protection:	Wear a NIOSH approved particulate respirator if exposure to airborne particulates is unavoidable and where occupational exposure limits may be exceeded. If airborne exposures are anticipated to exceed applicable PELs or TLVs, a self-contained breathing apparatus or airline respirator is recommended.
Eye and face protection:	If eye contact is possible, wear protective glasses with side shields. Avoid contact lenses.
Hand and skin protection:	Wear gloves and protective clothing. Wash hands with soap and water after contact with material.

Section 9
Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

Property: Value	Property: Value
Appearance (physical state, color, etc.): Fine tan/ gray particulate	**Upper/lower flammability or explosive limits:** Not applicable
Odor: Odorless[1]	**Vapor Pressure (Pa):** Not applicable
Odor threshold: Not applicable	**Vapor Density:** Not applicable
pH (25 °C) (in water): Not Determined	**Specific gravity or relative density:** 2.2 – 2.9
Melting point/freezing point (°C): Not applicable	**Water Solubility:** Slight
Initial boiling point/boiling range (°C): NA	**Partition coefficient: n-octane/water:** NA
Flash point (°C): Not determined	**Auto ignition temperature (°C):** Not applicable
Evaporation rate: Not applicable	**Decomposition temperature (°C):** Not determined
Flammability (solid, gas): Not combustible	**Viscosity:** Not applicable

[1] The use of urea or aqueous ammonia injected into the flue gas to reduce nitrogen oxides (NOx) emissions may result in the presence of ammonium sulfate or ammonium bisulfate in the ash at less than 0.1%. When ash containing these substances becomes wet under high pH (>9), free ammonia gas may be released resulting in objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces.

Section 10
Stability and Reactivity

10.1 Reactivity:	The material is an inert, inorganic material primarily composed of elemental oxides.
10.2 Chemical stability:	The material is stable under normal use conditions.
10.3 Possibility of hazardous reactions:	The material is a relatively stable, inert material; however, when ash containing ammonia becomes wet under high pH (>9), free ammonia gas may be released resulting in an objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces. Polymerization will not occur.
10.4 Conditions to avoid:	Product can become airborne in moderate winds. Dry material should be stored in silos. Materials stored out of doors should be covered or maintained in a damp condition.
10.5 Incompatible materials:	None known.
10. 6 Hazardous decomposition products:	None known.

Section 11
Toxicological Information

11.1 Information on Toxicological Effects

Endpoint	Data
Acute oral toxicity	LD50 > 2000 mg/kg
Acute dermal toxicity	LD50 > 2000 mg/kg
Acute inhalation toxicity	LD50 > 5.0 mg/L
Skin corrosion/irritation	Does not meet the classification criteria but may cause slight skin irritation. Product dust can dry the skin which can result in irritation.
Eye damage/irritation	Causes serious eye irritation. Positive scores for conjunctiva irritation and chemosis in 2/3 animals based on average of 24, 48 and 72-hour scores with irritation clearing within 21 days; No corneal or iritis effects observed.
Respiratory/skin sensitization	Not a respiratory or dermal sensitizer.
Germ cell mutagenicity	Not mutagenic in in-vitro and in-vivo assays with or without metabolic activation.
Carcinogenicity	Not available. Respirable crystalline silica has been identified as a carcinogen by OSHA, NTP, ACGIH and IARC.
Reproductive toxicity	No developmental toxicity was observed in available animal studies. Reproductive studies on CCPs showed either no reproductive effects, or some effects on male and female reproductive organs and parameters but without a clear dose response. Inorganic bromide salts have been shown to have adverse effects on reproductive parameters in some animal studies.
STOT-SE	CCPs when present as a nuisance dust may result in respiratory irritation.
STOT-RE	In a 180-day inhalation study with fly ash dust, no effects were observed at the highest dose tested. NOEC = 4.2 mg/m^3; it is not possible to assess the level at which toxicologically significant effects may occur. Repeated inhalation exposures to high levels of respirable crystalline silica may result in lung damage (i.e., silicosis).
Aspiration Hazard	Not applicable based product form.

Section 12
Ecological Information

12.1 Toxicity

Fly Ash C (CAS# 68131-74-8)	
Toxicity to Fish	LC50 > 100 mg/L
Toxicity to Aquatic Invertebrates	Data indicates that the test substance is not toxic to *Daphnia magna* (EC50 undetermined).
Toxicity to Aquatic Algae and Plants	EC50 = 10 mg/L

Calcium oxide CAS# 1305-78-8	
Toxicity to Fish	LC50 = 50.6 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Invertebrates	EC50 = 49.1 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Algae and Plants	NOEC =48 mg/L @ 72 hours based on $Ca(OH)_2$ The initial pH of the test medium was not directly related to the biologically relevant effects. The formation of precipitates is likely the result of the reaction between CO_2 dissolved in the medium.

12.2 Persistence and Degradability

Not relevant for inorganic materials.

12.3 Bioaccumulative Potential

This material does not contain any compounds that would bioaccumulate up the food chain.

12.4 Mobility in Soil

No data available.

12.5 Results of PBT and vPvB Assessment

This material does not contain any compounds classified as “persistent, bioaccumulative or toxic” nor as “very persistent/very bioaccumulative”.

12.6 Other Adverse Effects

None known.

Section 13

Disposal Considerations

See Sections 7 and 8 above for safe handling and use, including appropriate industrial hygiene practices.

Dispose of all waste product and containers in accordance with federal, state and local regulations.

Section 14
Transport Information

Regulatory entity: U.S. DOT	Shipping Name:	Not Regulated
	Hazard Class:	Not Regulated
	ID Number:	Not Regulated
	Packing Group:	Not Regulated

Section 15
Regulatory Information

15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Mixture

- TSCA Inventory Status

  All components are listed on the TSCA Inventory.

- California Proposition 65.

  The following substances are known to the State of California to be carcinogens and/or reproductive toxicants:

  - Respirable crystalline silica

- State Right-to-Know (RTK)

Component	CAS	MA[1,2]	NJ[3,4]	PA[5]	RI[6]
Ammonium bisulfate	7803-63-6	No	Yes	No	No
Ammonium sulfate	7783-20-2	Yes	No	Yes	No
Calcium oxide	1305-78-8	Yes	Yes	Yes	No
Iron oxide	1309-37-1	Yes	Yes	Yes	No
Magnesium oxide	1309-48-4	No	Yes	No	No
Manganese oxide-as manganese compounds	1313-13-9; Various	No	No	Yes	Yes
Phosphorus pentoxide (or phosphorus oxide)	1314-56-3	Yes	Yes	Yes	No
Potassium oxide	12136-45-7	No	Yes	No	No
Silica-crystalline (SiO2), quartz	14808-60-7	Yes	Yes	Yes	No
Sodium oxide	1313-59-3	No	Yes	No	No
Titanium dioxide	13463-67-7	Yes	Yes	Yes	Yes

[1] Massachusetts Department of Public Health, no date
[2] 189th General Court of The Commonwealth of Massachusetts, no date
[3] New Jersey Department of Health and Senior Services, 2010a
[4] New Jersey Department of Health, 2010b
[5] Pennsylvania Code, 1986
[6] Rhode Island Department of Labor and Training, no date

Section 16
Other Information, Including Date of Preparation or Last Revision

16.1 Indication of Changes

Date of preparation or last revision: February 23, 2018

16.2 Abbreviations and Acronyms

- ACGIH: American Conference of Industrial Hygienists
- CA: California
- CAS: Chemical Abstract Services
- CCP: Coal Combustion Product
- CFR: Code of Federal Regulations
- EPA: Environmental Protection Agency

- GHS: Globally Harmonized System of Classification and Labelling
- IARC: International Agency for Research on Cancer
- LC50: Concentration resulting in the mortality of 50 % of an animal population
- LD50: Dose resulting in the mortality of 50 % of an animal population
- MA: Massachusetts
- NA: Not Applicable
- NJ: New Jersey
- NOEC: No observed effect concentration
- NIOSH: National Institute of Occupational Safety and Health
- NOx: Nitrogen oxides
- NTP: US National Toxicology Program
- OEL: Occupational Exposure Limit
- OSHA: Occupational Safety and Health Administration
- PA: Pennsylvania
- PBT: Persistent, Toxic and Bioaccumulative
- PEL: Permissible exposure limit
- PPE: Personal Protective Equipment
- REL: Recommended exposure limit
- RI: Rhode Island
- RCS: Respirable Crystalline Silica
- RTK: Right-to-Know
- SCBA: Self-contained breathing apparatus
- SDS: Safety Data Sheet
- STEL: Short-term exposure limit
- STOT-RE: Specific target organ toxicity-repeated exposure
- STOT-SE: Specific target organ toxicity-single exposure
- TLV: Threshold limit value
- TSCA: Toxic Substances Control Act
- TWA: Time-weighted average
- UEL: Upper explosive limit
- UVCB: Unknown or Variable Composition/Biological
- U.S.: United States
- U.S. DOT: United States of Department of Transportation

16.3 Other Hazards

Hazardous Materials Identification System (HMIS) Degree of hazard (0= low, 4 = extreme)							
Health:	2*	**Flammability:**	0	**Physical Hazards:**	0	**Personal protection:****	

** Chronic Health Effects*
******* Appropriate personal protection is defined by the activity to be performed.*
See Section 8 for additional information.

DISCLAIMER:

This SDS has been prepared in accordance with the Hazard Communication Rule 29 CFR 1910.1200. Information herein is based on data considered to be accurate as of date prepared. No warranty or representation, express or implied, is made as to the accuracy or completeness of this data and safety information. No responsibility can be assumed for any damage or injury resulting from abnormal use, failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.

ATTACHMENT T

Phil Morris
Illinois Power Resources Generating
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 Resources Generating, LLC

Dear Mr. LeCrone:

Pursuant to 35 I.A.C. 845.700(c), Illinois Power Resources Generating, LLC submits the information necessary to categorize the CCR surface impoundments located at the Edwards Power Plant and the now retired Duck Creek 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 Edwards and Duck Creek 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

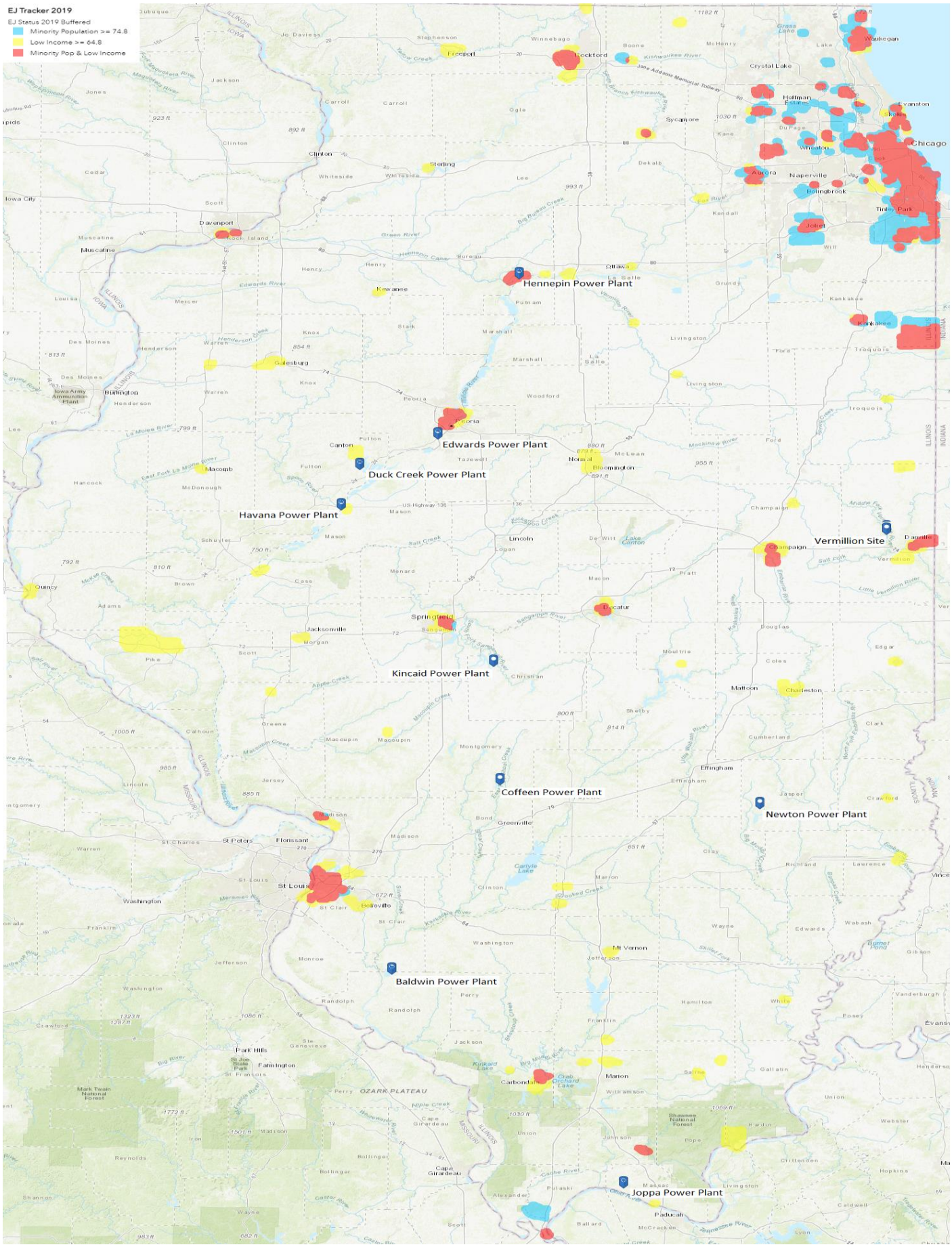
Facility	Pond Description	Classifications	Potable Water Supply Impacts (Category 1)	Human Health or Environment Threat (Category 2)	Located within Environmental Justice Areas[1] (Category 3)	Standards Exceedances[2] (Categories 4,5,6,7)	Impoundment Category 845.700(g)
Edwards	Ash Pond 1	Existing	No	No	No	Yes	5
Duck Creek	Bottom Ash Basin	Inactive	No	No	Yes	NA[3]	3
	GMF Pond	Inactive	No	No	Yes	NA[3]	3
	GMF Recycle Pond	Inactive	No	No	Yes	NA[3]	3

[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.
[3] NA for this determination since the CCR surface impoundment was assign a highest priority category

Table 2: Impacts to Potable Water Supply

Site Name	Private and Semi-Private Wells	Non-Community Water Supply (CWS) Wells	Non-CWS Surface Water Intakes	Community Water Supply Wells	CWS Surface Water Intakes
Edwards	**Present, but not at risk** Seven (7) water wells were identified and one (or possibly two) are located potentially downgradient of the site. Based on Ramboll's review of groundwater data, these wells are unlikely to be impacted by coal ash constituents.	**Present, but not at risk** One non-CWS well was identified; however, it is unlikely to be at risk because of its hydrogeologic location relative to the power plant.	Absent	Absent	Absent
Duck Creek	**Present, but not at risk** Three (3) water wells were identified; however, they are unlikely to be at risk because of their hydrogeologic location relative to the power plant and/or they are abandoned. None of the off-site wells are located in a downgradient direction.	Absent	Absent	Absent	Absent

Attachment 2: EJ Mapping Denoting Facilities with Impoundments



ATTACHMENT U

Geosyntec consultants

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PH 636-812-0800
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October 11, 2021

Illinois Power Resources Generating, LLC
17751 North Cilco Road
Canton, Illinois 61520

Subject: USEPA CCR Rule and IEPA Part 845 Rule Applicability Cross-Reference
2021 USEPA CCR Rule Periodic Certification Report
GMF Pond, Duck Creek Power Plant, Canton, Illinois

At the request of Illinois Power Resources Generating, LLC (IPRG), Geosyntec Consultants (Geosyntec) has prepared this letter to document how the attached 2021 United States Environmental Protection Agency (USEPA) CCR Rule Periodic Certification Report (Report) was prepared in accordance with both the Federal USEPA CCR Rule[1] and the state-specific Illinois Environmental Protection Agency (IEPA) Part 845 Rule[2]. Specific sections of the report and the applicable sections of the USEPA CCR Rule and Illinois Part 845 Rule are cross-referenced in **Table 1**. A certification from a Qualified Professional Engineer for each of the CCR Rule sections listed in **Table 1** is provided in Section 9 of the attached Report. This certification statement is also applicable to each section of the Part 845 Rule listed in **Table 1.**

Table 1 – USEPA CCR Rule and Illinois Part 845 Rule Cross-Reference

Report Section	USEPA CCR Rule		Illinois Part 845 Rule	
3	§257.73 (a)(2)	Hazard Potential Classification	845.440	Hazard Potential Classification Assessment[3]
4	§257.73 (c)(1)	History of Construction	845.220(a)	Design and Construction Plans (Construction History)
5	§257.73 (d)(1)	Structural Stability Assessment	845.450 (a) and (c)	Structural Stability Assessment
6	§257.73 (e)(1)	Safety Factor Assessment	845.460 (a-b)	Safety Factor Assessment
7	§257.82 (a)(1-3)	Adequacy of Inflow Design Control System Plan	845.510(a), (c)(1), (c)(3)	Hydrologic and Hydraulic Capacity Requirements / Inflow Design Flood Control System Plan
	§257.82 (b)	Discharge from CCR Unit	845.510(b)	Discharge from CCR Surface Impoundment

[1] United Stated Environmental Protection Agency, 2015. *40 CFR Parts 257 and 261, Hazardous and Solid Waste Management System, Disposal of Coal Combustion Residuals from Electric Utilities, Final Rule.*
[2] State of Illinois, Joint Committee on Administrative Rule, Administrative Code (2021). *Title 35: Environmental Protection, Subtitle G: Waste Disposal, Chapter I: Pollution Control Board, Subchapter j: Coal Combustion Waste Surface Impoundment, Part 845 Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments.*
[3] "Significant" and "High" hazard, per the CCR Rule[1], are equivalent to Class II and Class I hazard potential, respectively, per Part 845[2].

CLOSING

This letter has been prepared to demonstrate that the content and Qualified Professional Engineer Certification of the 2021 Periodic USEPA CCR Rule Certification Report fulfills the corresponding requirements of Part 845 of Illinois Administrative Code listed in **Table 1**.

Sincerely,

Lucas P. Carr, P.E.
Senior Engineer

John Seymour, P.E.
Senior Principal

2021 USEPA CCR RULE PERIODIC CERTIFICATION REPORT §257.73(a)(2), (c), (d), (e) and §257.82 GMF POND Duck Creek Power Plant Fulton County, Illinois

Submitted to

Illinois Power Resources Generating, LLC

17751 North Cilco Road
Canton, Illinois 61520

Submitted by

Geosyntec consultants

engineers | scientists | innovators

1 McBride and Son Center Drive, Suite 202
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October 11, 2021

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Attachment D Periodic Structural Stability and Safety Factor Assessment Analyses

EXECUTIVE SUMMARY

This Periodic United States Environmental Protection Agency (USEPA) Coal Combustion Residuals (CCR) Rule [1] certification report (Periodic Certification Report) for the GMF Pond[1] at the Duck Creek Power Plant (DCPP) 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 the Illinois Power Resources Generating, LLC (IPRG) CCR Website ([2], [3], [4], [5], [6]) be updated on a five-year basis.

The initial certification reports developed in 2016 and 2017 ([2], [7], [3], [4], [5], [6], [8]) were independently reviewed by Geosyntec. Additionally, field observations, interviews with plant staff, and evaluations were performed to compare conditions in 2021 at the GMF Pond relative to the 2016 initial certifications. These tasks determined that updates are not required for the Initial Hazard Potential Classification or Inflow Design Flood Control Plan. 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, and
- Initial Safety Factor Assessment.

Geosyntec's evaluations of the initial certification reports and updated engineering evaluations determined that the GMF Pond meets all requirements for hazard potential classification, history of construction reporting, structural stability assessment, safety factor assessment, and hydrologic and hydraulic control. **Table 1** provides a summary of the initial 2016 certifications and the updated 2021 periodic certifications.

[1] The GMF Pond is also referred to as ID Number W05780100001-04, GMF Pond by the Illinois Environmental Protection Agency (IEPA); CCR unit ID 203 by IPRG, and IL50573 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 GMF Pond or the GMFP.

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	A history of Construction report was prepared for the GMF Pond [3].	Yes	The Duck Creek Power Plant closed and CCR materials are no longer being placed in the GMF Pond. A letter listing updates to the History of Construction report is provided in **Attachment C.**
Structural Stability Assessment						
5	§257.73(d)(1)(i)	Stable foundations and abutments	Yes	Foundations and abutments were found to be stable [8].	Yes	Foundations and abutments were found to be stable after performing updated slope stability analyses.
	§257.73(d)(1)(ii)	Adequate slope protection	Yes	Slope protection was adequate [8].	Yes	No changes were identified that may affect this requirement.
	§257.73(d)(1)(iii)	Sufficiency of dike compaction	Yes	Dike compaction was sufficient for expected ranges in loading conditions [8].	Yes	Dike compaction found to be sufficient after performing updated slope stability analyses.
	§257.73(d)(1)(iv)	Presence and condition of slope vegetation	Yes	Vegetation was present on exterior slopes and is maintained. Interior slopes had alternate protection (geomembrane liner) [8].	Yes	No changes were identified that may affect this requirement.
	§257.73(d)(1)(v)(A) and (B)	Adequacy of spillway design and management	Yes	Spillways were adequately designed and constructed and were expected to adequately manage flow during 1,000-year flood [8].	Yes	No changes were identified that may affect this requirement.
	§257.73(d)(1)(vi)	Structural integrity of hydraulic structures	Not Applicable	Hydraulic structures penetrating the dikes or underlying the base of the GMF Pond were not present [8].	Not Applicable	No changes were identified that may affect this requirement.
	§257.73(d)(1)(vii)	Stability of downstream slopes inundated by water body.	Not Applicable	Inundation of exterior slopes was not expected; this requirement was not applicable [8].	Not Applicable	No changes were identified that may affect this requirement.
Safety Factor Assessment						
6	§257.73(e)(1)(i)	Maximum storage pool safety factor must be at least 1.50	Yes	Safety factors were calculated to be 4.27 and higher [8].	Yes	Safety factors from an updated slope stability analyses were calculated to be 3.47 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 4.26 and higher [8].	Yes	Safety factors from an updated slope stability analyses were calculated to be 3.47 and higher.
	§257.73(e)(1)(iii)	Seismic safety factor must be at least 1.00	Yes	Safety factors were calculated to be 2.37 and higher [8].	Yes	Safety factors from an updated slope stability analyses were calculated to be 1.88 and higher.
	§257.73(e)(1)(iv)	For dike construction of soils that have susceptible to liquefaction, safety factor must be at least 1.20	Not Applicable	Dike soils were not susceptible to liquefaction [8].	Not Applicable	No changes were identified that may affect this requirement.
Inflow Design Flood Control System Plan						
7	§257.82(a)(1), (2), (3)	Adequacy of inflow design control system plan.	Yes	Flood control system adequately managed inflow and peak discharge during the 1,000-year, 24-hour, Inflow Design Flood [8].	Yes	No changes were identified that may affect this requirement.
	§257.82(b)	Discharge from CCR Unit	Yes	Discharge into Waters of the United States is not expected during 1,000-year, 24-hour Inflow Design Flood conditions [8].	Yes	No changes were identified that may affect this requirement.

SECTION 1

INTRODUCTION AND BACKGROUND

This Periodic United States Environmental Protection Agency (USPA) Coal Combustion Residual (CCR) Rule [1] Certification Report was prepared by Geosyntec Consultants (Geosyntec) for Illinois Power Resources Generations, LLC (IPRG) to document the periodic certification of the GMF Pond at the Duck Creek Power Plant (DCPP) located at 17751 North Cilco Road in Canton, Illinois, 61520. The location of Duck Creek is provided in **Figure 1**, and a site plan showing the location of the GMF Pond, among other closed and open CCR units and non-CCR surface impoundments, is provided in **Figure 2**.

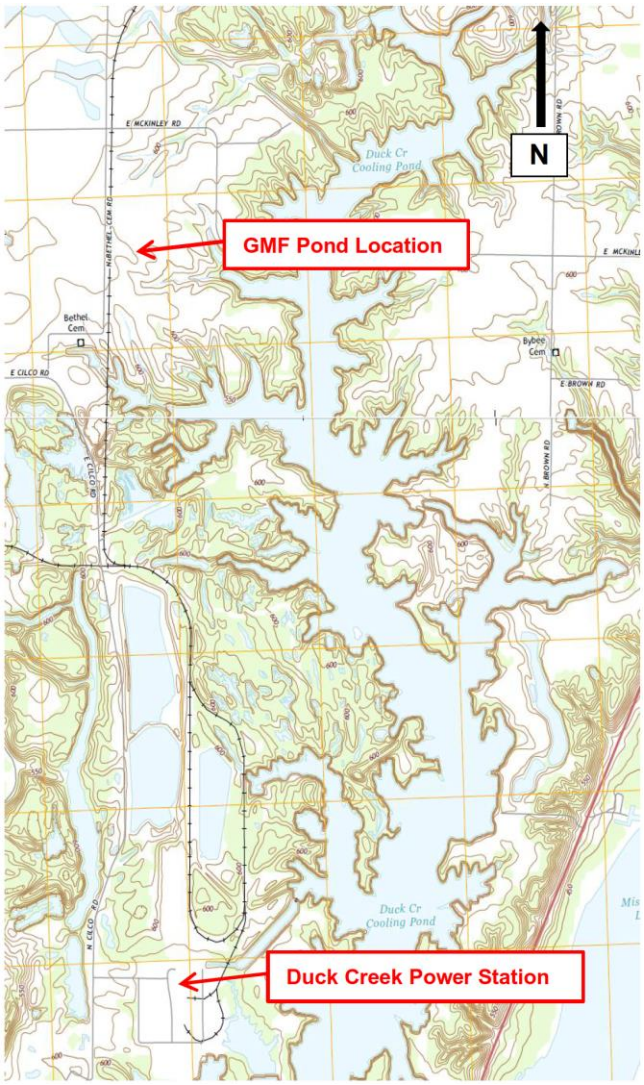


Figure 1 – Site Location Map (from AECOM, 2016)

Figure 2 – Site Plan

1.1 GMF Pond Description

DCPP was retired in 2019. Prior to retirement, two active CCR surface impoundments – the GMF Pond and the Bottom Ash Basin, and one CCR landfill, were used for managing CCRs generated at DCPP [8]. This certification report only pertains to the GMF Pond. The GMF Pond 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], [7]).

The GMF Pond served as the wet impoundment basin for gypsum proceeded by the emissions scrubbers at DCPP. The GMF Pond was constructed between 2008 and 2009 and received inflow from three pairs of 10-in diameter high-density polyethylene (HDPE) gypsum slurry pipes. Clear water discharge from the GMF Pond flows downstream into the approximately 8.5-acre GMF Recycle Pond, which is a non-CCR unit, via a lined channel (transfer channel). The transfer channel is approximately 150-ft long, trapezoidal in shape, lined with 60-mil HDPE, has 3H:1V (horizontal to vertical) side slopes, and a depth of 6 ft. Stoplogs are present within the transfer channel that would allow the pool level to be maintained as high as El. 616.0 ft[2]. The channel transitions from a 16-ft bottom width at an invert elevation of 614.0 ft at the upstream end to a 35-ft bottom width at an invert elevation of 609.0 ft at the downstream end. Outflow from the GMF Recycle Pond was formerly pumped back to DCPP to be recycled for use in the wet scrubber system [8]. Currently, the GMF Pond and GMF Recycle Pond are maintained in a zero-discharge configuration, where the only inflows are precipitation flowing directly into the impoundments and the only outflows are evaporation.

The GMF Pond has a composite liner system that is present underneath the entire footprint of the pond and extends up the interior slopes. The liner system includes, from bottom to top, a 3-ft thick layer of compacted clay that is overlain by a geosynthetic clay liner (GCL) and a 60-mil textured HDPE geomembrane, all of which serve as the lower liner. Above the lower liner, a 10-oz

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

geotextile is overlain by a 1-ft thick granular drainage layer and a 4-oz geotextile filter. The upper liner is comprised from bottom to top of a 1-ft thick soil cushion layer and a 60-mil textured HDPE geomembrane. The upper geomembrane liner is exposed at the pond bottom and side slopes [8].

As formerly operated, the normal pool of the GMF Pond was El. 615.0 ft, as controlled by the stoplog structure at the top of the transfer channel. The GMF Pond is approximately 31.6 acres in size and has a total perimeter embankment length of approximately 4,560 ft. The perimeter dike was constructed to include a crest width of approximately 30 ft and crest height ranging from approximately 5 to 10 ft along the eastern side of the pond. The interior of the ponds extends deeper than the exterior slopes; the maximum interior slope height is approximately 45 ft in the southwest corner of the pond. The design elevation of the embankment crest is 620 ft. Both interior and exterior slopes have an orientation of 3.5H:1V (horizontal to vertical).

Initial certifications for the GMF Pond for Hazard Potential Classification (§257.73(a)(2)), History of Construction (§257.73(c)), Structural Stability Assessment (§257.73(d)), Safety Factor Assessment (§257.73(e)(1)), and Inflow Design Flood Control System Plan (§257.82) were completed by Stantec and AECOM in 2016 and 2017 and subsequently posted to IPRG's CCR Website ([2], [3], [4], [5], [6]). Additional documentation for the initial certifications included a detailed operating record reports containing calculations and other information prepared for the hazard potential classification by Stantec [7] and for the structural stability assessment, safety factor assessment, and inflow design flood control system plan by AECOM [8]. These operating record reports were not posted to IPRG's CCR Website.

1.2 Report Objectives

The following objectives are associated with this report:

- Compare site conditions from 2015/2016, when the initial certifications were developed, to site conditions in 2020/2021, when data for the periodic certification was obtained, and evaluate if updates are required to the:
    - §257.73(a)(2) Hazard Potential Classification [2].
    - §257.73(c) History of Construction [3].
    - §257.73(d) Structural Stability Assessment [4].
    - §257.73(e) Safety Factor Assessment [5], and/or
    - §257.82 Inflow Design Flood Control System Plan [6].
- Independently review the Hazard Potential Classification ([2], [7]), Structural Stability Assessment ([4], [8]), Safety Factor Assessment ([5], [8]), and Inflow Design Flood

Control System Plan ([6], [8]) reports to determine if updates may be required based on technical considerations.

- The History of Construction report [3] was not independently reviewed for technical considerations, as this report contained historical information primarily developed prior to promulgation of the CCR Rule [1] for the CCR units at DCPP, and did not include calculations or other information used to certify performance and/or integrity of the impoundments under §257.73(a)(2), §257.73(c)-(e), or §257.82.

- Confirm that the GMF Pond meets all of the requirements associated with §257.73(a)(2), (c), (d), (e), and §257.82, or, if the GMF Pond does not meet any of these requirements, provide recommendations for compliance with those sections of the CCR Rule [1].

SECTION 2

COMPARISION OF INITIAL AND PERIODIC SITE CONDITIONS

2.1 Overview

This section describes the comparison of conditions at the GMF Pond between the start of the initial CCR certification program in 2015 and 2016 (initial conditions) and subsequent collection of periodic certification site data in 2020 and 2021 (periodic conditions).

2.2 Review of Annual Inspection Reports

Annual onsite inspections for the GMF Pond were performed between 2016 and 2020 ([9], [10], [11], [12], [13]) 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;
- A statement that no instrumentation was present;
- 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; and
- 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 GMF Pond between 2015 and 2020. No signs of instability, structural weakness, or changes which may have affected the operation or stability of the GMF Pond were noted in the inspection reports.

2.3 Review of Instrumentation Data

Multiple groundwater monitoring wells are present around the GMF Pond. Eight of the groundwater monitoring wells, G50S, G51S, G54C, G57C, G57S, G60S, G64S, and X301 have been monitored periodically since by IPRG. Water level readings were provided from December 2, 2015 through June 21, 2021 for most of the wells, with the exception of X301, for which water level readings were provided starting on March 2, 2015, and G54C, for which readings were provided starting on April 14, 2021. Geosyntec reviewed the water levels 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 ([4], [5], [8]) and June 21, 2021. Available monitoring well water levels are plotted in **Attachment A**.

In summary, only minor changes in phreatic conditions were observed in the available monitoring well level data. Phreatic levels typically exhibited consistent seasonal variations of 5 to 10 ft, with the exception of X301 and G54C, which varied by approximately 2 ft. These levels do not significantly differ from those utilized for the initial structural stability and factor of safety certifications ([4], [5], [8]).

2.4 Comparison of Initial to Periodic Surveys

The initial survey of the GMF Pond, conducted by Weaver Consultants (Weaver) in 2015 [14], was compared to the periodic survey of the GMF Pond, conducted by IngenAE, LLC (IngenAE) in 2020 [15], using AutoCAD Civil3D 2021 software. This comparison quantified changes in the volume of CCR placed within the GMF Pond 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 [6]. Potential changes to embankment geometry were also evaluated. This comparison is presented in side-by-side comparison of the two surveys in **Drawing 1,** and a plan view isopach map denoting changes in ground surface elevation in **Drawing 2**. A summary of the water elevations and changes in CCR volumes is provided in **Table 2**.

Table 2 – Initial to Periodic Survey Comparison

Initial Surveyed Pool Elevation (ft)	614.2
Periodic Surveyed Pool Elevation (ft)	613.9
Initial §257.82 Starting Water Surface Elevation (SWSE) (ft)	616.0
Total Change in CCR Volume* (CY)	+ 8,000 (Fill)
Change in CCR Volume Above SWSE* (CY)	- 9,000 (Cut)
Change in CCR Volume Below SWSE* (CY)	+ 17,000 (Fill)

*All volumes rounded to the nearest 1,000 CY

The comparison indicated that approximately 8,000 CY of CCR was placed in the GMF Pond between the initial and periodic surveys. The CCR was placed entirely below the SWSE and a net cut occurred above the SWSE. CCR grades above the SWSE were generally similar to the initial survey (e.g., within +/- 2 ft). These changes are considered unlikely to result in increase in the peak water surface elevation (PWSE) during a flood event, as additional flood storage is present relative to conditions observed in 2015. No significant changes to embankment geometry appeared to have occurred between the initial and periodic surveys.

2.5 Comparison of Initial to Periodic Aerial Photography

Initial aerial photographs of the GMF Pond collected by Weaver in 2015 [14] were compared to periodic aerial photographs collected by IngenAE in 2020 [15] 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**. No significant changes were noted during this comparison.

2.6 Comparison of Initial to Periodic Site Visits

An initial site visit to the GMF Pond was conducted by AECOM in 2015 and documented with a Site Visit Summary and corresponding photographs [16]. A periodic site visit was conducted by Geosyntec on May 27, 2021, with Mr. Lucas P. Carr, P.E. conducting the site visit. The site visit was intended to evaluate potential changes at the site since the initial certifications were prepared (i.e., modification to the embankment, outlet structures or other appurtenances, limits of CCR, maintenance programs, repairs), in addition to performing visual observations of the GMF Pond to evaluate if the structural stability requirements (§257.73(d)) were still met. The stie visit included walking the perimeter of the GMF Pond, visually observing conditions, recording field notes, and collecting photographs. The site visit is documented in a photographic log provided in **Appendix A**. A summary of significant findings from the periodic site visit is provided below:

- Overall site maintenance appears to be similar to conditions observed in 2015.
- No signs or structural stability, erosion, or required maintenance items were observed during the stie visit.

2.7 Interview with Power Plant Staff

An interview with Mr. Daryl Johnson and Mr. Brandon Potter of the DCPP was conducted by Lucas P. Carr, P.E. of Geosyntec on May 27, 2021. Mr. Johnson, at the time of the interview, had been employed at the DCPP for 8 years and was responsible for environmental compliance and completed weekly CCR inspections on some years, including for the GMF Pond, in addition to managing vegetation maintenance. Mr. Potter, at the time of the interview, had been employed at DCPP for 10 years and assisted in the inspection and operation of the GMF Pond. The interview included a discussion of included a discussion of potential changes that that may have occurred at the GMF Pond since development of the initial certifications ([2], [7], [3], [4], [5], [6], [8]).

- Were any construction projects completed for the GMF Pond since 2015, and, if so, are design drawings and/or details available?
    - No.
- Were there any changes to the purpose of the GMF Pond since 2015?
    - The DCPP was closed in December of 2019. Sluicing into the GMF Pond and pumping of water from the GMF Recycle Pond was stopped at this time.
- Were there any changes to the to the instrumentation program and/or physical instruments for the GMF Pond since 2015?

  - The GMF Pond does not have instrumentation, so no changes occurred.

- Have area-capacity curves for the GMF Pond been prepared since 2015?
  - No known area-capacity curves have been developed.
- Were there any changes to spillways and/or diversion features for the GMF Pond completed since 2015?
  - No.
- Were there any changes to construction specifications, surveillance, maintenance, and repair procedures for the GMF Pond since 2015?
  - No.
- Were there any instances of dike and/or structural instability for the GMF Pond since 2015?
  - No known instances occurred.

SECTION 3

HAZARD POTENTIAL CLASSIFICATION - §257.73(a)(2)

3.1 Overview of Initial HPC

The Initial Hazard Potential Classification (Initial HPC) was prepared by Stantec Consulting Services, Inc. (Stantec) in 2016 ([2], [7]), following the requirements of §257.73(a)(2). The Initial HPC included the following information:

- Visual analysis to evaluate potential hazards associated with a failure of the GMF Pond perimeter dike, along the north, south, east, and west embankments of the GMF Pond.
- Evaluation of potential breach flow paths using elevation data and aerial imagery to assess potential impacts to downstream structures, infrastructure, and waterways.
- While a breach map is not included within the Initial HPC, it included within the §257.73(a)(3) Initial Emergency Action Plan (Initial EmAP) [17].

The visual analysis indicated that only structures owned by DCPP were within the potential breach path, and that public impacts were limited to portions of North Bethel Cemetery Road and the railroad leading to the Power Plant. The reported noted that North Bethel Cemetery Road is intermittently used, and the at-risk population was considered transient. The Initial HPC concluded that breach of the GMF pond would be unlikely to result in a probable loss of human life, although the breach could cause CCR to be released into downstream waterways, thereby causing environmental damage. The Initial HPC therefore recommended a “Significant” hazard potential classification for the GMF Pond [2].

3.2 Review of Initial HPC

Geosyntec performed a review of the Initial HPC ([2], [7]), in terms of technical approach, assessment of the results, and applicable requirements of the CCR Rule [1]. No significant technical issues were noted within the technical review, although a detailed review (e.g., check) of the calculations was not performed as the initial HPC utilized a visual assessment.

3.3 Summary of Site Changes Affecting the Initial HPC

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 observed to be present in the probable breach area indicated in the Initial EmAP [17]. 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 GMF Pond, 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 3.3**, and the lack of significant review comments, as described in **Section 3.2**. Updates to the Initial HPC reports ([2], [7]) 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 all non-incised CCR surface impoundments at DCPP, including the GMF Pond, Ash Pond No. 1, and Ash Pond No. 2. This report only discusses the HoC as it pertains to the GMF Pond. The Initial HoC included the following information for the GMF Pond:

- The name and address of the owner/operator,
- Location maps,
- Statements of purpose,
- The names and size of the surrounding watershed,
- A description of the foundation and abutment materials,
- A description of the dike materials,
- Approximate dates and stages of construction,
- Available design and engineering drawings,
- A summary of instrumentation,
- Area-capacity curves for the GMF Pond,
- Information on spillway structures,
- Construction specifications,
- Inspection and surveillance plans,
- A statement that operations and maintenance plans are being generated or revised, and that the report will be updated when the new plans are available,
- A statement that no known historical structural instability has occurred at the CCR surface impoundments.

4.2 Summary of Site Affecting the Initial HoC

One significant change at the site that occurred after development of the initial HoC report [3] was identified and is described below:

- Electricity generation at the DCPP ceased in December of 2019 and the pumping of inflow and outflow into and from the GMF Recycle Pond ceased at this time.
    - An update to the HoC report was performed to state that the DCPP is no longer active and the GMF Pond is no lower receiving inflows and outflow is no longer pumped back to the DCPP. 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], [8]), following the requirements of §257.73(d)(1), and included the following evaluations:

- Stability of dike foundations, dike abutments, slope protection, dike compaction, and slope vegetation,
- Spillway stability including capacity, structural stability and integrity; and
- Downstream slope stability under sudden drawdown conditions for a downstream water body.

The Initial SSA ([4], [8]) concluded that the GMF Pond met all structural stability requirements for §257.73(d)(1)(i)-(vii). This included noting that the structural integrity of hydraulic structures (§257.73(d)(1)(vi)) was not applicable, due to no hydraulic structures penetrating or underlying the base of the GMF Pond. Additionally, it was noted that the stability of downstream slopes inundated by water bodies (§257.73(d)(1)(vii) was also not applicable, due to inundation of the downstream slopes not being expected.

5.2 Review of Initial SSA and Updated Periodic SSA

Geosyntec performed a review of the Initial SSA ([4], [8]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing photographs collected in 2015 and used to demonstrate compliance with §257.73(d)(1)(i)-(vii).
- Reviewing geotechnical calculations used to demonstrate the stability of foundations, per §257.73(d)(1)(i) and sufficiency of dike compaction, per §257.73(d)(1)(iii), in terms of supporting geotechnical investigation and testing data, input parameters, analysis methodology, selection of critical cross-sections, and loading conditions.
- Review of the methodology used to demonstrate that a downstream water body that could induce a sudden drawdown condition, per §257.73(d)(1)(vii), is not present.

One review comment and corresponding recommended technical update was identified during review of the geotechnical analyses supporting the sufficiency of dike compaction

(§257.73(d)(1)(i)) and foundation and abutment stability (§257.73(d)(1)(iii) portions of the Initial SSA. These analyses were performed for the Initial Safety Factor Assessment (SFA) but also utilized to support the initial SSA. The review comment and subsequent updates the Initial SFA, are discussed in **Section 6.**

5.3 Summary of Site Changes Affecting the Initial SSA

No changes since development of the Initial SSA were identified that would require updates to the Initial SSA ([4], [8]).

5.4 Periodic SSA

The updated Periodic SFA (**Section 7**) indicates that foundations and abutments are stable and dike compaction is sufficient for expected ranges in loading conditions, as slope stability factors of safety for slip surfaces passing through the dike and foundation were found to meet or exceed the requirements of §257.73(e)(1), including for static maximum 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.

SECTION 6

SAFETY FACTOR ASSESSMENT - §257.73(e)(1)

6.1 Overview of Initial SFA

The Initial Safety Factor Assessment (Initial SFA) was prepared by AECOM in 2016 ([5], [8]) following the requirements of §257.73(e)(1). The Initial SFA included the following information:

- A geotechnical investigation program with in-situ and laboratory testing;
- An assessment of the potential for liquefaction in the dike and foundation soils;
- The development of a single slope stability cross-sections for limit equilibrium stability analysis utilizing GeoStudio SLOPE/W software; and
- The analysis of the cross-section for maximum storage pool, maximum surcharge pool, and seismic loading conditions.
    - Liquefaction loading conditions were not evaluated as liquefaction-susceptible soil layers were not identified in either the embankments or foundation soils.

The Initial SFA concluded that the GMF Pond met all safety factor requirements, per §257.73(e), as all calculated safety factors were equal to or higher than the minimum required values.

6.2 Review of Initial SFA

Geosyntec performed a review of the Initial SFA ([5], [8]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing geotechnical calculations used to demonstrate the acceptable safety factors, per §257.73(e)(1), in terms of:
    - Completeness and adequacy of supporting geotechnical investigation and testing data;
    - Completeness and approach of liquefaction triggering assessments; and
    - Input parameters, analysis methodology, selection of critical cross-sections, and loading conditions utilized for slope stability analyses.
    - Phreatic conditions based on piezometric data collected between March 2, 2015 June 21, 2021, as discussed in **Section 2.3**.

One review comment was identified during review of the Initial SFA. The comment and the is described below:

- The Initial SFA utilized a single cross-section (A-A') along the eastern embankment where the exterior slope is approximately 8 ft tall. However, the maximum height of the exterior slope is approximately 11 ft at the southwest corner of the embankment.

6.3 Summary of Site Changes Affecting the Initial SFA

No changes since development of the Initial SFA were identified that would require updates to the Initial SFA ([5], [8]).

6.4 Periodic SFA

Following review of the Initial SFA ([5], [8]), Geosyntec developed a new slope stability analysis cross-section (B-B') at the southwest corner of the GMF Pond embankment to account for the maximum embankment height of 11 ft. The model was developed utilizing the following approach and input data:

- Ground surface geometry was obtained from the 2020 survey of the GMF Pond [15].

- Subsurface stratigraphy was obtained from 2007 borings B-53 and B-67, as provided in the Initial SFA report [8]. Geosyntec reviewed the boring data and determined that subsurface conditions were similar to conditions at cross-section A-A'. Therefore, the soil properties (i.e., strength, unit weight) from the Initial SFA ([5], [8]) were utilized for cross-section B-B',

- Piezometric levels in the foundation soils were assumed to follow the ground surface past the embankment toe, per providing readings from monitoring wells G51S and G54C; and,

- All other analysis settings and input data from the Initial SFA ([5], [8]) was utilized, including, but not limited to, software package and version, slip surface search routines and methods, and pseudostatic seismic coefficients.

Factors of safety form the Periodic SFA (cross-section B-B') and Initial SFA (cross-section A-A') are summarized in **Table 3** and confirm that the GMF Pond meets the requirements of §257.73(e)(1). A location of the cross-section B-B' in plan and analysis output data for cross-section B-B' 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 §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**	**Foundation Liquefaction §257.73(d)(1)(i) Minimum Required = 1.20**
A-A'	4.27	4.26	2.37	N/A	N/A
B-B'	3.47*	3.47*	1.88*	N/A	N/A

Notes:
[1]Denotes cross-section where results from the Initial SFA are presented due to no observed changes relative to the Initial IDF.
[2]Denotes cross-section where changes are occurred, and results are presented from the updated Periodic SFA.
*Indicates critical cross-section (i.e., lowest calculated factor of safety out of the two cross-sections analyzed)
N/A – Loading condition is not applicable.

SECTION 7

INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN - §257.82

7.1 Overview of Initial IDF

The Initial Inflow Design Flood Control System Plan (Initial IDF) was prepared by AECOM in 2016 ([6], [8]) following the requirements of §257.82. The Initial IDF included the following information:

- A hydraulic and hydrologic analysis, performed for the 1,000-year design flood event because of the hazard potential classification of "significant", which corresponded to 9.37 inches of rainfall over a 24-hour period.
- The Initial IDF utilized a HydroCAD Version 8.5 model to evaluate spillway flows and pool level increases during the design flood, with a SWSE of 616.0 ft.

The Initial IDF ([6], [8]) concluded that the GMF Pond met the requirements of §257.82, as the peak water surface estimated by the HydroCAD model was El. 618.3 ft, relative to a minimum GMF Pond dike crest elevation of 620.0 ft. Therefore, overtopping was not expected. The Initial IDF also evaluated the potential for discharge from the CCR unit and determined that discharge into Waters of the United States and no overtopping was expected during the 1,000-year design flood.

7.2 Review of Initial IDF

Geosyntec performed a review of the Initial IDF ([6], [8]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing the return interval used vs. the hazard potential classification.
- Reviewing the rainfall depth and distribution for appropriateness.
- Performing a high-level review of the inputs to the hydrological modeling.
- Reviewing the hydrologic model parameters for spillway parameters, starting pool elevation, and storage vs. the reference data.
- Reviewing the overall Initial IDF vs. the applicable requirements of the CCR Rule [1].

No significant technical issues were noted within the technical review, although a detailed review (e.g., check) of the calculations was not performed.

7.3 Summary of Site Changes Affecting the Initial IDF

No changes since development of the Initial IDF were identified that would require updates to the Initial IDF ([6], [8]).

SECTION 8

CONCLUSIONS

The GMF Pond at DCPP was evaluated relative to the USEPA CCR Rule periodic assessment requirements for:

- Hazard potential classification (§257.73(a)(2)),
- History of Construction reporting (§257.73(d)),
- Structural stability assessment (§257.73(d)),
- Safety factor assessment (§257.73(e)), and
- Inflow design flood control system planning (§257.82).

Based on the evaluations presented herein, the referenced requirements are satisfied.

SECTION 9

CERTIFICATION STATEMENT

CCR Unit: Illinois Power Resources Generation, LLC; Duck Creek Power Plant, GMF Pond

I, Lucas P. Carr, 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, emergency action plan, 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.

Lucas P. Carr

10/11/2021

Date

Exp. 11/30/2021

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 Potential Classification Assessment, EPA Final CCR Rule, GMF Pond, Duck Creek Power Station, Fulton County, Illinois," Fenton, MO, October 12, 2016.

[3] AECOM, "History of Construction, USEPA Final CFR Rule, 40 CFR §257.73(c), Duck Creek Power Station, Canton, Illinois," October 2016.

[4] AECOM, "CCR Rule Report: Initial Structural Stability Assessment for GMF Pond at Duck Creek Power Station," October 2016.

[5] AECOM, "CCR Rule Report: Initial Safety Factor Assessment for GMF Pond at Duck Creek Power Station," St. Louis, MO, October 2016.

[6] AECOM, "CCR Rule Report: Initial Inflow Design Flood Control System Plan for GMF Pond at Duck Creek Power Station," October 2016.

[7] Stantec Consulting Services Inc., "Documentation of Initial Hazard Potential Classification Assessment, GMF Pond, Duck Creek Power Station, Fulton County, Illinois," October 12, 2016.

[8] AECOM, "CCR Certification Report: Initial Structural Stability Assessment, Initial Safety Factor Assessment, and Initial Inflow Design Flood Control System Plan for GMF Pond at Duck Creek Power Station," October 2016.

[9] J. Knutelski and J. Campbell, "Annual CCR Surface Impoundment Inspection Report (per 40 CFR 257.83(b)(2)), Duck Creek Power Station, GMF Pond," January 18, 2017.

[10] J. Knutelski and J. Campbell, "Annual CCR Surface Impoundment Inspection Report (per 40 CFR 257.83(b)(2)), Duck Creek Power Station, GMF Pond," February 7, 2018.

[11] J. Knutelski, "Annual Inspection by a Qualified Professional Engineer, 40 CFR §2357.83(b), Duck Creek Power Station, GMF Pond," January 10, 2019.

[12] J. Knutelski, "Annual Inspection by a Qualified Professional Engineer, 40 CFR §257.83(b), Duck Creek Power Station, GMF Pond," January 8, 2020.

[13] J. Knutelski, "Annual Inspection by a Qualified Professional Engineer, 40 CFR §257.83(b), Duck Creek Power Station, GMF Pond," January 6, 2021.

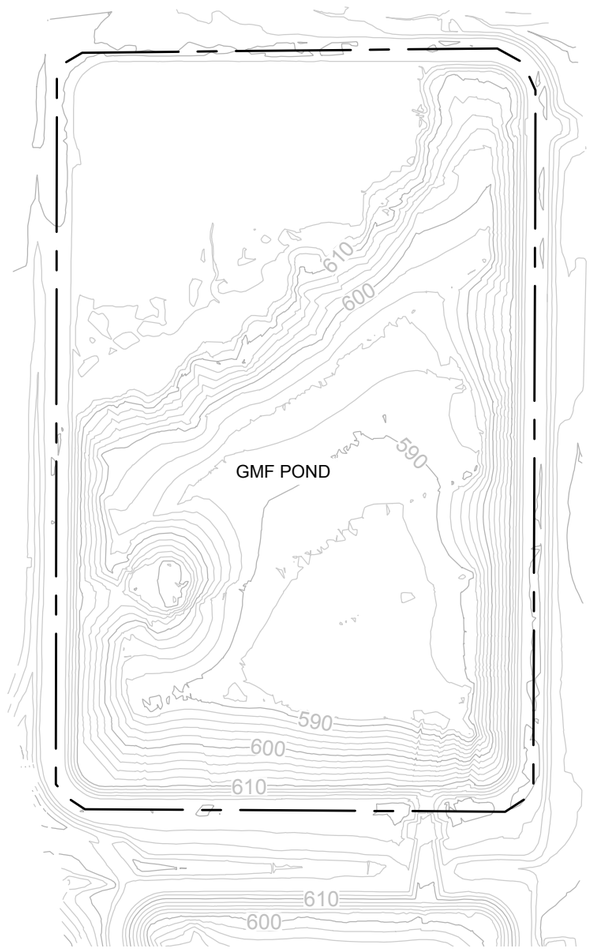
[14] Weaver Consultants Group, "Dynegy, Collinsville, Illinois, 2015 - Duck Creek Existing Topography," December 1, 2015.

[15] IngenAE, "Luminant, Illinois Power Resrouces Generating, LLC, Duck Creek Power Station, December 2020 Topography," February 9, 2021.

[16] AECOM, "Initial Site Visit CCR Unit Summary, Dynegy CCR Compliance Program - Duck Creek, Duck Creek GMF Primary Pond," June 23, 2015.

[17] Stantec Consulting Services Inc., "Duck Creek Power Station, Emergency Action Plan (EAP)," April 13, 2017.

DRAWINGS



INITIAL SURVEY
12-01-2015 TOPOGRAPHY

PERIODIC SURVEY
02-09-2021 TOPOGRAPHY

0 300
SCALE IN FEET

NOTES:

1. THE INITIAL SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “DYNEGY, COLLINSVILLE, ILLINOIS, 2015 - DUCK CREEK EXISTING TOPOGRAPHY”, PREPARED BY WEAVER CONSULTANTS GROUP, DATED DECEMBER 1, 2015.
2. THE PERIODIC SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “LUMINANT, ILLINOIS POWER RESOURCES GENERATING, LLC, DUCK CREEK POWER STATION, DECEMBER 2020 TOPOGRAPHY”, PREPARED BY INGENAE, DATED FEBRUARY 9, 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.

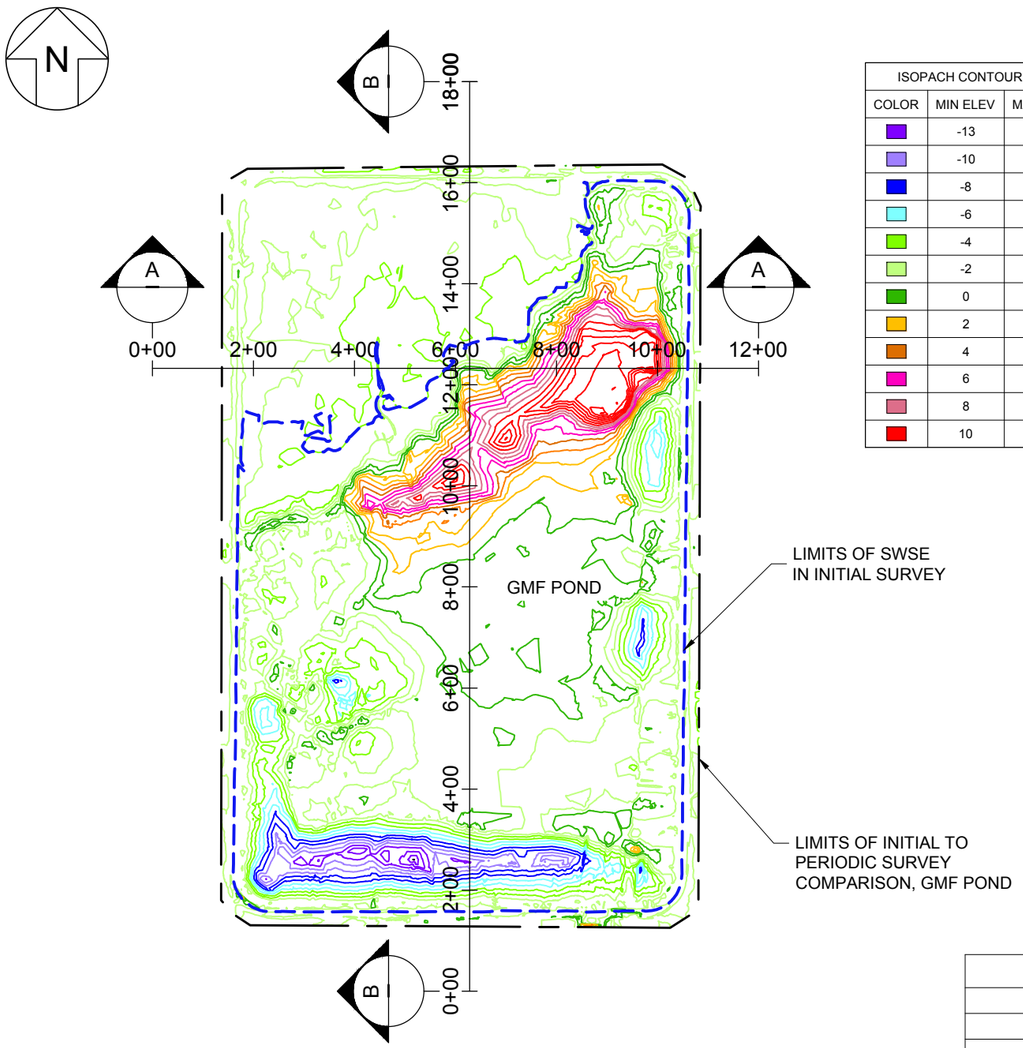
INITIAL TO PERIODIC SURVEY COMPARISON
GMF POND
DUCK CREEK POWER STATION
CANTON, ILLINOIS

Geosyntec consultants

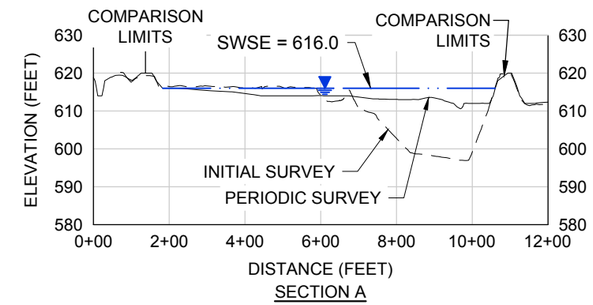
DRAWING 1

GLP8027.03 | MAY 2021

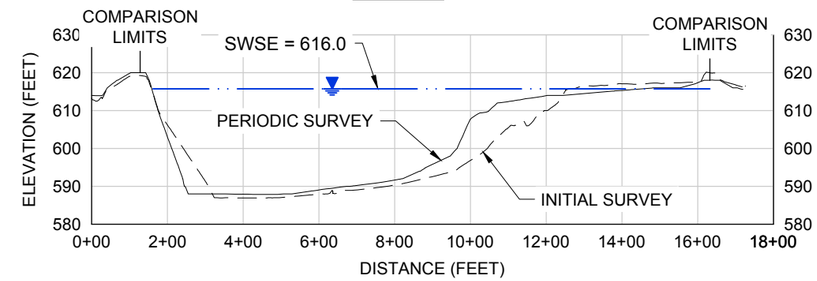
P:\CADD\PROJECTS\VVISTRA PONDS\DUCK CREEK\FIGURES\GLP802703F01 - Last Saved by: KHanavec on 5/19/21



ISOPACH CONTOUR KEY		
COLOR	MIN ELEV	MAX ELEV
	-13	-10
	-10	-8
	-8	-6
	-6	-4
	-4	-2
	-2	0
	0	2
	2	4
	4	6
	6	8
	8	10
	10	17



SECTION A



SECTION B

0 40
VERT: SCALE IN FEET

0 400
HORZ: SCALE IN FEET

INITIAL TO PERIODIC SURVEY COMPARISON SUMMARY			
SURFACE IMPOUNDMENT	CUT*	FILL*	NET (CU. YD.)*
GMF POND	54,000	62,000	8,000 (FILL)
ABOVE SWSE	10,000	1,000	9,000 (CUT)
BELOW SWSE	44,000	61,000	17,000 (FILL)

* ALL VOLUMES ROUNDED TO THE NEAREST 1,000 CY

NOTES:

1. THE INITIAL SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “DYNEGY, COLLINSVILLE, ILLINOIS, 2015 - DUCK CREEK EXISTING TOPOGRAPHY”, PREPARED BY WEAVER CONSULTANTS GROUP, DATED DECEMBER 1, 2015.
2. THE PERIODIC SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “LUMINANT, ILLINOIS POWER RESOURCES GENERATING, LLC, DUCK CREEK POWER STATION, DECEMBER 2020 TOPOGRAPHY”, PREPARED BY INGENAE, DATED FEBRUARY 9, 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 GMF POND IS EL. 616.0 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 GMF POND AT DUCK CREEK POWER STATION”, PREPARED BY AECOM, DATED OCTOBER, 2016.

0 300
SCALE IN FEET

GMF POND
DUCK CREEK POWER PLANT
CANTON, ILLINOIS

Geosyntec consultants

DRAWING 2

GLP8027.03 | AUGUST 2021

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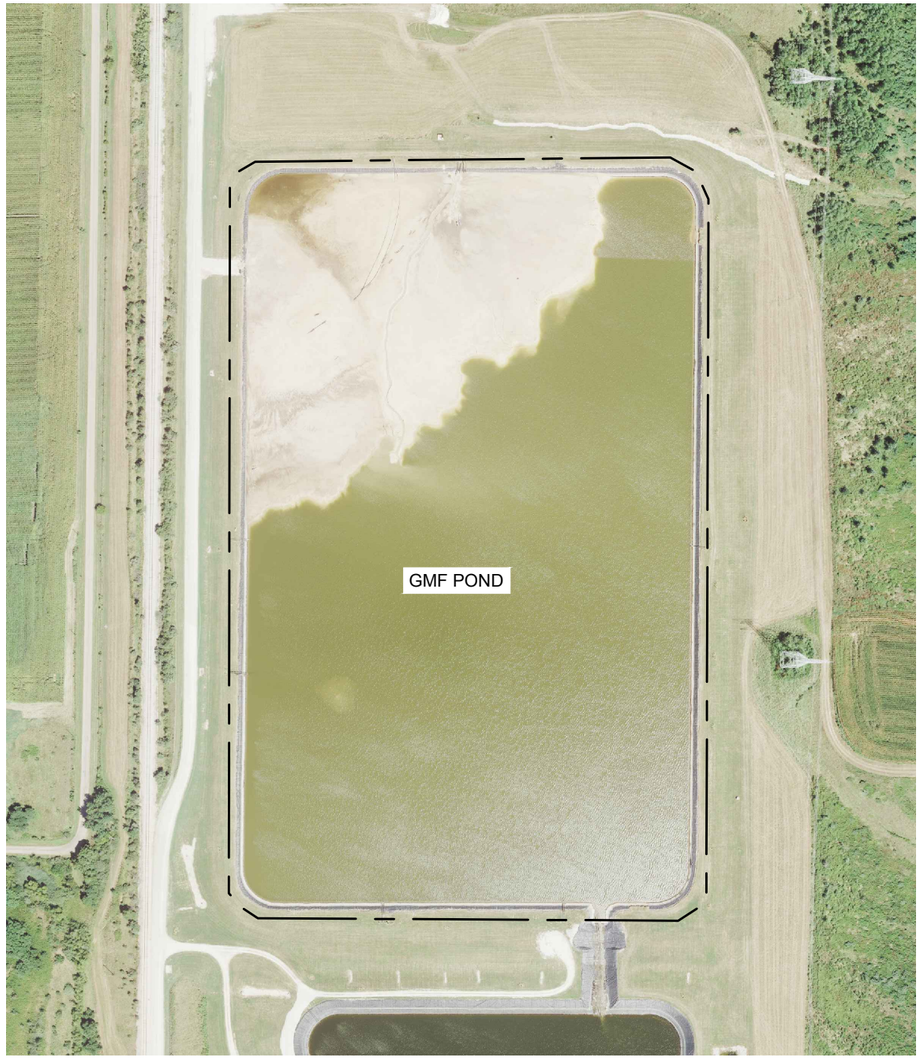


INITIAL AERIAL
12-01-2015 IMAGERY

PERIODIC AERIAL
02-09-2021 IMAGERY

0 300
SCALE IN FEET

NOTES:

1. THE INITIAL IMAGERY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “DYNEGY, COLLINSVILLE, ILLINOIS, 2015 - DUCK CREEK EXISTING TOPOGRAPHY”, PREPARED BY WEAVER CONSULTANTS GROUP, DATED DECEMBER 1, 2015.
2. THE PERIODIC IMAGERY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “LUMINANT, ILLINOIS POWER RESOURCES GENERATING, LLC, DUCK CREEK POWER STATION, DECEMBER 2020 TOPOGRAPHY”, PREPARED BY INGENAE, DATED FEBRUARY 9, 2021.

INITIAL TO PERIODIC AERIAL IMAGERY
COMPARISON
GMF POND
DUCK CREEK POWER STATION
CANTON, ILLINOIS

Geosyntec consultants

GLP8027.03 | MAY 2021

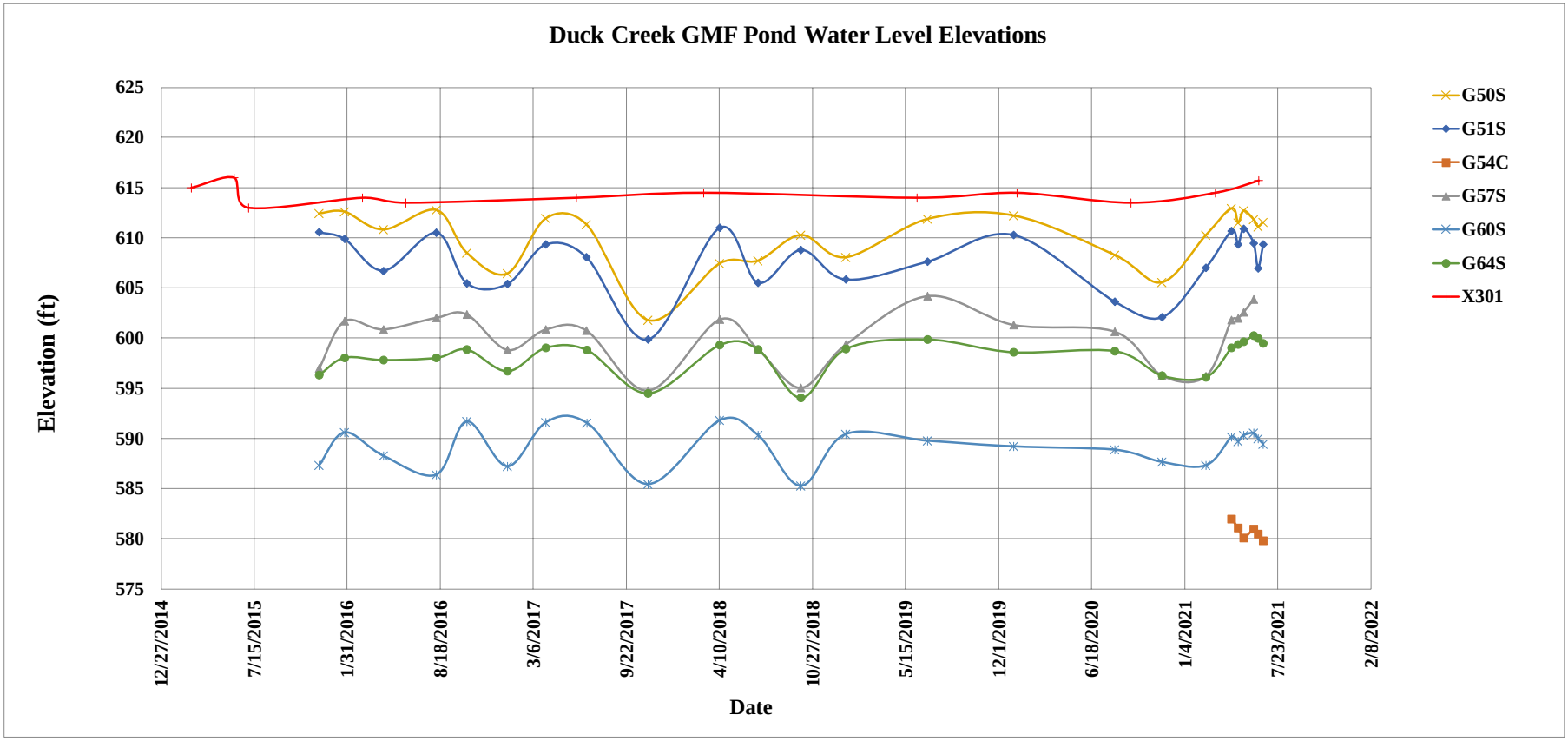
DRAWING
3

P:\CADD\PROJECTS\VISTRA PONDS\DUCK CREEK\FIGURES\GLP802703F02 - Last Saved by: KHanavec on 5/24/21

ATTACHMENTS

Attachment A

GMF Pond Piezometer Data Plots



NOTES:
1. Piezometeric data was taken from the spreadsheet titled "DC_GW_Elev_Export_Vistra_20210722", provided by the Duck Creek Power Plant.

PIEZOMETER DATA PERIODIC CERTIFICATION DUCK CREEK POWER PLANT- GMF POND FULTON, ILLINOIS		
Geosyntec consultants		Figure 1
GLP8027	7/23/2021	

Attachment B

GMF Pond Site Visit Photolog

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Illinois Power Resources Generating **Project Number:** GLP8027

CCR Unit: GMF Pond (GMFP) **Site:** Duck Creek Power Plant

Photo: 01

Date: 05/27/2021

Direction Facing: SE

Comments: GMFP north overview

Photo: 02

Date: 05/27/2021

Direction Facing: S

Comments: GMFP north overview

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Illinois Power Resources Generating **Project Number:** GLP8027

CCR Unit: GMF Pond (GMFP) **Site:** Duck Creek Power Plant

Photo: 03

Date: 05/27/2021

Direction Facing: E

Comments: GMFP north interior slope and crest.

Photo: 04

Date: 05/27/2021

Direction Facing: E

Comments: GMFP north exterior slope and crest.

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Illinois Power Resources Generating **Project Number:** GLP8027

CCR Unit: GMF Pond (GMFP) **Site:** Duck Creek Power Plant

Photo: 05

Date: 05/27/2021

Direction Facing: S

Comments: GMFP east exterior slope and crest.

Photo: 06

Date: 05/27/2021

Direction Facing: N

Comments: GMFP east exterior slope and crest.

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Illinois Power Resources Generating **Project Number:** GLP8027

CCR Unit: GMF Pond (GMFP) **Site:** Duck Creek Power Plant

Photo: 07

Date: 05/27/2021

Direction Facing: S

Comments: GMFP east interior slope and crest.

Photo: 08

Date: 05/27/2021

Direction Facing: S

Comments: GMFP east slope crest.

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Illinois Power Resources Generating **Project Number:** GLP8027

CCR Unit: GMF Pond (GMFP) **Site:** Duck Creek Power Plant

Photo: 09

Date: 05/27/2021

Direction Facing: W

Comments: GMFP south crest and transfer channel.

Photo: 10

Date: 05/27/2021

Direction Facing: W

Comments: GMFP transfer channel and weir. All stoplogs were installed.

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Illinois Power Resources Generating **Project Number:** GLP8027

CCR Unit: GMF Pond (GMFP) **Site:** Duck Creek Power Plant

Photo: 11

Date: 05/27/2021

Direction Facing: W

Comments: GMFP south dike interior slope.

Photo: 12

Date: 05/27/2021

Direction Facing: NW

Comments: GMFP southwest corner overview.

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Illinois Power Resources Generating **Project Number:** GLP8027

CCR Unit: GMF Pond (GMFP) **Site:** Duck Creek Power Plant

Photo: 13

Date: 05/27/2021

Direction Facing: W

Comments: GMFP southwest corner exterior dike overview.

Photo: 14

Date: 05/27/2021

Direction Facing: N

Comments: GMFP west dike overview.

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Illinois Power Resources Generating **Project Number:** GLP8027

CCR Unit: GMF Pond (GMFP) **Site:** Duck Creek Power Plant

Photo: 15

Date: 05/27/2021

Direction Facing: N

Comments: GMFP west interior dike overview.

Photo: 16

Date: 05/27/2021

Direction Facing: N

Comments: GMFP west exterior dike overview.

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Illinois Power Resources Generating **Project Number:** GLP8027

CCR Unit: GMF Pond (GMFP) **Site:** Duck Creek Power Plant

Photo: 17

Date: 05/27/2021

Direction Facing: N

Comments: GFMP west interior dike overview.

Photo: 18

Date: 05/27/2021

Direction Facing: N

Comments: GMFP west exterior dike overview.

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Illinois Power Resources Generating **Project Number:** GLP8027

CCR Unit: GMF Pond (GMFP) **Site:** Duck Creek Power Plant

Photo: 19

Date: 05/27/2021

Direction Facing: E

Comments: GMFP northwest corner overview.

Photo: 20

Date: 05/27/2021

Direction Facing: S

Comments: GMFP west dike overview.

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 11, 2021

Illinois Power Resources Generating, LLC
17751 North Cilco Road
Canton, Illinois 61520

Subject: Periodic History of Construction Report Update Letter
USEPA Final CCR Rule, 40 CFR §257.73(c)
Duck Creek Power Plant
Canton, Illinois

At the request of Illinois Power Resources Generating, LLC (IPRG), Geosyntec Consultants (Geosyntec) has prepared this Letter to documents updates to the Initial History of Construction (HoC) report for the Duck Creek Power Plant (DCPP), also known as the Duck Creek Power Station (DUC). 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 DCPP, which included three existing CCR surface impoundments, the GMF Pond (GMFP), Ash Pond No. 1 (AP1), and Ash Pond No. 2 (AP2), was prepared and subsequently posted to IPRG's CCR Website prior to October 17, 2016.

The CCR Rule requires that Initial HoC to be updated if there is a significant change to any information complied in the Initial HoC report, as listed below:

§ 257.73(c)(2): If there is a significant change to any information complied under paragraph (c)(1) of this section, the owner or operator of the CCR unit must update the relevant information and place it in the facility's operating record as required by § 257.105(f)(9).

IPRG retained Geosyntec to review the Initial HoC report, review reasonably and readily available information for the GMFP, AP1, and AP2 generated since the Initial HoC report was prepared, and perform a site visit to DCPP 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 GMFP, AP1, and AP2 at DCPP, as they pertain the requirements of §257.73(c)(1)(i)-(xii)

UPDATES TO HISTORY OF CONSTRUCTION REPORT

Geosyntec's evaluation for the DCPP GMFP, AP1, and AP2 determined that no known significant changes requiring updates to the information in the Initial HoC report pertaining to §257.73(c)(1)(i)-(ii), §257.73(c)(1)(iv)-(vii), §257.73(c)(1)(ix), and §257.73(c)(1)(xi)-(xii) of the CCR Rule had occurred since the Initial HoC report was developed.

However, Geosyntec's evaluation determined that significant changes at the DCPP GMFP, AP1, and AP2 pertaining to §257.73(c)(1)(iii), §257.73(c)(1)(viii), §257.73(c)(1)(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.

GMF Pond

GMFP is in operation since 2009. As of the date of this report, the GMFP has been present for approximately 12 years.

CCR placed in the GMFP is being used to store and dispose of gypsum and to clarify recycled process water for plant operations [4].

Ash Pond No. 1

AP1 was in operation from 1976 until November 2015, for a total of approximately 39 years.

CCR placed in AP1 was used to store and dispose of fly ash and bottom ash [4].

Ash Pond No. 2

AP2 was in operation from 1986 until November 2015, for a total of approximately 35 years.

CCR placed in AP2 was used to store and dispose of fly ash and bottom ash and to clarify CCR contact stormwater prior to discharge.

§257.73(c)(1)(i): The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.

The state identification numbers (ID) for the GMFP, AP1 and AP2 have been assigned by the Illinois Environmental Protection Agency (IEPA). The IDs are listed in **Table 1**.

Table 1 – IEPA ID Numbers

CCR Surface Impoundment		State ID
Ash Pond No. 1		W0578010001-01
Ash Pond No. 2		W0578010001-02
GMF Pond		W0578010001-04

§ 257.73(c)(1)(iii): A statement of the purpose for which the CCR unit is being used.

AP1 and AP2 were closed in 2021, in substantial compliance with the written closure plans posted to IPRG's CCR Website ([5], [6]), and as documented by a certified Notification of Completion of Closure posted to IPRG's CCR Website [7]. Therefore, AP1 and AP2 are no longer capable of storing CCR or free liquids.

The DCPP was retired in December of 2019, with the generation of electricity ceased at that time. Therefore, the GMFP is no longer being used to storge and disposed of gypsum or to clarify recycled process water for use in plant operations, as gypsum is no longer being generated and process water is no longer required by the DCPP.

§ 257.73(c)(1)(viii): A description of the type, purpose, and location of existing instrumentation.

Instrumentation monitoring at AP1 and AP2 is no longer required as both CCR surface impoundments were closed in accordance with §257.102 [7], and the instrumentation

network was modified at that time. Therefore, the instrumentation locations shown in Appendix C of the Initial HoC report are no longer applicable to AP1 and AP2.

§ 257.73(c)(1)(x): A description of each spillway and diversion design features and capacities and calculations used in their determination.

AP1 and AP2 no longer retain free water as both CCR surface impoundments were closed in 2021 [7]. Therefore, spillways are no longer present the information regarding the spillways of these structures, as presented in the Initial HoC report, is no longer applicable to AP1 and AP2.

CLOSING

This letter has been prepared to document Geosyntec's evaluation of changes that have occurred at the GMFP, AP1, and AP2 at the DCPP since the Initial HoC was developed, based on reasonably and readily available information provided by IPRG, observed by Geosyntec during the site visit, or generated by Geosyntec as part of subsequent calculations.

Sincerely,

Lucas P. Carr, 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), Duck Creek Power Station, Canton, Illinois," October 2016.

[2] United Stated Environmental Protection Agency, "40 CFR Parts 257 and 261, Hazardous and Solid Waste Management System, Disposal of Coal Combustion Residuals from Electric Utilities, Final Rule, 2015," 2015.

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

[4] AECOM, "History of Construction, USEPA Final CCR Rule, 40 CFR § 257.73(c), Hennepin Power Station, Hennepin, Illinois," October 2016.

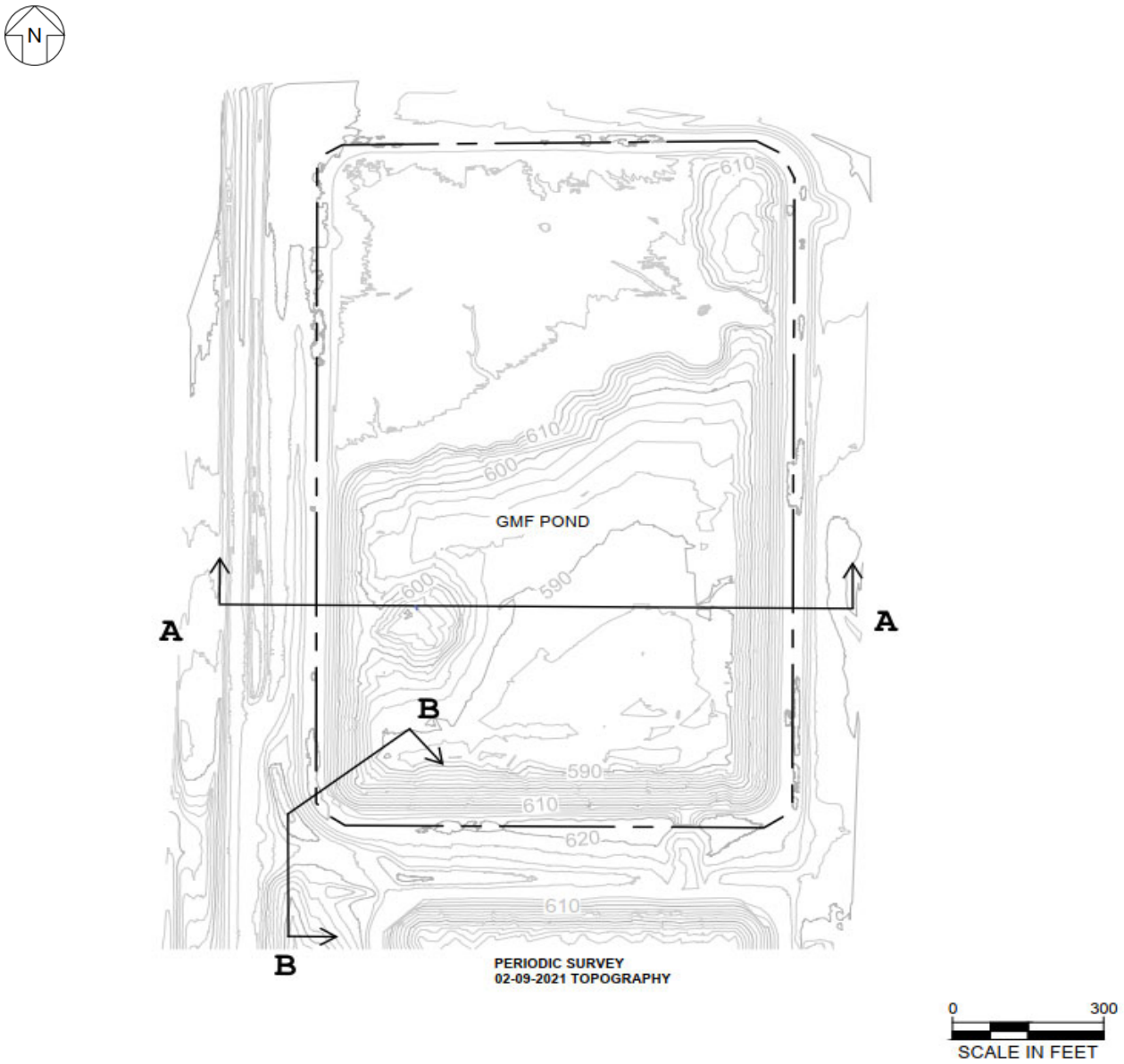
[5] V. Modeer, "Closure Plan for Existing CCR Sruface Impoundment, 40 CFR 257.102(b), Duck Creek Power Station, Illinois Power Resoruces Generation, LLC, Ash Pond No. 1," December 17, 2020.

[6] V. Modeer, "Closure Plan for Existing CCR Surface Impoundment, 40 CFR 257.102(b), Duck Creek Power Station, Illinois Power Resoruces Generating, LLC, Ash Pond No. 2," December 17, 2020.

[7] D. Tickner, "Duck Creek Power Station; Ash Pond No.1 and No. 2, Notificaiton of Completion of Closure," Luminant, Collinsville, Illinois, January 22, 2021.

Attachment D

Periodic Structural Stability and Safety Factor Assessment Analyses



NOTES:

1. The cross-sections are shown on the periodic topography of GMF Pond, prepared by IngenAE, dated February 9, 2021.
2. A-A is the cross-section used in the 2016 AECOM initial SFA & SSA and cross-section B-B is the 2021 Geosyntec updated periodic SFA.

CROSS-SECTION LOCATIONS
PERIODIC CERTIFICATION
DUCK CREEK POWER PLANT- GMF POND
FULTON, ILLINOIS

Geosyntec consultants

Figure D-1

GLP8027 | 8/25/2021

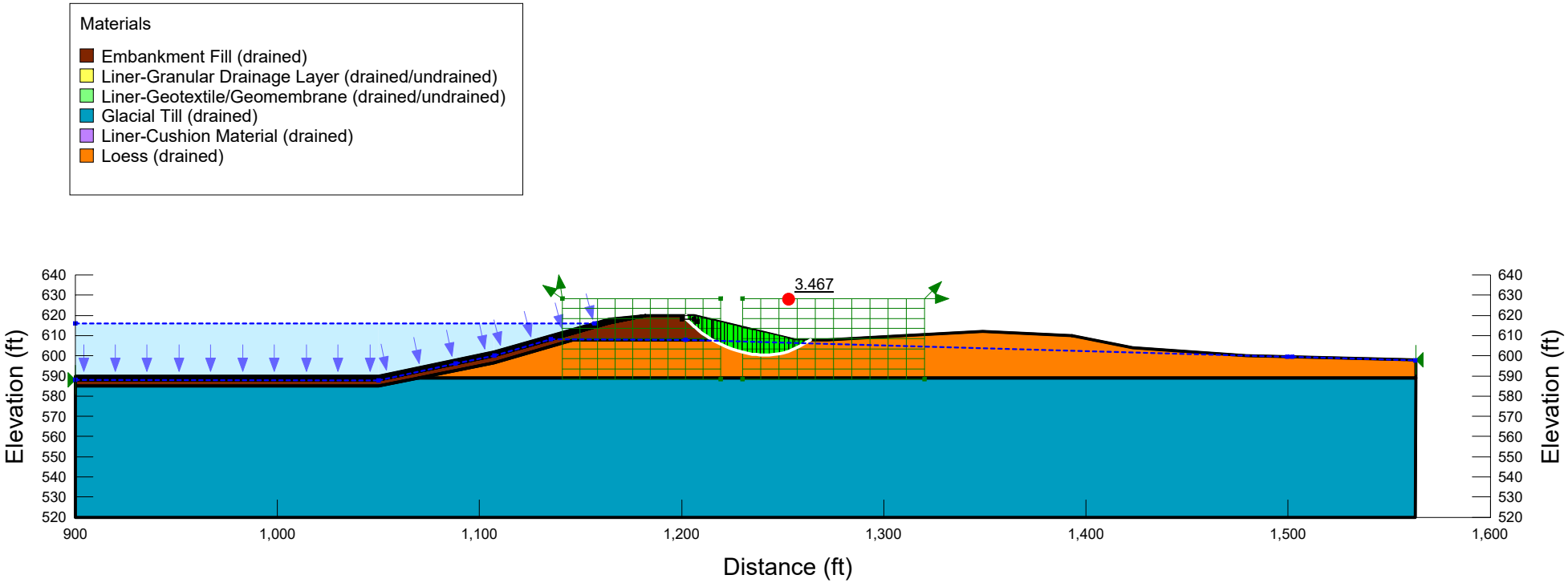
\\STLOUISMO-01\Data\Company\Projects_post_2014\GLP8027_CCR_ReCert\500_Technical\503_DUC\503d_Periodic_Report\GMF\Revised SFA New Section_2021\DUC_GMF_New Section_20210824.kbl[Pin12]

Dynegy CCR Program - Duck Creek Power Plant
GMF Pond Section B-B
Canton, Illinois

Drawn by: PK Date: 8/25/2021
Checked by: LPC Date: 8/25/2021

Name: Static, Long-Term, Block Failure Surface

Name: Embankment Fill (drained) Unit Weight: 116 pcf Cohesion': 150 psf Phi': 32 °
Name: Liner-Granular Drainage Layer (drained/undrained) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 33 °
Name: Liner-Geotextile/Geomembrane (drained/undrained) Unit Weight: 75 pcf Cohesion': 100 psf Phi': 25 °
Name: Glacial Till (drained) Unit Weight: 125 pcf Cohesion': 200 psf Phi': 30 °
Name: Liner-Cushion Material (drained) Unit Weight: 116 pcf Cohesion': 0 psf Phi': 38 °
Name: Loess (drained) Unit Weight: 116 pcf Cohesion': 100 psf Phi': 32 °



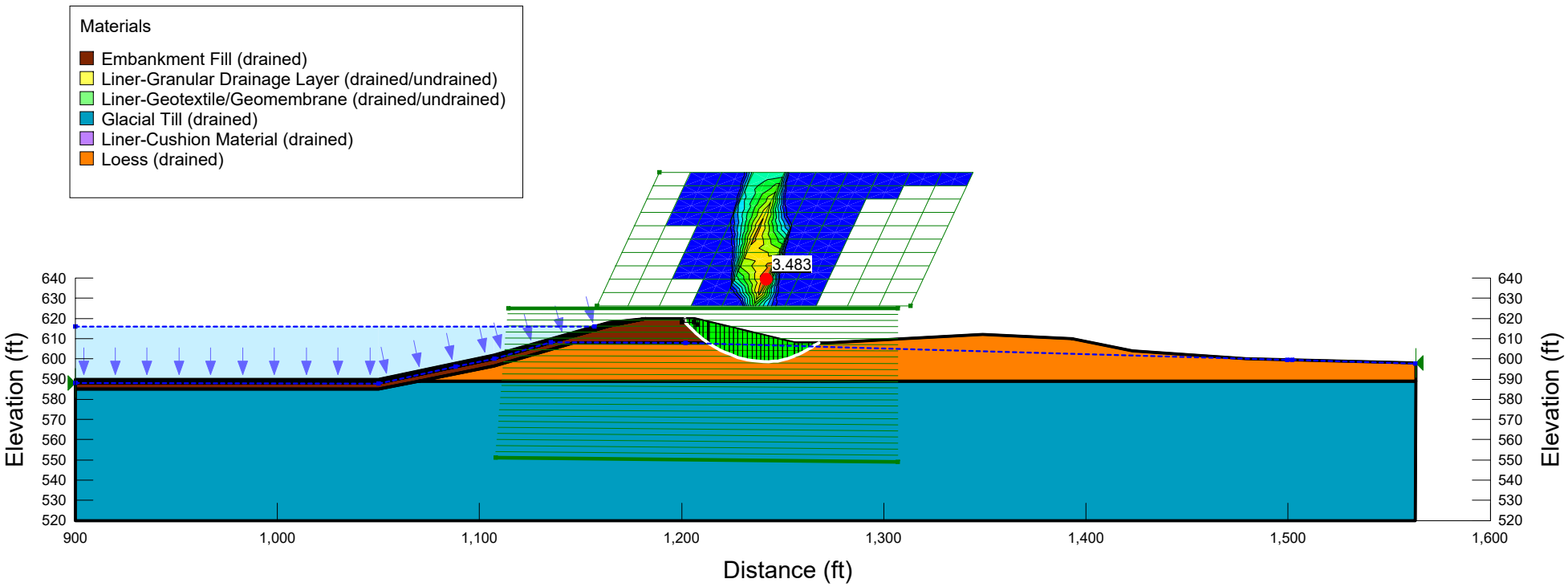
\\STLOUISMO-01\Data\Company\Projects_post_2014\GLP8027_CCR_ReCert\500_Technical\503_DUC\503d_Periodic_Report\GMF\Revised SFA\New Section_2021\GMF_PK_20210805_v2.gsz

Dynegy CCR Program - Duck Creek Power Plant
GMF Pond Section B-B
Canton, Illinois

Drawn by: PK Date: 8/25/2021
Checked by: LPC Date: 8/25/2021

Name: Static, Long-Term, Circular Failure Surface

Name: Embankment Fill (drained) Unit Weight: 116 pcf Cohesion': 150 psf Phi': 32 °
Name: Liner-Granular Drainage Layer (drained/undrained) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 33 °
Name: Liner-Geotextile/Geomembrane (drained/undrained) Unit Weight: 75 pcf Cohesion': 100 psf Phi': 25 °
Name: Glacial Till (drained) Unit Weight: 125 pcf Cohesion': 200 psf Phi': 30 °
Name: Liner-Cushion Material (drained) Unit Weight: 116 pcf Cohesion': 0 psf Phi': 38 °
Name: Loess (drained) Unit Weight: 116 pcf Cohesion': 100 psf Phi': 32 °



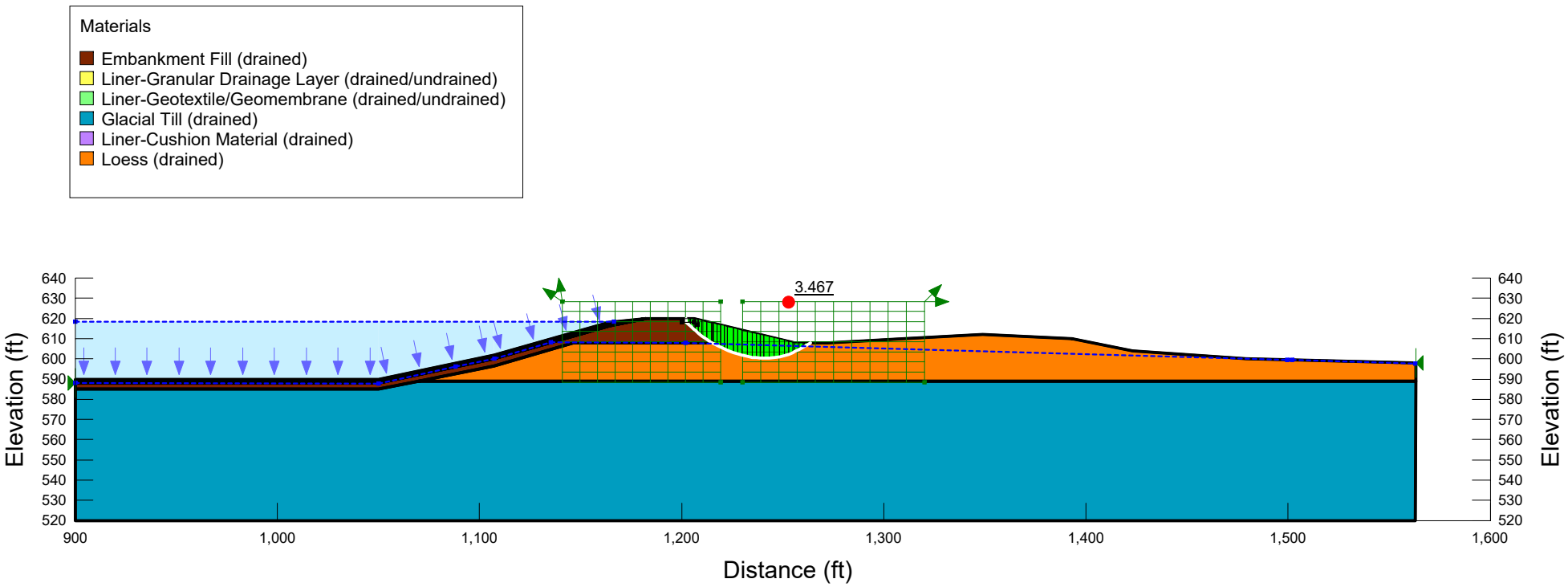
\\STLOUISMO-01\Data\Company\Projects_post_2014\GLP8027_CCR_ReCert\500_Technical\503_DUC\503d_Periodic_Report\GMF\Revised SFA\New Section_2021\GMF_PK_20210805_v2.gsz

Dynegy CCR Program - Duck Creek Power Plant
GMF Pond Section B-B
Canton, Illinois

Drawn by: PK Date: 8/25/2021
Checked by: LPC Date: 8/25/2021

Name: Static, Surchage Pool, Block Failure Surface

Name: Embankment Fill (drained) Unit Weight: 116 pcf Cohesion': 150 psf Phi': 32 °
Name: Liner-Granular Drainage Layer (drained/undrained) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 33 °
Name: Liner-Geotextile/Geomembrane (drained/undrained) Unit Weight: 75 pcf Cohesion': 100 psf Phi': 25 °
Name: Glacial Till (drained) Unit Weight: 125 pcf Cohesion': 200 psf Phi': 30 °
Name: Liner-Cushion Material (drained) Unit Weight: 116 pcf Cohesion': 0 psf Phi': 38 °
Name: Loess (drained) Unit Weight: 116 pcf Cohesion': 100 psf Phi': 32 °



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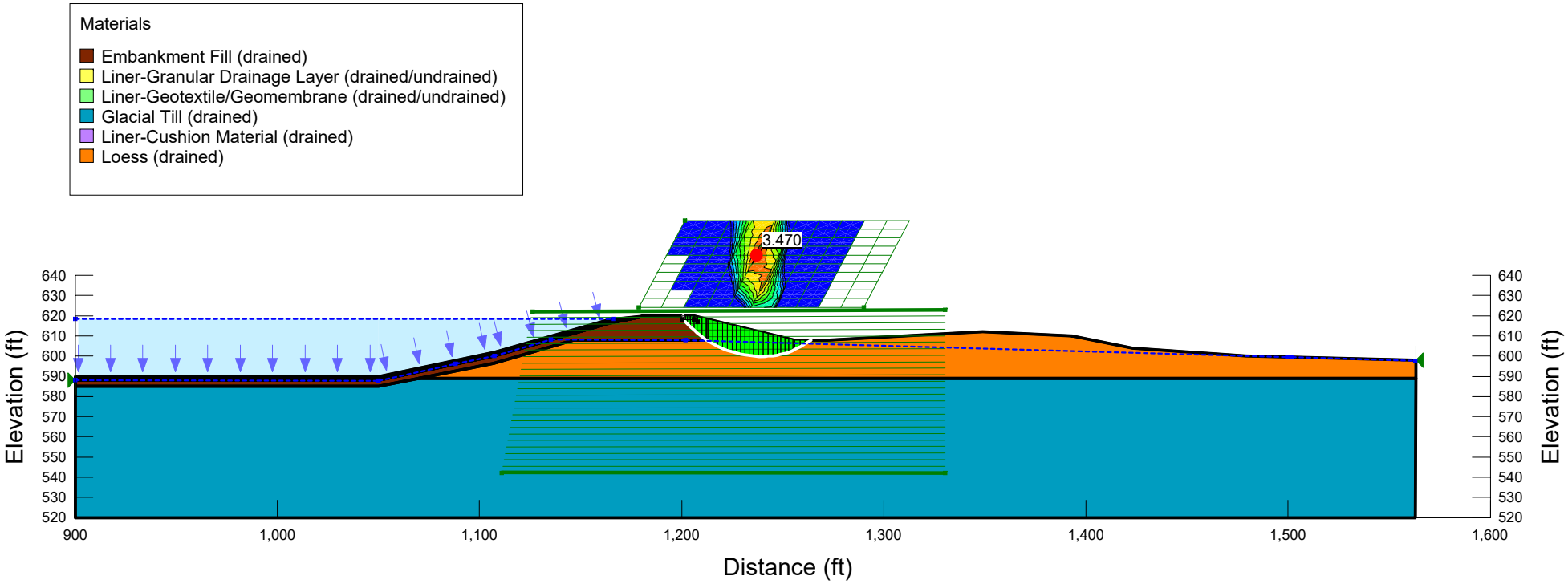
Dynegy CCR Program - Duck Creek Power Plant
GMF Pond Section B-B
Canton, Illinois

Drawn by: PK Date: 8/25/2021
Checked by: LPC Date: 8/25/2021

Name: Static, Surcharge Pool, Circular Failure Surface

Name: Embankment Fill (drained) Unit Weight: 116 pcf Cohesion': 150 psf Phi': 32 °
Name: Liner-Granular Drainage Layer (drained/undrained) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 33 °
Name: Liner-Geotextile/Geomembrane (drained/undrained) Unit Weight: 75 pcf Cohesion': 100 psf Phi': 25 °
Name: Glacial Till (drained) Unit Weight: 125 pcf Cohesion': 200 psf Phi': 30 °
Name: Liner-Cushion Material (drained) Unit Weight: 116 pcf Cohesion': 0 psf Phi': 38 °
Name: Loess (drained) Unit Weight: 116 pcf Cohesion': 100 psf Phi': 32 °



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Dynegy CCR Program - Duck Creek Power Plant
GMF Pond Section B-B
Canton, Illinois

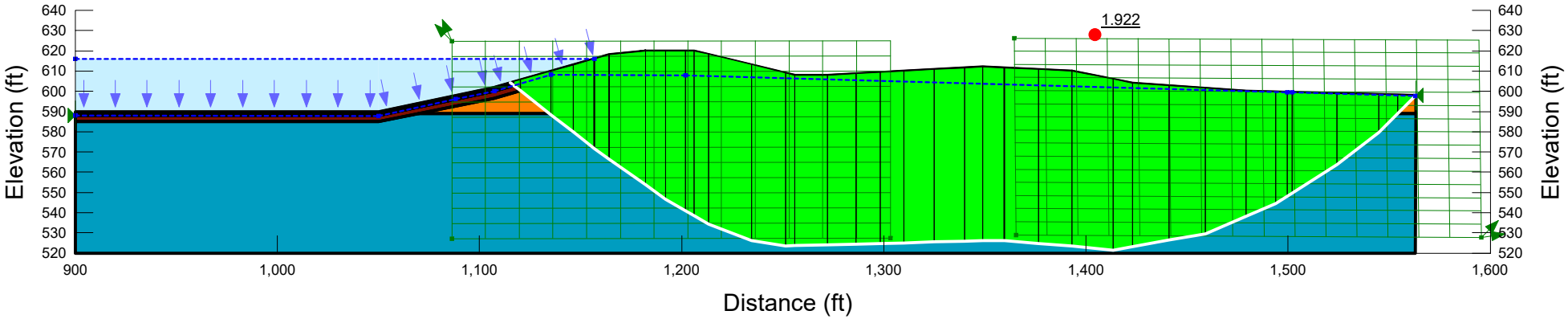
Drawn by: PK Date: 8/25/2021
Checked by: LPC Date: 8/25/2021

Name: Seismic, Block Failure Surface

Name: Liner-Granular Drainage Layer (drained/undrained) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 33 °
Name: Liner-Geotextile/Geomembrane (drained/undrained) Unit Weight: 75 pcf Cohesion': 100 psf Phi': 25 °
Name: Liner-Cushion Material (undrained) Unit Weight: 116 pcf Cohesion': 660 psf Phi': 0 °
Name: Embankment Fill (undrained) Unit Weight: 116 pcf Cohesion': 2,150 psf Phi': 0 °
Name: Glacial Till (undrained) Unit Weight: 125 pcf Cohesion': 1,900 psf Phi': 0 °
Name: Loess (undrained) Unit Weight: 116 pcf Cohesion': 1,250 psf Phi': 0 °

Horz Seismic Coef.: 0.116 g

Materials
- Liner-Granular Drainage Layer (drained/undrained)
- Liner-Geotextile/Geomembrane (drained/undrained)
- Liner-Cushion Material (undrained)
- Embankment Fill (undrained)
- Glacial Till (undrained)
- Loess (undrained)



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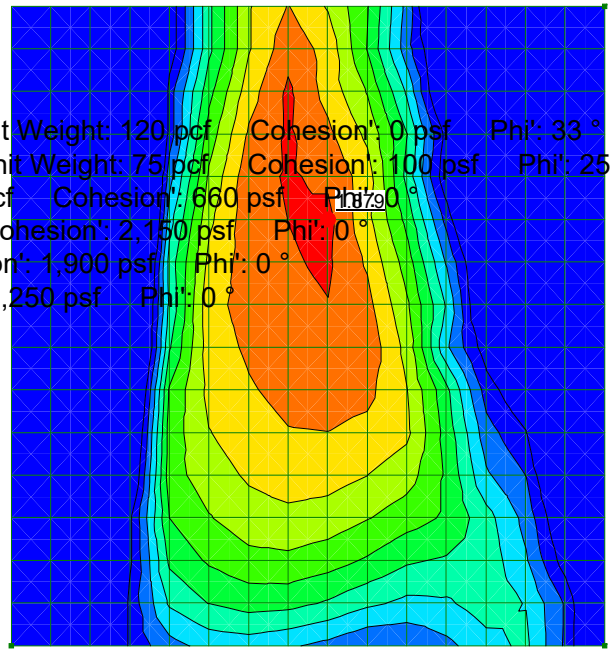
Dynegy CCR Program - Duck Creek Power Plant
GMF Pond Section B-B
Canton, Illinois

Drawn by: PK Date: 8/25/2021
Checked by: LPC Date: 8/25/2021

Name: Seismic, Circular Failure Surface

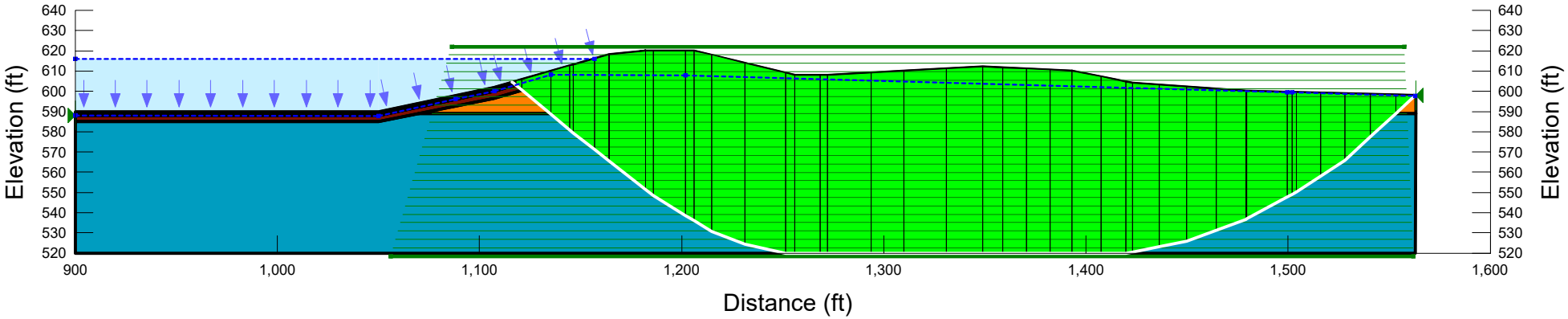
Name: Liner-Granular Drainage Layer (drained/undrained) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 33 °
Name: Liner-Geotextile/Geomembrane (drained/undrained) Unit Weight: 75 pcf Cohesion': 100 psf Phi': 25 °
Name: Liner-Cushion Material (undrained) Unit Weight: 116 pcf Cohesion': 660 psf Phi': 0 °
Name: Embankment Fill (undrained) Unit Weight: 116 pcf Cohesion': 2,150 psf Phi': 0 °
Name: Glacial Till (undrained) Unit Weight: 125 pcf Cohesion': 1,900 psf Phi': 0 °
Name: Loess (undrained) Unit Weight: 116 pcf Cohesion': 1,250 psf Phi': 0 °

Horz Seismic Coef.: 0.116 g



Materials

- Liner-Granular Drainage Layer (drained/undrained)
- Liner-Geotextile/Geomembrane (drained/undrained)
- Liner-Cushion Material (undrained)
- Embankment Fill (undrained)
- Glacial Till (undrained)
- Loess (undrained)



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Dynegy CCR Program - Duck Creek Power Plant
GMF Pond Section B-B
Canton, Illinois

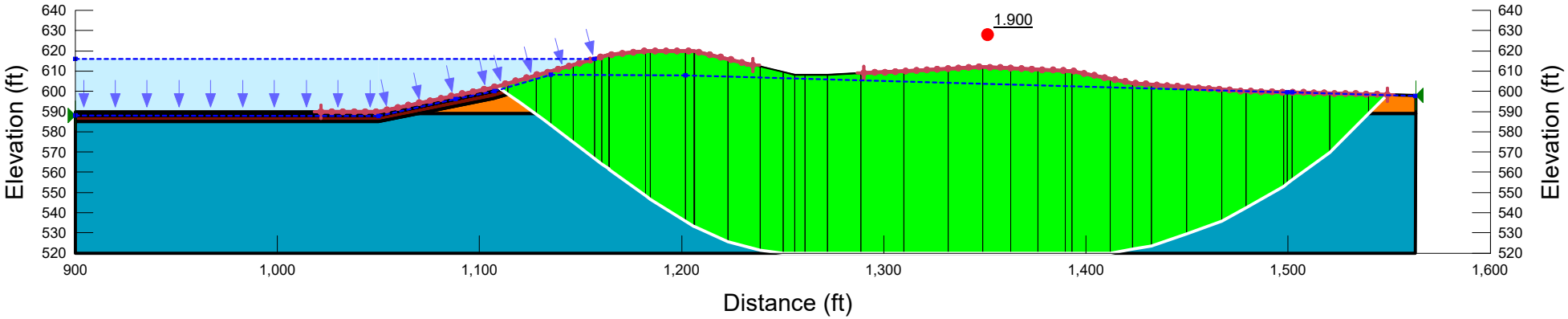
Drawn by: PK Date: 8/25/2021
Checked by: LPC Date: 8/25/2021

Name: Seismic, Entry-Exit Failure Surface

Name: Liner-Granular Drainage Layer (drained/undrained) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 33 °
Name: Liner-Geotextile/Geomembrane (drained/undrained) Unit Weight: 75 pcf Cohesion': 100 psf Phi': 25 °
Name: Liner-Cushion Material (undrained) Unit Weight: 116 pcf Cohesion': 660 psf Phi': 0 °
Name: Embankment Fill (undrained) Unit Weight: 116 pcf Cohesion': 2,150 psf Phi': 0 °
Name: Glacial Till (undrained) Unit Weight: 125 pcf Cohesion': 1,900 psf Phi': 0 °
Name: Loess (undrained) Unit Weight: 116 pcf Cohesion': 1,250 psf Phi': 0 °

Horz Seismic Coef.: 0.116 g

Materials
- Liner-Granular Drainage Layer (drained/undrained)
- Liner-Geotextile/Geomembrane (drained/undrained)
- Liner-Cushion Material (undrained)
- Embankment Fill (undrained)
- Glacial Till (undrained)
- Loess (undrained)



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October 2021