Luminant

Dynegy Midwest Generation, 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: Hennepin Power Plant Ash Pond No. 2 and No. 4; IEPA ID W1550100002-04, 07

Dear Mr. LeCrone:

In accordance with 35 I.A.C. § 845.200, Dynegy Midwest Generation, LLC (DMG) is submitting an operating permit application for the Hennepin Power Plant Ash Pond No.2 and No.4 (IEPA ID W1550100002-04, 07). 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 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

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

INITIAL OPERATING PERMIT

HENNEPIN ASH PONDS No.2 and No.4

Prepared by

BURNS McDONNELL

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

October 25, 2021

ATTACHMENTS

Attachment A	Legal Description
Attachment B	History of Construction (845.220)
Attachment E	Permanent Markers (845.130)
Attachment H	Hydrogeologic Site Characterization (845.620)
Attachment I	Groundwater Sampling and Analysis Program (845.640)
Attachment J	Slope Maintenance (845.320)
Attachment K	Post Closure Care Plan (845.780)
Attachment M	History of Known Groundwater Exceedances (845.600)
Attachment N	Financial Assurance Requirements (845.900)

1. INTRODUCTION

Dynegy Midwest Generation, LLC (DMG) is operator of the inactive coal-fired Hennepin Power Plant (Plant) located in Putnam County near Hennepin, Illinois. The IEPA assigned identification number assigned to the Hennepin Ash Ponds No. 2 and No.4 is: W1550100002-04,07. The National Inventory of Dams (NID) number assigned for the Hennepin Ash Ponds No.2 and No.4 by the Illinois Department of Natural Resources (IDNR) is IL50663.

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 Ash Ponds No.2 and No.4.

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:	Hennepin Ash Ponds No.2 and No.4 Hennepin Power Plant 13498 East 800th Street Hennepin, IL 61327
Owner/Operator:	Dynegy Midwest Generation, 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 Hennepin 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 Dynegy Midwest Generation, LLC can be found in 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.

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.

No previous assessments are included in the Hennepin Ash Ponds No.2 and No.4 permit application.

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

No previous assessments are included in the Hennepin Ash Ponds No.2 and No.4 permit application.

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

No post-closure care plan 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 Hennepin Ash Ponds No.2 and No.4 is defined by the IEPA as closed inactive CCR surface impoundments that have not completed post-closure care. Per Part 845, DMG is submitting an initial operating permit application to IEPA by October 31, 2021. The permit applications (CCR-1 and CCR-2OE) 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.

2.3. 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 Hennepin Ash Ponds No.2 and No.4 as required by Section 845.130 is provided in Attachment E.

2.4. 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 Hennepin Ash Ponds No.2 and No.4 are not incised. Documentation of slope protection as required by Section 845.430 is provided in Attachment J.

2.5. Groundwater Monitoring

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

The groundwater monitoring information for the Hennepin Ash Ponds No.2 and No.4 are described in the following sections.

> <u>Section 845.230(d)(2)(I)(i):</u> *Hydrogeologic site characterization (see Section 845.620);*

Hydrogeologic site characterization for the Hennepin Ash Ponds No.2 and No.4 are provided in Attachment H.

> <u>Section 845.230(d)(2)(I)(ii):</u> *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.

> <u>Section 845.230(d)(2)(I)(iii):</u> *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.

> <u>Section 845.230(d)(2)(I)(iv):</u> *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.

2.6. Initial Post-Closure Care Plan

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

The Hennepin Ash Ponds No.2 and No.4 were closed 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.

2.7. History of Groundwater Exceedances

> <u>Section 845.230(d)(2)(M):</u> *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.

2.8. Financial Assurance Requirements

<u>Section 845.230(d)(2)(N):</u> 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.

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-2OE) 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: W1550100002-04, 07 **CCR Permit Number:** Initial Permit **Facility Name:** Hennepin 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		
	Hennepin 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 13498 East 800th Street		
	County name Putnam	County code (if known)	
	City or town Hennepin	State Illinois	Zip Code 61327
1.6	Name of Owner/Operator		
	Dynegy Midwest Generation, LLC		

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

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

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

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

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

SECTION 4: IMPOUNDMENT IDENTIFICATION

Impoundment Identification			
4.1	List all the impoundment identification numbers for your facility and check the corresponding box to indicate that you have attached a written description for each impoundment.		
	W1550100002-04 (see Attachment A)	☑	Attached written description
	W1550100002-07(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

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 2OE

Illinois Environmental Protection Agency

CCR Surface Impoundment Permit Application

Form CCR 2OE – Initial Operating Permit for Existing or Inactive CCR Surface Impoundment Where an Agency-approved Closure Has Been Completed Before July 30, 2021

Bureau of Water ID Number:

W1550100002-04, 07

CCR Permit Number:

Initial Permit

Initial Permit

Facility Name:

Hennepin Power Plant

Initial Permit

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.	
	Ash Pond No.2 and No.4	
1.2	Identification number of the CCR surface impoundment (if one has been assigned by the Agency).	
	W1550100002 - 04, 07	
1.3	Describe the boundaries of the CCR surface impoundment (35 Ill. Adm. Code 845.210 (c)).	
	See Attachment A	
1.4	State the purpose for which the CCR surface impoundment is being used.	
	See Attachment 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	
1.7	List the name of the watershed within which the CCR surface impoundment is located.	
	See Attachment B	
1.8	What is the size in acres of the watershed within which the CCR surface impoundment is located?	
	See Attachment B	
1.9	Check the corresponding boxes to indicate that you have attached the following:	
	✔	A description of the physical and engineering properties of the foundation and abutment materials on which the CCR surface impoundment is constructed.

Construction History		☑	A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR surface impoundment.
		☑	A statement of the method of site preparation and construction of each zone of the CCR surface impoundment.
		☑	A statement of the approximate dates of construction of each successive stage of construction of the CCR surface impoundment.
		☑	Drawings satisfying the requirements of 35 Ill. Adm. Code 845.220(a)(1)(F).
		☑	A description of the type, purpose, and location of existing instrumentation.
		☑	Area Capacity Curves for the CCR Impoundment.
		☑	A description of each spillway and diversion design features and capacities and provide the calculations used in their determination.
		☑	The construction specifications and provisions for surveillance, maintenance, and repair of the CCR surface impoundment.
	1.10.1	Is there any record or knowledge of structural instability of the CCR surface impoundment?	
		☐ Yes	☑ No
	1.10.2	If you answered yes to Item 1.10.1, provide detailed explanation of the structural instability.	

SECTION 2: ATTACHMENTS

Attachments	2.1	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 demonstrating 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.
		☐	Emergency Action Plan and accompanying certification required by 35 Ill. Adm. Code 845.520(e).
		☑	Written post-closure care plan, if applicable (see 35 Ill. Adm. Code 845.780(d)).
		☑	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.

SECTION 3: GROUNDWATER MONITORING

	3.1	Check the corresponding boxes to indicate whether you have attached the following groundwater monitoring information:	
		☑	A hydrogeologic site characterization meeting the requirements of 35 Ill. Adm. Code 845.620.

Groundwater		✔	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).

ATTACHMENT A

RESTRICTIVE USE AREA BOUNDARY CORNERS SET				
Point #	Northing	Easting	Elevation	Description
1006	1688871.73	2532765.64	485.11	SET I.P.
1007	1689359.80	2532369.84	461.03	SET I.P.
1008	1689379.32	2531787.93	469.12	SET I.P.
1009	1689729.20	2531512.98	465.44	SET I.P.
1010	1690054.43	2531932.43	465.88	SET I.P.
1011	1690304.29	2531993.85	444.20	SET I.P.
1012	1690614.71	2533053.27	449.90	SET I.P.
1013	1689896.08	2533261.65	497.75	SET I.P.
1014	1689723.50	2532799.73	495.69	SET I.P.
1015	1689102.71	2533256.07	499.11	SET I.P.
1016	1688913.96	2532999.05	494.63	SET I.P.

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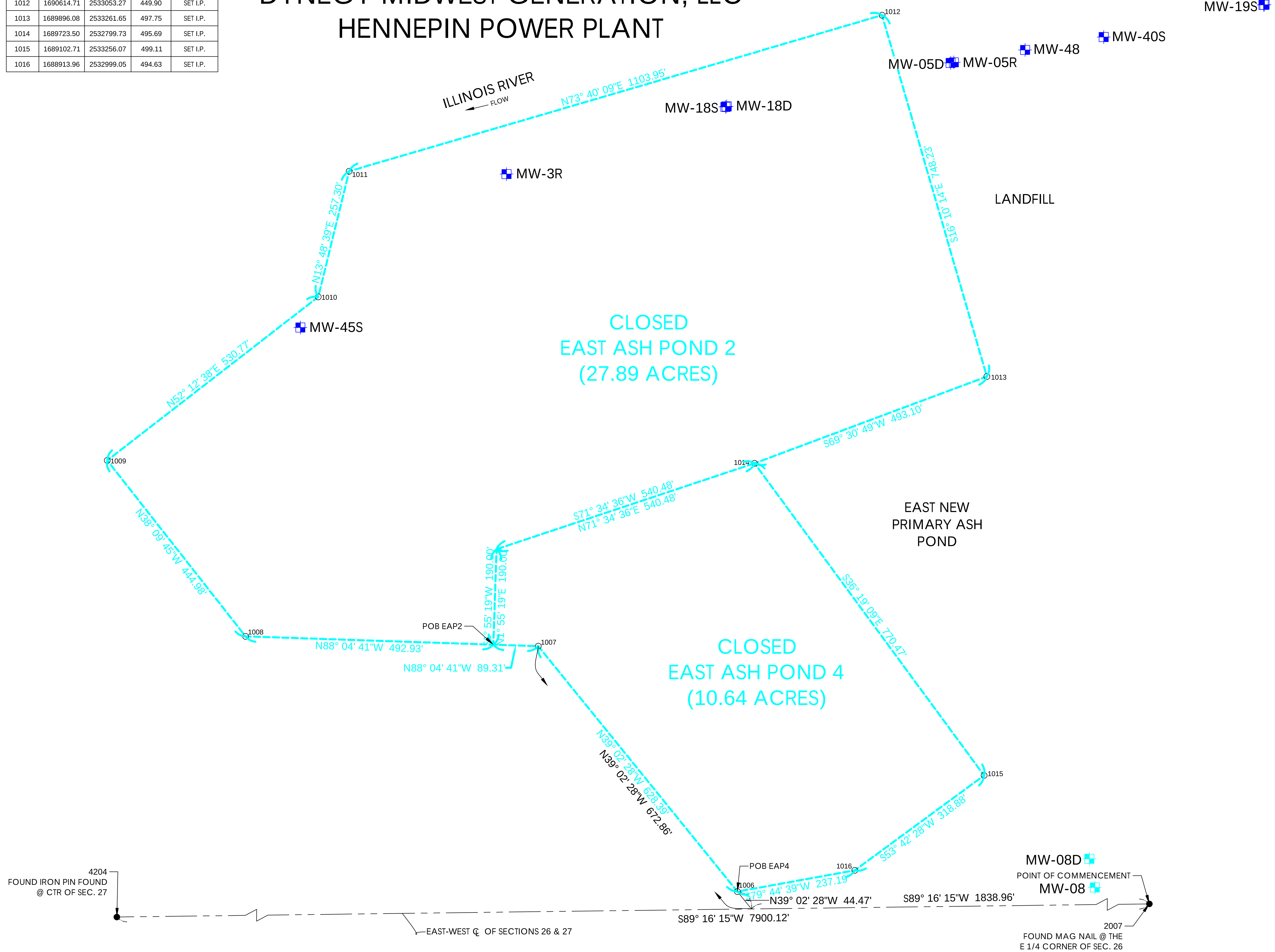
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER PLANT



N

0' 100' 200'

LEGEND

- *SECTION LINE*
- *RESTRICTED USE BOUNDARY*
- *FOUND SURVEY MARKER AS NOTED*
- *SET 5/8" IRON REBAR (UNLESS OTHERWISE NOTED)*
- *DOWNGRADIENT WELL*
- *UPGRADIENT WELL*

SURVEY NOTE:
THIS DRAWING AND THE INFORMATION SHOWN HERE ON WAS OBTAINED FROM DATA COLLECTED FROM A FIELD SURVEY MADE BY INGENAE, LLC BETWEEN FEBRUARY 12 THROUGH JULY 21, 2021. SURVEY COORDINATES, BEARINGS & DISTANCES ARE REFERENCED TO ILLINOIS WEST 1202 STATE PLANE COORDINATE SYSTEM NAD 1983.

CONTROL CORNERS AND WELLS				
POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
2007	1688860.60	2534632.47	526.23	FOUND MAG NAIL
2026	1687419.25	2526768.08	448.87	BRASS PLUG IN PVC CONCRETE MONUMENT
4204	1688760.04	2526732.99	443.25	FOUND IRON PIN
2047	1688936.86	2533465.34	499.19	MW-08D GROUND
2048	1688879.98	2533476.29	499.12	MW-08 GROUND
2049	1690635.53	2533813.65	484.09	MW-19D GROUND
2050	1690635.30	2533811.64	484.18	MW-19S GROUND
2051	1690571.19	2533493.89	484.77	MW-40S GROUND
2052	1690545.60	2533337.61	485.17	MW-48 GROUND
2053	1690520.89	2533196.01	485.85	MW-05R GROUND
2054	1690519.70	2533189.57	485.78	MW-05D GROUND
2055	1690433.28	2532744.49	484.90	MW-18D GROUND
2056	1690432.29	2532742.00	484.87	MW-18S GROUND
2057	1690298.67	2532306.75	479.59	MW-3R GROUND
2058	1689993.57	2531896.91	465.47	MW-45S GROUND

Land Description of the Hennepin Power Plant
Closed East Ash Pond 4 Restricted Use Area
10.64 Acres

Part of the North Half of Section 26 Township 33 North, Range 2 West of the Third Principal Meridian, Putnam County, Illinois being more particularly described as follows:

Commencing at the found Magnetic Nail at the East Quarter Corner of Section 26, from which bears an Iron Pin at the Center of Section 27, South 89 degrees 16 minutes 15 seconds West a distance of 7900.12 feet; thence from said commencement point at the East Quarter Corner of Section 26, South 89 degrees 16 minutes 15 seconds West a distance of 1838.96 feet; thence North 39 degrees 02 minutes 28 seconds West a distance of 44.47 feet to the Point of Beginning of the Tract described herein; thence continuing North 39 degrees 02 minutes 28 seconds West a distance of 628.39 feet; thence North 88 degrees 04 minutes 41 seconds West a distance of 89.31 feet; thence North 01 degrees 55 minutes 19 seconds East a distance of 190.00 feet; thence North 71 degrees 34 minutes 36 seconds East a distance of 540.48 feet; thence South 36 degrees 19 minutes 09 seconds East a distance of 770.47 feet; thence South 53 degrees 42 minutes 28 seconds West a distance of 318.88 feet; thence South 79 degrees 44 minutes 39 seconds West a distance of 237.19 feet to the Point of Beginning and containing 10.64 Acres.

Land Description of the Hennepin Power Plant
Closed East Ash Pond 2 Restricted Use Area
27.89 Acres

Part of the North Half of Section 26 Township 33 North, Range 2 West of the Third Principal Meridian, Putnam County, Illinois being more particularly described as follows:

Commencing at the found Magnetic Nail at the East Quarter Corner of Section 26, from which bears an Iron Pin at the Center of Section 27, South 89 degrees 16 minutes 15 seconds West a distance of 7900.12 feet; thence from said commencement point at the East Quarter Corner of Section 26, South 89 degrees 16 minutes 15 seconds West a distance of 1838.96 feet; thence North 39 degrees 02 minutes 28 seconds West a distance of 672.86 feet; thence North 88 degrees 04 minutes 41 seconds West a distance of 89.31 feet to the Point of Beginning of the Tract described herein; thence continuing North 88 degrees 04 minutes 41 seconds West a distance of 492.93 feet; thence North 38 degrees 09 minutes 45 seconds West a distance of 444.98 feet; thence North 52 degrees 12 minutes 38 seconds East a distance of 530.77 feet; thence North 13 degrees 48 minutes 39 seconds East a distance of 257.30 feet; thence North 73 degrees 40 minutes 09 seconds East a distance of 1103.95 feet thence South 16 degrees 10 minutes 14 seconds East a distance of 748.23 feet; thence South 69 degrees 30 minutes 49 seconds West a distance of 493.10 feet; thence South 71 degrees 34 minutes 36 seconds West a distance of 540.48 feet; thence South 01 degrees 55 minutes 19 seconds West a distance of 190.00 feet to the Point of Beginning and containing 27.89 Acres.

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

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

STATE OF ILLINOIS
MICHAEL J. GRAMINSKI
035-002901
PROFESSIONAL LAND SURVEYOR

Sept 22 2021

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

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

Submissions / Revisions:	Date:
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	

Luminant

Project Name & Location:

HENNEPIN
POWER PLANT
13498 EAST 800TH STREET
HENNEPIN, IL
61327

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

Drawing Name:
EAST ASH POND 2 & 4 RESTRICTED USE BOUNDARY EXHIBIT

Date: 9/22/2021	Project No.
Type: SITE	Drawing No. 3
Drawn By: CB	
Approved By: MG	
Scale: AS NOTED	

RESTRICTIVE USE AREA BOUNDARY CORNERS SET				
Point #	Northing	Easting	Elevation	Description
1006	1688871.73	2532765.64	485.11	SET I.P.
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1012	1690614.71	2533053.27	449.90	SET I.P.
1013	1689896.08	2533261.65	497.75	SET I.P.
1014	1689723.50	2532799.73	495.69	SET I.P.
1015	1689102.71	2533256.07	499.11	SET I.P.
1016	1688913.96	2532999.05	494.63	SET I.P.

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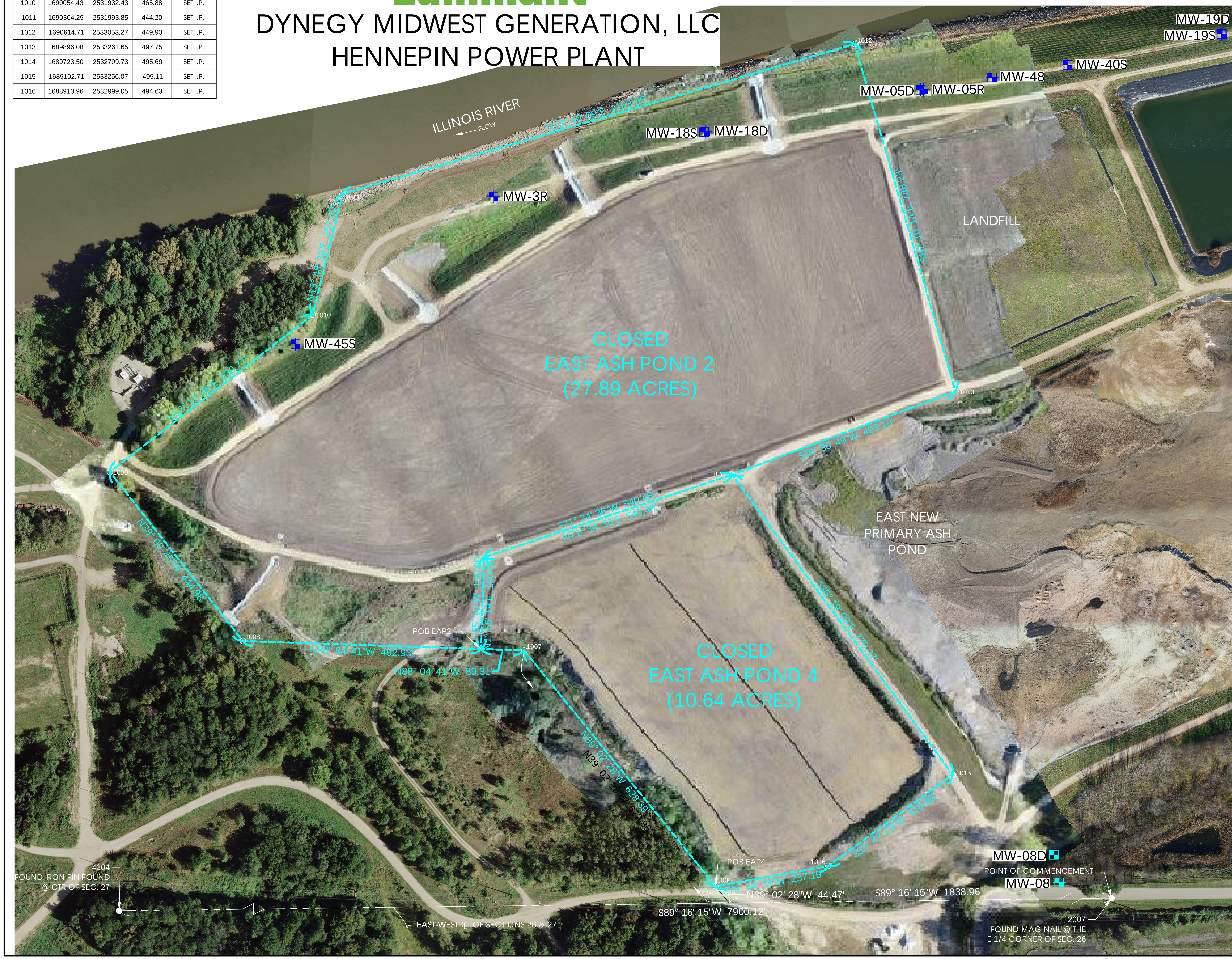
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER PLANT

N

0' 100' 200'

LEGEND

- SECTION LINE
- RESTRICTED USE BOUNDARY
- FOUND SURVEY MARKER AS NOTED
- SET 5/8" IRON REBAR (UNLESS OTHERWISE NOTED)
- DOWNGRADIENT WELL
- UPGRADIENT WELL



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2047	1688936.86	2533465.34	499.19	MW-08D GROUND
2048	1688879.98	2533476.29	499.12	MW-08 GROUND
2049	1690635.53	2533813.65	484.09	MW-19D GROUND
2050	1690635.30	2533811.64	484.18	MW-19S GROUND
2051	1690571.19	2533493.89	484.77	MW-40S GROUND
2052	1690545.60	2533337.61	485.17	MW-48 GROUND
2053	1690520.89	2533196.01	485.85	MW-05R GROUND
2054	1690519.70	2533189.57	485.78	MW-05D GROUND
2055	1690433.28	2532744.49	484.90	MW-18D GROUND
2056	1690432.29	2532742.00	484.87	MW-18S GROUND
2057	1690298.67	2532306.75	479.59	MW-3R GROUND
2058	1689993.57	2531896.91	465.47	MW-45S GROUND

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

Submissions / Revisions:	Date:
1	
2	
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Luminant

Project Name & Location:

HENNEPIN
POWER PLANT
13498 EAST 800TH STREET
HENNEPIN, IL
61327

Drawing Name:
EAST ASH POND 2 & 4
RESTRICTED USE
BOUNDARY EXHIBIT

Date: 9/22/2021	Project No.
Type: SITE	Drawing No. 4
Drawn By: CB	
Approved By: MG	
Scale: AS NOTED	

ATTACHMENT B

AECOM

October 2016

Dynegy Midwest Generation, LLC
13498 E 800th St.
Hennepin, IL 61327

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

On behalf of Dynegy Midwest Generation, LLC, AECOM has prepared the following history of construction for the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond at the Hennepin Power Station in accordance with 40 CFR § 257.73(c).

BACKGROUND

40 CFR § 257.73(c)(1) requires the owner or operator of an existing coal combustion residual (CCR) surface impoundment that either (1) has a height of five feet or more and a storage volume of 20 acre-feet or more, or (2) has a height of 20 feet or more to compile a history of construction by October 17, 2016 that contains, to the extent feasible, the information specified in 40 CFR § 257.73(c)(1)(i)–(xii).

The history of construction presented herein was compiled based on existing documentation, to the extent that it is reasonably and readily available (see 80 Fed. Reg. 21302, 21380 [April 17, 2015]), and AECOM's site experience. AECOM's document review included construction drawings, geotechnical investigations, operation and maintenance information, etc. for Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond at the Hennepin Power Station.

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HISTORY OF CONSTRUCTION

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

Owner:	Dynegy Midwest Generation, LLC
Address:	1500 Eastport Plaza Drive Collinsville, IL 62234
CCR Units:	Old West Polishing Pond Old West Ash Pond (Pond No. 1 and Pond No. 3) Ash Pond No. 2 East Ash Pond, IDNR Dam ID No. IL50363

The Old West Polishing Pond, Old West Ash Pond, and Ash Pond No. 2 do not have a state assigned identification number.

§ 257.73(c)(1)(ii): The location of the CCR unit identified on the most recent USGS $7^1/_2$ or 15 minute topographic quadrangle map or a topographic map of equivalent scale if a USGS map is not available.

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

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

The following captures the purpose of each CCR unit:

- The Old West Polishing Pond (inactive) was used to store and dispose fly ash and bottom ash and is currently being used to clarify stormwater runoff from the Old West Ash Pond prior to discharge in accordance with the station's NPDES permit.
- The Old West Ash Pond (inactive) was used to store and dispose fly ash and bottom ash.
- The Ash Pond No. 2 (inactive) was used to store and dispose fly ash, bottom ash, and other non-CCR waste streams including coal pile runoff.
- The East Ash Pond is being used to store and dispose bottom ash, fly ash, and other non-CCR waste and to clarify process water prior to discharge in accordance with the station's NPDES permit.

Notice of intent to close the Old West Polishing Pond, Old West Ash Pond, 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 Hennepin Power Station. The inclusion of the Old West Polishing Pond, Old West Ash Pond, and Ash Pond No. 2 in this history of construction report does not concede and should not be construed to concede that the Old

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

The Hennepin Power Station and the above-referenced CCR units are located at the western edge of the Depue Lake-Illinois River Watershed with a 12-digit Hydrologic Unit Code (HUC) of 071300010804 and a drainage area of 44,525 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 the Old West Polishing Pond and Old West Ash Pond are described as cohesive material underlain by granular material. The cohesive material consists of lean clay, gravelly clay, silt, clayey silt, and sandy silt. The consistency of the cohesive material varies from very soft to medium stiff. The granular material consists of silty sand and clayey gravel. The relative density of the granular materials varies from loose to very dense and generally increases with depth. An available summary of the engineering properties of the foundation materials for the Old West Polishing Pond and Old West Ash Pond is presented in **Table 1** below. The engineering properties are based on previous geotechnical explorations and laboratory testing.

Table 1. Summary of Material Engineering Properties for the Old West Polishing Pond and Old West Ash Pond

Layer	Unit Weight (pcf)	Total (undrained) Shear Strength Parameters		Effective (drained) Shear Strength Parameters	
		ϕ (deg)	*c (psf)*	*ϕ′ (deg)*	*c′ (psf)*
CL (soft)	120	0	500	28	0
CL (medium stiff gravely clay)	120	28	0	28	0
ML (soft to medium stiff)	125	28	0	28	0
CL-ML (very soft)	120	0	400	26	0
SM (very loose)	125	28	0	28	0
GC (dense)	130	34	0	34	0
GC (very dense)	130	36	0	36	0
Fill: GC (very dense)	130	34	50	34	0

West Polishing Pond, Old West Ash Pond, and Ash Pond No. 2 are subject to the Design Criteria or all Operating Criteria in the CCR Rule.

The Old West Polishing Pond and Old West Ash Pond are enclosed impoundments with dikes and do not have abutments.

Physical properties of the foundation and abutment materials for Ash Pond No. 2 and the East Ash Pond are described as gravel materials with varying amounts of silt and clay. The relative density of the gravel is medium dense to very dense. An available summary of the engineering properties of the foundation materials for Ash Pond No. 2 and the East Ash Pond is presented in **Table 2** below. The engineering properties are based on previous geotechnical explorations and laboratory testing.

Table 2. Summary of Foundation and Abutment Material Engineering Properties for the Ash Pond No. 2 and East Ash Pond

Material	Unit Weight (pcf)	Effective (drained) Shear Strength Parameters		Total (undrained) Shear Strength Parameters	
		c' (psf)	Φ' (°)	c (psf)	Φ (°)
Alluvial Foundation	135	0	38	0	38

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

Physical properties of the embankment materials for the Old West Polishing Pond and Old West Ash Pond are described as gravel with occasional zones of clayey sand and lean clay. The gravel has a general relative density of very dense. An available summary of the engineering properties of the embankment materials for the Old West Polishing Pond and Old West Ash Pond is presented in **Table 1** above. The engineering properties are based on previous geotechnical explorations and laboratory testing.

The physical properties of Ash Pond No. 2 embankment construction materials are described in this paragraph. The original embankments are constructed of sand with varying amounts of coal pieces and gravel. The initial embankment raise is constructed of silty clay, clayey sand, sand, and gravel and the later embankment raise is constructed with layers of lean clay, silty clay, clayey silt, clayey, and gravel. An available summary of the engineering properties of the embankment materials for Ash Pond No. 2 is presented in **Table 3** below. The engineering properties are based on previous geotechnical explorations and laboratory testing.

Table 3. Summary of Construction Material Engineering Properties for Ash Pond No. 2

Material	Unit Weight (pcf)	Effective (drained) Shear Strength Parameters		Total (undrained) Shear Strength Parameters	
		c' (psf)	Φ' (°)	c (psf)	Φ (°)
Fill: GP-GM (medium dense)	125	0	32	0	32
Fill: CL (hard)	120	0	32	4000	0
Fill: ML (hard)	120	0	32	4500	0
Fill: SC (medium dense)	120	0	28	0	28

Physical properties of the embankment materials for the East Ash Pond are described as clayey silt and clay. The consistency of both the clayey silt and clay ranges from stiff to hard. The original pond surface is lined with a 4-foot thick compacted clay layer of 1.0×10^{-7} cm/s underlain by a 1-foot thick sand layer. The liner system of the embankment raise consists of a (from top to bottom) 45 mil reinforced polyethylene geomembrane, a 1-foot thick clay layer, and an 8 oz/sy polypropylene geotextile. A typical cross section profile of the liner system is shown on drawing C-56 presented in **Appendix B**. An available summary of the construction material engineering properties for the East Ash Pond is presented in **Table 4** below. The engineering properties are based on previous geotechnical explorations and laboratory testing.

Table 4. Summary of Construction Material Engineering Properties for the East Ash Pond

Material	Unit Weight (pcf)	Effective (drained) Shear Strength Parameters		Total (undrained) Shear Strength Parameters	
		c' (psf)	Φ' (°)	c (psf)	Φ (°)
Embankment Fill	105	30	32	2500	0
Liner System	120	60	30	2500	0

The method of site preparation and construction of the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and the original East Ash Pond are not reasonably and readily available. Site preparation and construction of the 2003 East Ash Pond liner raise were completed in accordance with the applicable construction specification (see § 257.73(c)(1)(xi) below).

Reasonably and readily available approximate dates of construction of each successive stage of construction of the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond are provided in **Table 5** below.

Table 5. Approximate dates of construction of each successive stage of construction.

Date	Event
1951 to 1952	Construction of historical Ash Pond No. 1
1958	Construction of Ash Pond No. 2
Late 1960's	Construction of historical Ash Pond No. 3
1978	Embankment raise of Ash Pond No. 2
1985	Embankment raise of Ash Pond No. 2 to elevation 484 feet and Ash Pond No. 3 (Old West Ash Pond) to elevation 460 feet
1988 to 1989	Embankment raise of Old West Ash Pond to elevation 465 feet that merged historical Ash Pond No. 1 and Ash Pond No. 3 into one single pond and created the Old West Polishing Pond
1989	Embankment raise of Ash Pond No. 2 to elevation 494 feet
1995 to 1996	Construction of East Ash Pond
2003	Embankment liner raise of East Ash Pond
2009 to 2010	Eastern portion of Ash Pond No. 2 was removed to facilitate construction of the Leachate Pond
2011	Landfill Cell 1 was constructed over placed CCR in Ash Pond No. 2 adjacent to the Leachate Pond
2014	North Embankment tree removal, grading, and vegetation re-establishment of Ash Pond No. 2

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

Drawings that contain items pertaining to the requested information for the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond are listed in **Table 6** below. Items marked as "Not Available" are items not found during a review of the reasonably and readily available record documentation.

Table 6. List of drawings containing items pertaining to the information requested in § 257.73(c)(1)(vii).

	Old West Polishing Pond	Old West Ash Pond	Ash Pond No. 2	East Ash Pond
Dimensional plan view (all zones)	HEN1-B460-2	HEN1-B460-1 to 2	HEN1-B461, HEN1-C117	HEN1-C55
Dimensional cross sections	HEN1-B452 to B457	HEN1-B452 to B457	HEN1-B458-1 to 7, Berm Modification Drawings 7 to 9	HEN1-C56 to C59
Foundation Improvements	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Drainage Provisions	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Spillways and Outlets	Not Available	Not Available	Not Applicable	HEN1-C8 to C9, HEN1-C109, HEN1-C113
Diversion Ditches	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Instrument Locations	Figure 2D	Figure 2C	Figure 2A	Figure 2B
Slope Protection	Not Available	Not Available	Berm Modification Drawings 3 to 9	HEN1-C56 to C59
Normal Operating Pool Elevation	Not Available	Not Available	Not Available	Not Available
Maximum Pool Elevation	Not Available	Not Available	Not Available	Not Available
Approximate Maximum Depth of CCR in 2016	11 feet	15 feet	46 feet	35 feet

All drawings referenced in **Table 6** above can be found in **Appendix B** and **Appendix C**.

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

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

Existing instrumentation consists of open-standpipe piezometers installed in 2015. The purpose of the piezometers is to measure the pore water pressures within the embankments of the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond. There are seven (7) existing piezometers within the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond. A location map of the existing instrumentation is presented in **Appendix C**.

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

Area-capacity curves for the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond are not reasonably and readily available.

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

The Old West Polishing Pond contains a 24-inch diameter corrugated metal pipe (CMP) outlet that discharges stormwater to the Illinois River in accordance with the station's NPDES permit. Current capacity and calculation information for the Old West Polishing Pond's discharge capability is not reasonably and readily available.

The Old West Ash Pond contains a 24-inch dia. pipe culvert. Stormwater collected within the CCR unit drains via surface flow and through the pipe culvert into the Old West Polishing Pond. Current capacity and calculation information for the Old West Ash Pond's discharge capability is not reasonably and readily available.

The Ash Pond No. 2 does not contain a spillway or diversion feature. Stormwater collected within the CCR unit drains via surface flow into the East Ash Pond. Current capacity and calculation information for the Ash Pond No. 2's discharge capability is not reasonably and readily available.

The East Ash Pond contains two outlet structures. The southeast outlet is a 5-foot wide stop-log structure that is connected to a 36-inch diameter reinforced concrete pipe (RCP). The 36-inch diameter RCP discharges into the East Polishing Pond. The northeast outlet, located on the northeast corner of the East Ash Pond, is a headwall structure connected to an 18-inch diameter RCP. The 18-inch diameter RCP discharges into the East Leachate Pond. In 2016, the discharge capacity of the East Ash Pond was evaluated using HydroCAD 10 software modeling a 1,000-year, 24-hour rainfall event. The model results indicate that the East Ash Pond has enough storage capacity and will not overtop the embankment during the 1,000-year, 24-hour storm event. The results of the HydroCAD 10 analysis are presented below in **Table 7**.

Table 7. Results of HydroCAD 10 analysis

	East Ash Pond
Approximate Minimum Berm Elevation[1] (ft)	493.0
Approximate Emergency Spillway Elevation[1] (ft)	Not Applicable
Starting Pool Elevation[1] (ft)	490.4
Peak Elevation[1] (ft)	492..2
Time to Peak (hr)	12.5
Surface Area (ac)	6.5
Storage[2] (ac-ft)	8.4

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

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

The construction specifications for Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and the original East Ash Pond are not reasonably and readily available. The construction specification for the 2003 East Ash Pond liner raise is located in *Specification J-2616, Rev. A* (presented in **Appendix D**).

The provisions for surveillance, maintenance, and repair of the Old West Polishing Pond and Old West Ash Pond are located in *Hennepin Power Station; West Ash Disposal Pond Maintenance Plan* (2013) (presented in **Appendix E**). The provisions for surveillance, maintenance, and repair of Ash Pond No. 2 are located in *Hennepin Power Station; Old East Ash Disposal Pond Maintenance Plan* (2013) (presented in **Appendix F**). The provisions for surveillance, maintenance, and repair of the East Ash Pond are located in *Hennepin Power Station; East Ash Disposal Pond Maintenance Plan* (2014) (presented in **Appendix G**).

The operations and maintenance plans for the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond are currently being revised by Dynegy Midwest Generation, LLC.

§ 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 the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond at the Hennepin Power Station.

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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

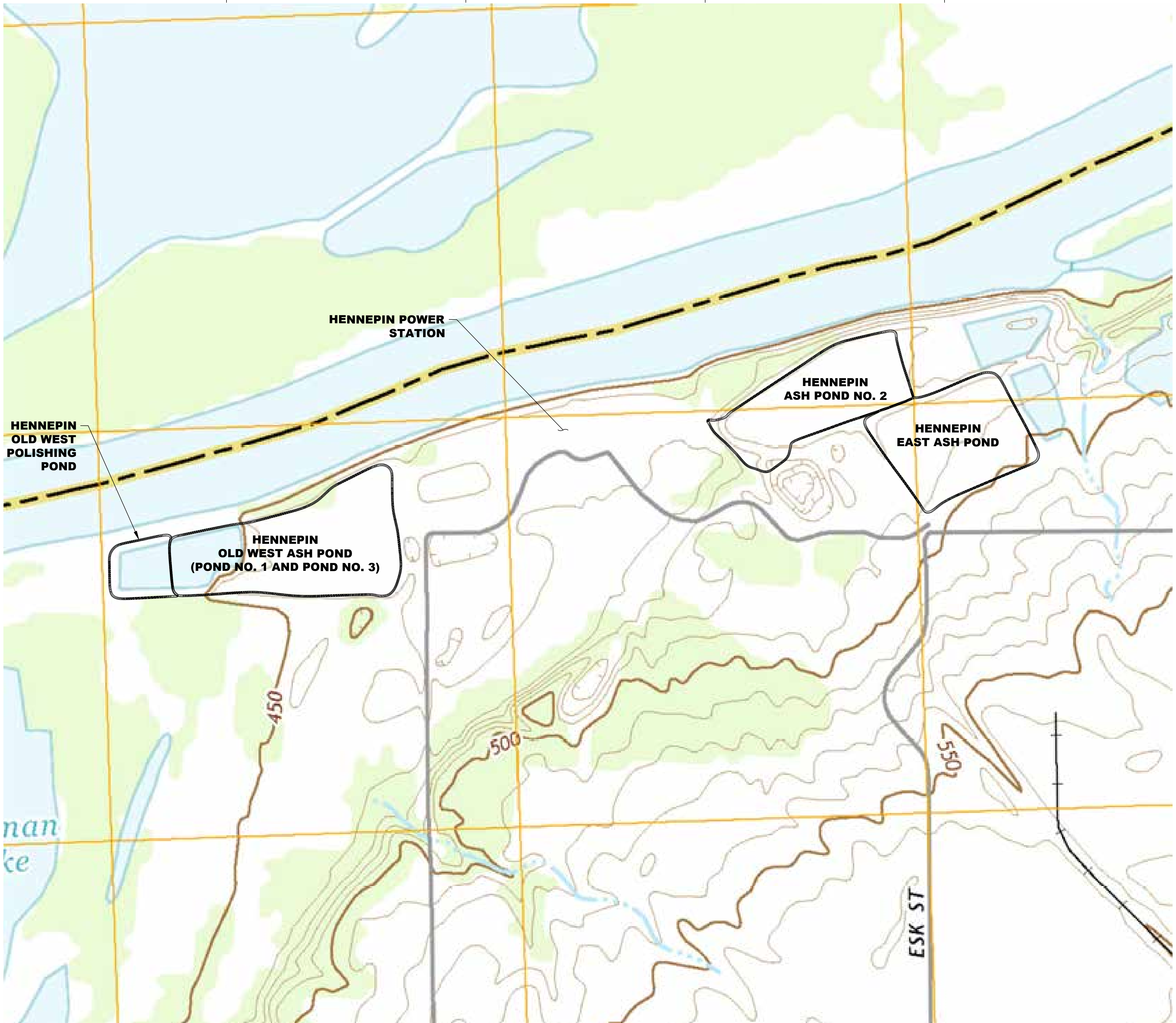
United States Environmental Protection Agency (USEPA). (2015). *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule.* 40 CFR Parts 257 and 261, 80 Fed. Reg. 21302, 21380 April 17, 2015.

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: Hennepin Power Station Drawings
Appendix C: Hennepin Power Station Piezometer Locations
Appendix D: Specification J-2616, Rev. A, Primary Ash Pond Modifications
Appendix E: Hennepin Power Station; West Ash Disposal Pond Maintenance Plan (2013)
Appendix F: Hennepin Power Station; Old East Ash Disposal Pond Maintenance Plan (2013)
Appendix G: Hennepin Power Station; East Ash Disposal Pond Maintenance Plan (2014)

Appendix A: History of Construction Vicinity Map

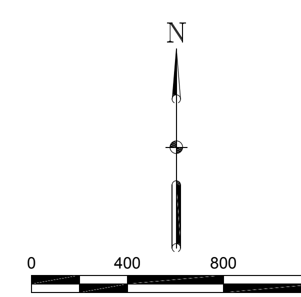


LEGEND

CCR UNITS

SOURCE:
MAP PROVIDED FROM ELECTRONIC USGS DIGITAL RASTER GRAPHIC 7.5 MINUTE TOPOGRAPHIC MAP OF DEPUE ILLINOIS, REVISED 2015.

QUADRANGLE LOCATION



SCALE IN FEET

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

DYNEGY MIDWEST GENERATION, L.L.C.
13498 East 800th Street
Hennepin, IL 61327

HISTORY OF CONSTRUCTION

HENNEPIN POWER STATION
HENNEPIN, 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" = 400'
ACAD VER:	2014

SHEET TITLE

HISTORY OF CONSTRUCTION VICINITY MAP

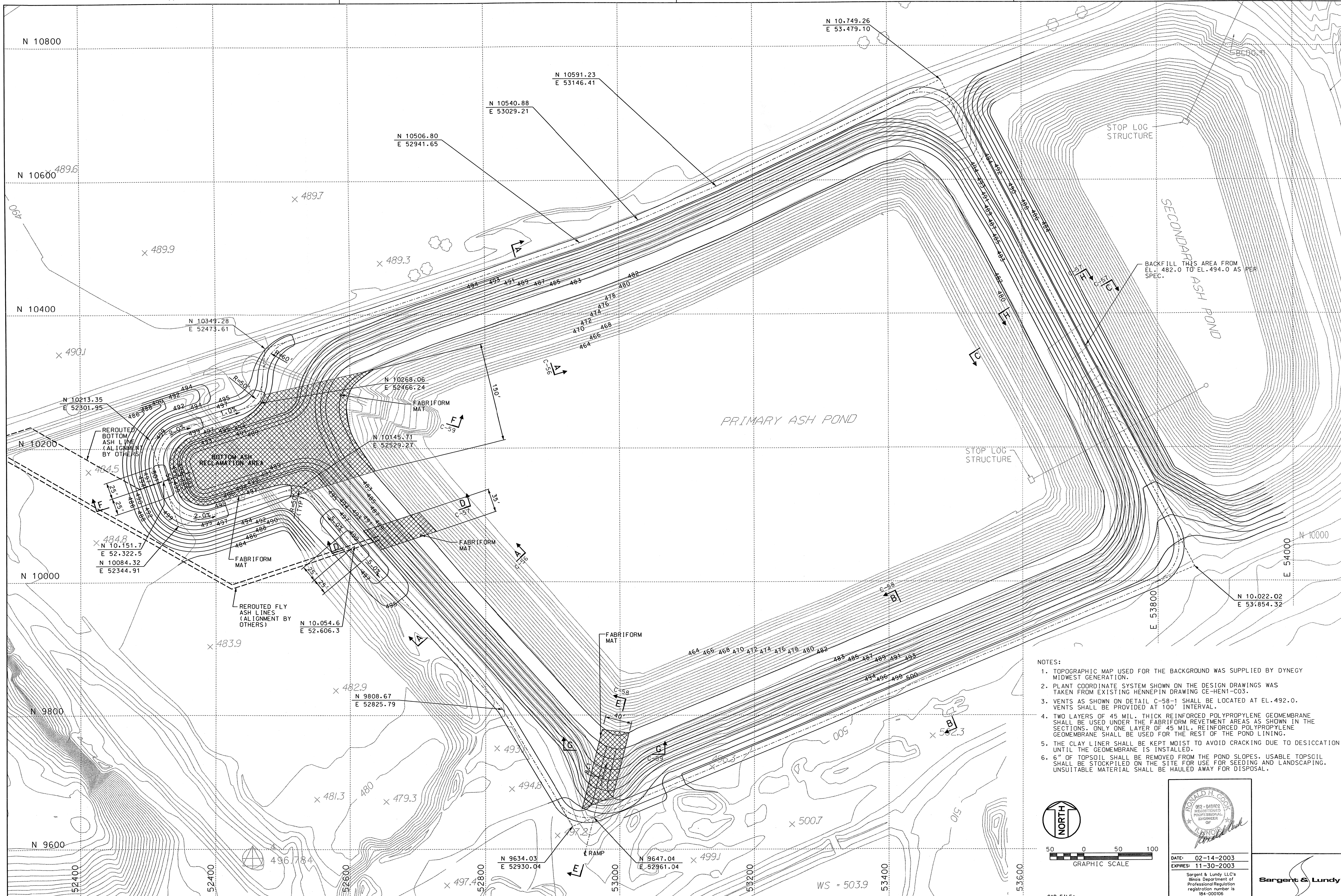
01

Appendix B: Hennepin Power Station Drawings

1. "Plan of Primary Ash Pond, Modification to Primary Ash Pond", Drawing No. C-55, Revision 0.1, 14 February, 2003, Sargent & Lundy, LLC.
2. "Sections and Details – Sheet 1, Modification to Primary Ash Pond", Drawing No. C-56, Revision 0.1, 14 February, 2003, Sargent & Lundy, LLC.
3. "Sections and Details – Sheet 2, Modification to Primary Ash Pond", Drawing No. C-57, Revision 0.1, 14 February, 2003, Sargent & Lundy, LLC.
4. "Sections and Details – Sheet 3, Modification to Primary Ash Pond", Drawing No. C-58, Revision 0.1, 14 February, 2003, Sargent & Lundy, LLC.
5. "Sections and Details – Sheet 4, Modification to Primary Ash Pond", Drawing No. C-59, Revision 0.1, 14 February, 2003, Sargent & Lundy, LLC.
6. "Cross Sections of Ash Pond Berm Extension, Sta 1+00, 5+00 & 9+50", Drawing No. E-HEN1-B452, Revision 0, 4 November, 1997, Illinois Power Company.
7. "Cross Sections of Ash Pond Berm Extension, Sta 14+25, 20+80 & 26+00", Drawing No. E-HEN1-B453, Revision 0, 4 November, 1997, Illinois Power Company.
8. "Cross Sections of Ash Pond Berm Extension, Sta 30+00, 35+00 & 39+00", Drawing No. E-HEN1-B454, Revision 0, 4 November, 1997, Illinois Power Company.
9. "Cross Sections of Ash Pond Berm Extension, Sta 40+00, 42+00, 44+90", Drawing No. E-HEN1-B455, Revision 0, 4 November, 1997, Illinois Power Company.
10. "Cross Sections of Ash Pond Berm Extension, Sta 47+00, 51+00 & 56+00", Drawing No. E-HEN1-B456, Revision 0, 4 November, 1997, Illinois Power Company.
11. "Cross Sections of Ash Pond Berm Extension, Sta 61+50", Drawing No. E-HEN1-B457, Revision 0, 4 November, 1997, Illinois Power Company.
12. "Cross Sections, East Ash Pond Extension", Drawing No. E-HEN1-B458-1, Revision 0, 8 March, 1990, Illinois Power Company.
13. "Cross Sections, East Ash Pond Extension", Drawing No. E-HEN1-B458-2, Revision 0, 8 March, 1990, Illinois Power Company.
14. "Cross Sections, East Ash Pond Extension", Drawing No. E-HEN1-B458-3, Revision 0, 8 March, 1990, Illinois Power Company.
15. "Cross Sections, East Ash Pond Extension", Drawing No. E-HEN1-B458-4, Revision 0, 8 March, 1990, Illinois Power Company.
16. "Cross Sections, East Ash Pond Extension", Drawing No. E-HEN1-B458-5, Revision 0, 8 March, 1990, Illinois Power Company.
17. "Cross Sections, East Ash Pond Extension", Drawing No. E-HEN1-B458-6, Revision 0, 8 March, 1990, Illinois Power Company.
18. "Cross Sections, East Ash Pond Extension", Drawing No. E-HEN1-B458-7, Revision 0, 8 March, 1990, Illinois Power Company.
19. "Plan-Unit #1 Ash Pond Extension, Sheet #1", Drawing No. E-HEN1-B460-1, 2 February, 1988, Illinois Power Company.
20. "Plan-Unit #1 Ash Pond Extension, Sheet #2", Drawing No. E-HEN1-B460-2, 2 February, 1988, Illinois Power Company.

Appendix B: Hennepin Power Station Drawings (continued)

21. “Contour and Grading Plan, Unit #2 Ash Pond Extension”, Drawing No. CE-HEN1-B461, Revision 0, 8 March, 1990, Illinois Power Company.
22. “Pond 2 East, Flexible Membrane Liner and Structures”, Drawing No. HEN1-C109, Revision 0, 28 July, 2010, Civil & Environmental Consultants, Inc.
23. “Pond 2 East, Details”, Drawing No. HEN1-C113, Revision 0, 28 July, 2010, Civil & Environmental Consultants, Inc.
24. “Landfill Phase 1 Construction, Existing Conditions”, Drawing No. HEN1-C117, Revision 0, 28 November, 2010, Civil & Environmental Consultants, Inc.
25. “Layout-Pond Discharge Structures, 1995 Ash Facility”, Drawing No. CE-HEN1-C8, Revision 0, 17 September, 1996, Illinois Power Company.
26. “Details: Pond Discharge Structure, 1995 Ash Facility”, Drawing No. CE-HEN1-C9, Revision 0, 17 September, 1996, Illinois Power Company.
27. “East Berm Modification, Existing Site Conditions”, Drawing No. 3, Revision 3, 4 February, 2015, Civil & Environmental Consultants, Inc.
28. “East Berm Modification, Proposed Site Plan”, Drawing No. 4, Revision 3, 4 February, 2015, Civil & Environmental Consultants, Inc.
29. “East Berm Modification, Proposed Grading Plan 1 of 2”, Drawing No. 5, Revision 3, 4 February, 2015, Civil & Environmental Consultants, Inc.
30. “East Berm Modification, Proposed Grading Plan 2 of 2”, Drawing No. 6, Revision 3, 4 February, 2015, Civil & Environmental Consultants, Inc.
31. “East Berm Modification, Proposed Sections Sta 1+00 to 15+00”, Drawing No. 7, Revision 3, 4 February, 2015, Civil & Environmental Consultants, Inc.
32. “East Berm Modification, Proposed Sections Sta 16+00 to 23+50”, Drawing No. 8, Revision 3, 4 February, 2015, Civil & Environmental Consultants, Inc.
33. “East Berm Modification, Berm and Erosion Control Details”, Drawing No. 9, Revision 3, 4 February, 2015, Civil & Environmental Consultants, Inc.



NOTES:

1. TOPOGRAPHIC MAP USED FOR THE BACKGROUND WAS SUPPLIED BY DYNEGY MIDWEST GENERATION.
2. PLANT COORDINATE SYSTEM SHOWN ON THE DESIGN DRAWINGS WAS TAKEN FROM EXISTING HENNEPIN DRAWING CE-HEN1-CO3.
3. VENTS AS SHOWN ON DETAIL C-58-1 SHALL BE LOCATED AT EL.492.0. VENTS SHALL BE PROVIDED AT 100′ INTERVAL.
4. TWO LAYERS OF 45 MIL. THICK REINFORCED POLYPROPYLENE GEOMEMBRANE SHALL BE USED UNDER THE FABRIFORM REVETMENT AREAS AS SHOWN IN THE SECTIONS. ONLY ONE LAYER OF 45 MIL. REINFORCED POLYPROPYLENE GEOMEMBRANE SHALL BE USED FOR THE REST OF THE POND LINING.
5. THE CLAY LINER SHALL BE KEPT MOIST TO AVOID CRACKING DUE TO DESICCATION UNTIL THE GEOMEMBRANE IS INSTALLED.
6. 6″ OF TOPSOIL SHALL BE REMOVED FROM THE POND SLOPES. USABLE TOPSOIL SHALL BE STOCKPILED ON THE SITE FOR USE FOR SEEDING AND LANDSCAPING. UNSUITABLE MATERIAL SHALL BE HAULED AWAY FOR DISPOSAL.

RONALD H. COOK 062-048602 REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS

DATE: 02-14-2003
EXPIRES: 11-30-2003

Sargent & Lundy LLC's Illinois Department of Professional Regulation registration number is 184-000106

Sargent & Lundy LLC

CAD FILE:

REFERENCE DRAWINGS

NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0.1	02-14-2003	FOR PERMIT	MED	VP	——

NO.	DATE	REVISION	PREP'D	REV'D	APPR'D

SCALE: 1″=50′
DWN. M.DOWNS DATE 02-12-03
CHK. V.PATEL DATE 02-14-03
APPV. DATE

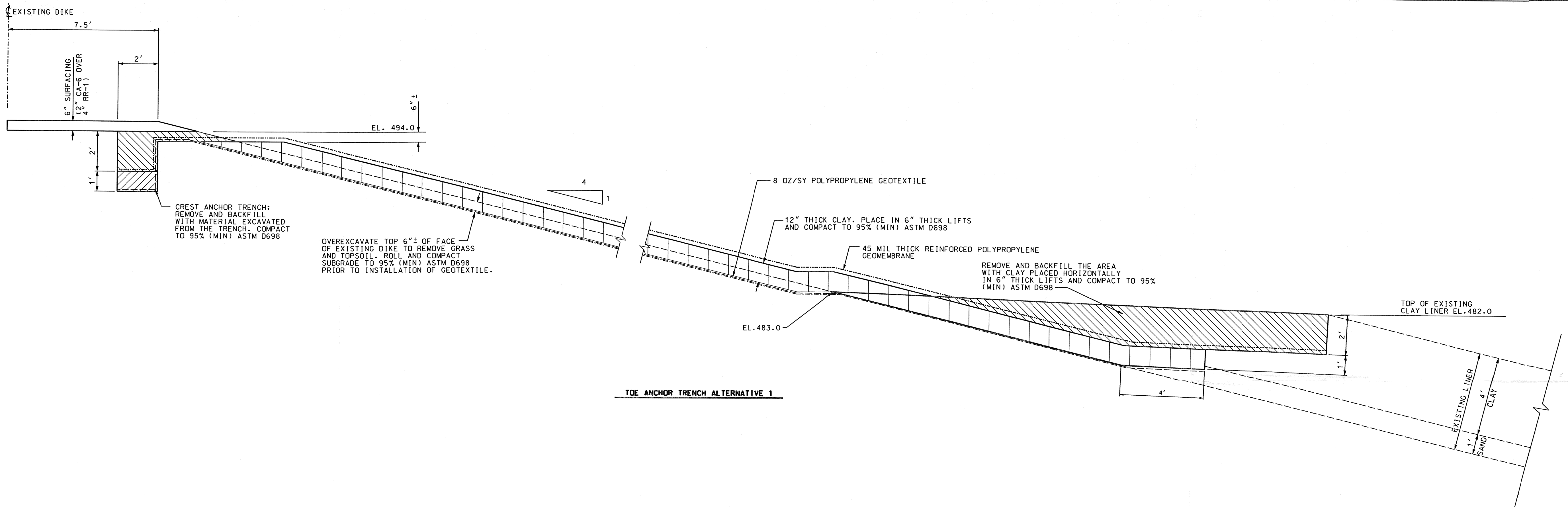
DYNEGY

PLAN OF PRIMARY ASH POND

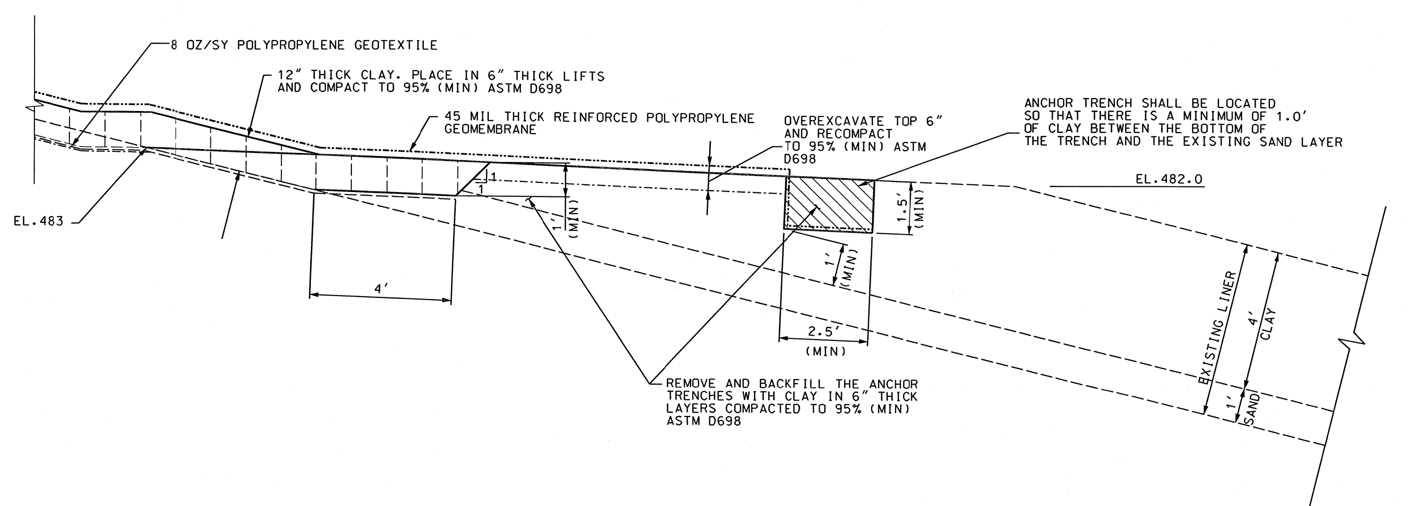
MODIFICATION TO PRIMARY ASH POND
HENNEPIN POWER STATION

PROJECT NO.: 08820-331
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C-55
REV. 0.1

E-WDR1-E157-1.DGN VAV
07-10-2001
02-13-03 ALS



TOE ANCHOR TRENCH ALTERNATIVE 1



TOE ANCHOR TRENCH ALTERNATIVE 2

SECTION A

SEE DWG C-55

GRAPHIC SCALE HOR 1/2"=1'-0"

GRAPHIC SCALE VER 1/2"=1'-0"

NOTES:

1. CONTRACTOR SHALL BE RESPONSIBLE FOR CHECKING EXISTING ELEVATIONS AND DIMENSIONS PRIOR TO FABRICATION OF THE GEOMEMBRANE LINER.
2. CONTRACTOR MAY USE EITHER ALTENATIVE 1 OR ALTERNATIVE 2 AS APPROVED BY THE BUYER FOR ALL TOE ANCHOR TRENCH DETAILS.
3. DIMENSIONS WERE TAKEN FROM TYPICAL SECTION ON DRAWING CH-HEN1-C6.1 DATED 12-9-93.

1 2 3 4

RONALD H. COOK 062-045802 REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS

DATE: 02-14-2003
EXPIRES: 11-30-2003
Sargent & Lundy LLC's Illinois Department of Professional Regulation registration number is 184-000106

Sargent & Lundy LLC

CAD FILE:

REFERENCE DRAWINGS

NO.	DATE	REVISION	PREP'D	REV'D	APPR'D	NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0.1	02-14-2003	FOR PERMIT	MED	VP	——						

SCALE:	
DWN. M.DOWNS	DATE 02-12-02
CHK. V.PATEL	DATE 02-14-03
APPV.	DATE

DYNEGY

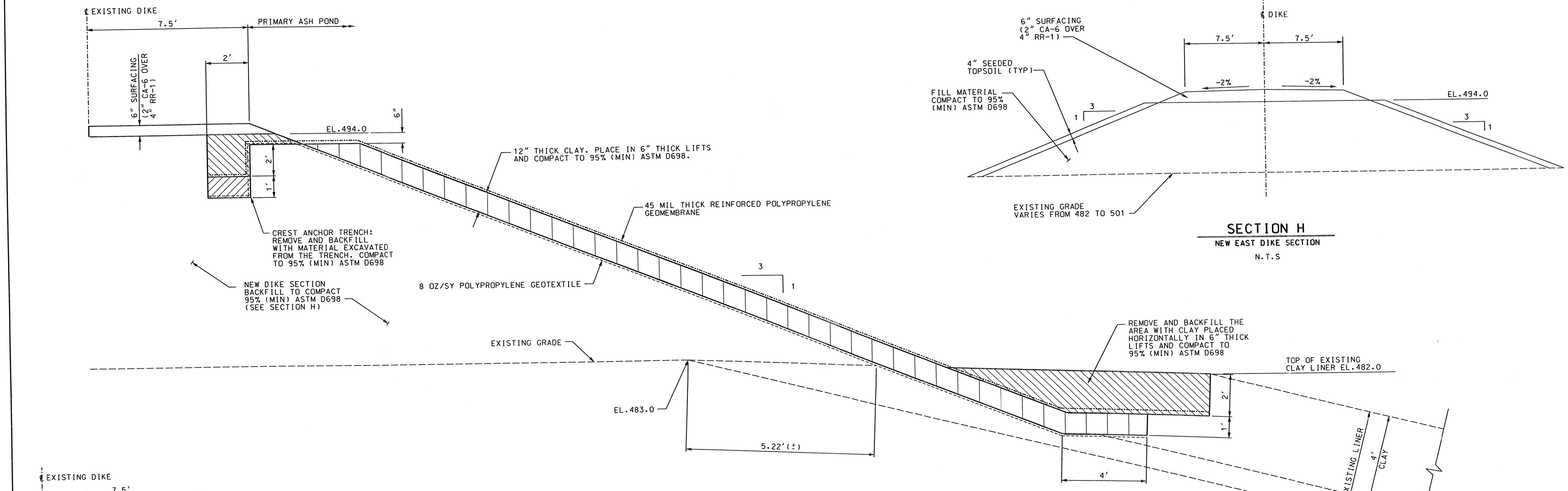
SECTIONS AND DETAILS - SHEET 1

MODIFICATION TO PRIMARY ASH POND
HENNEPIN POWER STATION

PROJECT NO.: 08820-331
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C-56
REV. 0.1

E-WDR1-E157-1.DGN VAV 07-10-2001

02-13-03 ALS



SECTION H

NEW EAST DIKE SECTION

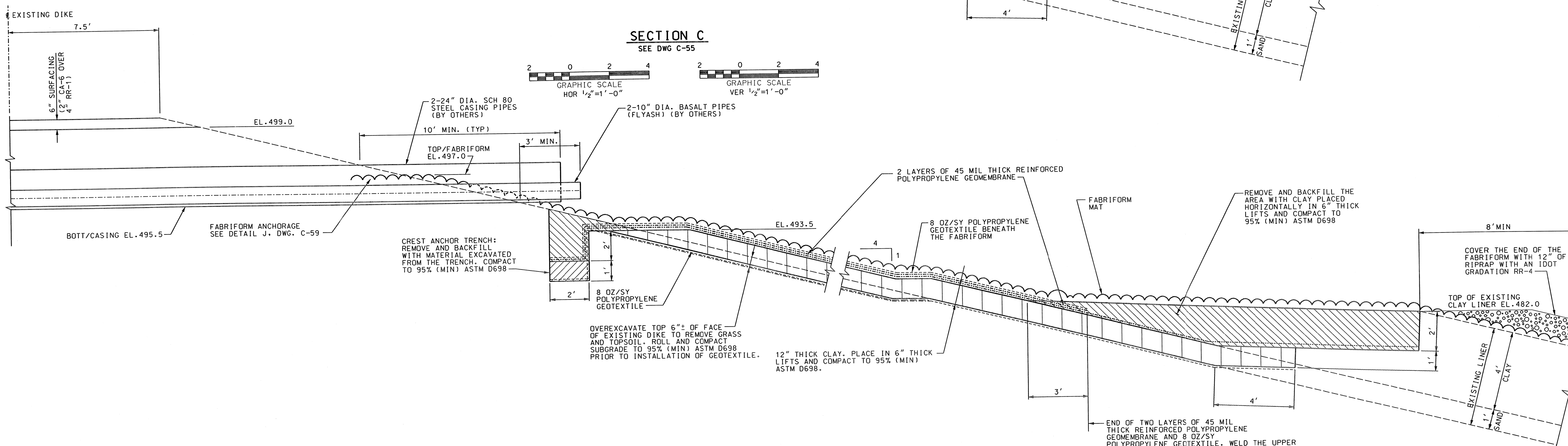
N.T.S

SECTION C

SEE DWG C-55

GRAPHIC SCALE HOR 1/2"=1'-0"

GRAPHIC SCALE VER 1/2"=1'-0"



SECTION D

SEE DWG C-55

GRAPHIC SCALE HOR 1/2"=1'-0"

GRAPHIC SCALE VER 1/2"=1'-0"

DATE: 02-14-2003
EXPIRES: 11-30-2003

Sargent & Lundy LLC's Illinois Department of Professional Regulation registration number is 184-000106

Sargent & Lundy LLC

CAD FILE:

REFERENCE DRAWINGS

NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0.1	02-14-2003	FOR PERMIT	MED	VP	——

SCALE: 1/2"=1'-0"
DWN. M.DOWNS DATE 02-12-02
CHK. V.PATEL DATE 02-14-03
APPV. DATE

DYNEGY

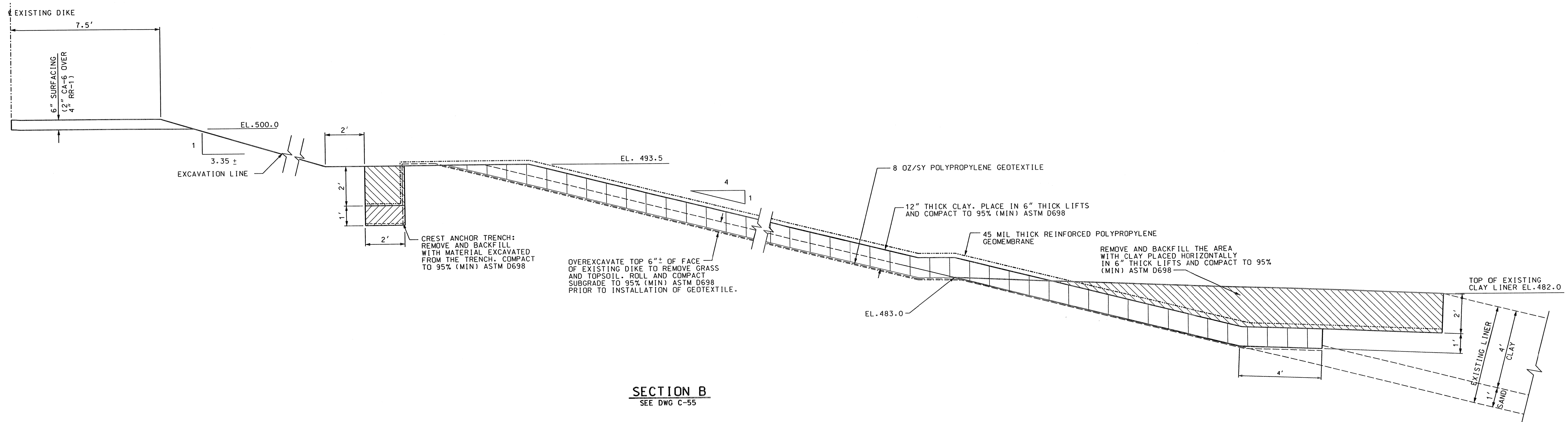
SECTIONS AND DETAILS - SHEET 2

MODIFICATION TO PRIMARY ASH POND
HENNEPIN POWER STATION

PROJECT NO.: 08820-331
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C-57
REV. 0.1

E-WOR1-E157-1.DGN VAV 07-10-2001

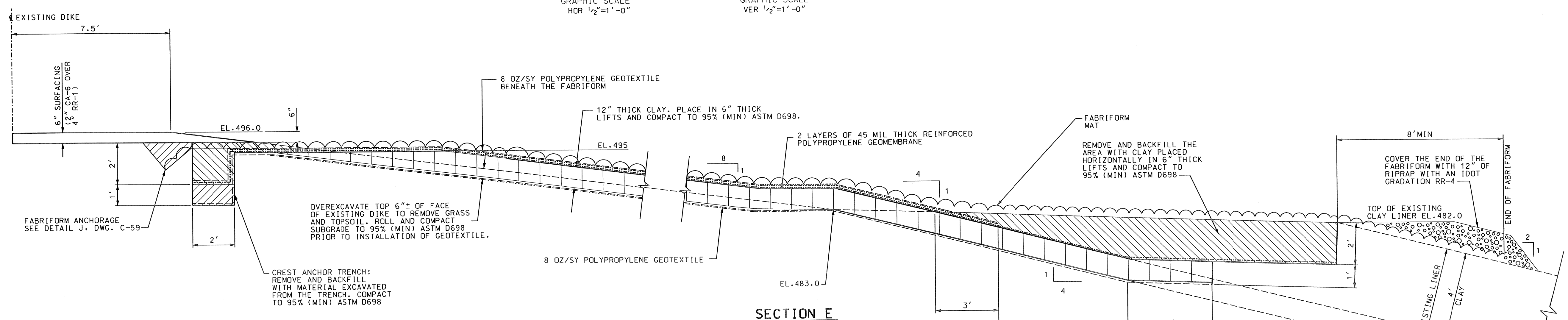
02-13-03 ALS



SECTION B
SEE DWG C-55

GRAPHIC SCALE HOR 1/2"=1'-0"

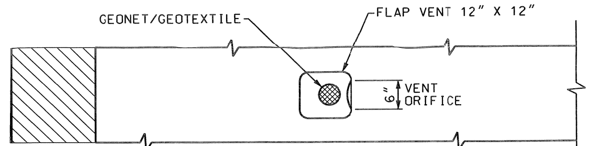
GRAPHIC SCALE VER 1/2"=1'-0"



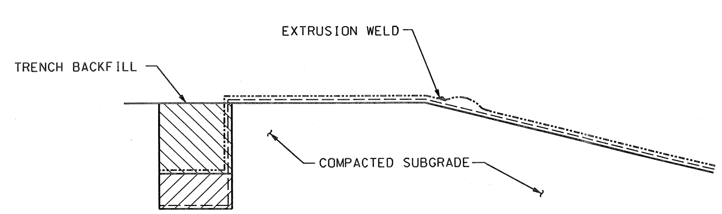
SECTION E
SEE DWG C-55

GRAPHIC SCALE HOR 1/2"=1'-0"

GRAPHIC SCALE VER 1/2"=1'-0"



PLAN



SECTION

DETAIL C-58-1
MAXIMUM INTERVAL SHALL BE 100'

CAD FILE:

DATE: 02-14-2003
EXPIRES: 11-30-2003
Sargent & Lundy LLC's Illinois Department of Professional Regulation registration number is 184-000106

Sargent & Lundy LLC

REFERENCE DRAWINGS

NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0.1	02-14-2003	FOR PERMIT	MED	VP	——

NO.	DATE	REVISION	PREP'D	REV'D	APPR'D

SCALE: 1/2"=1'-0"
DWN. M.DOWNS DATE 02-14-03
CHK. V.PATEL DATE 02-14-03
APPV. DATE

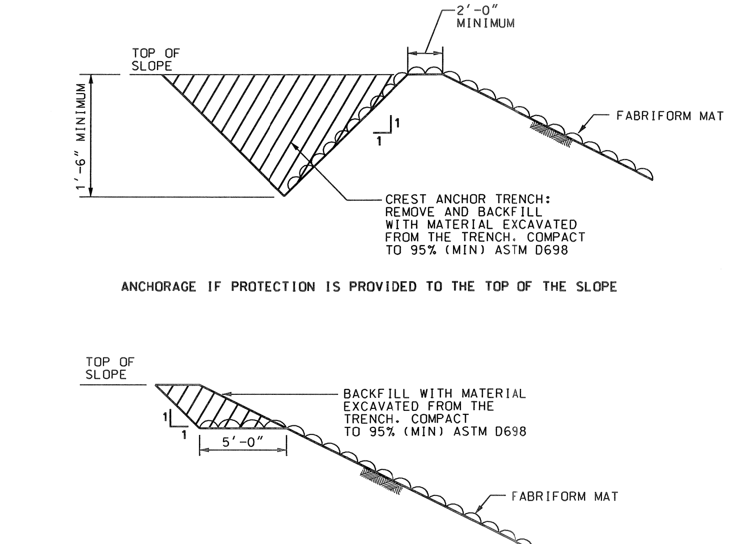
DYNEGY

SECTIONS AND DETAILS - SHEET 3

MODIFICATION TO PRIMARY ASH POND
HENNEPIN POWER STATION

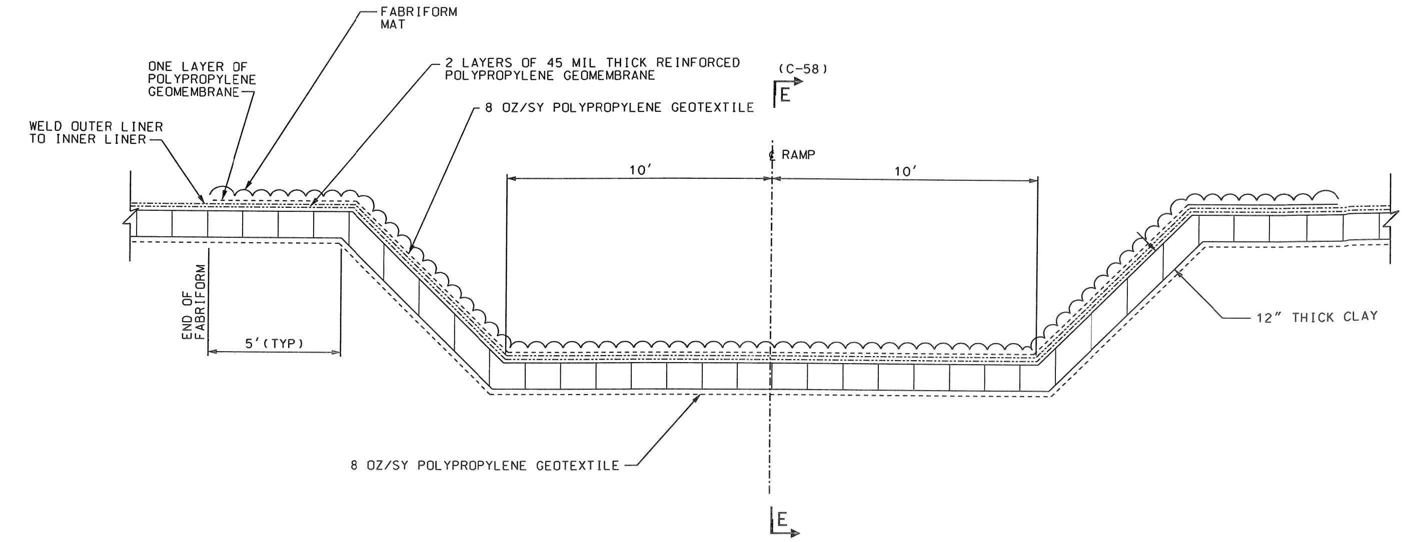
PROJECT NO.: 08820-331
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C-58
REV. 0.1

E-WDR1-E157-1.DGN VAV
07-10-2001
02-12-03 ALS



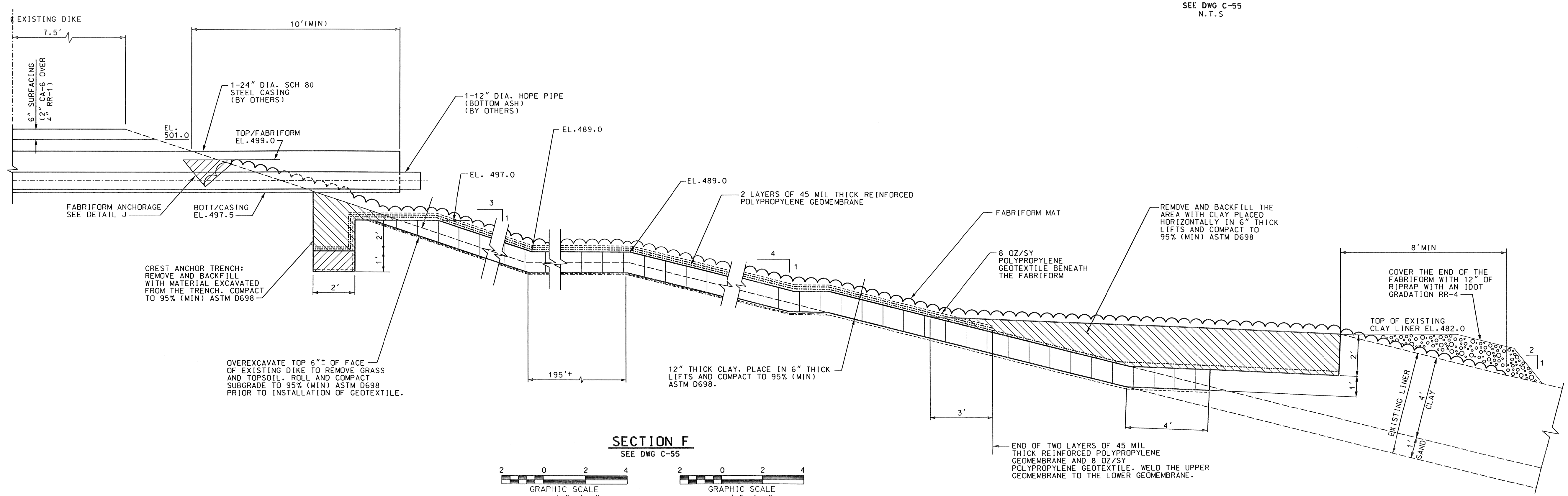
DETAIL J

ANCHORAGE FOR FABRIFORM MAT
N.T.S.



SECTION G

SEE DWG C-55
N.T.S



SECTION F

SEE DWG C-55

DATE: 02-14-2003
EXPIRES: 11-30-2003
Sargent & Lundy LLC's Illinois Department of Professional Regulation registration number is 184-000106

Sargent & Lundy LLC

CAD FILE:

DYNEGY CONFIDENTIAL
This drawing is the property of DYNEGY INC. Neither this drawing, nor reproductions of it, nor information derived from it, shall be given to others without the expressed written consent of DYNEGY INC. No use is to be made of it which is, or may be, injurious to DYNEGY INC.

REFERENCE DRAWINGS

NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0.1	02-14-2003	FOR PERMIT	MED	VP	—

SCALE: 1/4"=1'-0"
DWN. M.DOWNS DATE 02-12-02
CHK. V.PATEL DATE 02-14-03
APPV. DATE

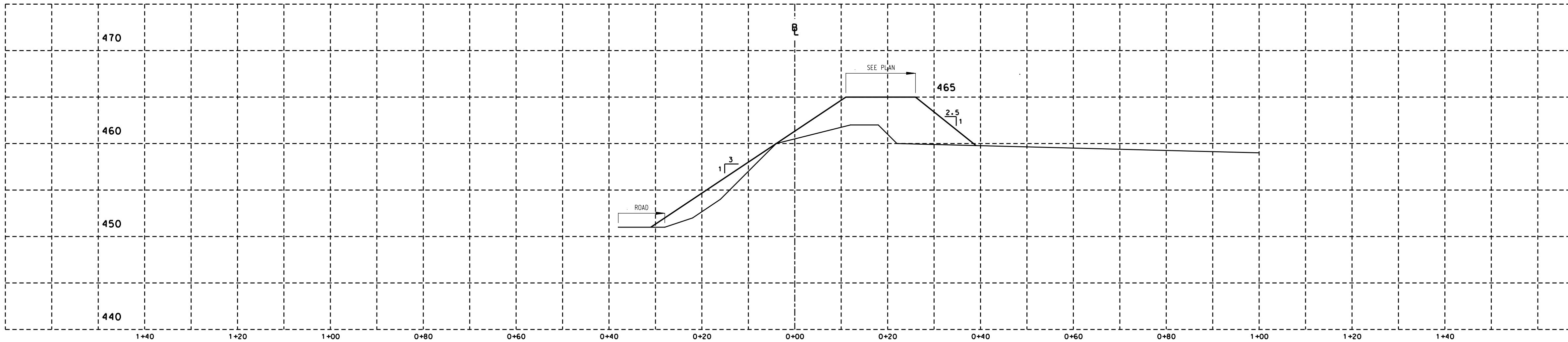
DYNEGY

SECTIONS AND DETAILS - SHEET 4

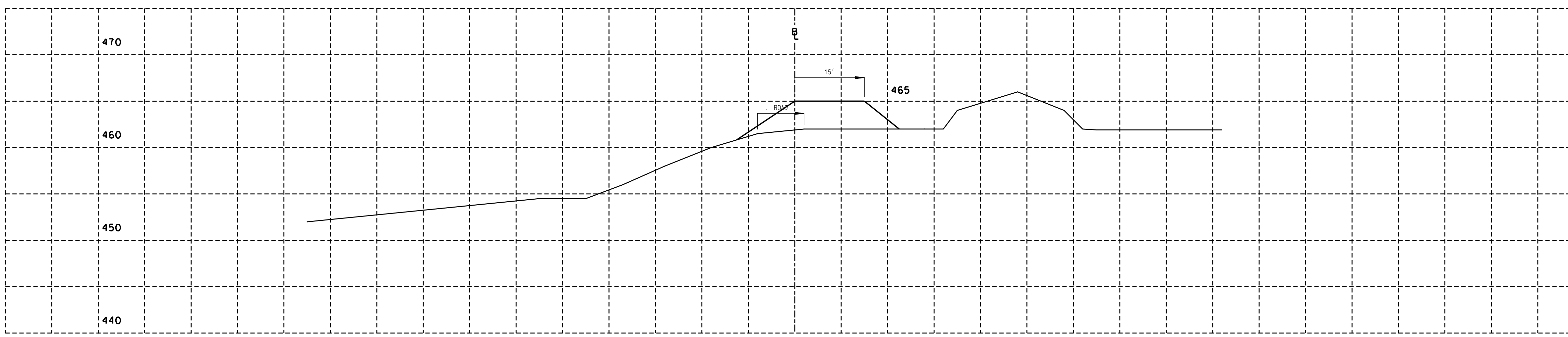
MODIFICATION TO PRIMARY ASH POND
HENNEPIN POWER STATION

PROJECT NO.: 08820-331
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C-59
REV. 0.1

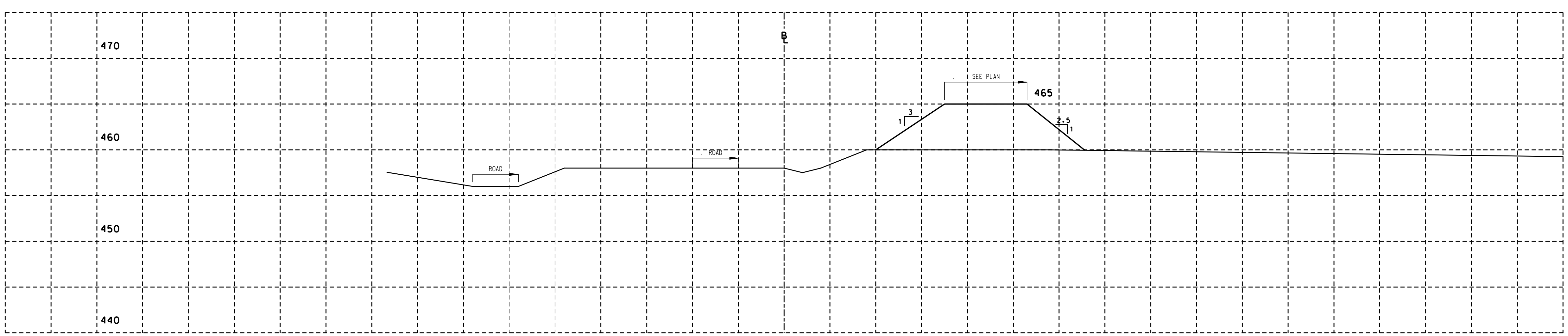
02-13-03 ALS



STATION 9+50



STATION 5+00



STATION 1+00

LEDGEND

BL REFERENCE BASE LINE SHOWN ON PLAN

OLD BERM

NEW BERM

WATER LINE

* ESTIMATED ELEVATION

E-HEN1-B452

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
0													

NOTES

REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD

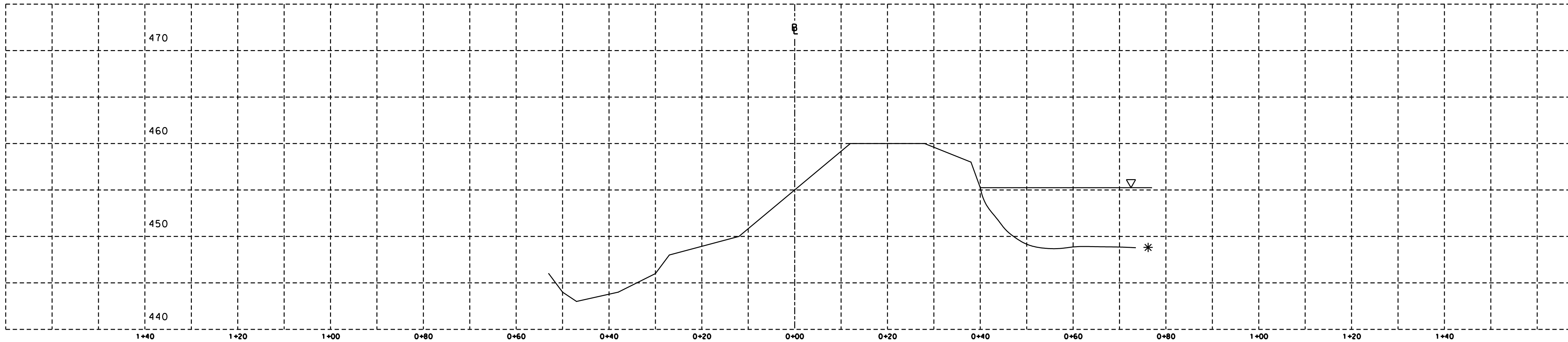
0

ILLINOIS POWER COMPANY
DECATUR

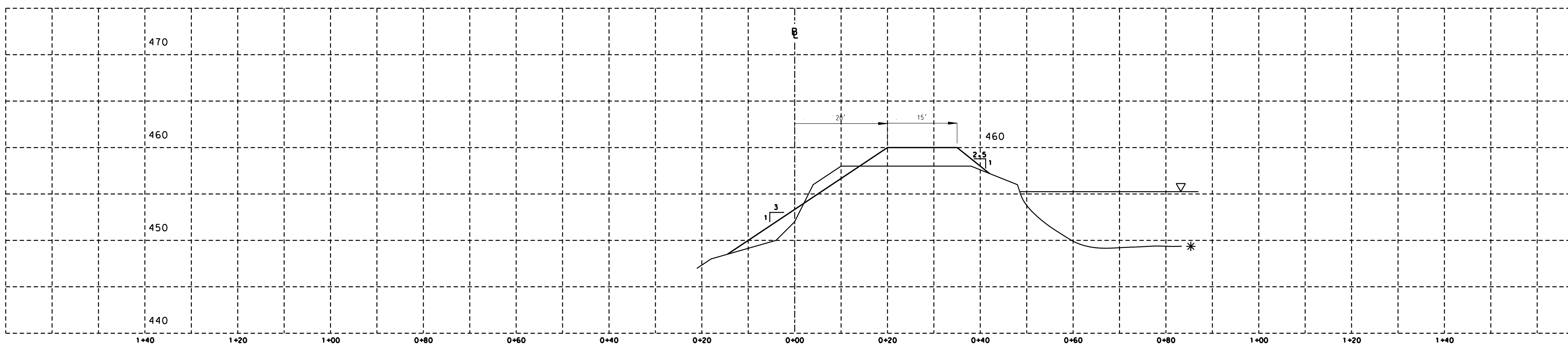
CROSS SECTIONS OF
ASH POND BERM EXTENSION
STA 1+00, 5+00 & 9+50
HENNEPIN POWER STATION

DR GRH	CAD EM	DATE 12-30-87
OK	CKD	SCALE 1"=10'H, 1"=5'V
APP	PLOTTED 11-4-97	E-HEN1-B452
APP		

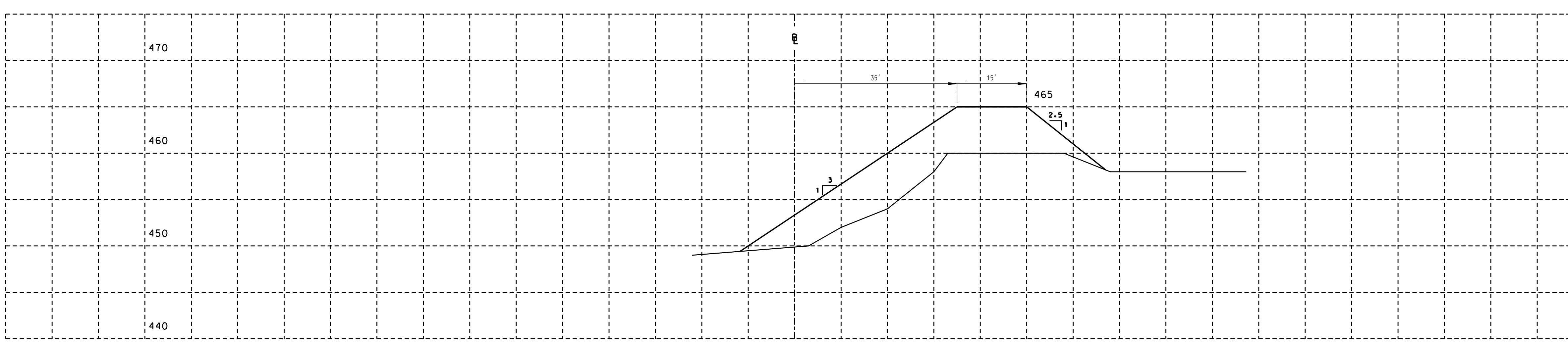
COMPUTER DWG. - DO NOT REVISE MANUALLY



STATION 26+00



STATION 20+80



STATION 14+25

LEDGEND

- REFERENCE BASE LINE SHOWN ON PLAN
- OLD BERM
- NEW BERM
- WATER LINE
- ✳ ESTIMATED ELEVATION

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
0													

NOTES

REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

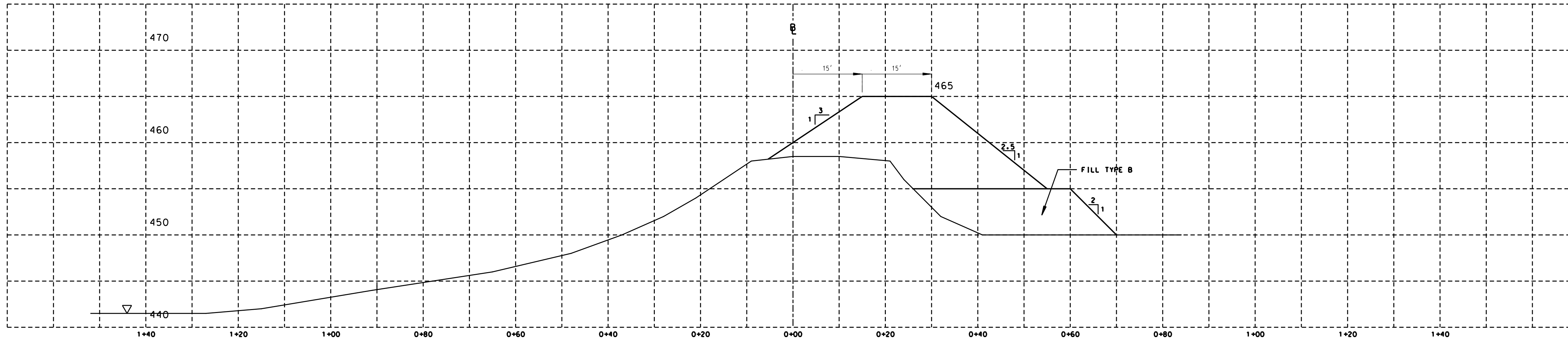
ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS OF
ASH POND BERM EXTENSION
STA 14+25, 20+80 & 26+00
HENNEPIN POWER STATION

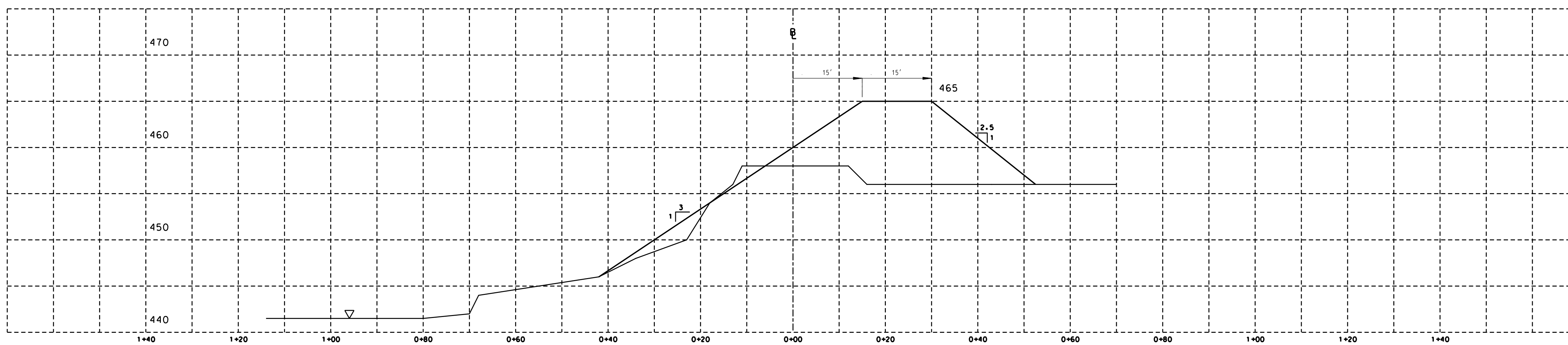
DR GRH	CAD EM	DATE 12-30-87
OK	CKD	SCALE 1"=10'H, 1"=5'V
APP	PLOTTED 11-4-97	E-HEN1-B453
APP		

E-HEN1-B453

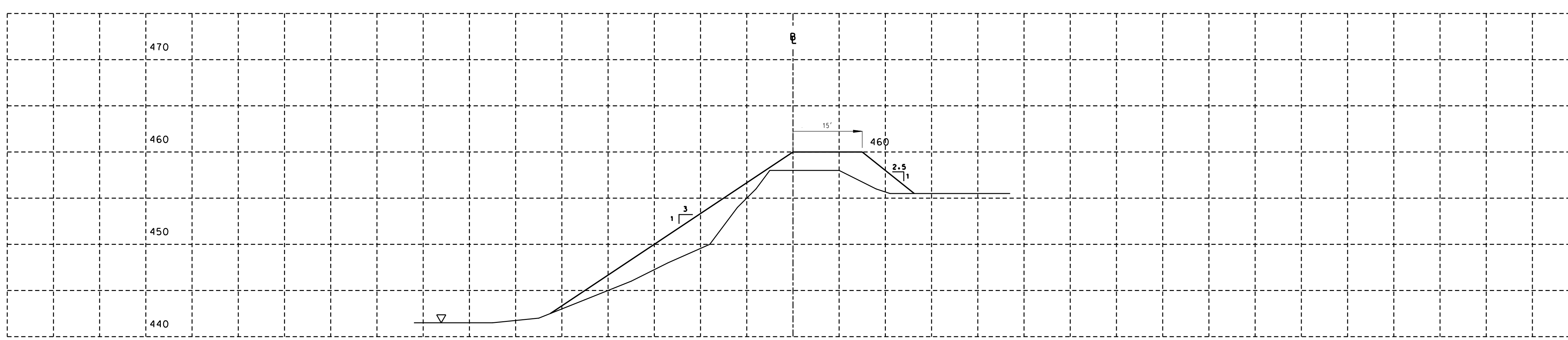
COMPUTER DWG. - DO NOT REVISE MANUALLY



STATION 39+00



STATION 35+00



STATION 30+00

LEDGEND

℄ REFERENCE BASE LINE SHOWN ON PLAN

OLD BERM

NEW BERM

▽ WATER LINE

✳ ESTIMATED ELEVATION

E-HEN1-B454

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
0													

NOTES

REFERENCES

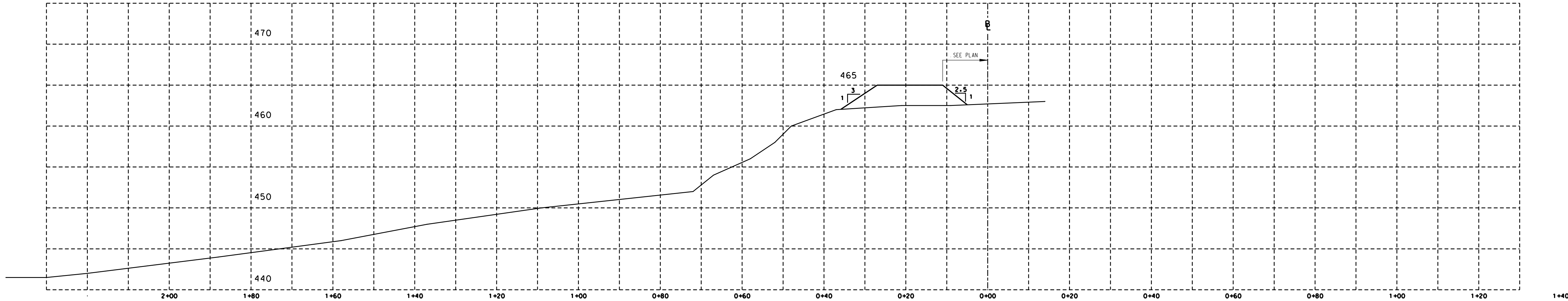
REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

ILLINOIS POWER COMPANY
DECATUR

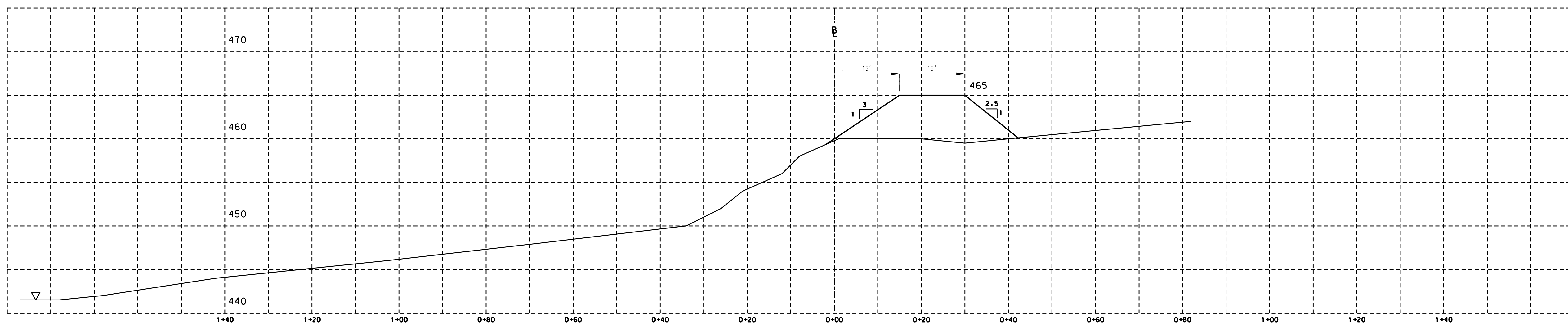
CROSS SECTIONS OF
ASH POND BERM EXTENSION
STA 30+00, 35+00 & 39+00
HENNEPIN POWER STATION

DR GRH	CAD EM	DATE 12-30-87
OK	CKD	SCALE 1"=10'H,1"=5'V
APP	PLOTTED 11-4-97	E-HEN1-B454
APP		

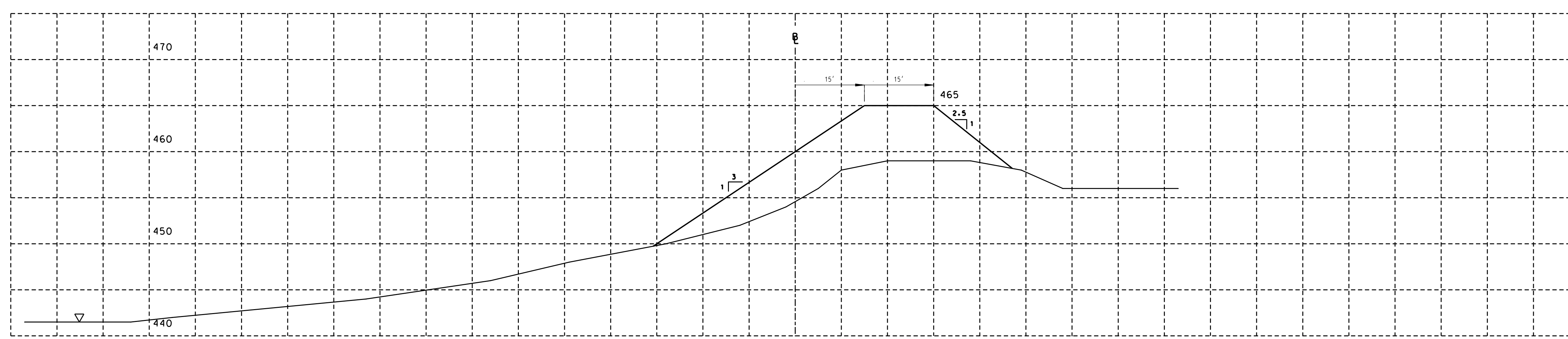
COMPUTER DWG. - DO NOT REVISE MANUALLY



STATION 44+90



STATION 42+00



STATION 40+00

LEDGEND

℄ REFERENCE BASE LINE SHOWN ON PLAN

OLD BERM

NEW BERM

▽ WATER LINE

✳ ESTIMATED ELEVATION

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
0													

NOTES

REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

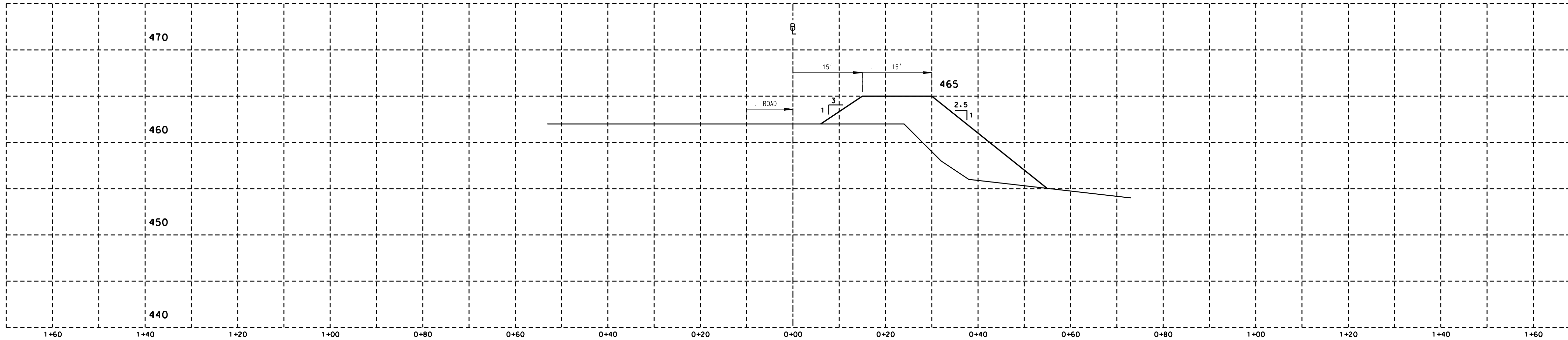
ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS OF
ASH POND BERM EXTENSION
STA 40+00, 42+00 & 44+90
HENNEPIN POWER STATION

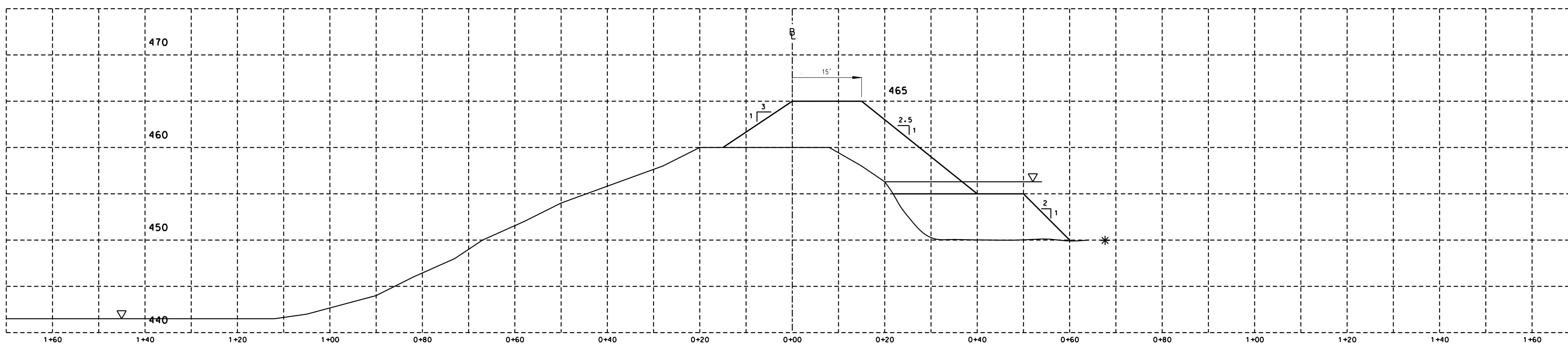
DR GRH	CAD EM	DATE 12-30-87
OK	CKD	SCALE 1"=10'H, 1"=5'V
APP	PLOTTED 11-4-97	E-HEN1-B455
APP		

E-HEN1-B455

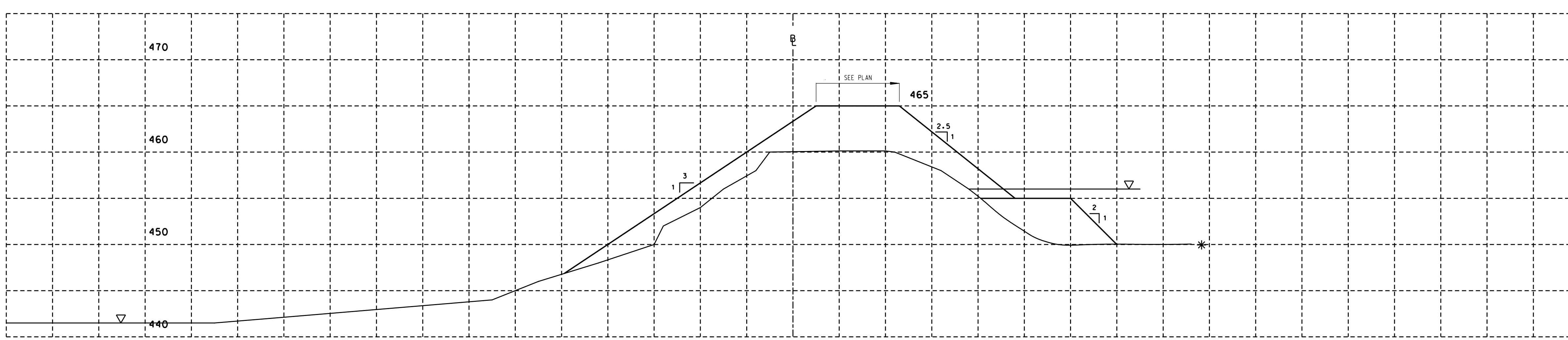
COMPUTER DWG. - DO NOT REVISE MANUALLY



STATION 56+00



STATION 51+00



STATION 47+00

LEDGEND

- REFERENCE BASE LINE SHOWN ON PLAN
- OLD BERM
- NEW BERM
- ▽ WATER LINE
- * ESTIMATED ELEVATION

E-HEN1-B456

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
0													

NOTES

REFERENCES

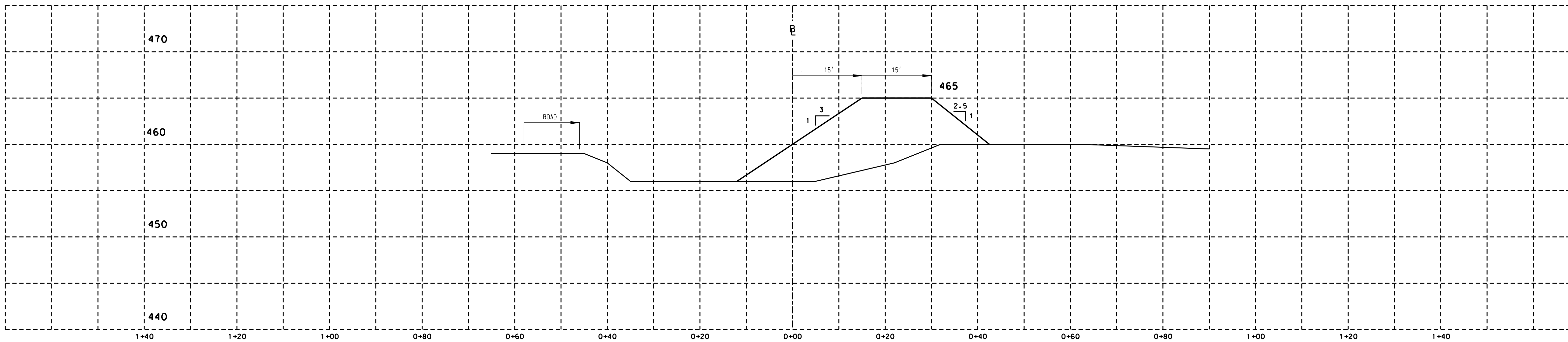
REVISION STATUS
□ -CONSTRUCTION
○ -RECORD

ILLINOIS POWER COMPANY
DECATUR

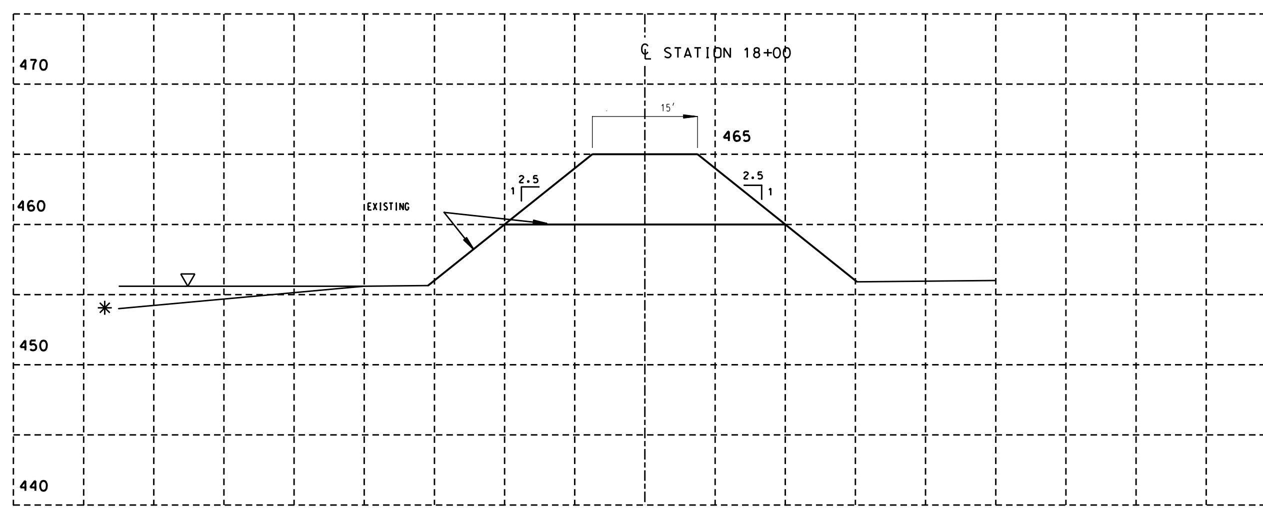
CROSS SECTIONS OF
ASH POND BERM EXTENSION
STA 47+00, 51+00 & 56+00
HENNEPIN POWER STATION

DR GRH	CAD EM	DATE 12-30-87
OK	CKD	SCALE 1"=10'H, 1"=5'V
APP	PLOTTED 11-4-97	E-HEN1-B456
APP		

COMPUTER DWG. - DO NOT REVISE MANUALLY



STATION 61+50



SECTION A-A

LEDGEND

- REFERENCE BASE LINE SHOWN ON PLAN
- OLD BERM
- NEW BERM
- WATER LINE
- ✳ ESTIMATED ELEVATION

E-HEN1-B457

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
0													

NOTES

REFERENCES

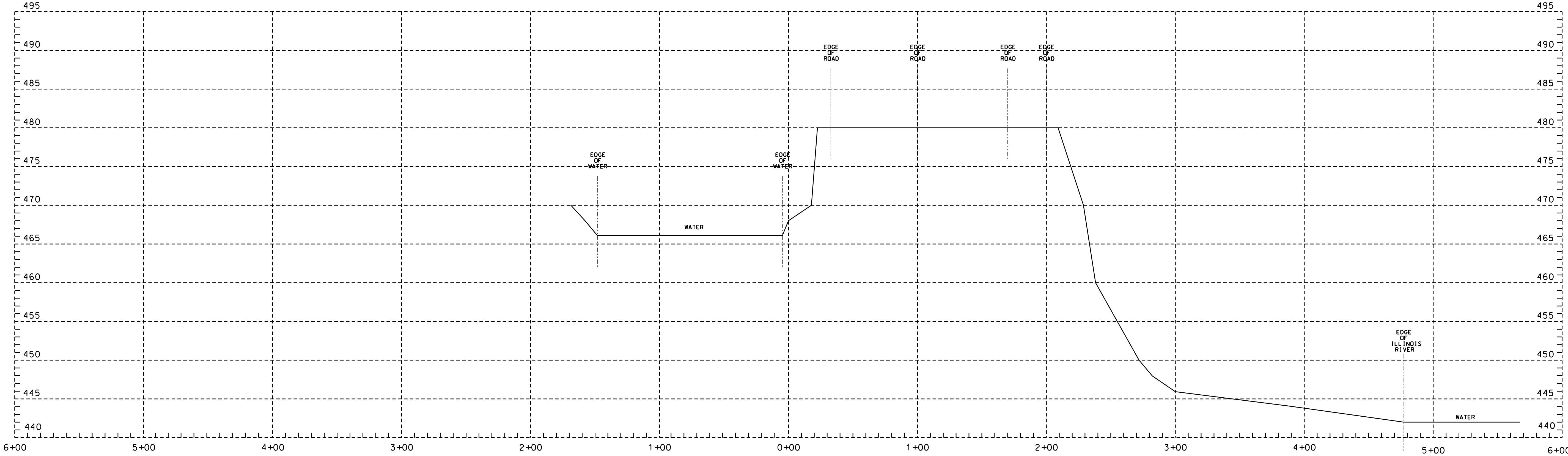
REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS OF
ASH POND BERM EXTENSION
STA 61+50
HENNEPIN POWER STATION

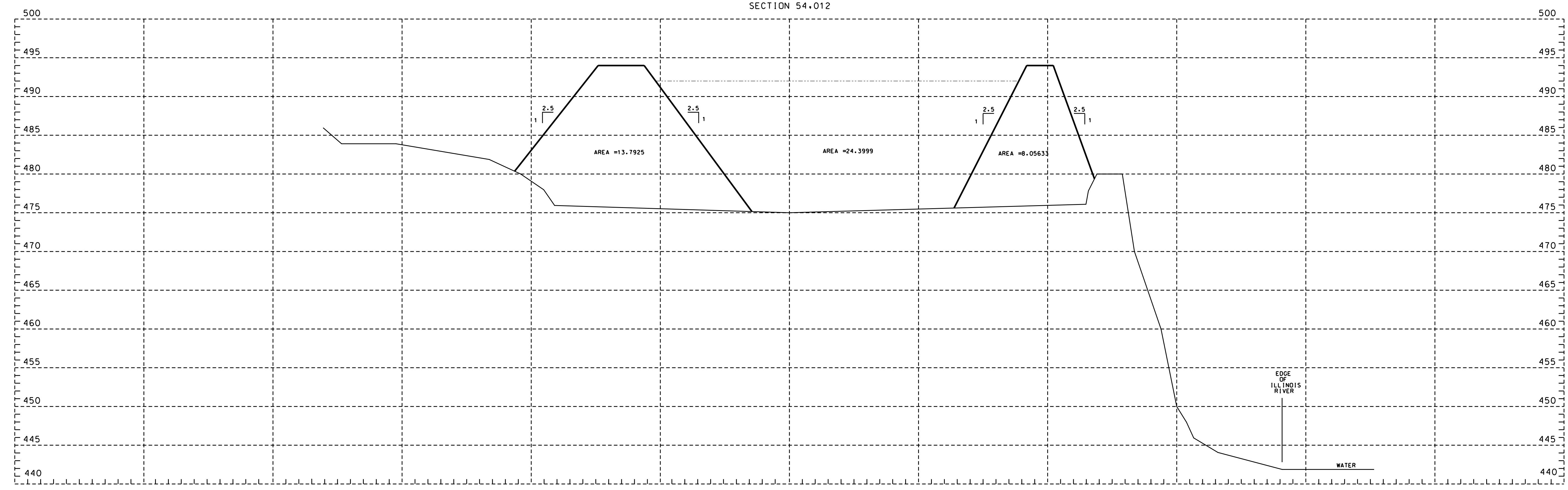
DR GRH	CAD EM	DATE 12-30-87
OK	CKD	SCALE 1"=10'H.1"=5'V
APP	PLOTTED 11-4-97	E-HEN1-B457
APP		

COMPUTER DWG. - DO NOT REVISE MANUALLY



BASE LINE N. 11.000

SECTION 54.012



BASE LINE N. 11.000

SECTION E. 53.812

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
0													

NOTES

1. DATA COLLECTED FROM TOPO ON DWG. CE-HEN1-B-450 DATED NOV. 4, 1987, REV. 0
2. COORDINATES WERE SUPPLIED BY G. DECKARD FIELD INFORMATION TIEING TO J.L. FISHER'S PANELS.

REFERENCES

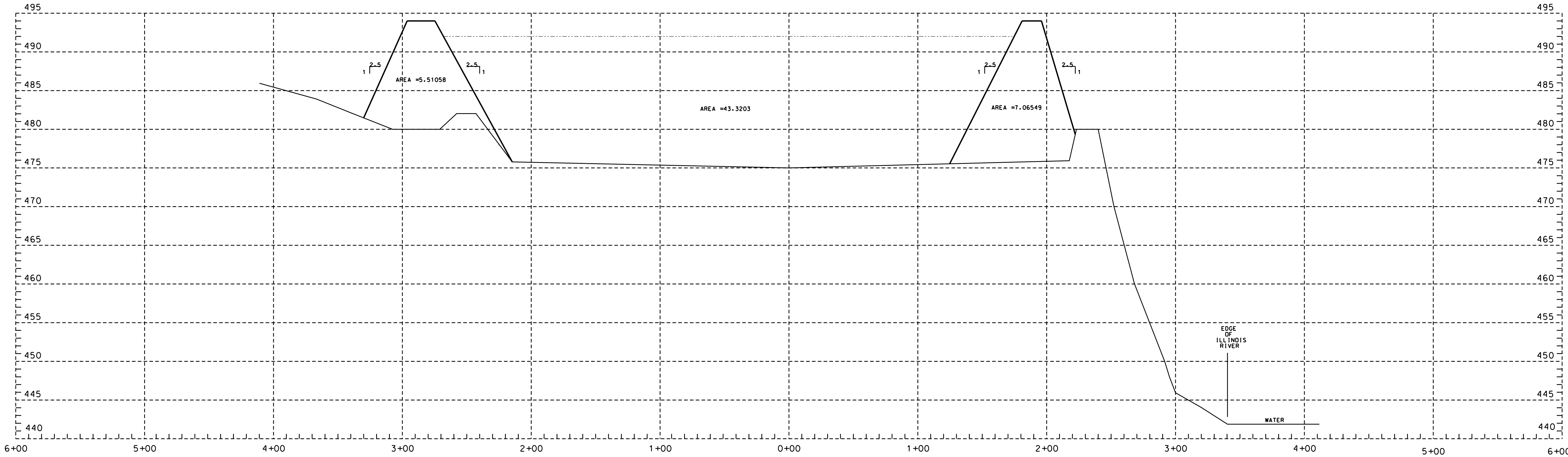
REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

ILLINOIS POWER COMPANY

DECATUR

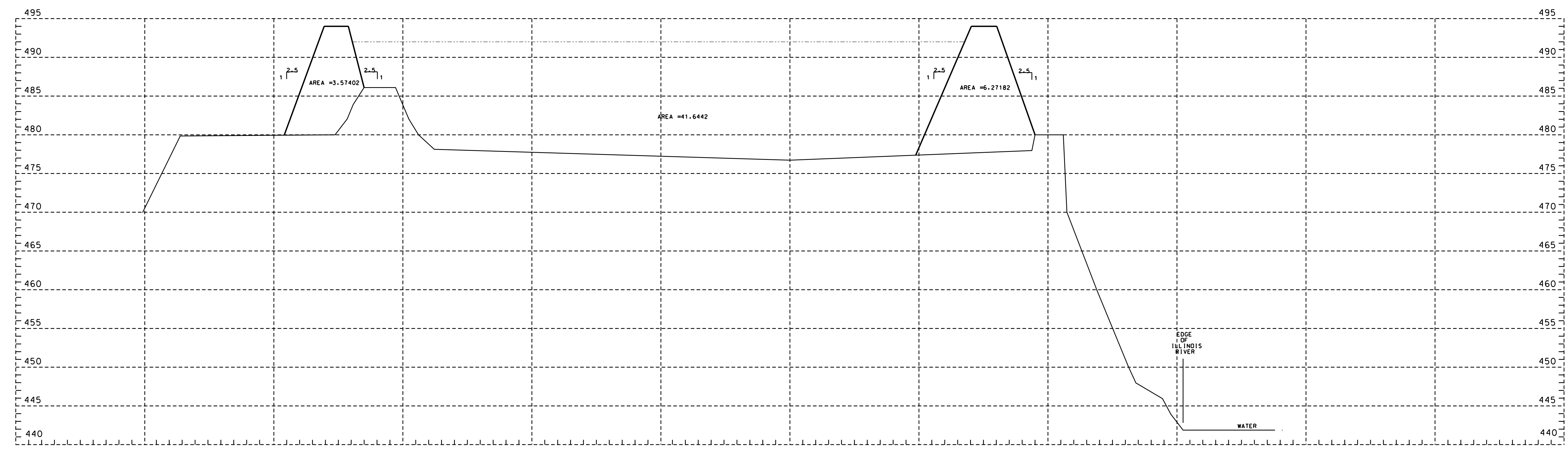
CROSS SECTIONS
EAST ASH POND EXTENSION
HENNEPIN POWER STATION

DR WJM	CAD WJM	DATE 1-11-89
OK	CKD	SCALE 1"=5' V. 1"=30' H.
APP	PLOTTED 03-08-90	CE-HEN1-B458-1
APP		



BASE LINE N. 11.000

SECTION E. 53.692



BASE LINE N. 11.000

SECTION E. 53.492

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
0													

NOTES

1. DATA COLLECTED FROM TOPO ON DWG. CE-HEN1-B-450 DATED NOV. 4. 1987. REV. 0
2. COORDINATES WERE SUPPLIED BY G. DECKARD FIELD INFORMATION TIEING TO J.L. FISHER'S PANELS.

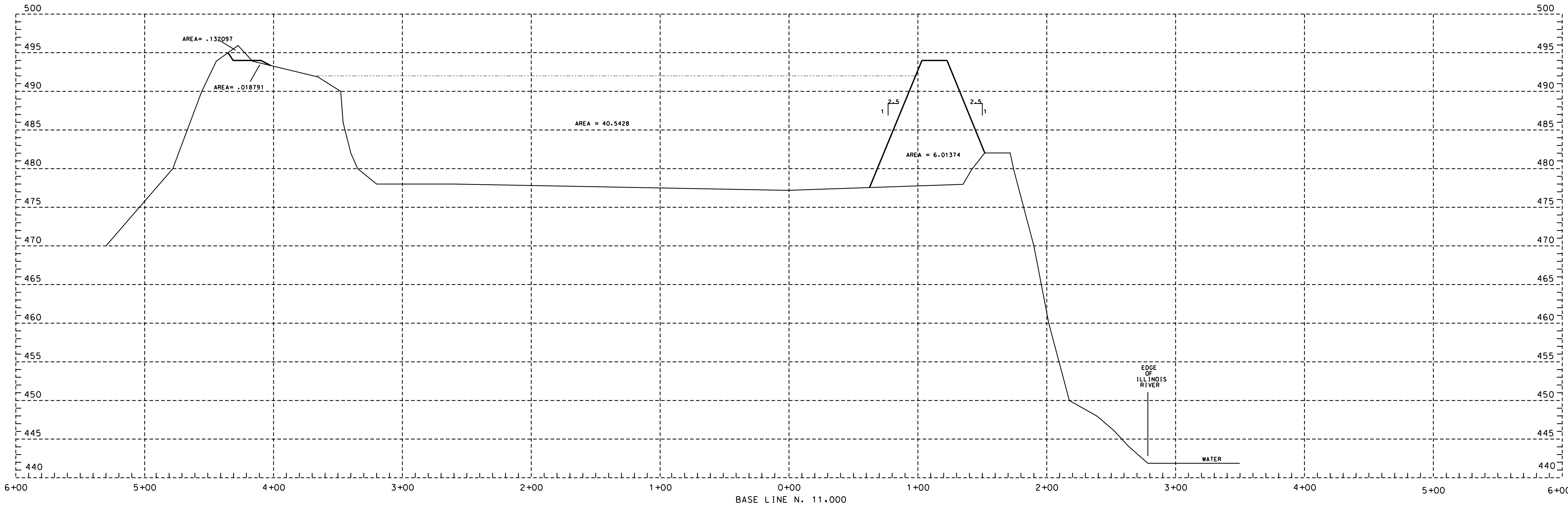
REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

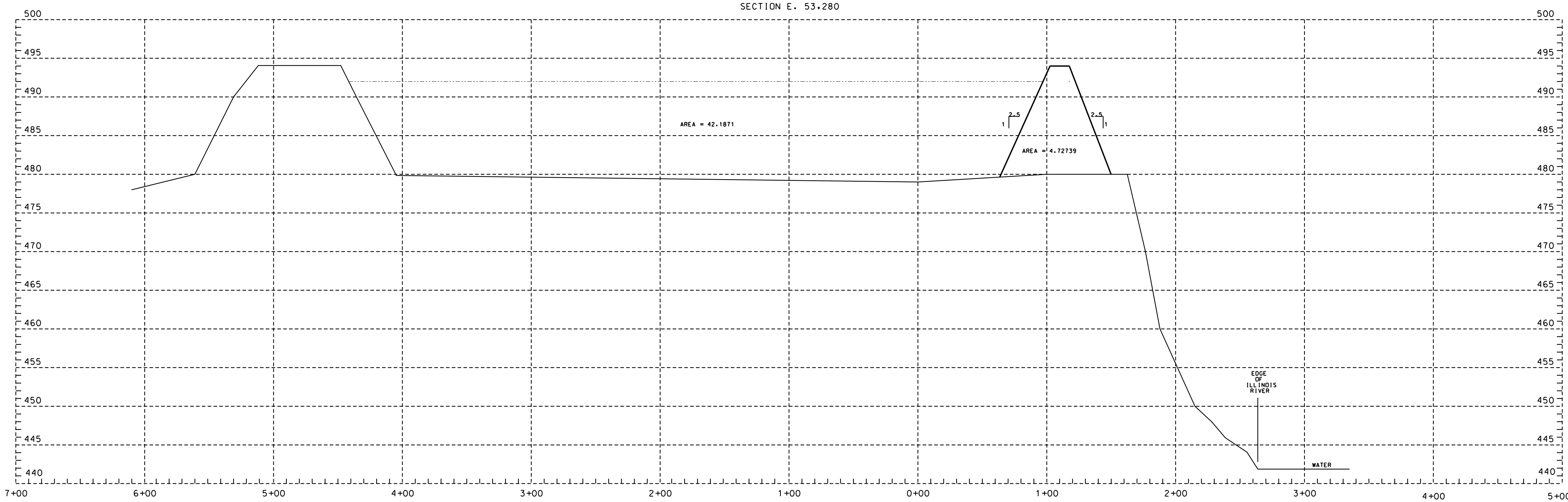
ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS
EAST ASH POND EXTENSION
HENNEPIN POWER STATION

DR WJM	CAD WJM	DATE 1-12-89
OK	CKD	SCALE 1"=5' V. 1"=30' H.
APP	PLOTTED 03-08-90	CE-HEN1-B458-2
APP		



SECTION E. 53,280



SECTION E. 53,080

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
0													

NOTES

1. DATA COLLECTED FROM TOPO ON DWG. CE-HEN1-B-450 DATED NOV. 4, 1987, REV. 0
2. COORDINATES WERE SUPPLIED BY G. DECKARD FIELD INFORMATION TIEING TO J.L. FISHER'S PANELS.

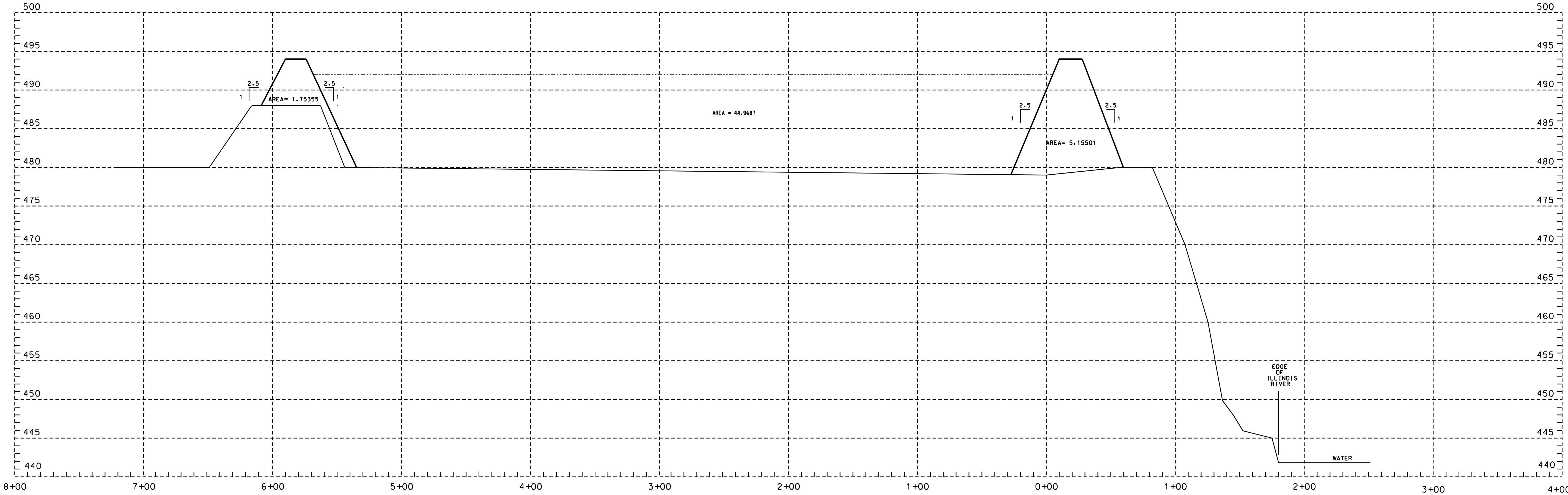
REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

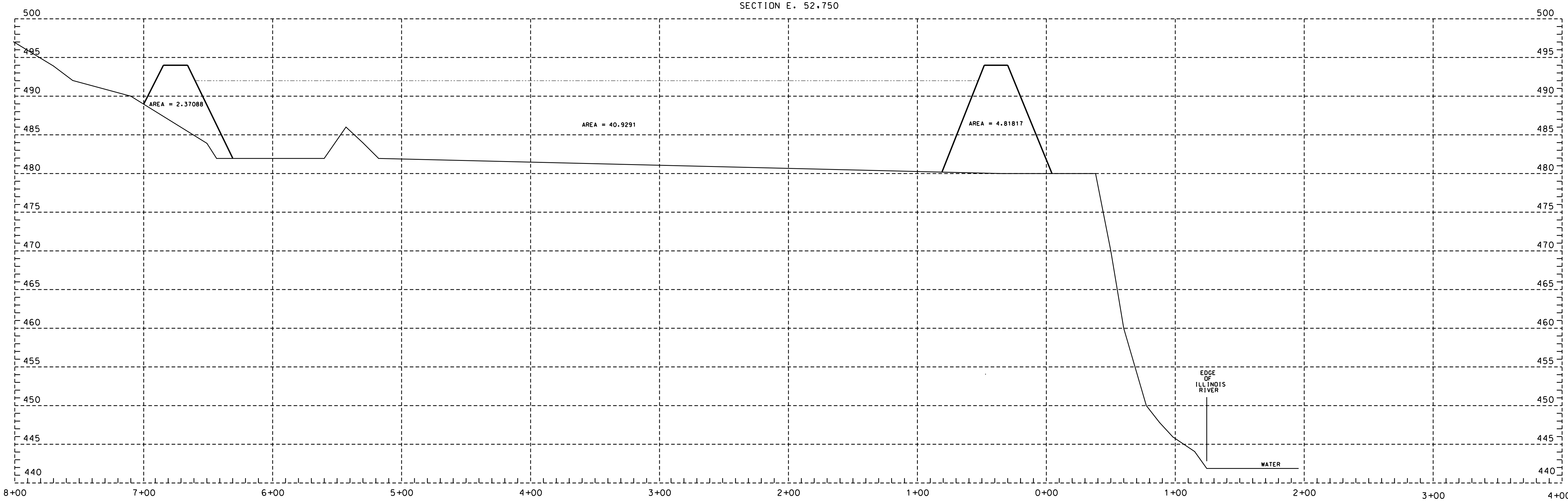
ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS
EAST ASH POND EXTENSION
HENNEPIN POWER STATION

DR WJM	CAD WJM	DATE 1-12-89
OK	CKD	SCALE 1"=5' V. 1"=30' H.
APP	PLOTTED 03-08-90	CE-HEN1-B458-3
APP		



SECTION E. 52.750



SECTION E. 52.448

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
0													

NOTES

1. DATA COLLECTED FROM TOPO ON DWG. CE-HEN1-B-450 DATED NOV. 4, 1987, REV. 0
2. COORDINATES WERE SUPPLIED BY G. DECKARD FIELD INFORMATION TIEING TO J.L. FISHER'S PANELS.

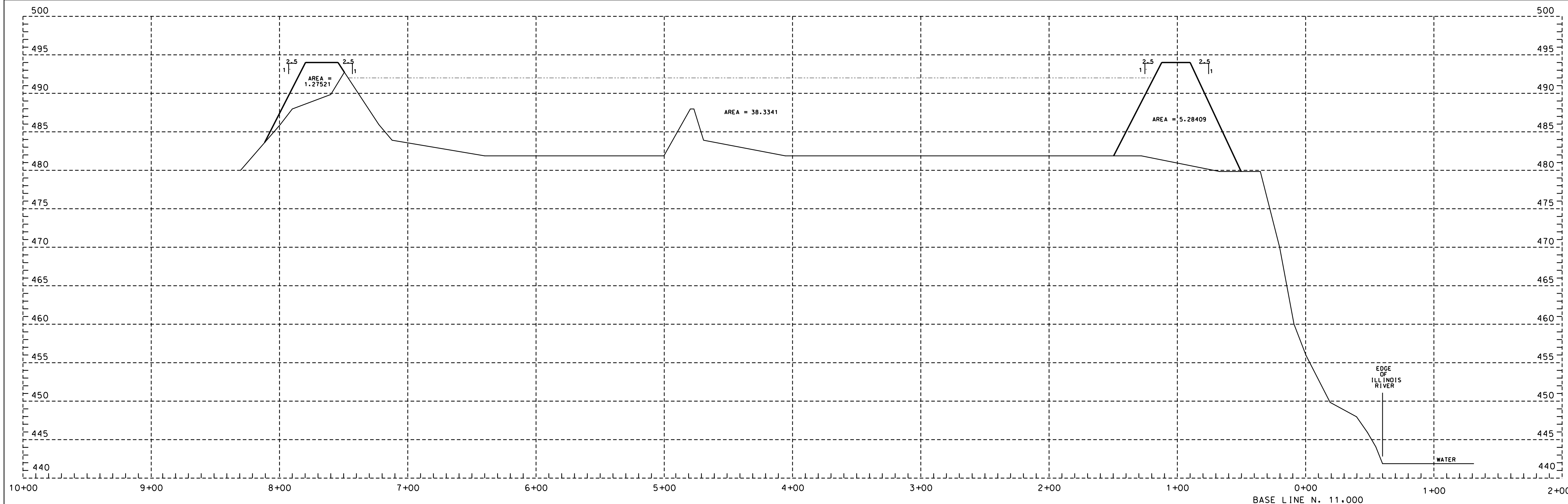
REFERENCES

REVISION STATUS
-CONSTRUCTION
-RECORD
0

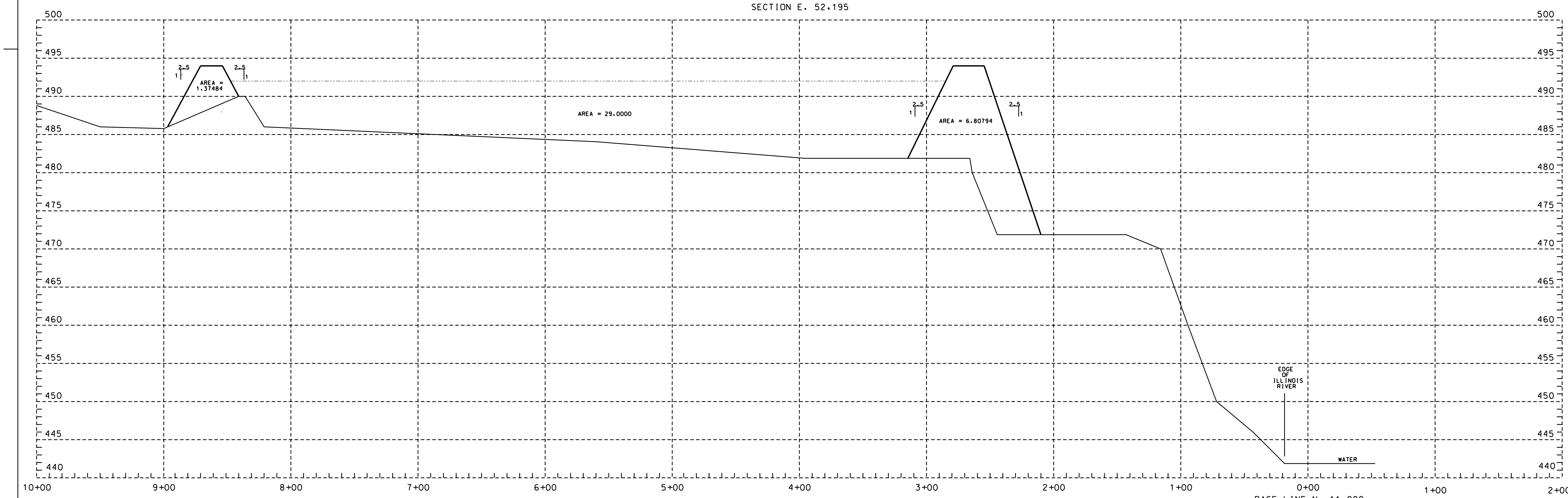
ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS
EAST ASH POND EXTENSION
HENNEPIN POWER STATION

DR WJM	CAD WJM	DATE 1-12-89
OK	CKD	SCALE 1"=5' V. 1"=30' H.
APP	PLOTTED 03-08-90	CE-HEN1-B458-4
APP		



SECTION E. 52,195



SECTION E. 51,920

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
0													

NOTES

1. DATA COLLECTED FROM TOPO ON DWG. CE-HEN1-B-450 DATED NOV. 4, 1987, REV. 0
2. COORDINATES WERE SUPPLIED BY G. DECKARD FIELD INFORMATION TIEING TO J.L. FISHER'S PANELS.

REFERENCES

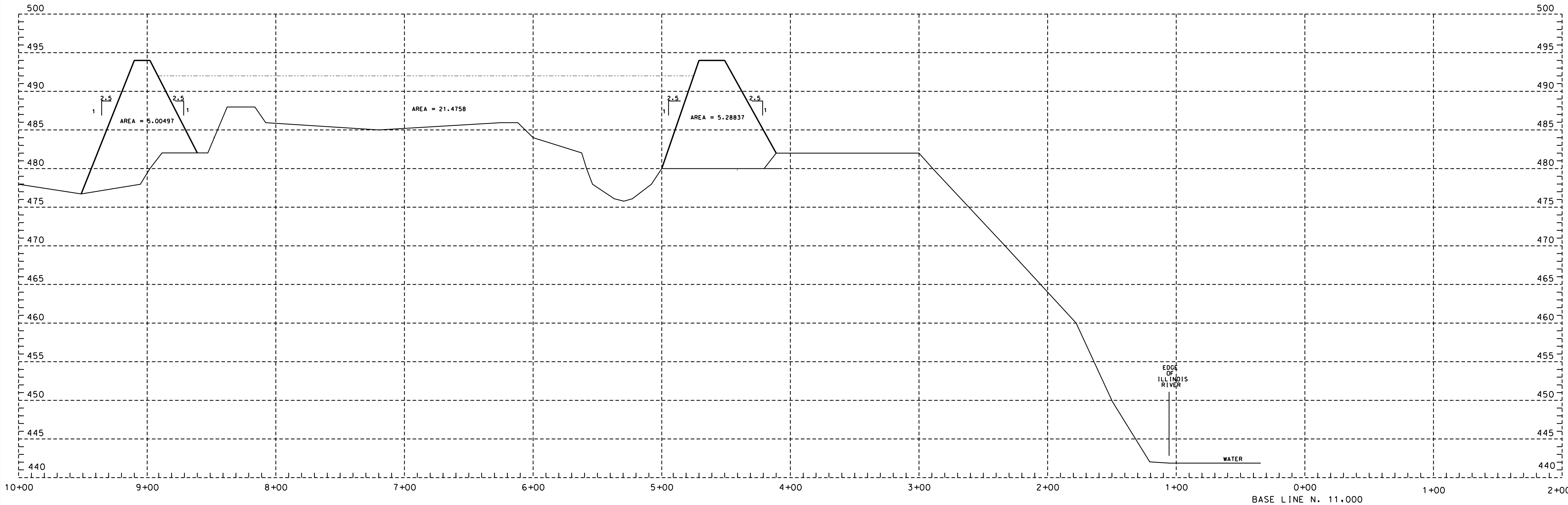
REVISION STATUS
- CONSTRUCTION
- RECORD

0

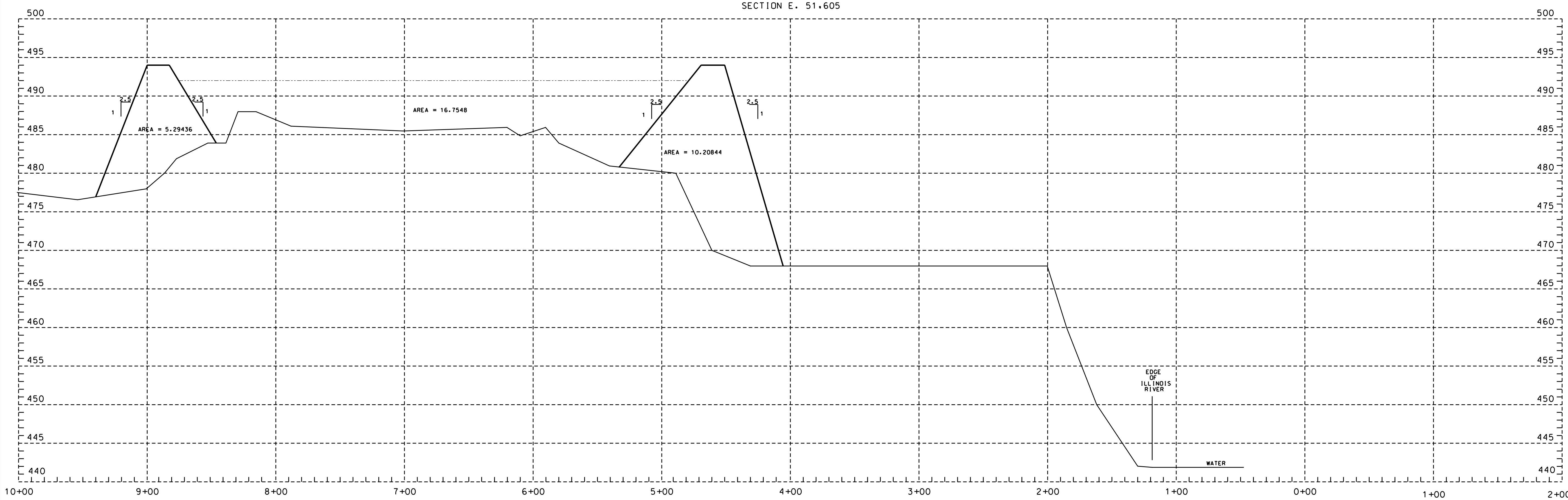
ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS
EAST ASH POND EXTENSION
HENNEPIN POWER STATION

DR WJM	CAD WJM	DATE 1-12-89
OK	CKD	SCALE 1"=5' V. 1"=30' H.
APP	PLOTTED 03-08-90	CE-HEN1-B458-5
APP		



SECTION E. 51,605



SECTION E. 51,552

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
0													

NOTES

1. DATA COLLECTED FROM TOPO ON DWG. CE-HEN1-B-450 DATED NOV. 4, 1987, REV. 0
2. COORDINATES WERE SUPPLIED BY G. DECKARD FIELD INFORMATION TIEING TO J.L. FISHER'S PANELS.

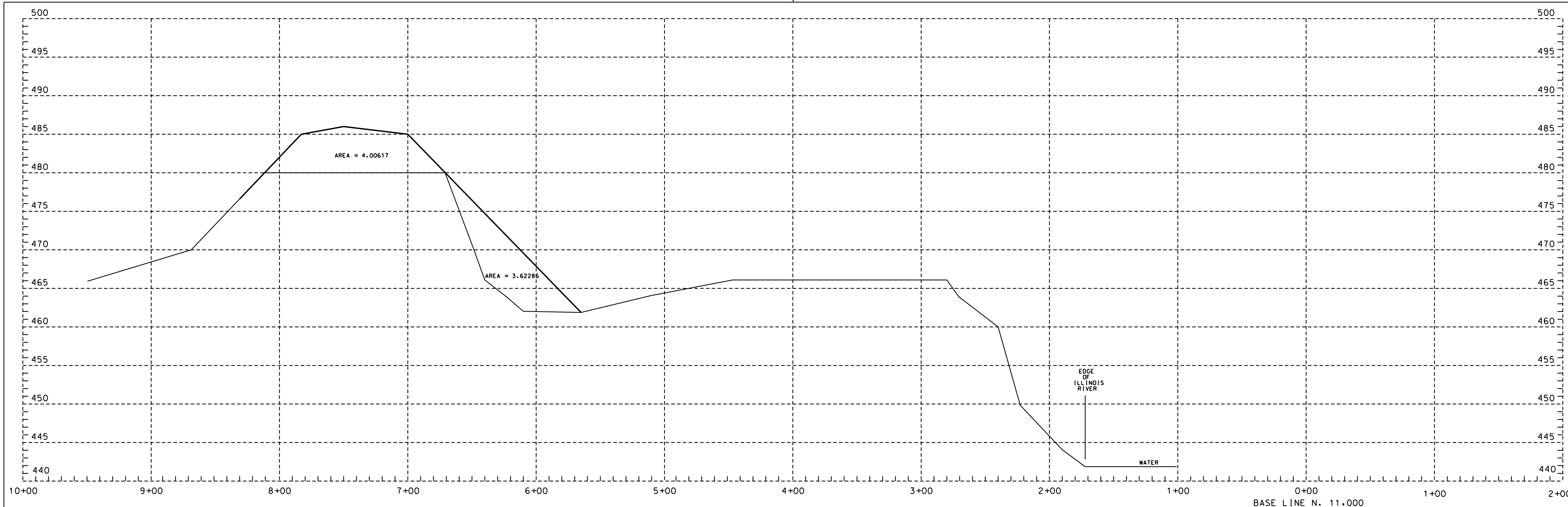
REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS
EAST ASH POND EXTENSION
HENNEPIN POWER STATION

DR WJM	CAD WJM	DATE 1-12-89
OK	CKD	SCALE 1"=5' V. 1"=30' H.
APP	PLOTTED 03-08-90	CE-HEN1-B458-6
APP		



SECTION E. 51,285

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
0													

NOTES

1. DATA COLLECTED FROM TOPO ON DWG. CE-HEN1-B-450 DATED NOV. 4, 1987, REV. 0
2. COORDINATES WERE SUPPLIED BY G. DECKARD FIELD INFORMATION TIEING TO J.L. FISHER'S PANELS.

REFERENCES

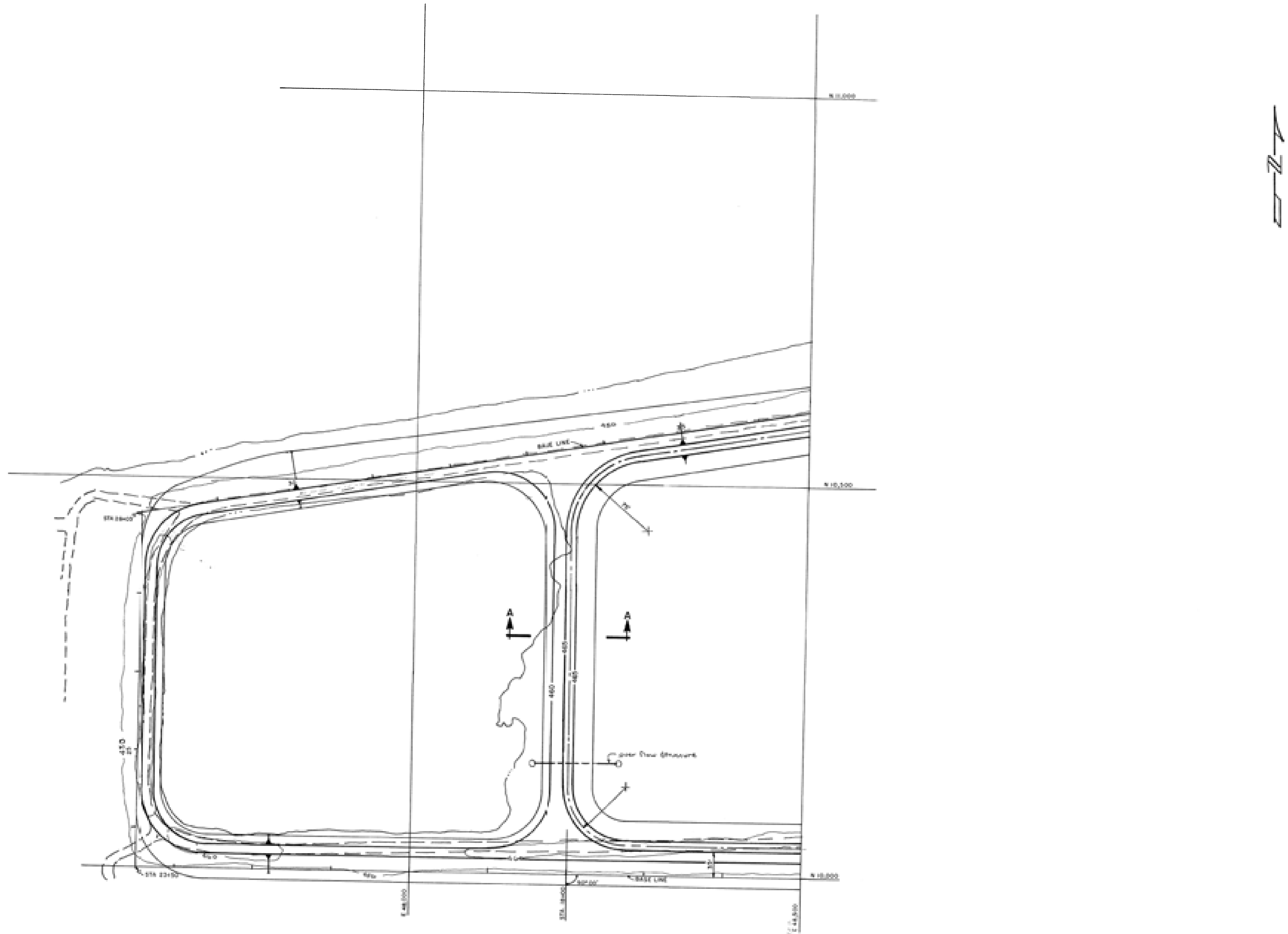
REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS
EAST ASH POND EXTENSION
HENNEPIN POWER STATION

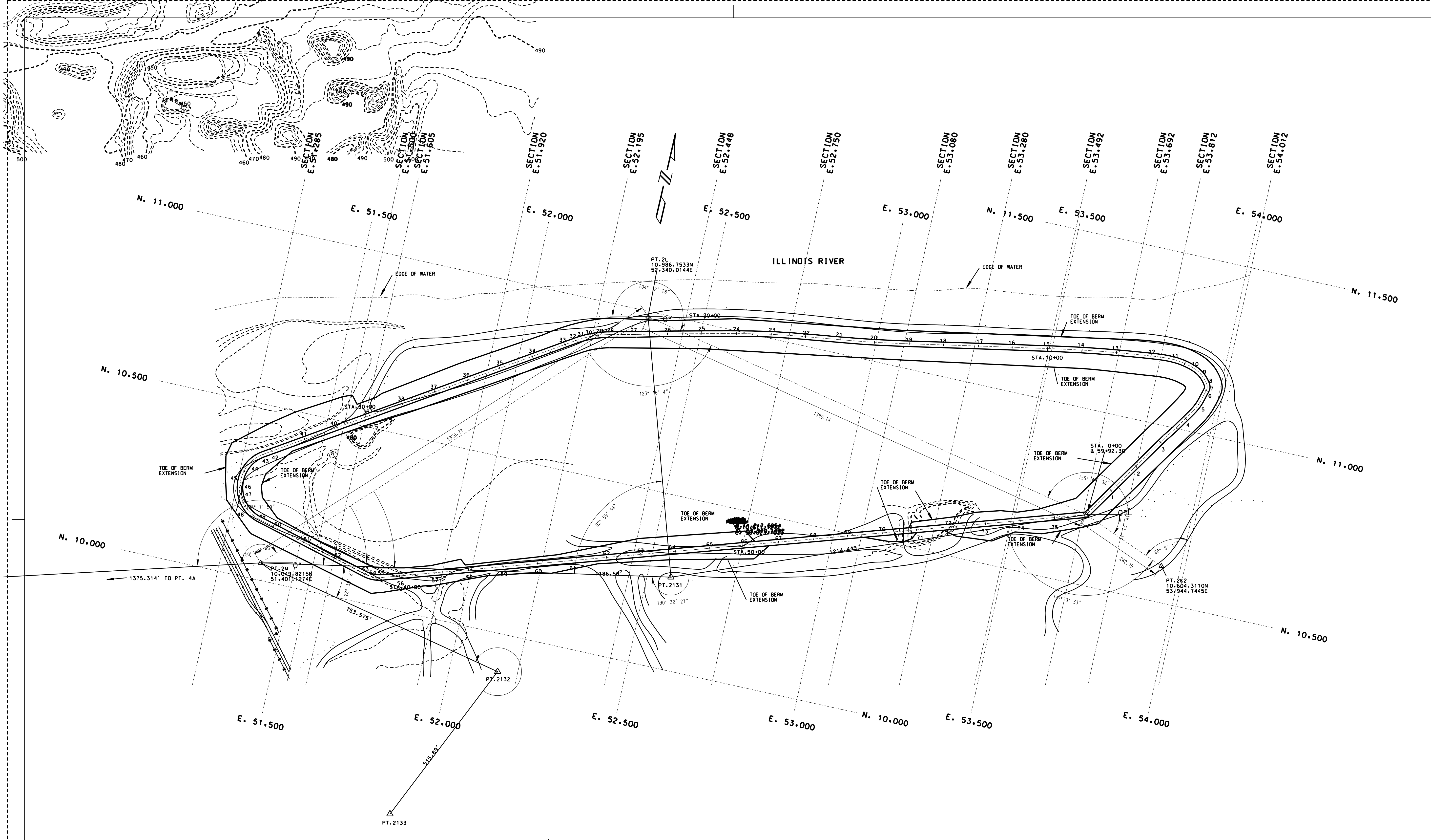
DR WJM	CAD WJM	DATE 1-12-89
OK	CKD	SCALE 1"=5' V. 1"=30' H.
APP	PLOTTED 03-08-90	CE-HEN1-B458-7
APP		

REVISION STATUS	**ILLINOIS POWER COMPANY** DECATUR
	PLAN-UNIT#1 ASH POND EXTENSION HENNEPIN POWER STATION SHEET # 1
DR. C.R.H.	DATE 2-2-88
	SCALE 1"=50'
	E-HEN1-B460-1



REVISIONS

ILLINOIS POWER COMPANY DECATUR	
PLAN - UNIT#I ASH POND EXTENSION HENNEPIN POWER STATION SHEET #2	
DR. G.B.H.	DATE 2-2-88
CK. NGD	SCALE 1" = 50'
	E-HEN1-B460-2



NOTE: TOPO WAS DIDGITIZED FROM DWG. CE-HEN1-B-450 DATED 11-4-87

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
0													

NOTES

REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD

0

ILLINOIS POWER COMPANY

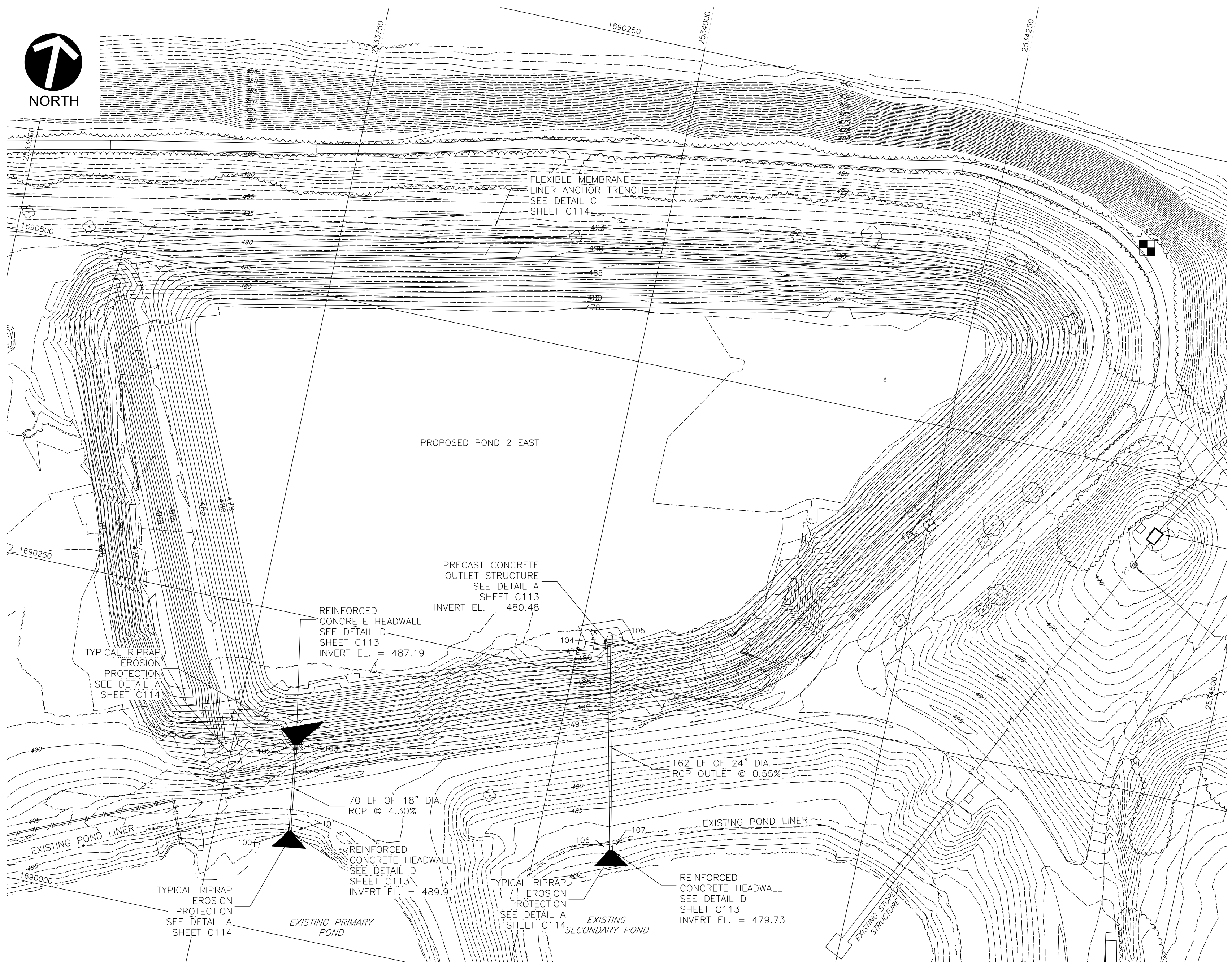
DECATUR

CONTOUR AND GRADING PLAN
UNIT #2 ASH POND EXTENSION
HENNEPIN POWER STATION

DR WJM	CAD WJM	DATE 1-11-89
OK	CKD	SCALE 1"=100"
APP	PLOTTED 03-08-90	CE-HEN1-B461
APP		

OVO.1.2.3.4.5

A B C D



SCALE IN FEET

0 40 80

DRAWING NOT TO SCALE IF SCALE BAR DOES NOT MEASURE 2 INCHES

REFERENCE

1. TOPOGRAPHIC INFORMATION BASED UPON AERIAL SURVEY CONDUCTED BY SURDEX CORPORATION FLOWN ON OCTOBER 26, 2008.

STRUCTURE TABLE		
Point #	Northing	Easting
100	1690080.864	2533807.450
101	1690081.207	2533809.928
102	1690149.246	2533797.977
103	1690149.589	2533800.456
104	1690276.331	2534020.790
105	1690282.205	2534024.973
106	1690118.909	2534057.560
107	1690119.451	2534060.003

NOTE

THE LOCATION OF THE ABOVE AND BELOW GRADE STRUCTURES SHOWN ON THESE DRAWINGS ARE APPROXIMATE. PRIOR TO PERFORMING EXCAVATIONS, THE CONTRACTOR SHALL FIELD LOCATE STRUCTURES THAT MAY BE WITHIN THE LIMITS OF WORK AND PROTECT THEM ACCORDINGLY.

LEGEND

- 495 — PROPOSED INDEX CONTOURS
- 495 — PROPOSED INTERMEDIATE CONTOURS
- 495 — EXISTING INDEX CONTOURS
- 495 — EXISTING INTERMEDIATE CONTOURS
- ?? — EXISTING STORM WATER DRAINS
- EXISTING ACCESS ROAD

1 2 3 4

Civil & Environmental Consultants, Inc.

5910 Haper Road, Suite 106 - Solon, OH 44139
Ph: 330.310.6800 · 866.507.2324
www.cecinc.com

REFERENCE DRAWINGS

NO.	DATE	REVISION	BY	APPROVED

NO.	DATE	REVISION	BY	APPROVED
0	7/28/10	RECORD REVISION - 082-255	DFB	SFP

SCALE: AS_NOTED

DWN. DFB	DATE 07/05/2010
CHK. RTM	DATE 07/12/2010
APPV. SFP	DATE 07/12/2010

DYNEGY

DYNEGY MIDWEST GENERATION, INC.
HENNEPIN POWER STATION
POND 2 EAST
FLEXIBLE MEMBRANE LINER AND STRUCTURES

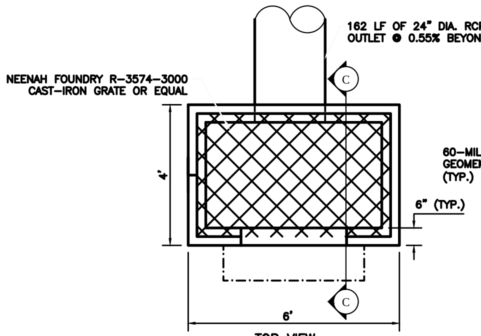
PROJECT NO.: 082-255

CLIENT: DYNEGY

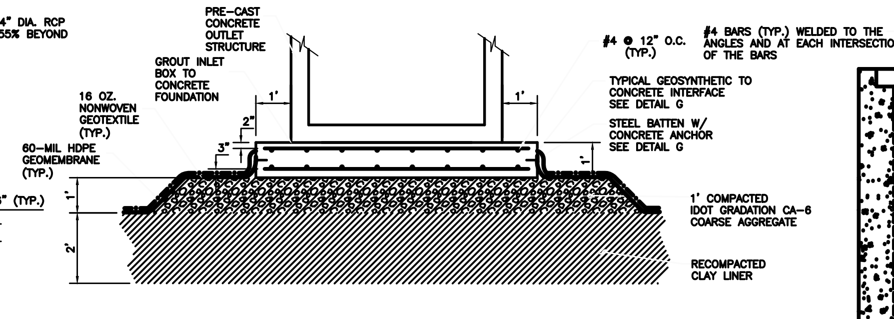
DWG. NO.: HEN1-C109

REV. 0

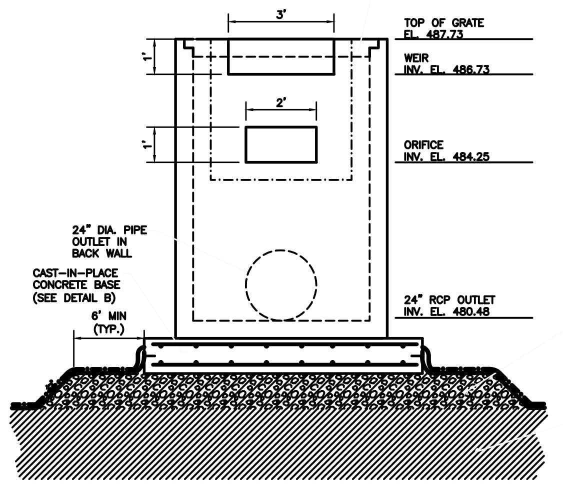
HENNEPIN HEN1-C109 DFB 07/05/2010



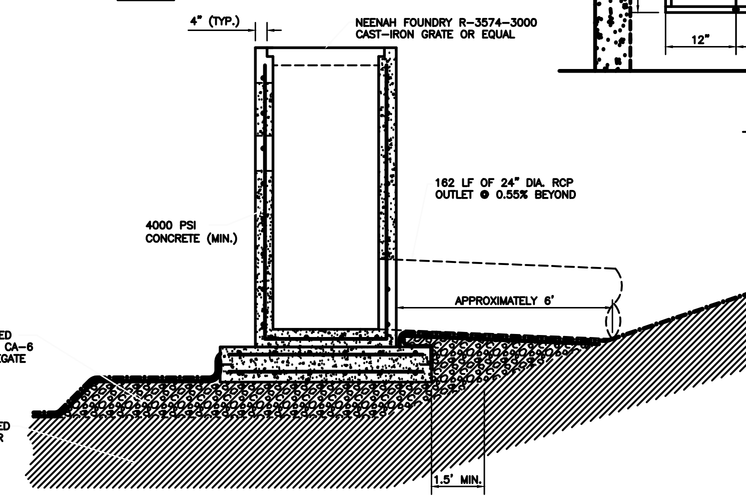
TOP VIEW



DETAIL B



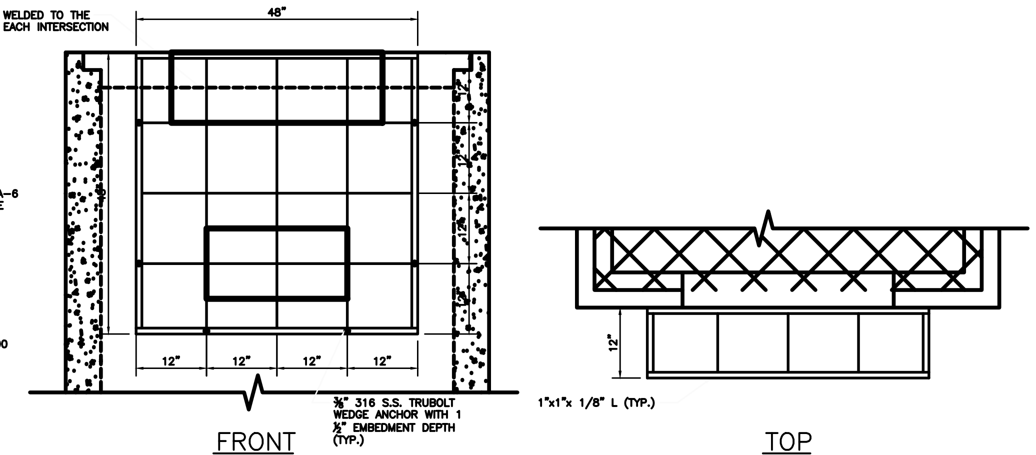
FRONT VIEW



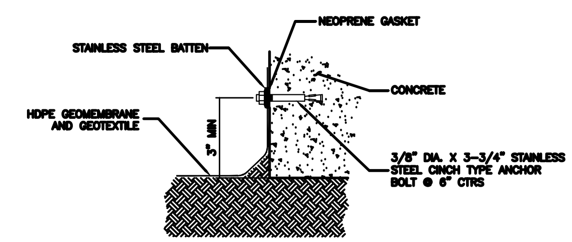
DETAIL A
PRECAST CONCRETE OUTLET STRUCTURE
N.T.S.

SECTION C-C

NOTES
1. REFER TO ILLINOIS DEPARTMENT OF TRANSPORTATION (IDOT) STANDARD FOR OUTLET REINFORCING.



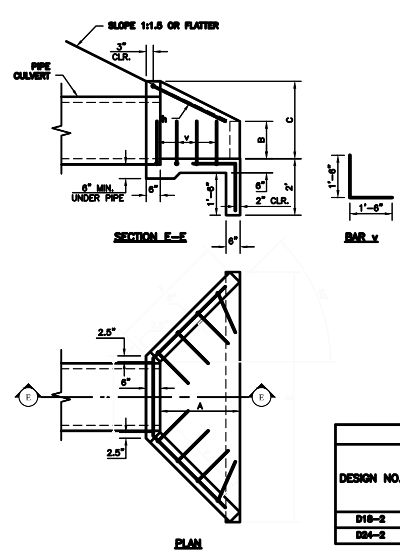
DETAIL E
TRASH RACK
N.T.S.

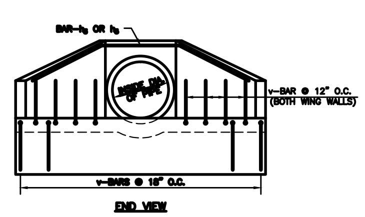


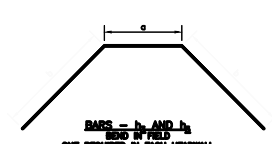
STEEL BATTEN W/ CONCRETE ANCHOR

DETAIL G
TYPICAL GEOSYNTHETIC TO CONCRETE INTERFACE
N.T.S.

NOTES
1. EARTH ADJACENT TO CONCRETE TO BE WELL COMPACTED TO PREVENT FUTURE DIFFERENTIAL SETTLEMENT.
2. ALL CONCRETE COLLARS TO BE CHAMFERED A MINIMUM OF 1" (TYP.) @ ALL CORNERS IN CONTACT WITH LINER







DETAIL D
REINFORCED CONCRETE HEADWALL
N.T.S.

NOTES
1. REFER TO IDOT STANDARD 542101-02 REINFORCED CONCRETE HEADWALL DETAIL FOR FINAL DESIGN.

DIMENSIONS OF BARS-h_3 AND h_5

BAR	a	b
h_3	2'-1"	3'-2.50"
h_5	2'-9"	4'-1.50"

DIMENSIONS AND QUANTITIES

DESIGN NO.	NOMINAL INSIDE DIA. OF PIPE	SLOPE OF WING WALLS	DIMENSIONS (A)	DIMENSIONS (B)	DIMENSIONS (C)	DIMENSIONS (D)	DIMENSIONS (E)	DIMENSIONS (F)	CONCRETE 2 END SECS. CU. YDS.	NO.4 REBAR h-BARS (BAR)	NO.4 REBAR h-BARS (LENGTH)	NO.4 REBAR v-BARS NO.	NO.4 REBAR TOTAL WT. 2 END SECS. LBS.
D18-2	1'-6"	1 TO 2	2'-2"	1'-1"	2'-2"	2'-3"	6'-10.50"	3'-3.25"	1.30	h_3	8'-6"	22	60
D24-2	2'-0"	1 TO 2	2'-10"	1'-4"	2'-9"	2'-11"	8'-10.50"	4'-2.50"	2.00	h_5	11'-0"	28	70

Civil & Environmental Consultants, Inc.
5910 Haper Road, Suite 106 - Solon, OH 44139
Ph: 330.310.6800 · 866.507.2324
www.cecinc.com

REFERENCE DRAWINGS

NO.	DATE	REVISION	BY	APPROVED
0	7/28/10	RECORD REVISION - 082-255	DFB	SFP

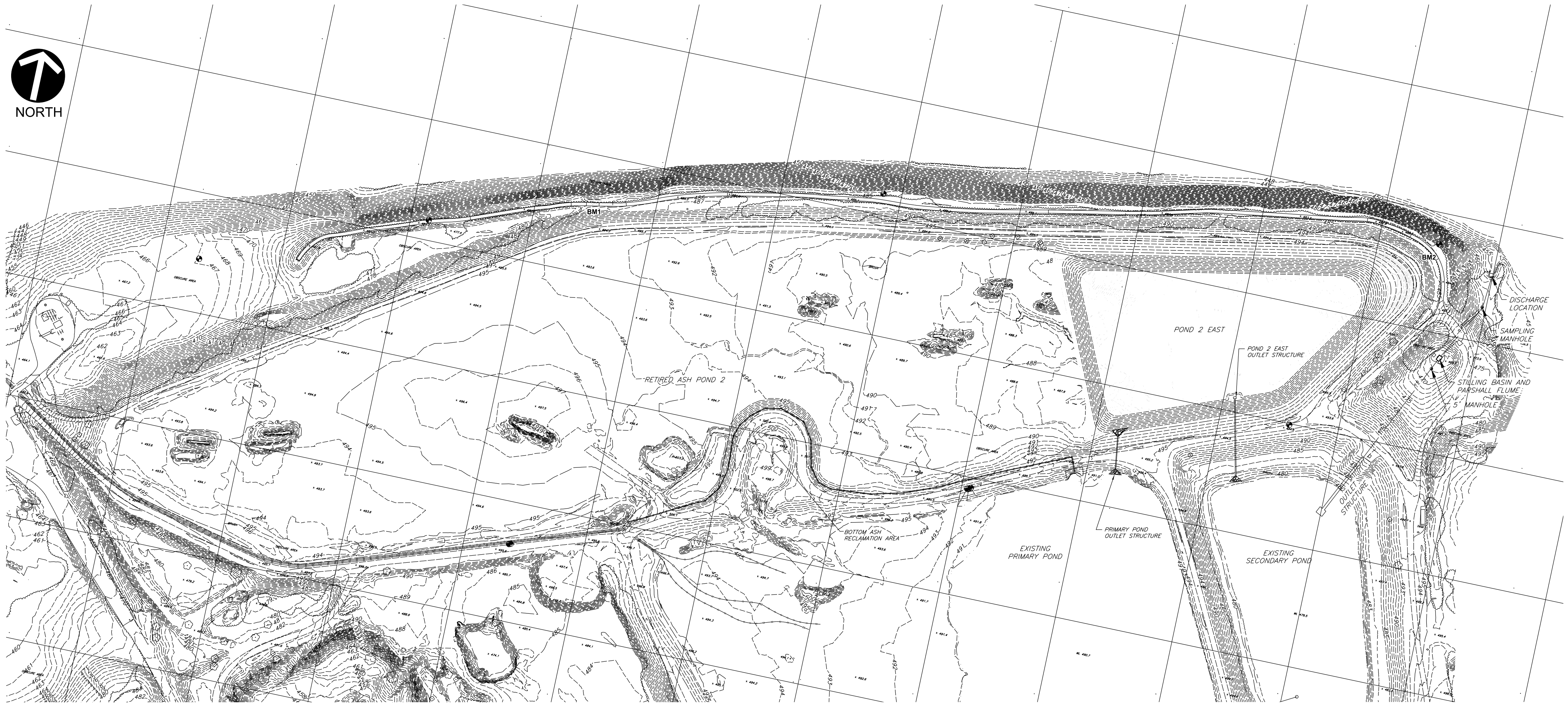
SCALE: AS_NOTED
DWN. DFB DATE 07/05/2010
CHK. RTM DATE 07/12/2010
APPV. SFP DATE 07/12/2010

DYNEGY

DYNEGY MIDWEST GENERATION, INC.
HENNEPIN POWER STATION
POND 2 EAST
DETAILS

PROJECT NO.: 082-255
CLIENT: DYNEGY
DWG. NO.: HEN1-C113
REV. 0

HENNEPIN HEN1-C113 DFB 07/05/2010



BENCHMARK LOCATIONS			
NUMBER	NORTHING	EASTING	ELEVATION
1	1690395.43	2532618.60	482.19
2	1690670.86	2534372.87	484.00
3*	1689478.87	2534643.99	506.80
4*	1688458.82	2533256.76	499.45
5*	1688781.84	2531352.15	468.27
6*	1689875.08	2531310.12	463.75

* BENCHMARKS BEYOND DRAWING BOUNDARY.

SCALE IN FEET

0 100 200

DRAWING NOT TO SCALE IF SCALE BAR DOES NOT MEASURE 2 INCHES

REFERENCE:

1. TOPOGRAPHIC INFORMATION BASED UPON AERIAL SURVEY CONDUCTED BY SURDEX CORPORATION FLOWN ON SEPTEMBER 10, 2008.

   DUE TO CONSTRUCTION ACTIVITIES, ACTUAL FIELD TOPOGRAPHY MAY VARY.

2. POND 2 EAST CONTOURS FROM CONSTRUCTION DRAWINGS SUBMITTED AUGUST 2009.

LEGEND

- MISCELLANEOUS FLOW PIPING
- EXISTING STORMWATER DRAINS
- EXISTING TREELINE
- EXISTING PIPING
- EXISTING ACCESS ROAD
- EXISTING PONDS/STREAMS
- EXISTING FENCE
- EXISTING BENCHMARK
- 500 EXISTING INDEX CONTOUR
- 499 EXISTING INTERMEDIATE CONTOUR
- EXISTING ROCK CHANNEL PROTECTION
- EXISTING MONITORING WELL

Civil & Environmental Consultants, Inc.
5910 Haper Road, Suite 106 - Solon, OH 44139
Ph: 330.310.6800 · 866.507.2324
www.cecinc.com

REFERENCE DRAWINGS

NO.	DATE	REVISION	BY	APPROVED
0	11/28/10	RECORD REVISION - 082-255	DFB	SFP

SCALE: AS_NOTED

DWN. DFB DATE 11/05/2010

CHK. RTM DATE 11/12/2010

APPV. SFP DATE 11/12/2010

EAPP_BY EABD

FEAPP_BY FEABD

DYNEGY

DYNEGY MIDWEST GENERATION, INC.
HENNEPIN POWER STATION
LANDFILL PHASE 1 CONSTRUCTION
EXISTING CONDITIONS

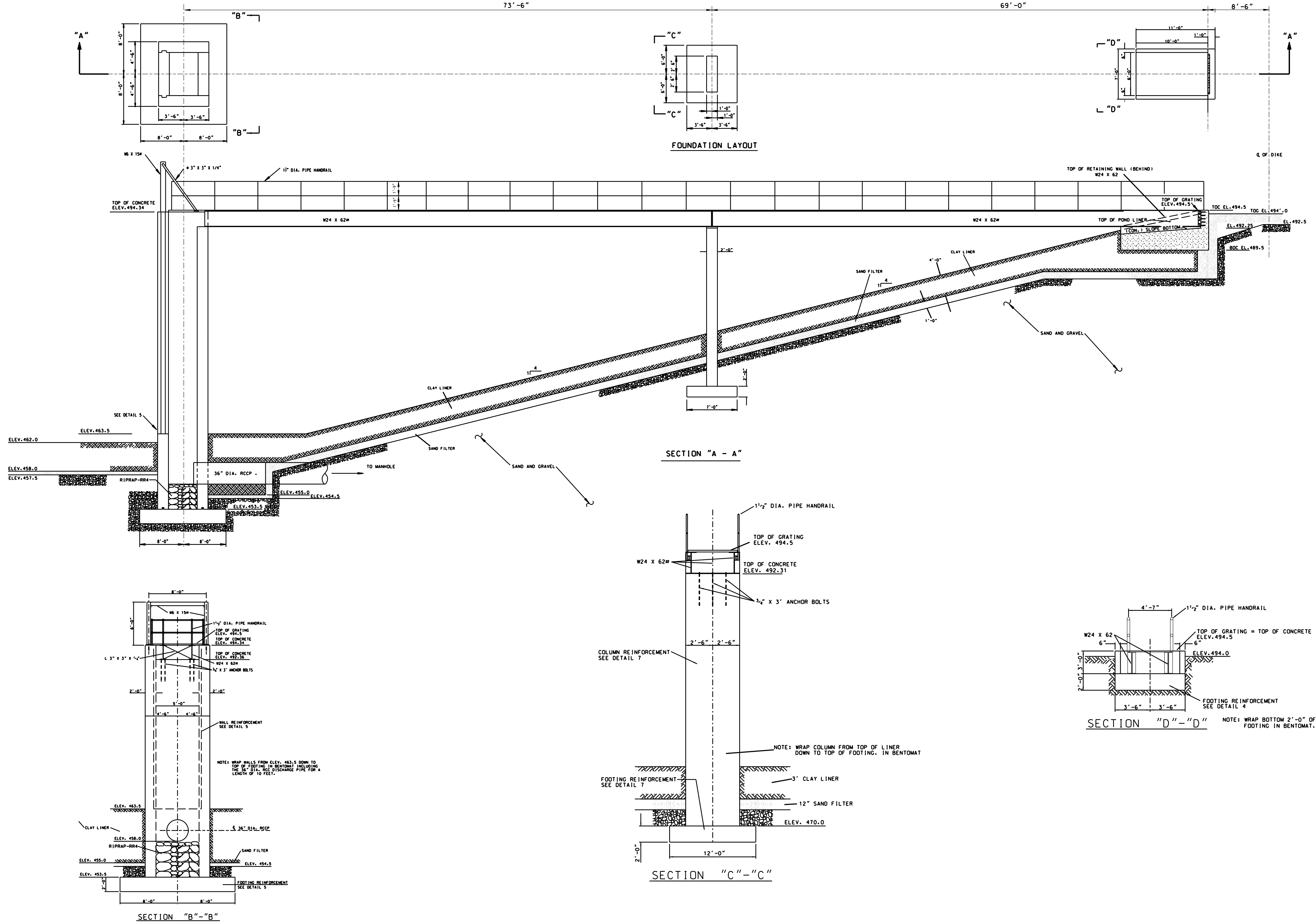
PROJECT NO.: 082-255

CLIENT: DYNEGY

DWG. NO.: HEN1-C117

REV. 0

HENNEPIN HEN1-C117 DFB 07/05/2010



NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
0													

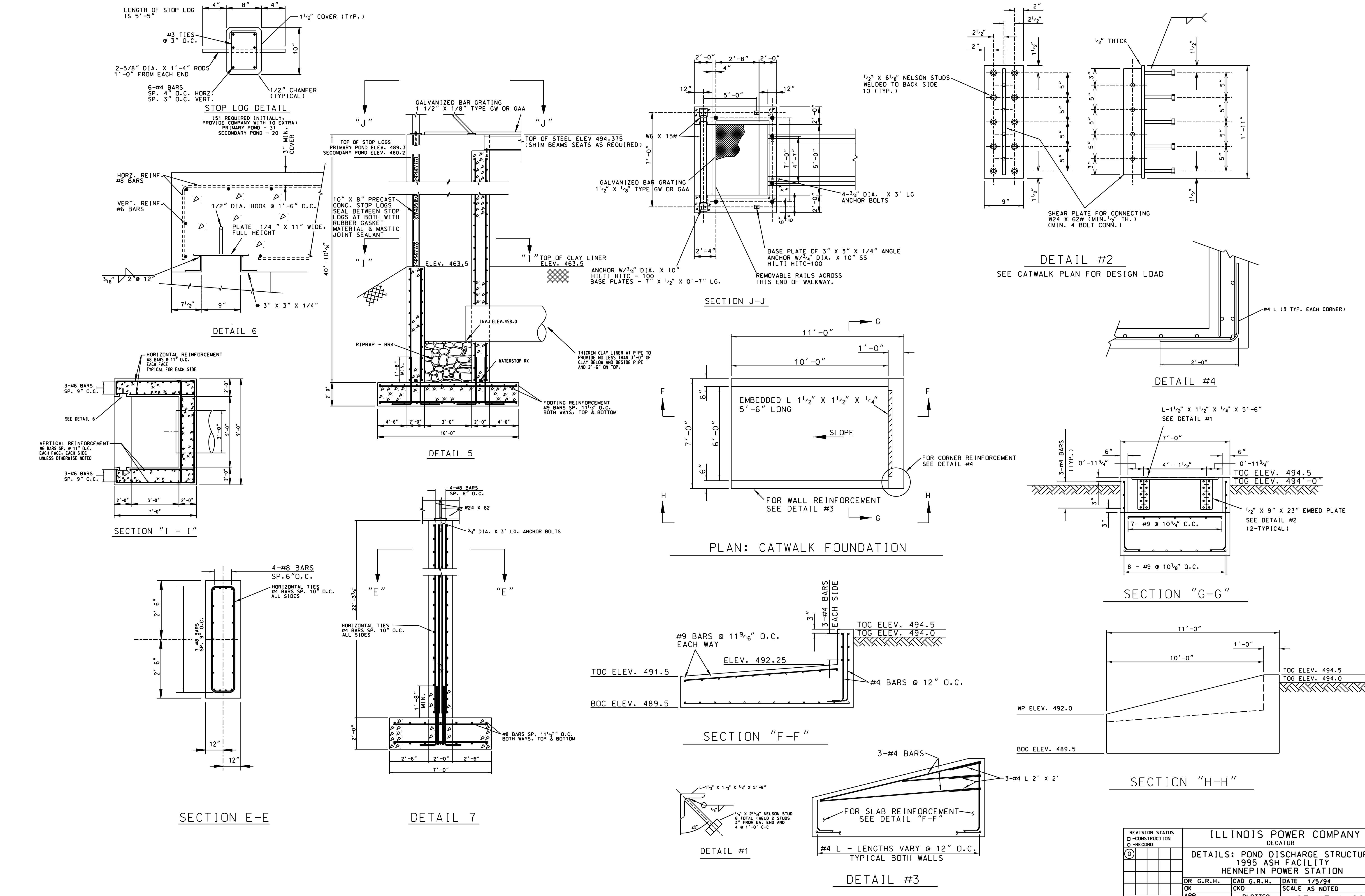
REVISION STATUS
□ -CONSTRUCTION
○ -RECORD

ILLINOIS POWER COMPANY
DECATUR

LAYOUT-POND DISCHARGE STRUCTURES
1995 ASH FACILITY
HENNEPIN POWER STATION

DR G.R.H.	CAD G.R.H.	DATE 1/5/94	
OK	CKD	SCALE NO SCALE	
APP	PLOTTED 9/17/96	CE-HEN1-C8	
APP			

p0019275.dgn



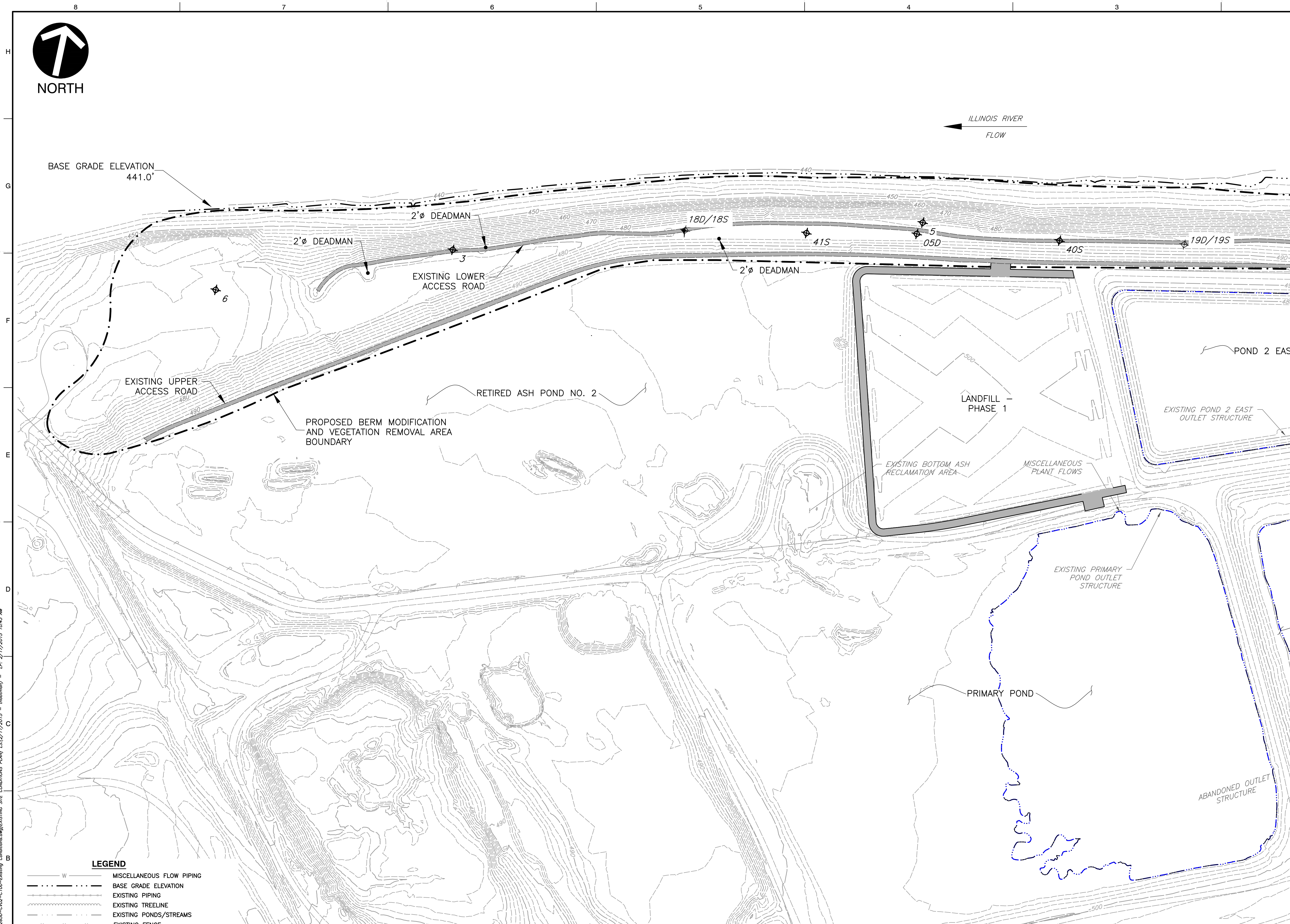
REVISION STATUS
□ -CONSTRUCTION
○ -RECORD

ILLINOIS POWER COMPANY
DECATUR

DETAILS: POND DISCHARGE STRUCTURE
1995 ASH FACILITY
HENNEPIN POWER STATION

DR G.R.H.	CAD G.R.H.	DATE 1/5/94
CK	CKD	SCALE AS NOTED
APP	PLOTTED 9/17/96	CE-HEN1-C9
APP		

p0019276.dgn



SUBMITTAL RECORD

NO	DATE	DESCRIPTION
1	5/2013	IDNR DAM MODIFICATION PERMIT
2	6/9/2014	ISSUED FOR CONSTRUCTION
3	2/4/2015	AS-BUILT CONSTRUCTION DRAWINGS

REVISION RECORD

NO	DATE	DESCRIPTION
△		
△		
△		
△		

LEGEND

- MISCELLANEOUS FLOW PIPING
- BASE GRADE ELEVATION
- EXISTING PIPING
- EXISTING TREELINE
- EXISTING PONDS/STREAMS
- EXISTING FENCE
- EXISTING ACCESS ROAD
- EXISTING STORM WATER PIPING
- EXISTING UNDERGROUND PLANT FLOW PIPING
- EXISTING PLANT FLOW PIPING
- 495 EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- 18D EXISTING MONITORING WELL LOCATIONS
- EXISTING ACCESS ROAD
- PROPOSED EAST BERM MODIFICATIONS AREA BOUNDARY

REFERENCE:

1. TOPOGRAPHIC INFORMATION BASED UPON AERIAL SURVEY CONDUCTED BY SURDEX CORPORATION FLOWN ON SEPTEMBER 10, 2008.
2. EMBANKMENT AREA SURVEY RECEIVED BY CEC FROM DLZ ON MARCH 4, 2013 AND JANUARY 10, 2014.
3. IL DNR PERMIT NO. DS2014017–DAM I.D. NO. 50663
4. AS–BUILT SURVEY RECEIVED BY CEC FROM DLZ, DECEMBER 12, 2014.

AS-BUILT CONSTRUCTION PLANS

SCALE IN FEET
0 100 200

* HAND SIGNATURE ON FILE

CEC
Civil & Environmental Consultants, Inc.
555 Butterfield Road, Suite 300 - Lombard, IL 60148
Ph: 630.963.6026 · 877.963.6026 · Fax: 630.963.6027
www.cecinc.com

DYNEGY MIDWEST GENERATION, INC.
HENNEPIN POWER STATION
EAST BERM MODIFICATION
HENNEPIN, ILLINOIS

DRAWN BY: DFB	CHECKED BY: MDJ	APPROVED BY: *MDJ
DATE: FEBRUARY 2015	DWG SCALE: AS NOTED	PROJECT NO: 132-650

EXISTING SITE CONDITIONS PLAN

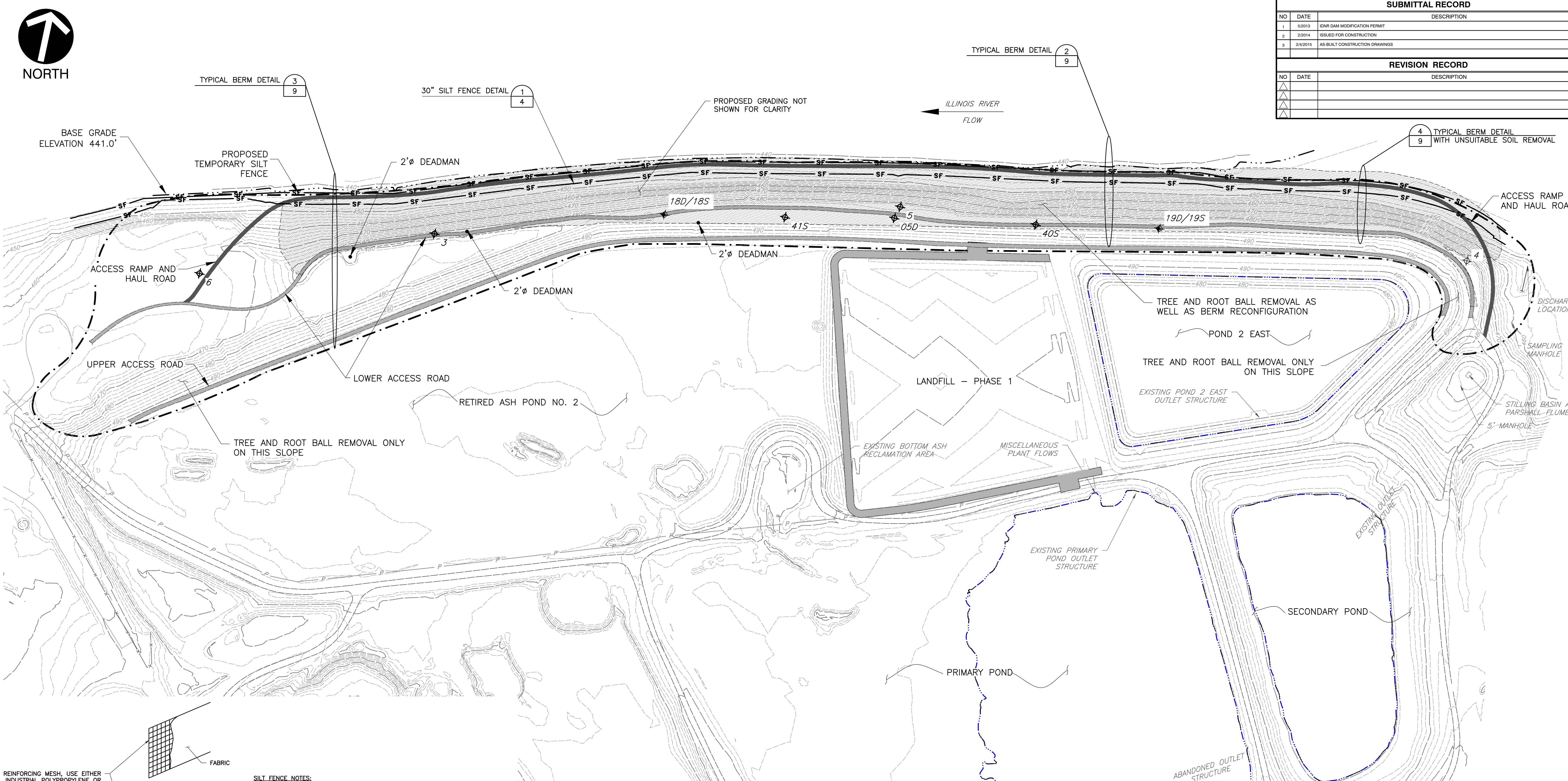
DRAWING NO.: 3
SHEET 3 OF 9

p:\2013\132-650.0200\-CADD\Dwg\CV02\132650-CV02-C100-Existing Conditions.dwg{EXISTING SITE CONDITIONS PLAN} LS:(2/11/2015 - lrnealman) - LP: 2/11/2015 10:43 AM

NO	DATE	DESCRIPTION
		SUBMITTAL RECORD
1	5/2013	IDNR DAM MODIFICATION PERMIT
2	2/2014	ISSUED FOR CONSTRUCTION
3	2/4/2015	AS-BUILT CONSTRUCTION DRAWINGS

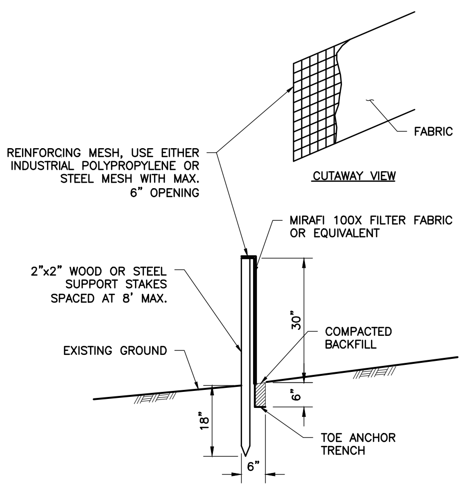
REVISION RECORD

NO	DATE	DESCRIPTION



SITE PLAN
SCALE: 1" = 100'

* HAND SIGNATURE ON FILE



DETAIL 1
30" SILT FENCE DETAIL
N.T.S.

SILT FENCE NOTES:

1. SILT FENCE SHALL BE PLACED ON LEVEL GRADE, WHERE POSSIBLE, AND BOTH ENDS OF THE SILT FENCE SHALL BE EXTENDED UP THE SLOPE.
2. SILT FENCE SHALL NOT BE PLACED IN ANY AREA OF CONCENTRATED FLOW NOR IN AREAS WHERE ROCK OR ROCKY SOILS PREVENT THE FULL AND UNIFORM ANCHORING OF THE FENCE TOE.
3. THE CONTRACTOR SHALL INSPECT THE SILT FENCE AFTER EVERY PRECIPITATION EVENT AND IMMEDIATELY REPAIR ANY DEFICIENCIES.
4. THE CONTRACTOR SHALL REMOVE ACCUMULATED SEDIMENTS AS REQUIRED TO KEEP THE FENCE FUNCTIONAL. IN ALL CASES, THE CONTRACTOR SHALL REMOVE DEPOSITS WHERE ACCUMULATIONS REACH ONE-HALF THE ABOVE GROUND HEIGHT OF THE FENCE.
5. THE CONTRACTOR SHALL IMMEDIATELY REPAIR ALL UNDERCUTTING OR EROSION OF THE ANCHOR TOE WITH A ROCK FILTER OUTLET.
6. THE CONTRACTOR SHALL CONFORM TO ANY RECOMMENDATIONS BY THE MANUFACTURER FOR REPLACING FILTER FABRIC FENCE DUE TO WEATHERING.

LEGEND

Symbol	Description
W	MISCELLANEOUS FLOW PIPING
	BASE GRADE ELEVATION
	EXISTING PIPING
	EXISTING TREELINE
	EXISTING PONDS/STREAMS
X	EXISTING FENCE
	EXISTING ACCESS ROAD
ST	EXISTING STORM WATER PIPING
P	EXISTING UNDERGROUND PLANT FLOW PIPING
	EXISTING PLANT FLOW PIPING
495	EXISTING INDEX CONTOURS
	EXISTING INTERMEDIATE CONTOURS
18D	EXISTING MONITORING WELL LOCATIONS
	PROPOSED CONSTRUCTION ACCESS ROAD
	PROPOSED EAST BERM MODIFICATIONS AREA BOUNDARY
SF	PROPOSED SILT FENCE
	PROPOSED GRADING LIMITS

AS-BUILT CONSTRUCTION PLANS

NOTE:
MONITORING WELLS EXIST WITHIN THE PROPOSED BERM MODIFICATION AREA. CONTRACTOR SHALL PROTECT EXISTING MONITORING WELLS WHILE PERFORMING BERM MODIFICATION ACTIVITIES.

REFERENCE:

1. TOPOGRAPHIC INFORMATION BASED UPON AERIAL SURVEY CONDUCTED BY SURDEX CORPORATION FLOWN ON SEPTEMBER 10, 2008.
2. EMBANKMENT AREA SURVEY RECEIVED BY CEC FROM DLZ ON MARCH 4, 2013 AND JANUARY 10, 2014.
3. IL DNR PERMIT NO. DS2014017-DAM I.D. NO. 50663
4. AS-BUILT SURVEY RECEIVED BY CEC FROM DLZ, DECEMBER 12, 2014.

SCALE IN FEET
0 100 200

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Civil & Environmental Consultants, Inc.
555 Butterfield Road, Suite 300 - Lombard, IL 60148
Ph: 630.963.6026 · 877.963.6026 · Fax: 630.963.6027
www.cecinc.com

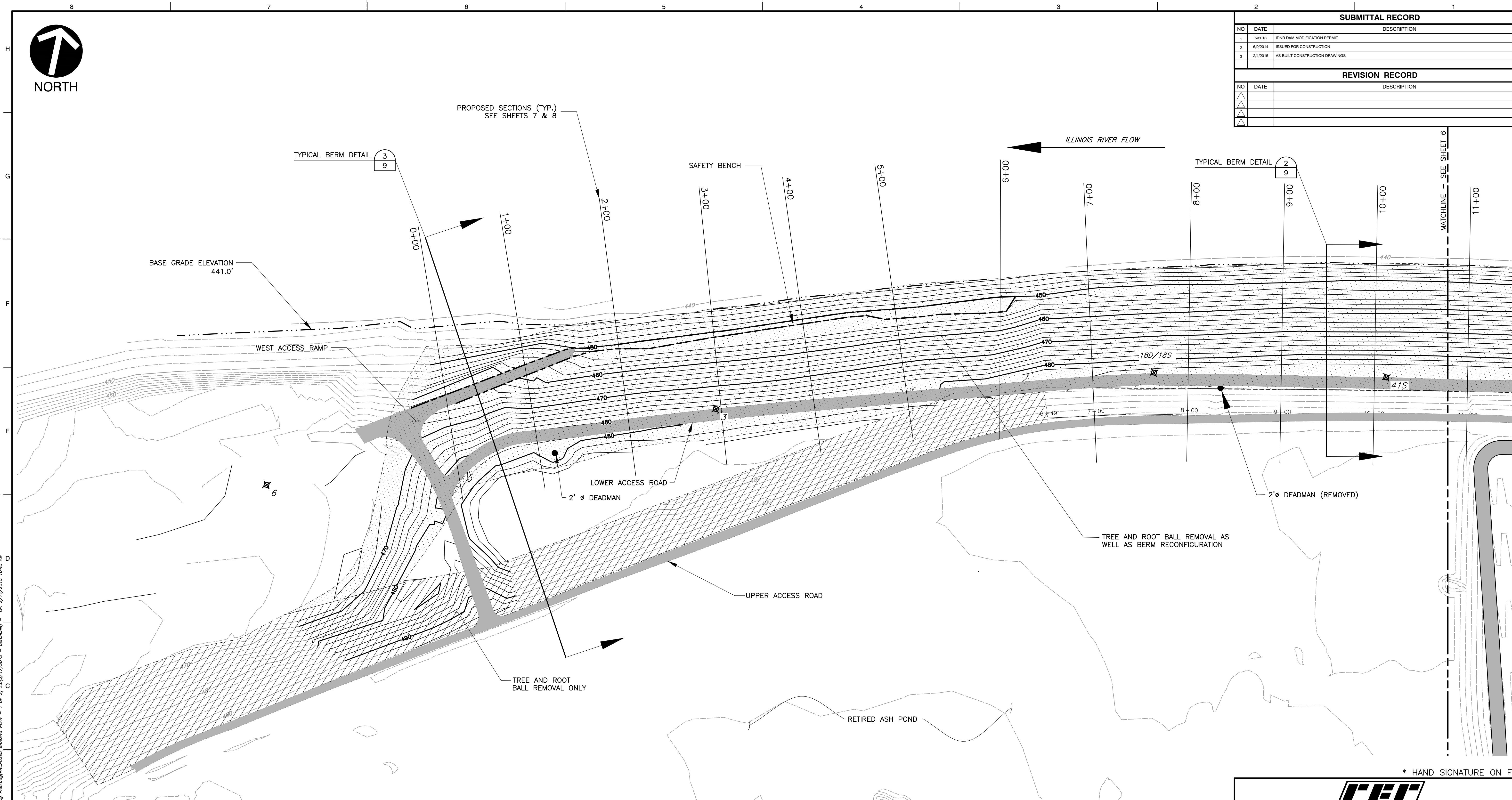
DYNEGY MIDWEST GENERATION, INC.
HENNEPIN POWER STATION
EAST BERM MODIFICATION
HENNEPIN, ILLINOIS

DRAWN BY:	DFB	CHECKED BY:	MDJ	APPROVED BY:	*MDJ
DATE:	FEBRUARY 2015	DWG SCALE:	AS NOTED	PROJECT NO:	132-650

PROPOSED SITE PLAN

DRAWING NO.: 4

SHEET 4 OF 9



* HAND SIGNATURE ON FILE

LEGEND

—W—	MISCELLANEOUS FLOW PIPING
	BASE GRADE ELEVATION
	EXISTING TREELINE
	EXISTING PONDS/STREAMS
—X—X—	EXISTING FENCE
	EXISTING ACCESS ROAD
—ST—	EXISTING STORM WATER PIPING
—P—	EXISTING UNDERGROUND PLANT FLOW PIPING
	EXISTING PLANT FLOW PIPING
—495—	EXISTING INDEX CONTOURS
	EXISTING INTERMEDIATE CONTOURS
18D	EXISTING MONITORING WELL LOCATIONS
	EXISTING ACCESS ROAD
	PROPOSED EAST BERM MODIFICATIONS AREA BOUNDARY
	PROPOSED INDEX CONTOUR
	PROPOSED INTERMEDIATE CONTOUR
	PROPOSED SAFETY BENCH
	TREE/ROOT BALL REMOVAL ONLY
	TREE/ROOT BALL REMOVAL WITH BERM RECONFIGURATION

AS-BUILT CONSTRUCTION PLANS

REFERENCE:

1. TOPOGRAPHIC INFORMATION BASED UPON AERIAL SURVEY CONDUCTED BY SURDEX CORPORATION FLOWN ON SEPTEMBER 10, 2008.
2. EMBANKMENT AREA SURVEY RECEIVED BY CEC FROM DLZ ON MARCH 4, 2013 AND JANUARY 10, 2014.
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SCALE IN FEET
0 50 100

SUBMITTAL RECORD

NO	DATE	DESCRIPTION
1	5/2013	IDNR DAM MODIFICATION PERMIT
2	6/9/2014	ISSUED FOR CONSTRUCTION
3	2/4/2015	AS-BUILT CONSTRUCTION DRAWINGS

REVISION RECORD

NO	DATE	DESCRIPTION
△		
△		
△		
△		

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HENNEPIN, ILLINOIS

DRAWN BY:	DFB	CHECKED BY:	MDJ	APPROVED BY:	*MDJ
DATE:	FEBRUARY 2015	DWG SCALE:	AS NOTED	PROJECT NO:	132-650

PROPOSED GRADING PLAN
1 OF 2

DRAWING NO.: 5

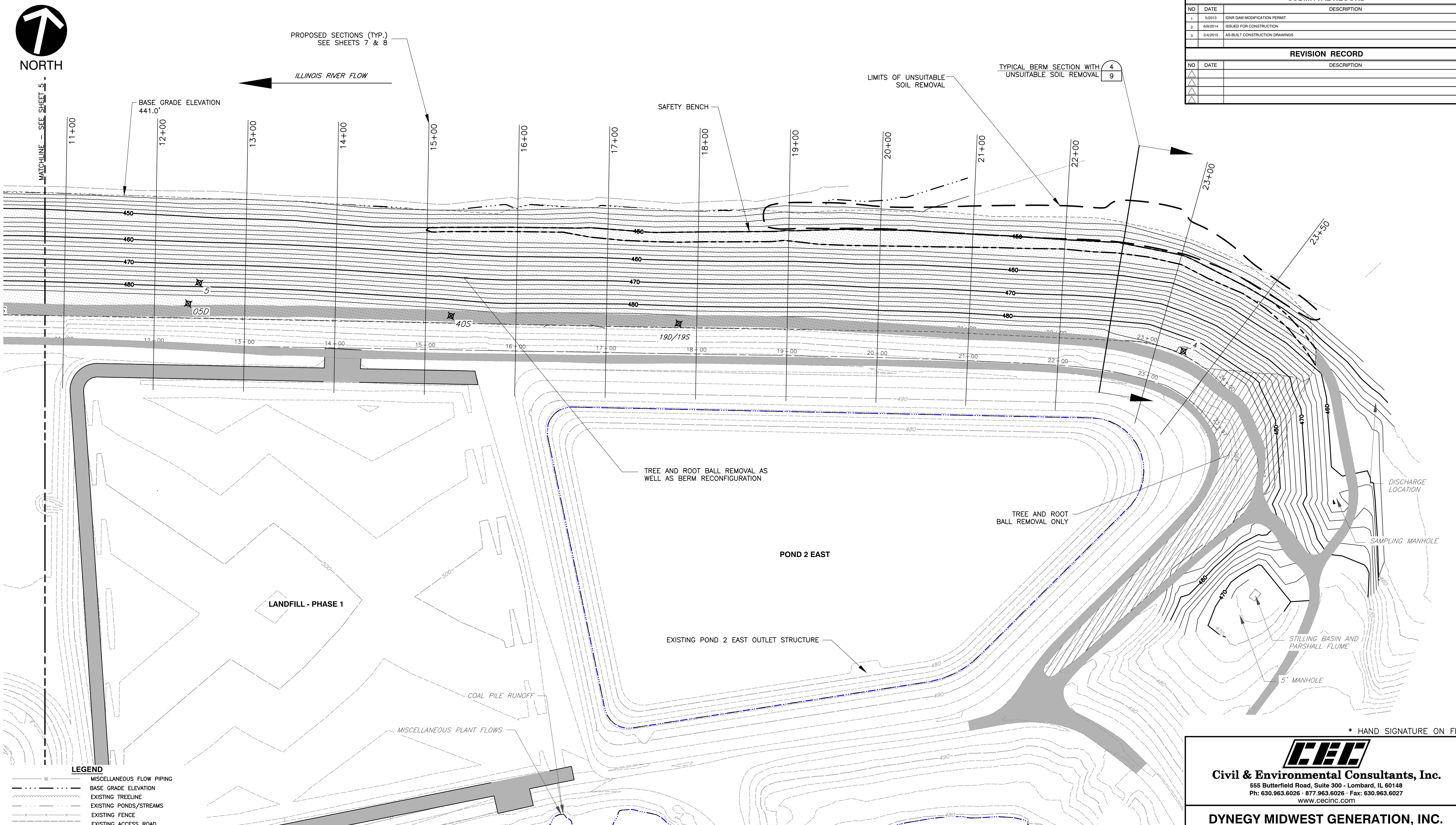
SHEET 5 OF 9

SUBMITTAL RECORD

NO	DATE	DESCRIPTION
1	5/2013	IDNR DAM MODIFICATION PERMIT
2	6/9/2014	ISSUED FOR CONSTRUCTION
3	2/4/2015	AS-BUILT CONSTRUCTION DRAWINGS

REVISION RECORD

NO	DATE	DESCRIPTION
△		
△		
△		
△		



LEGEND

- MISCELLANEOUS FLOW PIPING
- BASE GRADE ELEVATION
- EXISTING TREELINE
- EXISTING PONDS/STREAMS
- EXISTING FENCE
- EXISTING ACCESS ROAD
- EXISTING STORM WATER PIPING
- EXISTING UNDERGROUND PLANT FLOW PIPING
- EXISTING PLANT FLOW PIPING
- EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- EXISTING MONITORING WELL LOCATIONS
- EXISTING ACCESS ROAD
- PROPOSED EAST BERM MODIFICATIONS AREA BOUNDARY
- PROPOSED INDEX CONTOUR
- PROPOSED INTERMEDIATE CONTOUR
- PROPOSED SAFETY BENCH
- TREE/ROOT BALL REMOVAL ONLY
- TREE/ROOT BALL REMOVAL WITH BERM RECONFIGURATION

AS-BUILT CONSTRUCTION PLANS

REFERENCE:

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SCALE IN FEET
0 50 100

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EAST BERM MODIFICATION
HENNEPIN, ILLINOIS

DRAWN BY:	DFB	CHECKED BY:	MDJ	APPROVED BY:	*MDJ
DATE:	FEBRUARY 2015	DWG SCALE:	AS NOTED	PROJECT NO:	132-650

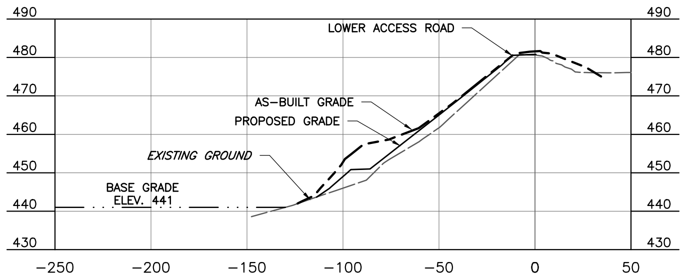
PROPOSED GRADING PLAN
2 OF 2

DRAWING NO.: 6

SHEET 6 OF 9

SUBMITTAL RECORD		
NO	DATE	DESCRIPTION
1	5/2013	IDNR DAM MODIFICATION PERMIT
2	6/9/2014	ISSUED FOR CONSTRUCTION
3	2/4/2015	AS-BUILT CONSTRUCTION DRAWINGS

REVISION RECORD		
NO	DATE	DESCRIPTION



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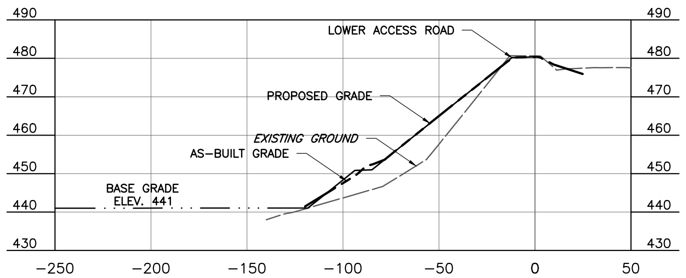

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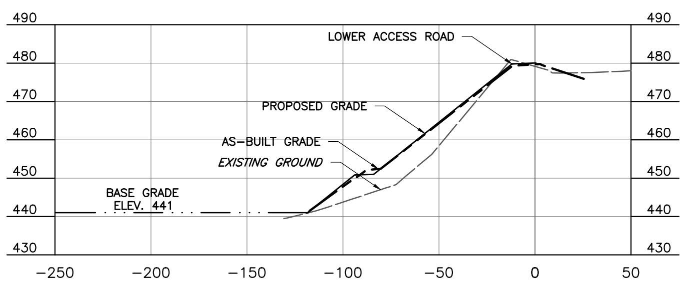

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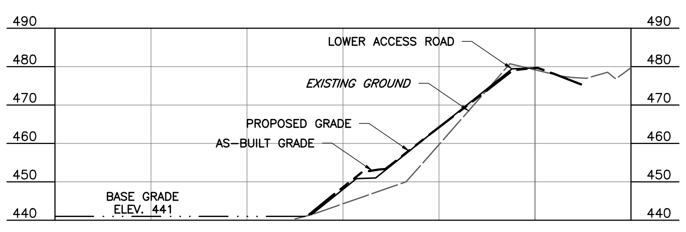

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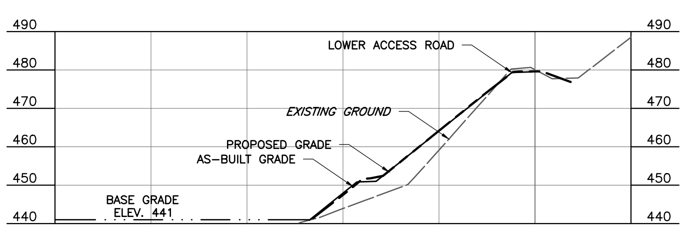

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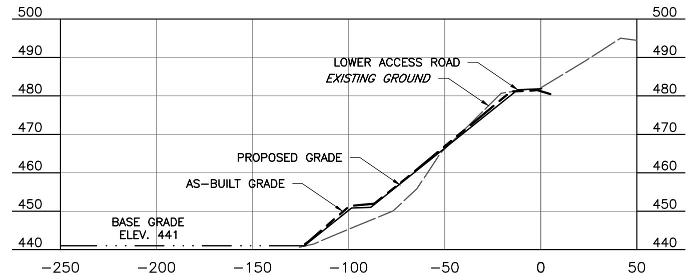

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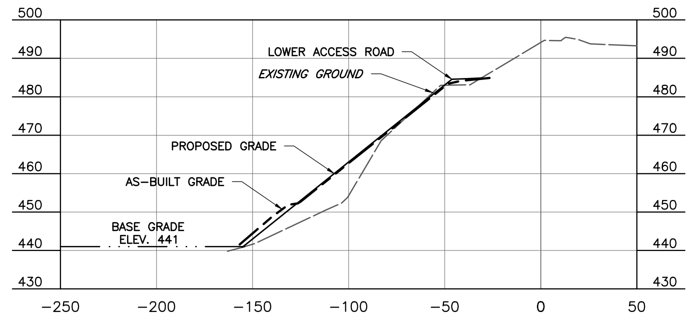

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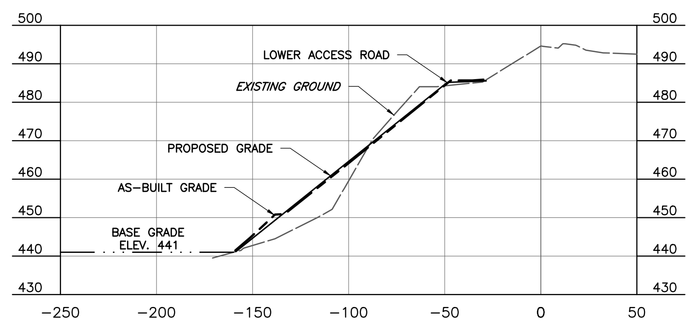

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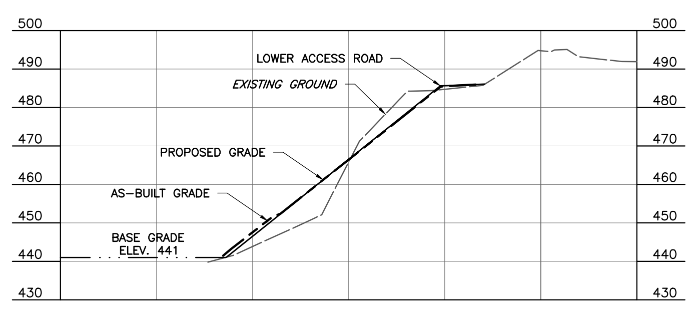

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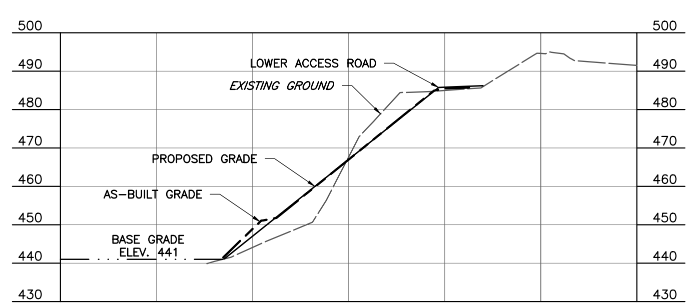

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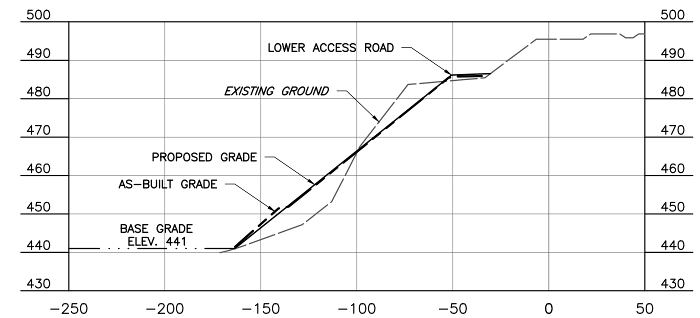

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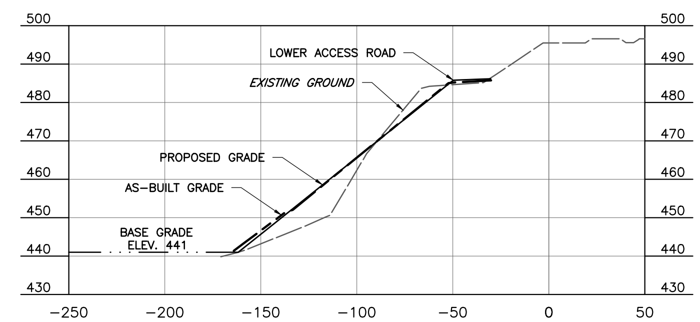

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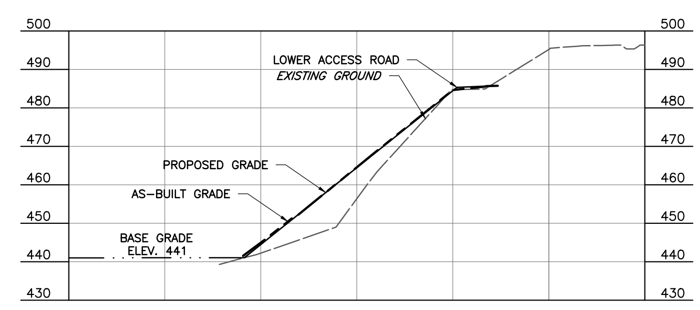

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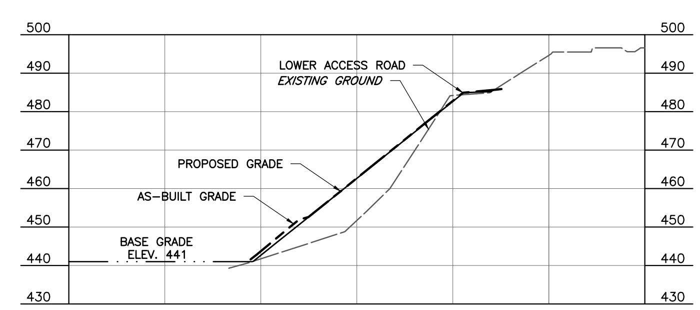

STA 15+00

REFERENCE:

1. TOPOGRAPHIC INFORMATION BASED UPON AERIAL SURVEY CONDUCTED BY SURDEX CORPORATION FLOWN ON SEPTEMBER 10, 2008.
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4. AS–BUILT SURVEY RECEIVED BY CEC FROM DLZ, DECEMBER 12, 2014.

AS-BUILT CONSTRUCTION PLANS

HORIZONTAL
SCALE IN FEET
0 50 100

VERTICAL
SCALE IN FEET
0 25 50

* HAND SIGNATURE ON FILE

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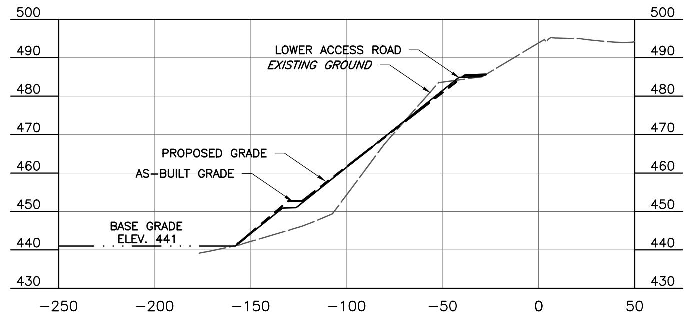
DYNEGY MIDWEST GENERATION, INC.
HENNEPIN POWER STATION
EAST BERM MODIFICATION
HENNEPIN, ILLINOIS

DRAWN BY: DFB	CHECKED BY: MDJ	APPROVED BY: *MDJ
DATE: FEBRUARY 2015	DWG SCALE: AS NOTED	PROJECT NO: 132-650

PROPOSED SECTIONS
STA 1+00 TO 15+00

DRAWING NO.: 7
SHEET 7 OF 9



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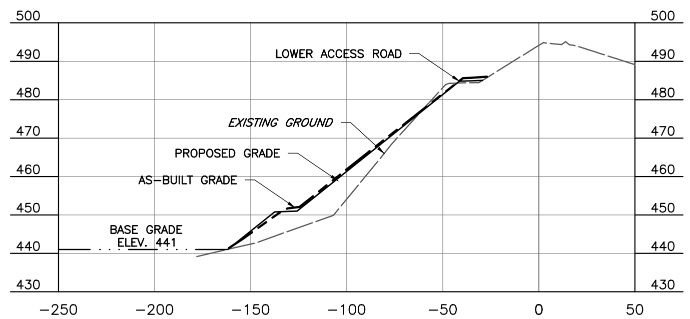

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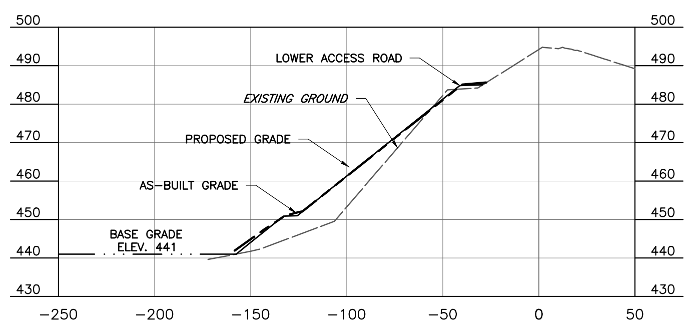

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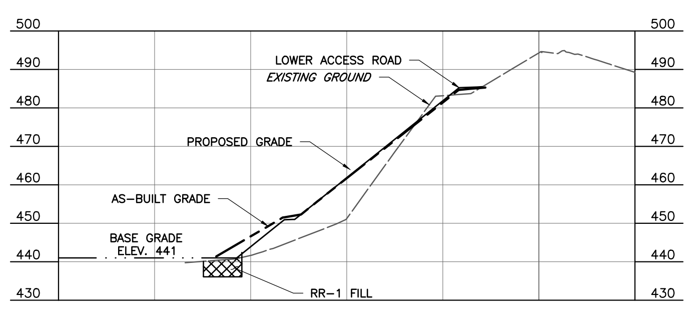

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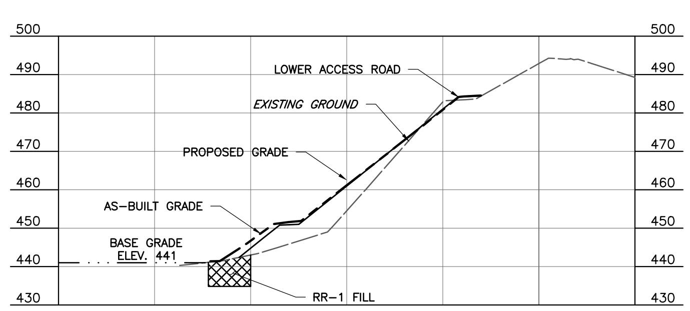
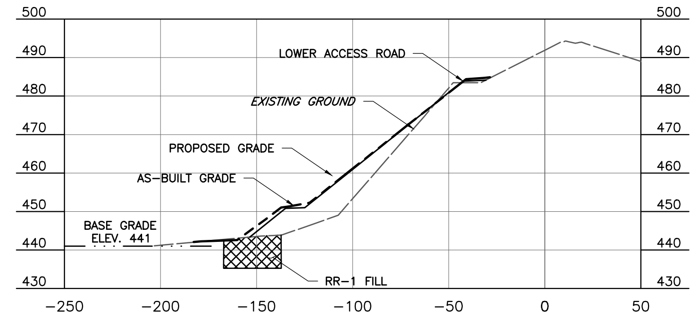
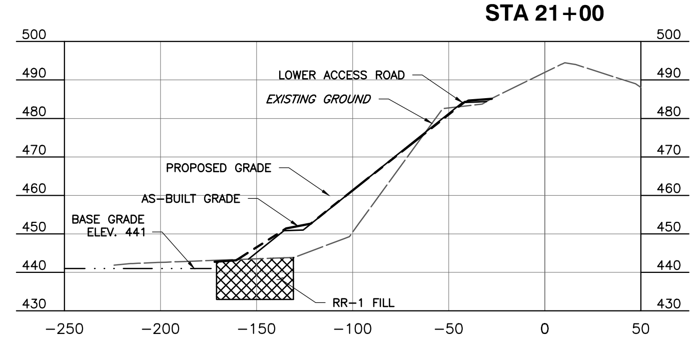


STA 20+00



STA 21+00



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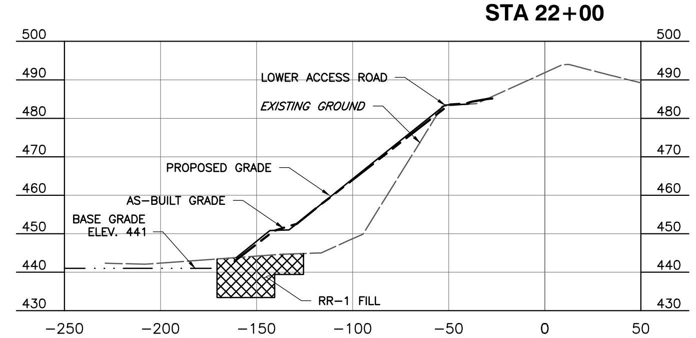

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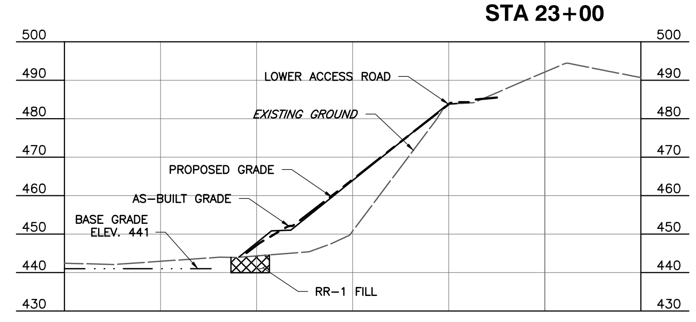

STA 23+50

SUBMITTAL RECORD

NO	DATE	DESCRIPTION
1	5/2013	IDNR DAM MODIFICATION PERMIT
2	6/9/2014	ISSUED FOR CONSTRUCTION
3	2/4/2015	AS-BUILT CONSTRUCTION DRAWINGS

REVISION RECORD

NO	DATE	DESCRIPTION
△		
△		
△		
△		

REFERENCE:

1. TOPOGRAPHIC INFORMATION BASED UPON AERIAL SURVEY CONDUCTED BY SURDEX CORPORATION FLOWN ON SEPTEMBER 10, 2008.
2. EMBANKMENT AREA SURVEY RECEIVED BY CEC FROM DLZ ON MARCH 4, 2013 AND JANUARY 10, 2014.
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4. AS-BUILT SURVEY RECEIVED BY CEC FROM DLZ, DECEMBER 12, 2014.

AS-BUILT CONSTRUCTION PLANS

HORIZONTAL
SCALE IN FEET
0 50 100

VERTICAL
SCALE IN FEET
0 25 50

* HAND SIGNATURE ON FILE

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HENNEPIN POWER STATION
EAST BERM MODIFICATION
HENNEPIN, ILLINOIS

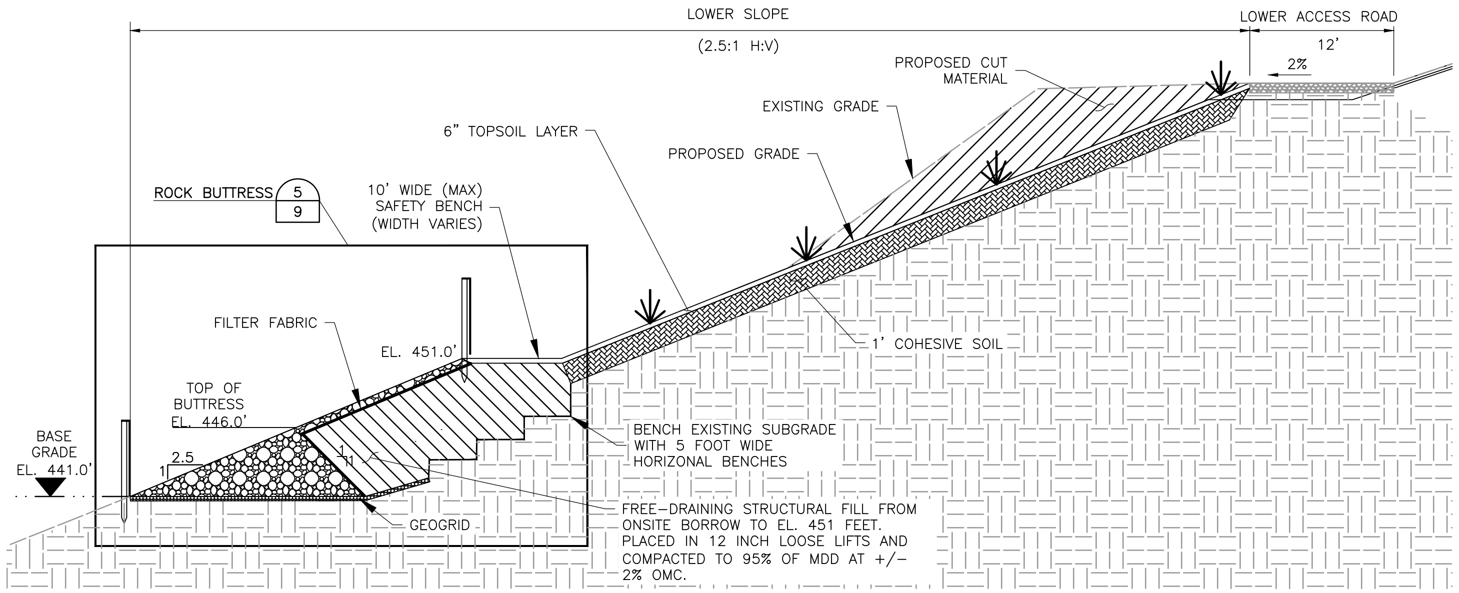
DRAWN BY:	DFB	CHECKED BY:	MDJ	APPROVED BY:	*MDJ
DATE:	FEBRUARY 2015	DWG SCALE:	AS NOTED	PROJECT NO:	132-650

PROPOSED SECTIONS
STA 16+00 TO 23+50

DRAWING NO.: **8**

SHEET 8 OF 9

p:\2013\132-650.0200\-CADD\Dwg\CIVIL\132650-CV02-C300-Proposed Grading Plan.dwg{CROSS SECTIONS (2)} LS:(2/17/2015 - dbrenczewski) - LP: 2/17/2015 10:43 AM



DETAIL 2
TYPICAL BERM DETAIL
SCALE: NTS

LEGEND

- PROPOSED CUT MATERIAL
- PROPOSED STRUCTURAL FILL
- UNSUITABLES/RR1 FILL
- RIPRAP
- DRAINAGE LAYER
- PROPOSED GRADELINE
- EXISTING GRADELINE
- WATER SURFACE ELEVATION
- VEGETATION

SUBMITTAL RECORD		
NO	DATE	DESCRIPTION
1	5/2013	IDNR DAM MODIFICATION PERMIT
2	6/9/2014	ISSUED FOR CONSTRUCTION
3	2/4/2015	AS-BUILT CONSTRUCTION DRAWINGS

REVISION RECORD		
NO	DATE	DESCRIPTION
△		
△		
△		
△		

REFERENCE:

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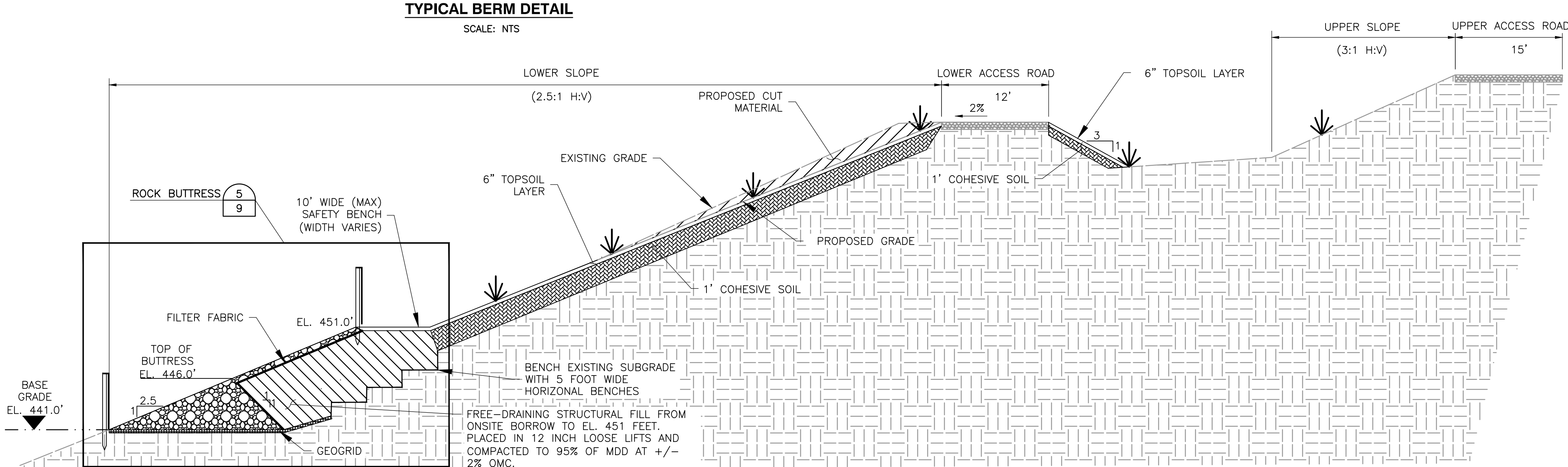
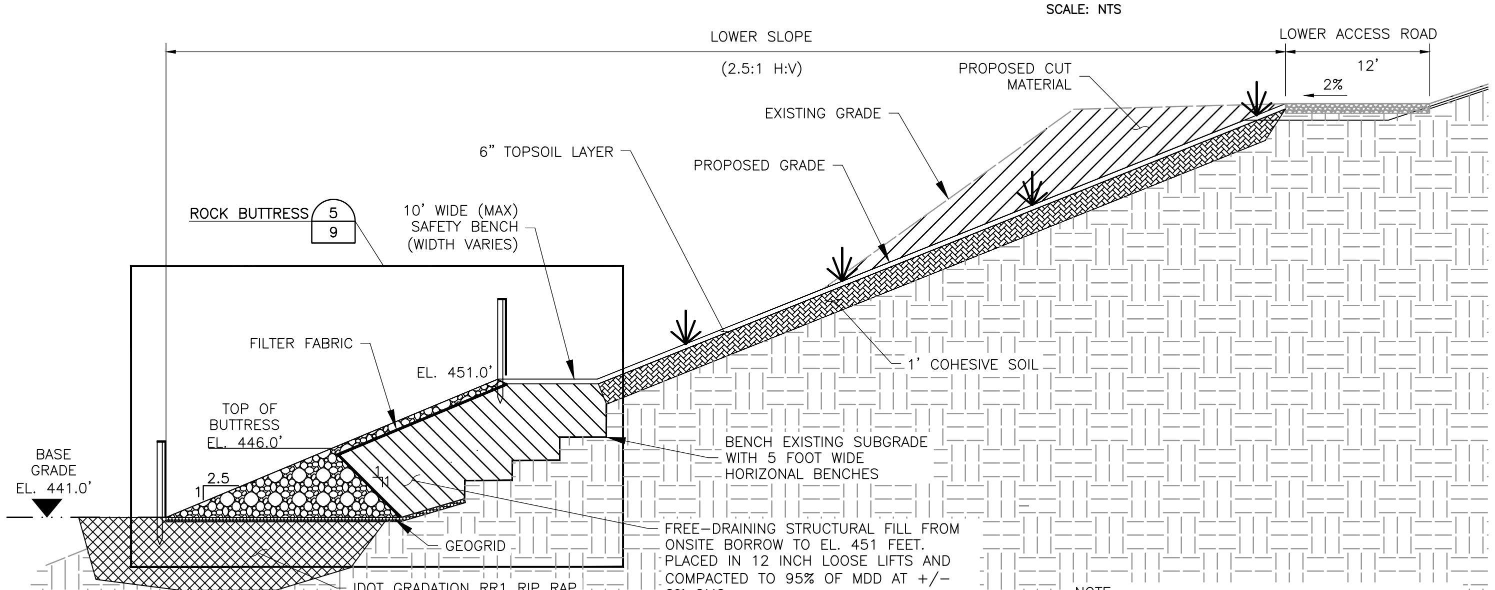


DETAIL 3
TYPICAL BERM DETAIL
SCALE: NTS

NOTE:

1. TEMPORARY SILT FENCE WAS INSTALLED PRIOR TO ROCK BUTTRESS INSTALLATION. UPON COMPLETION OF ROCK BUTTRESS. SILT FENCE WAS INSTALLED UP SLOPE OF ROCK BUTTRESS AND TEMPORARY SILT FENCE REMOVED.
2. AFTER PLACING TOPSOIL AND SEEDING, EROSION CONTROL BLANKETS WERE INSTALLED ON ALL SLOPES STEEPER THAN 3:1 FOR EROSION PROTECTION AND SEED ESTABLISHMENT. STRAW WATTLES WERE PLACED AT MID-HEIGHT OF BERM FOR ADDITIONAL EROSION PROTECTION.

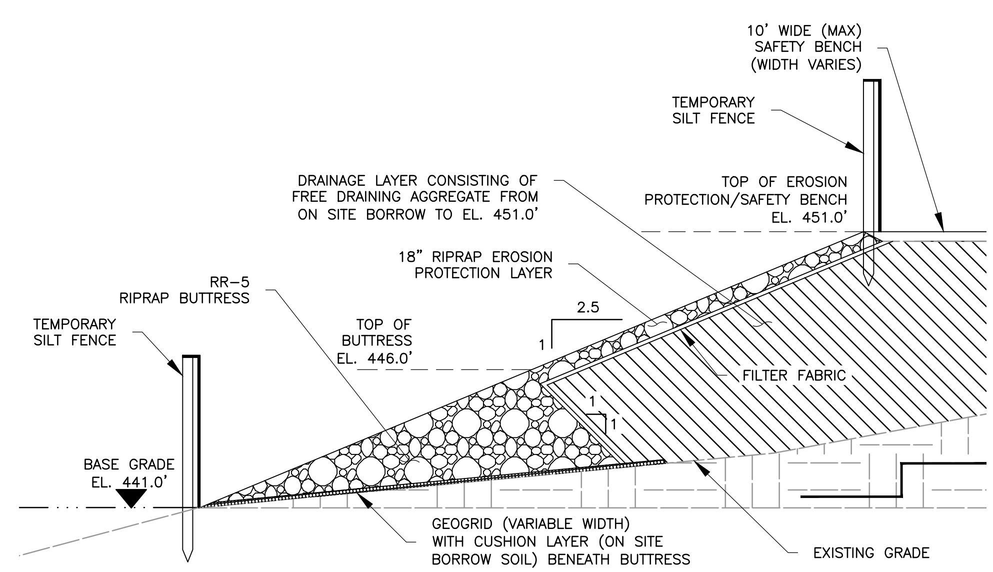
AS-BUILT CONSTRUCTION PLANS



DETAIL 4
TYPICAL BERM WITH UNSUTABLE SOIL REMOVAL DETAIL
SCALE: NTS

NOTE:

1. EXCAVATION FOR REMOVAL OF UNSUITABLE SOIL EXTENDED A DISTANCE OUT FROM THE TOE OF BERM EQUAL TO THE DEPTH OF EXCAVATION.



DETAIL 5
ROCK BUTRESS AND
EROSION PROTECTION LAYER DETAIL
SCALE: NTS

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HENNEPIN, ILLINOIS

DRAWN BY:	DFB	CHECKED BY:	MDJ	APPROVED BY:	*MDJ
DATE:	FEBRUARY 2015	DWG SCALE:	AS NOTED	PROJECT NO:	132-650

BERM AND EROSION CONTROL DETAILS

DRAWING NO.: 9

SHEET 9 OF 9

AECOM

Appendix C: Hennepin Power Station Piezometer Locations

EXPLORATION METHOD (B=BORING, C=CPT, P=PIEZOMETER)

XXX-X###

ID NUMBER

STATION ABBREVIATION

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

LEGEND

PIEZOMETER LOCATION

CCR UNIT BERM ALIGNMENT

0 200

APPROXIMATE SCALE FEET

DYNEGY MIDWEST GENERATION, LLC	PROJECT NO. 60439752
AECOM	
DRN. BY: djd October 2015 DSGN. BY: eg CHKD. BY: eg	Hennepin Ash Pond No. 2 Piezometer Locations
FIG. NO. 2A	

XXX-X###
EXPLORATION METHOD (B=BORING, C=CPT, P=PIEZOMETER)
ID NUMBER
STATION ABBREVIATION

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

LEGEND

PIEZOMETER LOCATION

CCR UNIT BERM ALIGNMENT

0 200
APPROXIMATE SCALE FEET

DYNEGY MIDWEST GENERATION, LLC		PROJECT NO. 60439752
AECOM		
DRN. BY: djd October 2015 DSGN. BY: eg CHKD. BY: eg	Hennepin East Ash Pond Piezometer Locations	FIG. NO. 2B

File: P:\PROJECTS\GEOTECH\60428794_DYNEGYCCR\04TASKS\00 PROGRAM TASKS\1.0 TASK 1 INITIAL UNIT ASSESSMENT\CCR FACT SHEETS\SITE MAPS\FIGURE 2A-2D PIEZOMETER LOCATION PLAN (HENNEPIN).DWG Last edited: NOV. 03, 15 @ 3:11 p.m. by: david_deguire

XXX-X###

EXPLORATION METHOD
(B=BORING, C=CPT,
P=PIEZOMETER)

ID NUMBER

STATION ABBREVIATION

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

LEGEND

PIEZOMETER LOCATION

CCR UNIT BERM ALIGNMENT

0 200

APPROXIMATE SCALE FEET

DYNEGY MIDWEST GENERATION, LLC		PROJECT NO. 60439752
AECOM		
DRN. BY: djd October 2015 DSGN. BY: eg CHKD. BY: eg	Hennepin Old West Ash Pond (Pond No. 1 and Pond No. 3) Piezometer Locations	FIG. NO. 2C

File: P:\PROJECTS\GEOTECH\60428794_DYNEGYCCR\04TASKS\00 PROGRAM TASKS\1.0 TASK 1 INITIAL UNIT ASSESSMENT\CCR FACT SHEETS\SITE MAPS\FIGURE 2A-2D PIEZOMETER LOCATION PLAN (HENNEPIN).DWG Last edited: NOV. 03, 15 @ 3:11 p.m. by: david_deguire

XXX-X### — EXPLORATION METHOD (B=BORING, C=CPT, P=PIEZOMETER) — ID NUMBER — STATION ABBREVIATION

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

LEGEND

PIEZOMETER LOCATION

CCR UNIT BERM ALIGNMENT

0 100

APPROXIMATE SCALE FEET

DYNEGY MIDWEST GENERATION, LLC	PROJECT NO. 60439752
AECOM	
DRN. BY: djd October 2015 DSGN. BY: eg CHKD. BY: eg	Hennepin Old West Polishing Pond Piezometer Locations — FIG. NO. 2D

File: P:\PROJECTS\GEOTECH\60428794_DYNEGYCCR\04TASKS\00 PROGRAM TASKS\1.0 TASK 1 INITIAL UNIT ASSESSMENT\CCR FACT SHEETS\SITE MAPS\FIGURE 2A-2D PIEZOMETER LOCATION PLAN (HENNEPIN).DWG Last edited: NOV. 03, 15 @ 3:11 p.m. by: david_deguire

AECOM

Appendix D: Specification J-2616, Rev. A, Primary Ash Pond Modifications

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Sargent & Lundy LLC

DYNEGY MIDWEST GENERATION
HENNEPIN POWER STATION

SPECIFICATION J-2616, REV. A
PERMIT APPLICATION

PRIMARY ASH POND MODIFICATIONS

Prepared By:
Sargent & Lundy, LLC
55 East Monroe Street
Chicago, Illinois 60603

PRIMARY ASH POND MODIFICATIONS

ISSUE SUMMARY

Rev.	Purpose of Issue	Date	Sections Affected
A	Spec No. J-2616 Released for Permit Application	02/14/03	All

CERTIFICATION OF SPECIFICATION

FOR

PRIMARY ASH POND MODIFICATION

I certify that this Specification was prepared by me or under my supervision and that I am a registered professional engineer under the laws of the State of Illinois.

Sargent & Lundy LLC's Illinois Department of Professional Regulation registration number is 184-000106.

Certified By: Ronald Cook Date: Feb 14, 2003

RONALD H. COOK
062 - 048602
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

EXP. 11-30-03

Seal

Revision:	Certified By:	Date:

PRIMARY ASH POND MODIFICATIONS

TABLE OF CONTENTS

Notes:

(1) Where Division and/or Sections are not included, work under the unlisted headings is not part of the Work.

(2) This Table of Contents will indicate the date of issue for the latest complete issue or revision issue of each section and any subsequent revision issue thereto.

(3) The numbering and subsequent Revisions to the Specification are in sequence with the previously issued Revision mark number.

FABRIC FORMED CONCRETE MATS

ISSUE SUMMARY

Rev.	Purpose of Issue	Date	Sections Affected	Prepared By	Reviewed By	Approved By
A	Permit Application	02/14/03	ALL	Ronald Cook	Daniel C. Kovich	Ronald Cook

FABRIC FORMED CONCRETE MATS

TABLE OF CONTENTS

Notes:

(1) This Table of Contents will indicate the date of issue for the latest complete issue or revision issue of each section and any subsequent revision issue thereto.

(2) The numbering and subsequent Revisions to the Specification are in sequence with the previously issued Revision mark number.

Fabric Formed Concrete Mats - Technical Specification and Optional Features/Accessories

1.0 Scope of Work

The intent of this specification is to define the material and installation requirements for fabric formed concrete mats installed in accordance with the Design Drawings, technical data and as specified herein.

1.1 Work Included

The work shall include, but not be limited to, the following items as indicated:

A. Preparation and grading of surfaces to receive fabric mats.

B. Placing fabric mats and filling them with a pumpable sand/cement slurry to form a stable erosion protection system.

C. Offsite disposal of excess or unsuitable materials and debris.

2.0 Codes and Standards

A. Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state or local codes having jurisdiction.

B. References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of contract for the work.

C. Abbreviations listed indicate the form used to identify the reference documents in the specification text.

2.1 ASTM – American Society for Testing and Materials

A. ASTM C 31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.

B. ASTM C 39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C. ASTM C 143 – Standard Test Method for Slump of Hydraulic Cement Concrete.

D. ASTM C 172 – Standard Practice for Sampling Freshly Mixed Concrete.

E. ASTM C 173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

F. ASTM C 231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

G. ASTM C1064 – Standard Test Method for Temperature of Freshly Mixed Portland-Cement Concrete.

H. ASTM D 543 – Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.

I. ASTM D 751 – Standard Test Methods for Coated Fabrics.

J. ASTM D 792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

K. ASTM D1777 – Standard Test Method for Thickness of Textile Materials.

L. ASTM D2101 – Standard Test Method for Tensile Properties of Single Man-Made Textile Fibers Taken From Yarns and Tows.

M. ASTM D3776 – Standard Test Methods for Mass Per Unit Area (Weight) of Fabric.

N. ASTM D3786 – Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics (Mullen Burst).

O. ASTM D3787 – Standard Test Method for Bursting Strength of Knitted Goods: Constant-Rate-of Traverse (CRT) Ball Burst Test.

P. ASTM D3885 – Standard Test Method for Abrasion Resistance of Textile Fabrics.

Q. ASTM D4355 – Standard Test Methods for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.

R. ASTM D4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

S. ASTM D4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

T. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

U. ASTM D5034 – Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test).

V. ASTM D5035 – Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Strip Method).

3.0 Supplier's Drawings and Data Submittals

A. Supplier shall submit drawings and data as specified. Supplier's drawings and data shall be submitted via electronic medium in a format compatible for importing into the Buyer's information systems specified by the Buyer.

3.1 Submittals Prior to Installation

The Supplier shall submit the following items at least 30 days prior to scheduled delivery of materials:

A. Manufacturer's literature providing specifications on the fabric mats that will be supplied.

B. Manufacturer's certification that the fabric mats to be supplied comply with the requirements of this Technical Specification.

C. Manufacturer's Quality Control and Construction Quality Control Plans. The MQC Plan shall state the frequency that index tests are performed on the fabric mat during manufacturing.

D. If requested by the Buyer, four samples of each fabric mat suitable for testing.

E. Required concrete grout slurry mix design, including requirements for compressive strength, slump, air content and maximum temperature.

3.2 Submittals During and After Installation

The Supplier shall submit the following items on a daily basis during installation and a complete set of data within 30 days of the completion of the work:

A. Results of tests performed on the concrete grout fill.

4.0 Construction Quality Assurance

A. The Supplier shall examine the areas and conditions under which the work is to be installed and notify Buyer in writing of conditions detrimental to the proper and timely completion of the work that have changed from the time of the bidder's walkdown.

B. Material and installation procedures are subject to inspection and tests conducted by an Independent Testing Service employed by the Buyer. Such inspections and tests will not relieve the Supplier of responsibility for providing material and installation procedures in compliance with specified requirements. The Buyer reserves the right, at any time before final acceptance, to reject material not complying with the specified requirements.

C. The Supplier shall correct deficiencies in the work which inspections and laboratory test reports have indicated to be not in compliance with requirements. The Supplier shall perform additional tests, at his expense, as may be necessary to reconfirm any noncompliance of the original work, and as may be necessary to show compliance of corrected work.

D. The Supplier shall promptly correct errors or flaws in material or placement of the protection mats identified during construction. The Supplier shall make immediate substitution of non-complying component or make field changes to make the non-complying component acceptable. Whether the correction is made by substitution or field correction, it shall be performed without cost to the Buyer.

4.1 Testing

4.1.1 Independent Testing Service

An Independent Testing Service shall perform the following:

A. Test material for the concrete slurry fill and prepare initial test cylinders in accordance with the requirements specified herein.

B. Prepare test cylinders and determine the compressive strength of job concrete fill test cylinders.

4.1.2 Concrete Grout Testing

A. Obtaining and testing concrete grout shall be by the Independent Testing Service in accordance with the following specifications:

- Sampling freshly mixed grout shall be done in accordance with ASTM C172.
- Making and curing concrete test specimens shall be in accordance with ASTM C31.
- Slump test shall be in accordance with ASTM C143.
- Air Content tests shall be in accordance with ASTM C173 or ASTM C231.
- Tests for the temperature of the freshly mixed grout shall be in accordance with ASTM C1064.
- Compressive strength test shall be in accordance with ASTM C39.

B. The frequency of testing shall be as directed by Buyer as follows:

- At least one test shall be made for each day's placement of grout, but not less than once for each 100 cubic yards or part thereof placed.
- A test shall consist of a minimum of four cylinders taken from the same truck. One 7-day and two 28-day tests shall be performed by the laboratory with results submitted to the Buyer as soon as possible. One spare cylinder shall be made and used as directed by the Buyer.
- A slump test and air content test shall be performed on every 100 cubic yards of concrete grout.
- The temperature of each 100 cubic yards shall be recorded in the field prior to placement. If the concrete grout temperature is in excess of 100°F, the concrete shall be rejected.

5.0 Materials

5.1 Fabric Design

A. Fabric-forming material shall consist of double-layer, open-selvage fabric joined in a mat configuration. The fabric shall be woven of 100% continuous multi-filament nylon fiber of which 50% by weight shall be bulk textured fiber. The use of staple yarns will not be permitted.

B. The fabric shall be woven in such a manner as to provide interwoven points of attachment on spaced centers. These points of attachment shall serve to control the thickness of the finished product and to also act as a filter point to provide relief of hydrostatic uplift pressure beneath the completed revetment. The fabric shall be woven in a basket or other open pattern to provide permeability at the filter points and the main fabric field.

C. The spacing of the filter points is indicated on the Design Drawings. This spacing will result in an average revetment thickness that is consistent with the average thickness published by the manufacturer for the designated style specified.

5.2 Fiber and Fabric Material

A. The warp fiber shall be 1260 Denier Nylon, 18.5 ends/inch per single layer and the fill fiber shall be 1900 Denier Nylon, 14 picks/inch per single layer. The fiber and fabric material shall meet the minimum requirements listed in Table 1.

TABLE 1
MATERIAL PROPERTIES

PROPERTY	ASTM TEST METHOD	MINIMUM TEST VALUE
Fiber count	-	0.164 g/m
Trapezoidal tear breaking force on the warp fiber at 70% elongation	D 4533	80 lbs/in
Trapezoidal tear breaking force on the fill fiber at 70% elongation	D 4533	40 lbs/in
Density	D 792	1.00 g/cm^3
Fiber dry breaking strength at 48% elongation	D 2101	20 lbs
Fiber wet breaking strength at 53% elongation (soaked in water for 2 hours)	D 2101	19 lbs
Tensile strength in the warp direction after exposure to 300 hours of Ca (OH) at a pH of 10	D 543	180 lbs/in
Tensile strength in the warp direction after exposure to 300 hours of H_2SO_4	D 543	170 lbs/in
Tensile breaking strength in the warp direction on a strip of the fabric at 39% elongation (1)	D 5034, D 5035	160 lbs/in
Tensile breaking strength in the fill direction on a strip of the fabric at 34% elongation (1)	D 5034, D 5035	190 lbs/in
Mass/unit area for a single layer of fabric	D 3776	7.8 oz/sq yd
Thickness of a single layer of fabric	D 1777	31 mils
Falling head permittivity of two layers of fabric woven together	D 4491	0.28 s^{-1} 0.04 cm/s (3)
Falling head permittivity of a single layer of fabric	D 4491	1.3 s^{-1} 0.12 cm/s
Seam strength (2)	D 751	35 lbs/in
Abrasion resistance in the warp direction	D 3885	160 lbs/in
Grab strength in the warp direction at 31% elongation	D 4632	350 lbs
Grab strength in the fill direction at 41% elongation	D 4632	275 lbs
Breaking strength in the warp direction after exposure to 500 hours of UV light	D 4355	190 lbs/in
Mullen burst test	D 3786	750 psi
Puncture test	D 3787	80 lbs

Notes for Table 1:

(1) 3" x 8" sample gripped along full width of the specimen with 3" of separation between grips. Strip test to be performed on single layer of fabric at cross-head speed of 5 inches per minute.

(2) Seam centered between grips 3" apart and gripped the full width of the specimen.

(3) Applies to Filter Points only

5.3 Fabric Assembly

A. Adjacent fabric panels shall be connected by sewing or by means of zipper.

B. The two top layers of fabric and the two bottom layers of fabric shall be joined separately permitting full mat thickness between the two parallel seams. A single seam in which all four layers of the fabric are joined at one point will not be permitted.

C. If required, grout stops may be installed parallel to and in between individual mill widths at predetermined intervals to regulate the flow of the concrete fill. Grout stops shall be so designed as to produce full mat thickness along the full length of the grout stop.

5.4 Concrete Grout

A. The concrete grout shall consist of a mixture of Portland cement, fine aggregate and water so proportioned and mixed as to provide a readily pumpable slurry.

B. Admixtures and/or a pozzolan may be used with the approval of the Buyer. The use of superplasticizers and/or silica fume require special precautions and the approval of the Buyer.

C. The hardened concrete shall exhibit a minimum compressive strength of 2,500 psi at 28 days when specimens are made and tested in accordance with the provisions of ASTM C 31 and ASTM C 39.

5.5 Acceptable Materials

The following companies manufacture products that meet the requirements of the specification:

A. Fabriform Filter Point Fabric as manufactured by Construction Techniques, Inc., Cleveland, Ohio, 440-572-8300.

B. Other approved by Buyer.

6.0 Execution

6.1 Acceptance and Storage at the Project Site

6.1.1 Handling of Rolls

A. The method of off-loading the fabric at the project site shall not cause any damage to the fabric, its core, nor its protective covering.

B. Any protective covering that is accidentally damaged or stripped off of a pallet or roll shall be immediately repaired or the pallet or roll shall be moved to an enclosed facility until the repair can be made.

6.1.2 Storage at the Field Site

A. The Buyer shall provide on-site storage space in a location near where the fabric will be placed such that on-site transportation and handling are minimized. The Supplier shall be responsible for protecting the stored material from theft and vandalism.

B. Rolls or pallets of fabric shall be stored in such a manner that cores are not crushed, the fabric damaged, and as required to provide protection from exposure to ultraviolet light, inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious condition.

C. Outdoor storage of rolls or pallets shall not exceed the manufacturer's recommendations or longer than six months, whichever is less.

6.2 Inspection upon Delivery

A. Upon delivery of the materials to the site, the Supplier shall conduct a visual inspection of all rolls of fabric for damage or defects. This inspection shall be done without unrolling any rolls unless damage to the inside of a roll is found or suspected.

B. Any damage or defects shall be noted and immediately reported to the Buyer, the manufacturer and the carrier that transported the material. Any roll, or portion thereof, which, in the judgement of the Buyer, is seriously damaged, shall be removed from the project site and replaced with complying material at no additional cost to the Buyer.

6.3 Fabric Placement

A. Prior to concrete injection, the fabric shall be positioned over a geotextile on the grade as indicated on the Design Drawings making appropriate allowances for contraction of the fabric mats as a result of injecting the concrete grout.

B. Anchoring of fabric shall be as shown on the Design Drawings.

C. Fabric panels may be factory assembled in predetermined sizes and joined together side-by-side at the project site by field sewing or by means of zipper closures attached to the upper and lower layers of the fabric. In no case will simple unattached butt joints between panels be allowed. Overlapping shall be allowed only if approved by the Buyer.

6.4 Concrete Injection

A. Following placement of the fabric mats the specified concrete grout shall be injected between the top and bottom layers of the fabric through small slits cut in the upper layer of the fabric. The injection pipe shall be wrapped tightly at the point of injection with a strip of burlap, or similar material, during pumping to seal the joint between the injection pipe and the slit. After pumping, the burlap shall be pushed into the slit as the injection pipe is withdrawn in order to minimize spillage of the concrete slurry onto the surface of the revetment.

B. The sequence of concrete slurry injection shall be such as to insure complete filling of the revetment-forming fabric to average thickness indicated by the manufacturer for the designated style specified on the Design Drawings.

C. Foot traffic will not be permitted on the freshly pumped mat since such traffic will cause permanent indentations in the mat surface. Walk boards shall be used where necessary.

D. Excess concrete slurry which has been inadvertently spilled on the mat surface shall be cleaned up with a broom and shovel. The use of a water hose to remove spillage from the surface of a freshly pumped mat will not be permitted.

E. During concrete slurry injection, the mat thickness shall be measured by inserting a short piece of stiff wire through the crowns of the mats midway between the filter points at several locations from the crest to the toe of the slope. Any mat measurements less than 90% of the average of all thickness measurements shall be re-injected until the average thickness indicated for the style specified has been attained.

TEMPORARY AND PERMANENT SEEDING (ILLINOIS)

ISSUE SUMMARY

Rev.	Purpose of Issue	Date	Sections Affected	Prepared By	Reviewed By	Approved By
A	Permit Application	02/14/03	ALL	Ronald Cook	Daniel Konik	Ronald Cook

TEMPORARY AND PERMANENT SEEDING (ILLINOIS)

TABLE OF CONTENTS

Notes:

(1) This Table of Contents will indicate the date of issue for the latest complete issue or revision issue of each section and any subsequent revision issue thereto.

(2) The numbering and subsequent Revisions to the Specification are in sequence with the previously issued Revision mark number.

Temporary and Permanent Seeding (Illinois) – Technical Specification and Optional Features/Accessories

1.0 Scope of Work

The intent of this specification is to define the minimum requirements for material and work for establishing a vegetative cover by planting grass seed.

1.1 Purpose and Use

A. All graded areas, slopes, and ditches which will not be paved or otherwise surfaced shall be provided with permanent seeding.

B. Graded areas subject to erosion shall not remain unprotected for longer than 30 days. Temporary seeding shall be provided by the Supplier to protect graded areas from erosion where permanent protection is not scheduled to be installed for 2 to 12 months after grading is completed.

1.2 Method of Seed and Mulch Application

Seed may be spread by a conventional method of application such as broadcasting, grass drill, or cultipacker followed by an application of mulch or by a hydro seeding procedure consisting of spraying a slurry mixture of water, seed, mulch, fertilizer, and tackifier onto the prepared seedbed.

1.3 Work Included

A. Furnish all materials.

B. Subgrade preparation.

C. Seedbed preparation, including placing topsoil and the addition of lime and fertilizer.

D. Seeding using broadcast, grass drill, or the cultipacker method and mulching, or hydro seeding with a mixture that contains seed, mulch and a tackifier.

E. Installation of matting where specified for erosion control.

F. Protection.

G. Maintenance.

H. Repairing and reseeding.

2.0 Codes and Standards

A. Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state or local codes having jurisdiction.

B. References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.

C. Abbreviations listed indicate the form used to identify the reference documents in the Specification text.

2.1 USDA - United States Department of Agriculture, Soil Conservation Service

A. USDA-SCS Soil Classification. Supplement to Soil Classification System (7th Approximation), SCS, USDA, Second Printing, March 1967.

2.2 ASTM - American Society for Testing and Materials

A. C602 - Specification for Agricultural Liming Materials.

B. D977 - Specification for Emulsified Asphalt.

C. D2026 - Specification for Cutback Asphalt (Slow-Curing Type).

D. D2027 - Specification for Cutback Asphalt (Medium-Curing Type).

E. D2028 - Specification for Cutback Asphalt (Rapid-Curing Type).

F. D2397 - Specification for Cationic Emulsified Asphalt.

G. D5268 - Specification for Topsoil Used for Landscaping Purposes.

3.0 Supplier's Drawings and Data Submittals

Supplier shall submit drawings and data not less than 30 days before material is to be delivered. Supplier's drawings and data shall be submitted via electronic medium in a format compatible for importing into the Buyer's information systems specified by the Buyer.

3.1 Topsoil

A. Topsoil Material:

- A copy of laboratory reports on two representative samples of topsoil. Laboratory tests shall be performed for:
- Percent deleterious material.
- Total organic content.

- Silt and clay contents.
- Sand content.
- pH.

B. If it is anticipated that topsoil stripped from either the present site or the borrow area will be used for permanent seeding, if requested by the Buyer, the Supplier shall provide two 50-pound samples to the Buyer's Testing Service for analyses.

3.2 Seed

A. A certified copy of a statement signed by the seed supplier that each lot of seed has been tested by a recognized seed-testing laboratory within six months before the date of delivery to the plant site.

B. A certified statement signed by the seed supplier that the maximum percentage of noxious weeds in the seed mixture complies with state law.

3.3 Data on Materials as Applied

As applied data on the following items:

A. Seed mixture and seed application rate.

B. Limestone application rate.

C. Fertilizer type, trademark name (if any), chemical composition, and application rate.

D. Mulch.

E. Tackifier.

3.4 Binder Spray

Data on the binder spray (tackifier) to be used on straw mulch or with hydro seeding. If a synthetic binder (tackifier) will be used, the Supplier shall provide a complete set of Manufacturer's specifications at least 30 days prior to anticipated use. Manufacturer's specifications shall contain a description of the binder material, the recommended method of application, and the recommended application rate.

3.5 Matting

Catalog data on the proposed erosion control matting and Manufacturer's literature on the recommended method of installation.

3.6 Samples

If requested by the Buyer, submit a sample of each material designated by the Buyer for laboratory testing.

4.0 Products

4.1 Topsoil

A. Topsoil shall consist of sandy clay loam, sandy loam, loam, clay loam, silty clay loam or silt loam as defined by the SCS Soil Classification System.

B. Topsoil shall be relatively free from large roots, sticks, weeds, brush or stones larger than 1 inch in diameter or other litter and waste products. It shall have at least 90 percent passing the No. 10 sieve.

C. The topsoil shall meet requirements of ASTM D5268 as follows:

- It shall contain not less than 2 percent nor more than 20 percent total organic matter.
- It shall contain not less than 35 percent nor more than 70 percent silt and clay.
- It shall contain not less than 20 percent nor more than 60 percent sand.
- The pH of the sample shall not be lower than 5.0 nor higher than 7.5.
- The percent deleterious material (rock, gravel, slag, cinder, roots, sod) shall not exceed 5 percent.

4.2 Seed

4.2.1 General Requirements

A. Grasses, legumes, or cover crop seed of the type specified herein shall conform to the standards of the United States Department of Agriculture for seed certification.

B. Seed or seeding mixtures shall be furnished in sealed bags or containers in accordance with standard commercial practice.

C. Each bag or container shall be tagged or labeled in accordance with state law. As a minimum, the tag or label shall provide the following information:

- Name and address of the supplier.
- Common name of seed.
- Lot number.
- Net weight.
- Guaranteed percentage of germination.
- Percentage of weed seed and inert material content.

D. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

E. All seed furnished shall be free of primary noxious weed seed such as Russian or Canadian Thistle, European Birdweed, Johnson Grass and Leafy Spurge. The maximum allowable percentage of noxious weed seed in the seed mixture shall comply with state law.

4.2.2
Seed Storage

If it is necessary to store seeds after their arrival on the site, they shall be stored in an approved weatherproof building in such a manner as to protect the seeds from deterioration and to permit easy access for inspection. The Buyer's approval for the storage building and the method of storage shall not relieve the Supplier of responsibility for the quality and fitness of the seeds at the time of their use.

4.2.3
Seed Mixture

A. Seed species, rate per acre, and other data relevant to permanent seeding are given in Table 1.

B. Seed species, rate per acre, and other data relevant to temporary seeding are given in Table 2.

TABLE 1
ACCEPTABLE MIXTURES FOR PERMANENT SEEDING

Mixture	Seed Species (1)	Seeding Rate, Pure Live Seed for Conventional Seed Application (2)		Suitable pH	Site Suitability			Acceptable Dates for Seeding
		Lbs. per acre	Lbs. per 1,000 sq. ft.		Sunny, Dry	Well Drained	Wet	
1	Smooth Bromegrass or Tall Fescue	30	0.75	6.0-7.5	X	X	X	4-1 to 6-1 8-1 to 9-1
	Alfalfa or Birdsfoot Trefoil	10	0.25					
2	Smooth Bromegrass or Tall Fescue	30	0.75	6.0-8.0	X	X		4-1 to 6-1 8-1 to 9-1
	Crown Vetch	20	0.50					
3	Tall Fescue	15	0.35	5.5-7.5		X	X	4-1 to 6-1 8-1 to 9-1
	Timothy or Redtop	3	0.07					
	Birdsfoot Trefoil	15	0.35					
4	Reed Canary Grass	15	0.35	5.5-7.5	X	X		4-1 to 6-1 8-1 to 9-1
	Smooth Bromegrass or Tall Fescue	15	0.35					
	Ladino (optional)	3	0.07					

Notes: (1) Mixtures as defined by SCS for Illinois.

(2) Triple the seeding rate shown in the table when hydro seeding.

TABLE 2
ACCEPTABLE MIXTURES FOR TEMPORARY SEEDING

MIXTURE	SEED SPECIES	MAXIMUM WEED SEED (percentage)	SEEDING RATE PER ACRE	SUITABLE pH	PLANTING DEPTH	ACCEPTABLE DATES FOR SEEDING
1	Wheat	0.50	150 lbs	5.5 to 7.0	1" to 1 ½"	3-1 to 5-15 7-1 to 10-15
2	Cereal Rye	0.50	150 lbs	5.5 to7.0	1" to 1 ½"	3-1 to 5-15 7-1 to 10-15
3	Spring Oats	0.50	100 lbs	5.5 to 7.0	1"	3-1 to 7-1
4	Perennial Ryegrass	0.50	40 lbs	5.0 to 7.5	1/4"	4-1 to 6-1 8-1 to 9-15

4.3
Lime (Agricultural Ground Limestone)

Agricultural lime shall be flour grade meeting the requirements of ASTM C602.

4.4
Fertilizer

A. Fertilizer shall be a standard brand commercial grade of inorganic fertilizer furnished in unopened containers. The material may be separate or in a mixture containing the percentage of total nitrogen, available phosphoric acid and water-soluble potash in the amounts specified. If materials are separate, the Buyer shall be present when the separate fertilizers are mixed in the field. The fertilizer shall be odor free.

B. Fertilizer shall be supplied in one of the following forms:

- A dry free-flowing granular fertilizer suitable for application by an agricultural fertilizer spreader.
- A soluble form that will permit complete suspension of insoluble particles in water, suitable for application by power sprayer.

C. The following information shall be shown on the fertilizer container or on a tag attached thereto:

- Name and address of manufacturer.
- Name, brand or trademark.
- Number of net pounds of ready-mixed material in the package.
- Chemical composition or analysis.
- Guarantee of analysis.

4.5
Mulch

4.5.1
Straw Mulch

A. Straw shall be stalks of small grain straw of wheat, rye, oats, barley or other approved grain. Straw shall be air dried and free of grain and noxious weed seed, other materials detrimental to plant life, and mold.

B. Straw shall be seasoned before bailing or loading. Straw mulch shall be suitable for spreading with mulch blower equipment.

C. Old dry straw which breaks up in the crimping process instead of bending, or straw in such advanced stages of decomposition that it will smother or retard the normal growth of grass, is not acceptable.

4.5.2
Wood Cellulose Fiber Mulch

A. Wood cellulose fiber shall be partly digested wood fibers.

B. The material shall be dyed green.

C. The material shall not contain growth or organism inhibiting agents.

D. The material shall be air-dried with a minimum of 30 percent of the fibers 3.7 mm (0.145 inch) or longer.

4.5.3 Binder Sprays

A. Cutback Asphalt shall be in accordance with ASTM D2026 (Slow-Curing Type), ASTM D2027 (Medium-Curing Type) or ASTM D2028 (Rapid-Curing Type).

B. Emulsified Asphalt shall be in accordance with D977 (Emulsified Asphalt) or D2397 (Cationic Emulsified Asphalt).

4.6 Tackifier (Synthetic Binder)

A. Tackifier material shall be an acrylic copolymer or a polyvinyl acetate emulsion in a liquid form. The material may contain additives to enhance its ability to penetrate the soil.

B. The material shall be non-toxic, non-flammable, and biodegradable.

C. Approved Materials:

- Soil Seal Concentrate manufactured by Soil Seal Corp., 1111 W. Sixth St., Los Angeles, California 90017, telephone number 213-481-7185.
- Reinco Mulch Binder and Terra Tac manufactured by Rienco Mulch Binder Corp., 520 North Avenue, Plainfield, New Jersey 07060, telephone number 1-800-526-7687.
- Aerospray 70 Binder manufactured by American Cyanamid Company, Mobile, Alabama 36601, telephone number 205-476-5800.

4.7 Inoculant

A. The inoculant for treating legume seeds shall be a pure culture of nitrogen fixing bacteria prepared specifically for the species and shall not be used later than the date indicated on the container. A mixing medium, as recommended by the manufacturer, shall be used to bond the inoculant to the seed.

B. All legumes not pre-inoculated shall be inoculated within 12 hours of seeding. If the seed was pre-inoculated more than 60 days prior to seeding then it must be reinoculated.

4.8 Matting for Erosion Control

A. Matting for erosion control may be one of the following unless a specific matting is specified on the Design Drawings.

- Jute mat shall be cloth of a uniform plain weave of undyed and unbleached single jute yarn, 48 inches in width, plus or minus 1 inch and weighing an average of 1.2 pounds per linear yard of cloth with a tolerance of plus or minus 5 percent, with approximately 78 warp ends per width of cloth and 41 weft ends per linear yard of cloth. The yarn shall be of a loosely twisted construction having an average twist of not less than 1.6 turns per inch and shall not vary in thickness by more than one-half its nominal diameter.

- Excelsior mat shall be wood excelsior, 48 inches in width plus or minus 1 inch and weighing 0.8 pounds per square yard plus or minus 10 percent. The excelsior material shall be covered with a netting to facilitate handling and to increase strength.
- Glass fiber matting of bonded textile glass fibers with an average fiber diameter of 8 to 12 microns, 2 to 4 inch strands of fiber bonded with phenol formaldehyde resin. Mat shall be roll type, water permeable, minimum thickness 1/4 inch, maximum thickness 1/2 inch, density not less than 3 pounds per cubic foot.

B. Staples for anchoring soil stabilizing materials shall be No. 11 gauge wire or heavier. Their length shall be 6 to 10 inches. Ten inch long staples shall be used on loose, unstable soils.

5.0 Execution

5.1 Site Preparation

A. Prior to seeding, install all erosion control facilities specified on the Design Drawings. These include: diversions, berms, sediment control traps, silt fences and straw bale dikes.

B. Grade areas as specified on the Design Drawings. Gullied and uneven areas shall be smoothed before starting seedbed preparation.

5.2 Limestone for pH Adjustment

A. The Supplier shall apply limestone as required to raise the pH of the subsoil. Apply a minimum of 4 tons of limestone per acre for clayey soils, 3 tons of limestone per acre for sandy loam, and 2 tons of limestone per acre for loamy sand or silty soils.

B. Thoroughly work the limestone into the subsoil to a depth of 2 to 3 inches with a harrow or disk. The limestone may be applied prior to or concurrently with the fertilizer described.

5.3 Fertilizer

A. The Supplier shall apply a 12-12-12 fertilizer to the subsoil at a rate of 300 pounds per acre.

B. Work the fertilizer into the soil to a depth of 2 to 3 inches with a harrow, disk, or rake. On slopes, operate the disk or rake across the slope.

C. If hydro seeding is used, the fertilizer may be added to the hydroseed mixture.

5.4 Tilling of Subsoil

Prior to placing the topsoil, scarify the subsoil to a depth of 3 inches immediately prior to spreading topsoil to ensure bonding of the topsoil and the subsoil. Repeat scarification in areas where equipment used for hauling and spreading topsoil has compacted the subsoil.

5.5
Placing Topsoil

Note: topsoil does not have to be placed for temporary seeding. Topsoil must be placed prior to permanent seeding.

A. Place topsoil during dry weather on a dry, unfrozen subgrade. Topsoil shall not be spread if it is frozen or muddy.

B. Remove large pieces of organic matter and foreign non-organic material from topsoil while spreading. There shall be no large roots, branches or trash of any kind in the topsoil.

C. Spread the topsoil to provide a compacted thickness of not less than 4 inches.

D. Compact the topsoil with a roller not exerting more than 100 pounds per square inch. The topsoil must be loose enough for water infiltration and root penetration. The soil surface on slopes shall be roughened to catch seeds if they are to be broadcast.

5.6
Seeding (Conventional Method)

A. Tables 1 and 2 list acceptable seed mixtures that may be used for seeding. The Supplier shall select a mixture from the appropriate table and plant within the dates shown in that table for that mixture.

B. Apply seed uniformly at the rate shown in the appropriate table with a rangeland grass drill or cultipacker type seeder, or broadcast seed uniformly. The seeding methods and equipment shall be submitted to the Buyer for approval prior to beginning work.

C. All seeders shall be calibrated and adjusted to sow seeds at the proper rate. Equipment shall be operated to ensure a complete and even coverage. Do not seed areas greater than that which can be mulched on the same day.

D. Do not sow immediately following a rain, where the ground is too dry, during windy periods, or otherwise when conditions are not proper for seeding.

E. No seeds shall be sown until the purity test has been completed for the seeds to be used and the tests show that the seed meets the noxious weed seed requirements.

F. Within 12 hours, all seeded areas shall be rolled at right angles to the runoff with a cultipacker or approved roller to compact the seedbed and place the seed in contact with the soil. The optimum depth for planting shall be 1/4 inch. Rolling is not required if the seeding equipment is equipped with a roller that achieves the desired compaction or a grass drill has been used. Note: For temporary seeding planted without topsoil, the optimum planting depth is shown in Table 2.

5.7
Mulching (Conventional Method)

5.7.1
Straw Mulching

A. All seeded areas shall be mulched with straw mulch within 24 hours after seeding. The mulch may be hand or machine applied. The mulch shall be uniformly applied in a loose enough condition to permit air to circulate, but compact enough to reduce erosion. About 25 percent of the solid surface should show through the mulch. If baled mulch material is used, care shall be taken that the material is in a loosened condition and contains no lumps or knots of compacted material.

B. Straw mulch shall be applied at the rate of 2 tons per acre, or 75 to 100 (two bales) pounds per 1,000 square feet.

C. Straw mulch shall be anchored immediately after placement to minimize loss by wind or water. Straw mulch shall be anchored using a mulch anchoring tool or by spraying with a liquid binder.

5.7.2 Anchoring Mulch Using a Mulch Anchoring Tool

A. The mulch anchoring tool shall be designed to punch and anchor the mulch into the top 2 to 3 inches of soil at 6 inch intervals. As an alternative, a smooth disk set in a straight position may be used.

B. On slopes flatter than 3 horizontal to 1 vertical, mulch anchoring shall cross the contour of the land (across slopes). On slopes steeper than 3 horizontal to 1 vertical, the mulch shall be anchored by tracking a bulldozer with 1-1/2 inch track cleats up and down slope making grooves running across the slope.

5.7.3 Anchoring Using a Sprayed Liquid Binder

A. A sprayed liquid binder may be used in lieu of crimping to anchor the mulch. The binder may be sprayed into the mulch as it leaves the blower pipe or it may be applied as an over spray. If over sprayed, the binder spray should be heavier at the edges where wind catches the mulch, in valleys and at crests of banks. Binder shall be applied uniformly over the remainder of the area. Caution shall be used when spraying binder near areas occupied by construction personnel.

B. Binder Spray shall be applied at the following rates:

- Cutback asphalt - Rapid curing (RC-70, RC-250, and RC-800) or medium curing (MC-250 or MC-800). Apply 5 gallons per 1,000 square feet or 218 gallons per acre.
- Emulsified asphalt - (SS-1, CSS-l, CMS-2, MS, RS-l, RS-2, CRS-l, and CRS-2). Apply 5 gallons per 1,000 square feet or 218 gallons per acre.
- Synthetic binders - Synthetic binders such as Acrylic Dir (Agri-Tac), DCA-70, Petroset or Terra Tack may be used at rates recommended by the manufacturer to anchor mulch material.

5.7.4 Repairing and Reseeding

A. Areas not mulched and anchored within 24 hours after seeding shall be reseeded and mulched.

B. Areas not properly mulched, or damaged due to construction activities, shall be repaired, reseeded, and remulched.

5.8 Hydro Seeding

A. Hydro seeding consists of spraying a slurry mixture of water, seed, fertilizer, mulch, and a tackifier on a prepared seed bed.

B. The slurry mixture shall be mixed and applied using a hydraulic seeder. Hydraulic seeding equipment shall include a pump rated and operated at not less than 100 gallons per minute and 100 psi pressure. The tank shall have a mechanical agitator powerful enough to keep the slurry mixture in a uniform suspension in water.

C. Hydrated lime **shall not** be added to the slurry mixture.

D. The slurry mixture shall contain a maximum of 55 percent solids (125 pounds of solids per 100 gallons of water).

E. The seed mixture shall be as specified in Table 1 or Table 2 except that the weight of seed in the slurry mixture shall be a minimum of three times the weight of pure live seed per acre specified in the appropriate table for conventional seed application.

F. The slurry mixture shall contain a minimum of 1500 pounds of wood cellulose fiber mulch per acre or 2000 pounds of straw mulch per acre.

G. The amount of tackifier provided per acre shall be in accordance with Manufacturer's recommendations.

H. The slurry-mixture shall contain a minimum of 1000 pounds of grade 12-12-12 fertilizer per acre or the equivalent weight of chemicals if another grade is used.

I. The soil surface shall be moist when the slurry mixture is applied.

5.9 Laying and Securing Matting

5.9.1 Laying and Securing Jute Matting

A. Prepare the seed bed as specified and lime, fertilize, and seed, except that when using jute matting, apply approximately one-half of the seed after laying the mat.

B. Most drainage channels will require multiple widths of jute matting. The total width shall be as specified on the Design Drawings. Unroll matting starting at the upper end of the channel allowing a 4 inch overlap of mattings along center of channel.

C. Bury the top ends of jute matting in a narrow trench. Backfill the trench and tamp firmly to conform to channel cross-section. Secure the matting with a row of staples about 4 inches down slope from the trench. Spacing between staples shall be a maximum of 6 inches.

D. Staple the 4 inch overlap in the center of the channel using an 18 inch spacing between staples. Before stapling the outer edges of the matting, make sure the matting is smooth and in firm contact with the soil. Staples shall be placed 2 feet apart along the outer edge of matting.

E. Where one roll of jute matting ends and another begins, the end of the top strip shall overlap the upper end of the lower strip by 4 inches, shiplap fashion.

F. Where matting crosses erosion stops, reinforce with a double row of staples placed six (6) inches apart in a staggered pattern on either side of erosion stop. Likewise, overlaps joining the length of matting together and the discharge end of the matting liner should be similarly secured with 2 double rows of staples.

5.9.2 Laying and Securing Excelsior Matting

A. Provide the same seedbed preparation as specified for jute matting with the exception that all seeding must be completed before laying excelsior matting.

B. Bury the top ends of excelsior matting in a trench as described for jute matting. As the blankets are unrolled down slope, the matting must be on top with the wood fibers in contact with the soils. Butt snugly at the ends and sides before stapling.

C. Using two (2) foot spacing between staples, excelsior matting shall be secured with four rows for each strip, with one row along each edge and alternating parallel rows down the center. The stapling over erosion stops, entrance and discharge ends of matting and butted end joints shall be the same as described for jute matting.

5.10 Construction Completed after Acceptable Seeding Dates

When construction is completed between October 15 and March 1 prepare the seedbed, fertilize and mulch as specified. Apply seed for permanent seed sometime between December 1 and March 1 increasing the seeding rates shown in Table 1 by 50 percent.

6.0 Protection

Planted areas shall be protected from damage and erosion. The Supplier shall provide and erect temporary barriers and signs as necessary to prevent vehicles, equipment and foot traffic from damaging seeded areas.

7.0 Maintenance

The Supplier shall perform the following maintenance tasks:

A. Keep seedbed continually moist with light, frequent sprinklings several times a day to prevent seedlings from drying out.

B. Inspect periodically after planting to see that vegetative stands are adequately established. Immediately reseed areas which show bare spots larger than 2 feet by 2 feet after germination.

C. Check for erosion damage after storm events and repair damage. Reseed and mulch, if necessary.

D. Fertilize newly permanent seeded areas one year after seeding with 300 pounds per acre of a complete (N-P-K) 10-10-10 or equivalent turf type slow release fertilizer.

- Application rate per acre shall be:

  Nitrogen (N) - 120 pounds of actual nitrogen.

Phosphorus (P) - 120 pounds of P_20_5.

Potassium (K) - 120 pounds of K_20.

Appendix E: Hennepin Power Station; West Ash Disposal Pond Maintenance Plan (2013)

DYNEGY MIDWEST GENERATION, LLC

Hennepin Power Station
Hennepin, Illinois

Putnam County

West Ash Disposal Pond

IDNR Permit No. (not permitted)

Dam ID No. (not permitted)

Maintenance Plan

September 2013

TABLE OF CONTENTS

1.0 GENERAL

The following operations and maintenance procedures are provided to maintain the structural integrity of the west ash storage surface impoundment at the Hennepin Power Station, which is unclassified and unpermitted, by the Illinois Department of Natural Resources, Office of Water Resources.

2.0 EMERGENCY OPERATIONS

2.1 Unusual Conditions

Any unusual condition discovered during major storm events or routine inspection, which may constitute an emergency, shall be handled as follows. Notice of any type of emergency involving the dikes or outfall shall be made to the Shift Leader on duty [(815) 339-9211]. The Shift Leader on duty shall notify the Station Manager, Ted Lindenbusch [home: (815) 875-2381], or, in his absence, the Environmental Coordinator, John P. Augspols [home: (815) 925-7488]. One of the above designated personnel shall notify the following city, county, state and federal regulatory authorities of the emergency condition.

- Division of Water Resources, Dam Safety Section, Dam Safety Engineers (217) 782-3862
- Illinois Emergency Management Agency, 24-hour service 1-(800) 782-7860
- Putnam County Sheriff/Hennepin Police Department (815) 925-7015
- Senior Director – Environmental Compliance, Dynegy Operating Company (618) 206-5912

2.2 Dewatering

The Station Manager or the Environmental Coordinator shall have the responsibility of determining how repairs shall be accomplished and whether dewatering of the disposal facility is necessary. Emergency dewatering shall be accomplished by portable pumps.

3.0 MAINTENANCE

3.1 Vegetation

Dikes shall be maintained to protect the structural integrity of the disposal facility. Damaged and barren areas shall be repaired as soon as appropriate after being discovered. Damaged areas shall be filled with topsoil. Limed, fertilized, and seeded with appropriate vegetation. Trees and shrubs observed during semiannual inspections shall be cut and removed from the dikes and discharge channel. This shall be done as frequently as is necessary to insure that no tree reaches a size where the root structure would require removal and filling. Woody vegetation, shrubs, and trees shall be removed during the early stages of growth before reaching a three-inch diameter.

Low growing vegetation, a prairie grass mixture that grows to a height of no more than six inches, shall be planted and maintained to facilitate inspections.

3.2 Discharge Structure

The discharge structure shall be inspected periodically for significant corrosion and deterioriation. Any defects discovered shall be promptly repaired.

3.3 Animal Damage and Repairs

Animal burrows discovered during inspections shall be promptly repaired by filling with grout.

3.4 Restriction of Unauthorized Vehicles

Facility approaches shall be posted with signs restricting unauthorized travel on the roadways and slopes.

3.5 Inspections/Remedial Measures

3.5.1 Weekly Inspections

Weekly inspections of the perimeter berms shall be conducted, looking for seepage and slumping, and unusual seepage at and/or blockage of the outfall structures in each cell. All findings shall be entered into the weekly inspection checklist, discussed in Section 4.0. Maintenance activities shall be initiated, if required. Refer to Section 4.0 for the recommended inspection checklist to be used for the weekly inspections.

3.5.2 Quarterly Inspections

Inspections shall be made quarterly by Station personnel to determine the general condition of the dam and embankments. During these inspections, embankment erosion, tree growth, and embankment seepage shall be monitored. Seepage shall be observed for change in quantity and coloration. Refer to Section 4.0, for the recommended inspection checklist to be used for documenting the quarterly inspections.

3.5.3 Annual Inspections

An annual inspection shall be made by a licensed professional engineer. This inspection shall follow the Illinois Department of natural Resources (IDNR) *Guidelines and Forms for Inspection of Illinois Dams*, and shall be followed by verbal and written reports by the consulting engineer. Based on the findings of the inspection, the Station Manager shall implement corrective action as required to promote dam safety. Procedures and methods for corrective action shall be performed in accordance with recommendations of the consulting engineer and as outlined above. Because the dam is not permitted by the IDNR, copies of the engineer's report, along with corrective action taken, will not be reported to the IDNR.

4.0 INSPECTION CHECKLISTS

The following Inspection checklists should be used during the weekly and quarterly inspections.

WEEKLY DAM INSPECTION FORM

Dam Location: Hennepin Power Station – West Ash Pond
Owner: Dynegy Midwest Generation, LLC, Havana Power Station
Permit No.: Not permitted **Class of Dam: Not classified**
Type of Dam: Homogeneous earth dam
Type of Spillway: Drop structure

Date Inspected: ______________________
Weather Conditions: ____
Pool Elevation: ______________________

Inspection Personnel:

______________________________ ______________________
Name / Title **Signature**

Inspection Item	Conditions	Location of Problem and Recommended Remedial Measures and Implementation Schedule
Vertical and Horizontal Alignment of Crest		
Unusual Movement or Cracking at or Beyond Toe		
Seepage		
Vegetative Cover		
Embankment Erosion		
Structural Cracking		
Outfall Structures		
Other		

QUARTERLY DAM INSPECTION FORM

Dam Location: Hennepin Power Station – West Ash Pond
Owner: Dynegy Midwest Generation, LLC, Hennepin Power Station
Permit No.: Not permitted **Class of Dam: Not classified**
Type of Dam: Homogeneous earth dam
Type of Spillway: Drop structure

Date Inspected: __________________
Weather Conditions: ____
Pool Elevation: _________________________

Inspection Personnel:

____
Name / Title **Signature**

Inspection Item	Conditions	Location of Problem and Recommended Remedial Measures and Implementation Schedule
Vertical and Horizontal Alignment of Crest	Good condition, with no significant issues	
Downstream Fill Slopes	Good condition, with no significant issues	
Upstream Fill Slopes	Good condition, with no significant issues	
Unusual Movement or Cracking at or Beyond Toe	Good condition, with no significant issues	
Seepage (Condition/Color)	Good condition, with no significant issues	
Vegetative Cover (Tree growth)	Good condition, with no significant issues	
Animal Damage	Good condition, with no significant issues	
Embankment Erosion	Good condition, with no significant issues	
Water Passages	Good condition, with no significant issues	
Structural Cracking	Good condition, with no significant issues	
Outfall Structures	Good condition	
Other		

Appendix F: Hennepin Power Station; Old East Ash Disposal Pond Maintenance Plan (2013)

DYNEGY MIDWEST GENERATION, LLC

Hennepin Power Station
Hennepin, Illinois

Putnam County

Old East Ash Disposal Pond

IDNR Permit No. (not permitted)

Dam ID No. (not permitted)

Maintenance Plan

September 2013

TABLE OF CONTENTS

1.0 GENERAL

The following operations and maintenance procedures are provided to maintain the structural integrity of the old east ash storage surface impoundment at the Hennepin Power Station, which is unclassified and unpermitted, by the Illinois Department of Natural Resources, Office of Water Resources.

This is primarily the @ 0.5 mile significant berm system that extends along the Illinois River. The old east ash pond system consists of the inactive cells # 2 and # 4. As a result of the May 2011 USEPA dam assessment, a dam safety permit was submitted to IDNR in May 2013, to address major modifications to this significant berm. These major modifications include extensive tree removal and resloping. Resloping is required to improve slope stability and allow safe access to slope, for long-term mowing and maintenance.

2.0 EMERGENCY OPERATIONS

2.1 Unusual Conditions

Any unusual condition discovered during major storm events or routine inspection, which may constitute an emergency, shall be handled as follows. Notice of any type of emergency involving the dikes or outfall shall be made to the Shift Leader on duty [(815) 339-9211]. The Shift Leader on duty shall notify the Station Manager, Ted Lindenbusch [home: (815) 875-2381], or, in his absence, the Environmental Coordinator, John P. Augspols [home: (815) 925-7488]. One of the above designated personnel shall notify the following city, county, state and federal regulatory authorities of the emergency condition.

- Division of Water Resources, Dam Safety Section, Dam Safety Engineers (217) 782-3862
- Illinois Emergency Management Agency, 24-hour service 1-(800) 782-7860
- Putnam County Sheriff/Hennepin Police Department (815) 925-7015
- Senior Director – Environmental Compliance, Dynegy Operating Company (618) 206-5912

2.2 Dewatering

Not applicable.

3.0 MAINTENANCE

3.1 Vegetation

Dikes shall be maintained to protect the structural integrity of the disposal facility. Damaged and barren areas shall be repaired as soon as appropriate after being discovered. Damaged areas shall be filled with topsoil. Limed, fertilized, and seeded with appropriate vegetation. Trees and shrubs observed during semiannual inspections shall be cut and removed from the dikes and discharge channel. This shall be done as frequently as is necessary to insure that no tree reaches a size where the root structure would require removal and filling. Woody vegetation, shrubs, and trees shall be removed during the early stages of growth before reaching a three-inch diameter.

Low growing vegetation, a prairie grass mixture that grows to a height of no more than six inches, shall be planted and maintained to facilitate inspections.

3.2 Discharge Structure

Not applicable.

3.3 Animal Damage and Repairs

Animal burrows discovered during inspections shall be promptly repaired by filling with grout.

3.4 Restriction of Unauthorized Vehicles

Facility approaches shall be posted with signs restricting unauthorized travel on the roadways and slopes.

3.5 Inspections/Remedial Measures

3.5.1 Weekly Inspections

Weekly inspections of the perimeter berms shall be conducted, looking for seepage and slumping. All findings shall be entered into the weekly inspection checklist, discussed in Section 4.0. Maintenance activities shall be initiated, if required. Refer to Section 4.0 for the recommended inspection checklist to be used for the weekly inspections.

3.5.2 Quarterly Inspections

Inspections shall be made quarterly by Station personnel to determine the general condition of the dam and embankments. During these inspections, embankment erosion, tree growth, and embankment seepage shall be monitored. Seepage shall be observed for change in quantity and coloration. Refer to Section 4.0, for the recommended inspection checklist to be used for documenting the quarterly inspections.

3.5.3 Annual Inspections

An annual inspection shall be made by a licensed professional engineer. This inspection shall follow the Illinois Department of natural Resources (IDNR) *Guidelines and Forms for Inspection of Illinois Dams*, and shall be followed by verbal and written reports by the consulting engineer. Based on the findings of the inspection, the Station Manager shall implement corrective action as required to promote dam safety. Procedures and methods for corrective action shall be performed in accordance with recommendations of the consulting engineer and as outlined above. Because the dam is not permitted by the IDNR, copies of the engineer's report, along with corrective action taken, will not be reported to the IDNR.

4.0 INSPECTION CHECKLISTS

The following Inspection checklists should be used during the weekly and quarterly inspections.

WEEKLY DAM INSPECTION FORM

Dam Location: **Hennepin Power Station – Old East Ash Pond**
Owner: **Dynegy Midwest Generation, LLC, Havana Power Station**
Permit No.: **Not permitted** **Class of Dam: Not classified**
Type of Dam: **Homogeneous earth dam**
Type of Spillway: **N/A**

Date Inspected: ______________________
Weather Conditions: ____
Pool Elevation: ______________________

Inspection Personnel:

______________________________ ______________________
Name / Title **Signature**

Inspection Item	Conditions	Location of Problem and Recommended Remedial Measures and Implementation Schedule
Vertical and Horizontal Alignment of Crest		
Unusual Movement or Cracking at or Beyond Toe		
Seepage		
Vegetative Cover		
Embankment Erosion		
Structural Cracking		
Outfall Structures		
Other		

QUARTERLY DAM INSPECTION FORM

Dam Location: **Hennepin Power Station – Old East Ash Pond**

Owner: **Dynegy Midwest Generation, LLC, Hennepin Power Station**

Permit No.: **Not permitted** **Class of Dam: Not classified**

Type of Dam: **Homogeneous earth dam**

Type of Spillway: **Not applicable**

Date Inspected: ____________________

Weather Conditions: ____

Pool Elevation: ____________________________

Inspection Personnel:

____

Name / Title **Signature**

Inspection Item	Conditions	Location of Problem and Recommended Remedial Measures and Implementation Schedule
Vertical and Horizontal Alignment of Crest	Good condition, with no significant issues	
Downstream Fill Slopes	Good condition, with no significant issues	
Upstream Fill Slopes	Good condition, with no significant issues	
Unusual Movement or Cracking at or Beyond Toe	Good condition, with no significant issues	
Seepage (Condition/Color)	Good condition, with no significant issues	
Vegetative Cover (Tree growth)	Good condition, with no significant issues	
Animal Damage	Good condition, with no significant issues	
Embankment Erosion	Good condition, with no significant issues	
Water Passages	Good condition, with no significant issues	
Structural Cracking	Good condition, with no significant issues	
Outfall Structures	Good condition	
Other		

Appendix G: Hennepin Power Station; East Ash Disposal Pond Maintenance Plan (2014)

DYNEGY MIDWEST GENERATION, LLC

Hennepin Power Station
Hennepin, Illinois

Putnam County

East Ash Disposal Pond

Small Class III Dam

IDNR Permit No. DS2011079

Dam ID No. IL50363

Maintenance Plan

Revised – August 2014

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1.0 GENERAL

The following operations and maintenance procedures are provided to maintain the structural integrity of the east ash storage surface impoundment at the Hennepin Power Station, which is classified as a small Class III dam by the Illinois Department of Natural Resources, Office of Water Resources. The primary pond's maximum normal poll elevation will be 489.5 msl with a dam crest at elevation 494.0 msl. The secondary pond's maximum normal pool elevation will be 480.5 with a dam crest at 494.0 msl.

2.0 EMERGENCY OPERATIONS

2.1 Unusual Conditions

Any unusual condition discovered during major storm events or routine inspection, which may constitute an emergency, shall be handled as follows. Notice of any type of emergency involving the dikes or outfall shall be made to the Shift Leader on duty [(815) 339-9211]. The Shift Leader on duty shall notify the Managing Director, Byron Veech [cell: (309) 543-8714], or, in his absence, the Environmental Coordinator, John P. Augspols [home: (815) 925-7488]. One of the above designated personnel shall notify the following city, county, state and federal regulatory authorities of the emergency condition.

- Division of Water Resources, Dam Safety Section, Dam Safety Engineers (217) 782-3862
- Illinois Emergency Management Agency, 24-hour service 1-(800) 782-7860
- Putnam County Sheriff/Hennepin Police Department (815) 925-7015
- Senior Director – Environmental Compliance, Dynegy Operating Company (618) 343-7761

2.2 Dewatering

The Station Manager or the Environmental Coordinator shall have the responsibility of determining how repairs shall be accomplished and whether dewatering of the disposal facility is necessary. Dewatering shall be accomplished by manually removing the concrete beams from the primary and/or secondary pond structures until the desired water level is reached.

3.0 MAINTENANCE

3.1 Vegetation

Dikes shall be maintained to protect the structural integrity of the disposal facility. Damaged and barren areas shall be repaired as soon as appropriate after being discovered. Damaged areas shall be filled with topsoil. Limed, fertilized, and seeded with appropriate vegetation. Trees and shrubs observed during periodic inspections shall be cut and removed from the dikes and discharge channel. This shall be done as frequently as is necessary to insure that no tree reaches a size where the root structure would require removal and filling. Woody vegetation, shrubs, and trees shall be removed during the early stages of growth before reaching a three-inch diameter.

Low growing vegetation shall be planted and maintained to facilitate inspections.

3.2 Discharge Structure

The discharge structure shall be inspected periodically for significant corrosion, spalling, and cracking. Any defects discovered shall be promptly repaired.

3.3 Animal Damage and Repairs

Animal burrows discovered during inspections shall be promptly repaired by filling with grout.

3.4 Restriction of Unauthorized Vehicles

Facility approaches shall be posted with signs restricting unauthorized travel on the roadways and slopes.

3.5 Inspections/Remedial Measures

3.5.1 Weekly Inspections

Weekly inspections of the perimeter berms shall be conducted, looking for seepage and slumping, and unusual seepage at and/or blockage of the outfall structures in each cell. All findings shall be entered into the weekly inspection checklist, discussed in Section 4.0. Maintenance activities shall be initiated, if required. Refer to Section 4.0 for the recommended inspection checklist to be used for the weekly inspections.

3.5.2 Quarterly Inspections

Inspections shall be made quarterly by Station personnel to determine the general condition of the dam and embankments. During these inspections, embankment erosion, tree growth, and embankment seepage shall be monitored. Seepage shall be observed for change in quantity and coloration. Refer to Section 4.0, for the recommended inspection checklist to be used for documenting the quarterly inspections.

3.5.3 Five-Year Inspections

Every five years, an inspection shall be made by a licensed professional engineer. This inspection shall follow the Illinois Department of natural Resources (IDNR) *Guidelines and Forms for Inspection of Illinois Dams*, and shall be followed by verbal and written reports by the consulting engineer. Based on the findings of the inspection, the Station Manager shall implement corrective action as required to promote dam safety. Procedures and methods for corrective action shall be performed in accordance with recommendations of the consulting engineer and as outlined above. Copies of the engineer's report, along with corrective actin taken, shall be reported to the IDNR.

3.6 Annual Statement

An annual statement on forms furnished by IDNR, certifying compliance with this maintenance plan, shall be submitted to IDNR.

4.0 INSPECTION CHECKLISTS

The following Inspection checklists should be used during the weekly and quarterly inspections.

WEEKLY DAM INSPECTION FORM

Dam Location: Hennepin Power Station – East Ash Pond
Owner: Dynegy Midwest Generation, LLC, Havana Power Station
Permit No.:DS2011079 **Class of Dam: III**
Type of Dam: Homogeneous earth dam, with clay and geosynthetic / clay liner
Type of Spillway: Drop structure and stop logs

Date Inspected: ______________________
Weather Conditions: ____
Pool Elevation: ______________________

Inspection Personnel:

_________________________________ _______________________
Name / Title **Signature**

Inspection Item	Conditions	Location of Problem and Recommended Remedial Measures and Implementation Schedule
Vertical and Horizontal Alignment of Crest		
Unusual Movement or Cracking at or Beyond Toe		
Seepage		
Vegetative Cover		
Embankment Erosion		
Structural Cracking		
Outfall Structures		
Other		

QUARTERLY DAM INSPECTION FORM

Dam Location: Hennepin Power Station – East Ash Pond
Owner: Dynegy Midwest Generation, LLC, Hennepin Power Station
Permit No.:DS2011079 **Class of Dam: III**
Type of Dam: Homogeneous earth dam, with clay and geosynthetic / clay liner
Type of Spillway: Drop structure and stop logs

Date Inspected: __________________
Weather Conditions: ____
Pool Elevation: _________________________

Inspection Personnel:

____
Name / Title **Signature**

Inspection Item	Conditions	Location of Problem and Recommended Remedial Measures and Implementation Schedule
Vertical and Horizontal Alignment of Crest	Good condition, with no significant issues	
Downstream Fill Slopes	Good condition, with no significant issues	
Upstream Fill Slopes	Good condition, with no significant issues	
Unusual Movement or Cracking at or Beyond Toe	Good condition, with no significant issues	
Seepage (Condition/Color)	Good condition, with no significant issues	
Vegetative Cover (Tree growth)	Good condition, with no significant issues	
Animal Damage	Good condition, with no significant issues	
Embankment Erosion	Good condition, with no significant issues	
Water Passages	Good condition, with no significant issues	
Structural Cracking	Good condition, with no significant issues	
Outfall Structures	Good condition	
Other		

ATTACHMENT E


HENNEPIN
WEST ASH POND 2
ID #: W1550100002-04
DYNEGY MIDWEST
GENERATION, LLC


HENNEPIN
EAST POND 4
ID #: W1550100002-07
DYNEGY MIDWEST
GENERATION, LLC

ATTACHMENT H

OBG

Hydrogeologic Site Characterization Report

Hennepin East Ash Pond No. 2

Hennepin, Illinois

Dynegy Midwest Generation, LLC

FINAL

December 20, 2017

Natural Resource Technology
AN OBG COMPANY

DECEMBER 20, 2017 | FINAL | PROJECT #2414

Hydrogeologic Site Characterization Report

Hennepin East Ash Pond No. 2
Hennepin, Illinois

Prepared for:

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

STUART J. CRAVENS, PG
Principal Hydrogeologist

ROBERT J KARNAUSKAS, PG, PH
Principal Hydrogeologist

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ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
bgs	below ground surface
CCR	coal combustion residual
CFR	Code of Federal Regulations
cm/s	centimeters per second
CWS	Community Water Supply
DMG	Dynegy Midwest Generation, Inc.
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
ft	feet
ft/ft	feet per feet
ft MSL	feet above Mean Sea Level
gal/day	gallons per day
IAC	Illinois Administrative Code
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
ISGS	Illinois State Geological Survey
ISWS	Illinois State Water Survey
MDL	method detection limit
mg/L	milligram per liter
NRT	Natural Resource Technology, an OBG Company
PCP	Pentachlorophenol
PWS	Public Water Supply
SVOC	Semivolatile Organic Compound
S.U.	Standard Units
TDS	total dissolved solids
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WHPA	Wellhead Protection Area
WMA	Wildlife Management Area

1 INTRODUCTION

1.1 OVERVIEW

This Hydrogeologic Site Characterization Report was prepared by Natural Resource Technology, Inc., an OBG Company (NRT) in support of a Closure Plan for impoundments located at the Hennepin Power Station, Hennepin, Illinois (Figure1) which is owned by Dynegy Midwest Generation, LLC (DMG). This report and the Closure Plan apply to Coal Combustion Residuals (CCR) surface impoundments associated with Ash Pond No. 2 within the East Ash Pond System and not to any of the other impoundments present at the Hennepin Power Station. However, information gathered to evaluate other CCR units on site regarding geology, hydrogeology, and groundwater quality is included, where appropriate. The Closure Plan for Hennepin Ash Pond No. 2 includes the area previously intended to be future CCR disposal cells west of the Landfill. A notice of intent to close Ash Pond No. 2 was provided in November 2015.

Numerous hydrogeologic investigations have been performed concerning the CCR Units located at the Site. The information presented in this site characterization report includes recent data collected to comply with the Federal CCR Rule (40 CFR Part 257) as well as comprehensive data collection and evaluations from prior hydrogeologic investigation reports, including, but not limited to, the following:

- ***Hydrogeologic Study, Existing Ash Ponds, Hennepin Power Plant, Illinois Power Company, Hennepin, Illinois. John Mathes & Associates, Inc.; April 19, 1983***. Six monitoring wells were installed, currently designated as wells 02 through 06. Well 01 was abandoned during construction of the East Ash Pond, Monitoring wells 03 through 06 are downgradient of Ash Pond No. 2 and well 02 is an upgradient well located south of the impoundment. Grain size analyses were performed on soil samples.
- ***Investigation of Site Closure Options at Illinois Power Company's Hennepin East Ash Impoundment. Report No. STMI/135/96-02. Science & Technology Management, Inc., June 1996***. A supplemental hydrogeologic characterization was conducted to further characterize the Hennepin East Ash Pond System, develop a groundwater flow and transport model and evaluate four alternative closure options using the model. Eight new monitoring wells (wells 10 through 17) were installed around the east ash impoundment system to augment the existing network. Six new wells were located along the intermediate berm that separates Ash Pond No. 2 from the East Ash Pond, and two wells were located up gradient of the East Ash Pond. Field permeability tests were conducted on eight wells.
- ***Field Implementation Plan, New East Ash Landfill, Hennepin Power Station, Hennepin, Illinois. Natural Resource Technology and Kelron Environmental; February 2, 2009***. Described the data collection and analysis to be performed to satisfy the requirements of the hydrogeologic investigation as well as complete the groundwater impact assessment and groundwater monitoring plan.
- ***Water Well Survey, Dynegy Midwest Generation, Hennepin Power Station, Hennepin, Illinois. Natural Resource Technology and Kelron Environmental; June 3, 2009***. A water well survey was performed in accordance with the "Right to Know" Potable Water Well Survey procedures of 35 Illinois Administrative Code 1600.210(b)(1) and 1600.210(b)(2). The purpose of this survey was to identify water wells located within 2,500 feet of DMG's Hennepin Power Station property boundary.
- ***Prediction of Groundwater Transport: Pond 2 East, Hennepin Power Station, Hennepin, Illinois. Natural Resource Technology and Kelron Environmental; July 8, 2009***. Groundwater transport modeling was completed to evaluate liner alternatives proposed for the Leachate Pond by simulating the effects of a release on groundwater quality.
- ***Assessment of Potential for Groundwater Impact on Identified Water Wells, Dynegy Midwest Generation, Hennepin Power Station, Hennepin, Illinois. Natural Resource Technology and Kelron Environmental; August 26, 2009***. An assessment of the potential for impact of the ash impoundment on water quality of potable water wells identified in the water well survey.

- ***New Coal Combustion Waste (CCW) Landfill, Initial Facility Report, Hydrogeologic Studies and Evaluations, Section 25 Hydrogeological Investigation, Hennepin Power Station, Hennepin, Illinois. Natural Resource Technology and Kelron Environmental; December 19, 2010***. Provided the foundation on which the monitoring system, groundwater impact assessment, and groundwater quality standards are to be developed for inclusion with the Initial Facility Report for the New CCW Landfill. Forty-one borings (B-1 through B-41) were advanced near and within the footprint of the Site during February and March 2009 for Site engineering studies. Four new monitoring wells (18S, 18D, 19S and 19D) were installed along the north perimeter, downgradient of the Site. One new well (08D) was located to the south adjacent to existing well 08.
- ***New Coal Combustion Waste Landfill, Initial Facility Report, Hydrogeologic Studies and Evaluations, Section 27 Groundwater Impact Assessment, Hennepin Power Station, Hennepin, Illinois. Natural Resource Technology and Kelron Environmental; December 19, 2010.*** Three-dimensional numerical flow and transport modeling was used to estimate the effect of leachate seepage from the landfill on groundwater concentrations at the downgradient edge of the zone of attenuation.
- ***New Coal Combustion Waste Landfill, Initial Facility Report, Hydrogeologic Studies and Evaluations, Section 28 Groundwater Monitoring Program, Hennepin Power Station, Hennepin, Illinois. Natural Resource Technology and Kelron Environmental; December 19, 2010***. Describes the groundwater monitoring program to identify discharges from all waste disposal units (Phases) within Ash Pond No. 2 and the leachate collection system associated with the new CCW Landfill.
- ***30% Design Data Report for Dynegy Hennepin Power Station; West Polishing Pond, West Ash Pond, East Ash Pond and Ash Pond No. 2 CCR Units. AECOM, January 12, 2016***. The data package included summary tables, geotechnical laboratory data and exploratory logs for 32 auger borings, 38 CPT soundings and 7 standpipe piezometers.
- ***2016 East Ash Pond and Coal Combustion Waste Landfill Annual Report, Hennepin Power Station, Dynegy Operating Company, Hennepin, Illinois. Natural Resource Technology, Inc., March 13, 2017***. Annual report assessing groundwater quality data, statistical trend analysis and a waste management summary for the CCW Landfill.

Pursuant to the December 2010 Initial Facility Report (IFR) prepared for the Landfill at the Hennepin Power Station, DMG is required to perform groundwater monitoring and prepare annual reports in accordance with 35 IAC Part 815. These annual reports have been submitted to the Illinois EPA from March 2012 through March 2017 and have documented the groundwater levels, flow, and water quality at the CCW Landfill and East Ash Pond System during this six-year period.

In conjunction with this report, a Groundwater Monitoring Plan and a Groundwater Management Zone Application are being prepared to support the closure of Ash Pond No. 2. In addition, the groundwater flow and transport model was updated to evaluate the effect of the ash pond closure on groundwater quality and to predict the fate and transport of CCR leachate components. Modeling has also been conducted to enable estimation of the time required for hydrostatic equilibrium of groundwater to be achieved beneath Ash Pond No. 2.

1.2 SITE LOCATION AND BACKGROUND

Ash Pond No. 2 is located in the northeast quarter of Section 26, Township 33 North, Range 2 West, Putnam County, Illinois and approximately 3 miles north-northeast of the Village of Hennepin (Figure 1). The impoundments are situated less than 200 feet south of the Illinois River and approximately one mile east of the Big Bend, where the river shifts course from predominantly west to predominantly south. Existing ash impoundments border Ash Pond No. 2 to the east and south. Surrounding areas include industrial properties to the east and south of the impoundments, agricultural land to the southwest, and the Hennepin Power Station to the west (Figure 2). The industrial properties include:

- Tricon Materials is located immediately east of the site at 13559 Esk Street. Tricon Materials is an aggregate business providing various fill and washed sand, gravel, crushed rock, rock and boulder products.
- Washington Mills (formerly known as Exolon) is located south of the impoundment at 13230 Esk Street. They produce abrasive grains and specialty electro-fused minerals.
- Between the Hennepin Power Station property and Washington Mills, north of Esk Street, is a 9-acre parcel that was once owned by Advanced Asphalt. The unoccupied property includes several abandoned buildings.

1.3 SITE HISTORY

The Hennepin Power Station had two coal-fired units constructed in 1953 and 1959 with a capacity of 210 MW. The coal source changed several times since the station was constructed. The Hennepin East Ash Pond System is shown on Figure 2 and consists of the following CCR units:

Ash Pond No. 2 (East Ash Pond No. 2): Used to store and dispose fly ash, bottom ash, and other non-CCR waste streams, including coal pile runoff. The pond, currently encompassing approximately 18 acres, is unlined with a variable but lowermost bottom elevation of 451 feet. The approximate dates of construction of each successive stage of Ash Pond No. 2 are summarized below.

Date	Event
1958	Construction of Ash Pond No. 2
1978	Embankment raise of Ash Pond No. 2
1985	Embankment raise of Ash Pond No. 2 to elevation 484 feet
1989	Embankment raise of Ash Pond No. 2 to elevation 494 feet
1996	Pond was removed from service and completely dewatered
2009 to 2010	Eastern portion of Ash Pond No. 2 was removed to facilitate construction of the Leachate Pond.
2010 / 2011	Landfill Phase I cell was constructed in 2010 over placed CCR in Ash Pond No. 2 adjacent to the Leachate Pond. In February 2011, 7,500 cubic yards of bottom ash was placed into the Phase I cell as a post-construction freeze-protection measure to protect the leachate collection system and geomembrane liner. No other material (fly ash or bottom ash) has been placed in the landfill since then.
2014	North Embankment tree removal, grading, and vegetation re-establishment adjacent to Ash Pond No. 2.

A Modified Closure Work Plan was submitted in 2010 which indicated Ash Pond No. 2 would be closed by capping as future landfill phases were constructed. This Work Plan was approved by the the IEPA in a letter dated March 3, 2010. The former proposed Landfill Phases II, III and IV will no longer be constructed above Ash Pond No. 2, which is the subject of this Closure Work Plan.

East Ash Pond (Primary Pond): Used to store and dispose bottom ash, fly ash, and other non-CCR waste and to clarify process water prior to discharge in accordance with the station's NPDES permit. The 510-acre-foot pond was constructed in two phases. The first phase occurred in 1995 when the pond bottom and sidewalls were constructed to a total depth of 32 feet with a variable but lowermost bottom elevation of 458 feet. The bottom and sidewall liners were constructed with 48 inches of compacted clay with a hydraulic conductivity of 1×10^{-7} centimeters per second (cm/sec). The sidewall liners constructed during the first phase extended 20 feet above the bottom liner and water level within the pond was limited to 15 feet above the bottom liner. The second phase of construction occurred in 2003 when the sidewall liners were raised an additional 12 feet and the total water depth was raised to approximately 30 feet. The raised sidewalls were lined with 12 inches of compacted clay having a hydraulic conductivity of 1×10^{-6} cm/s, a 45-mil polypropylene geomembrane, and a polypropylene geotextile fabric. This pond remains in service for the treatment of bottom ash transport waters, miscellaneous low volume wastewater streams, and unsold fly ash.

Polishing Pond (Secondary Pond): Constructed in 1995 with a 48-inch thick compacted clay liner having a vertical hydraulic conductivity of 1 x 10^{-7} cm/sec.

Leachate Pond (Pond 2 East): A 25.5-acre-foot pond constructed with a composite liner consisting of 60-mil HDPE overlying two feet of compacted clay with a vertical hydraulic conductivity of 1 x 10^{-7} cm/sec. Construction was completed December 2010.

Ash Pond No. 4 (Pond 4): A former unlined impoundment, now dry, classified as a non-CCR pond (capped or otherwise maintained).

2 REGIONAL AND LOCAL GEOLOGY

2.1 TOPOGRAPHY

There are three geomorphic features dominant in the immediate vicinity of the Hennepin Power Station: an upper river terrace at an elevation of about 500 to 550 feet, a lower river terrace at an elevation of about 450 to 460 feet, and the current river valley filled with alluvium to an elevation of about 445 feet. The plant and Ash Pond No. 2 were constructed on the original narrow lower terrace between the Illinois River and the uplands. The original lower terrace is approximately 10 to 20 feet above normal river level (441 feet at the Hennepin Power Station). The East Ash Pond, Polishing Pond and Ash Pond No. 4 were constructed on the upper terrace at an elevation of approximately 500 to 505 feet, or 60 to 65 feet above normal river level.

The lower road on the north side of the Site lies at an elevation of 480 to 485 feet. The upper road along the top of the north berm for Ash Pond No. 2 is at an elevation of approximately 494 to 500 feet. The berm slopes steeply toward the river and its base is close to the river bank.

2.2 REGIONAL GEOMORPHOLOGY

The Hennepin Power Station is located in the Bloomington Ridged Plain Section of the Central Lowland Province. The Bloomington Ridged Plain includes most of the Wisconsinan Stage moraines and is characterized by low, broad morainic ridges with intervening stretches of relatively flat or gently rolling ground moraine. Drainage is generally in the initial stages of development, and most streams follow, and are eroding, in constructional depressions, many of which cross morainic ridges. The valleys of principal streams are large and have floodplains bordered by valley-train terraces. The Illinois River has a broad, flat-bottomed valley with steep walls and is bordered by numerous steep-walled valleys with steep gradients.

2.3 SOILS

Surficial soils at the East Ash Pond System and vicinity are shown on Figure 3, based on the soil survey performed in Putnam County in 1986 (Soil Conservation Service, May 1992). Former soils underlying the Site are identified as Moundprairie Silty Clay Loam, Wet (#1480). The Moundprairie series soils consist of poorly drained, moderately permeable soils on floodplains. These soils formed in alluvium. This soil association is well suited for and used as habitat for wetland wildlife. These soils are unsuitable for dwellings and only moderately suitable for cultivated crops, due to shallow water table and flooding.

Areas surrounding the East Ash Pond System that are not designated Urban Land (#533) or Gravel Pits (#865) are predominantly classified as Wea Silt Loam (#398A, 398B). The Wea series consists of well drained soils on stream terraces. These soils formed in glacial outwash. Permeability is moderate in the upper part of the profile and very rapid in the lower part. Most areas of this association are well suited for and used in cultivating crops. Some areas are used as a source of sand and gravel, such as the property to the east.

2.4 BEDROCK

2.4.1 Lithology

The uppermost bedrock at the Hennepin Power Station, including the East Ash Pond System, is the Pennsylvanian Carbondale Formation (Kolata, 2005), which consists of shale with thin limestone, sandstone, and coal beds (Figure 4). The bedrock surface elevation is between 400 and 450 feet (Willman et al., 1967). Three deeper borings around the perimeter of the East Ash Pond System confirm the presence of shale bedrock between elevations 400 and 410. Water well logs at the power plant indicate shale bedrock at an elevation of roughly 350.

The thickness of the Pennsylvanian rocks ranges from 150 feet in the western part of Putnam County to more than 525 feet along the eastern margin of the county (Woller, 1976). In the vicinity of the Hennepin Power Station, the Pennsylvanian rocks have an estimated thickness of approximately 300 to 400 feet. Beneath the Pennsylvanian rocks are Mississippian and Devonian-age interbedded layers of limestone and shale over

Silurian-age dolomite. The dolomite generally ranges in thickness from 410 to 505 feet in the immediate region (Willman, 1942; Frankie, 2002). Crevassing in the unit varies widely and well yields are inconsistent.

Deeper bedrock units beneath the Silurian-age dolomite consist of the following in descending order (Woller, 1976; Frankie, 2002):

- Maquoketa Shale Group of Ordovician age, composed primarily of blue to green shales with some limestone and dolomite layers, occurs at depths of less than 1,000 feet in the northwest part of Putnam County to 1,200 feet in southern Putnam County, with a thickness generally ranging from 155 to 240 feet. This shale is an aquitard between the Silurian dolomite and deeper dolomite and sandstone aquifers.
- Ordovician age dolomite and sandstone aquifers, including the following:
  - Galena-Platteville Dolomite Group at depths of about 1,150 feet in northwest Putnam County to about 1,400 feet in the southeast, ranging in thickness from 320 to 380 feet
  - Glenwood-St. Peter Sandstone at depths of about 1,450 feet in west Putnam County near the site to 1,750 feet in the southeast part of the county, ranging in thickness from about 120 to 170 feet
  - Dolomite with some shale and sandstone beds below depths of 1,750 to 1,800 feet near the site, principally consisting of the Shakopee (130 to 150 feet thick), New Richmond (approximately 165 feet thick), and the Oneota (approximately 215 feet thick) formations
  - Cambrian age dolomite and sandstone aquifers, including the Ironton-Galesville and Elmhurst-Mt. Simon formations
  - Precambrian age igneous and metamorphic

Based on the directory of coal mines for Putnam County (ISGS, 2006), the nearest coal mines in the vicinity of the Hennepin Power Station are located approximately 3 miles to the northeast and 4 miles to the southeast. These mines, identified as #8 and #298, are both abandoned underground shaft mines that used the longwall method of mining, essentially removing all of the coal. The #8 mine, called the Lacey Mine, was active from 1883 to 1890. The coal seam at this location ranged from 28 to 42 inches in thickness. The #298 mine, called the St. Paul Mine, and later the Prairie State Mine, operated from 1905 to 1925 and from 1930 to 1939. The coal seam at this location ranged from 42 to 66 inches in thickness.

The coal mined is called the Colchester Seam, also known as the No. 2 and LaSalle Seam. The Colchester Seam is located within the lower portion of the Carbondale Formation, which is the shallowest coal mined in the region. In the vicinity of the site, the Colchester Coal occurs at a depth of approximately 200 to 300 feet.

2.4.2 Structure

The major geologic structural features around Illinois are shown on Figure 5. The Hennepin Power Station is located within a relatively stable region of the continent within the north-central portion of the Illinois Basin. Rock units to the northeast of the Site form the La Salle Anticlinorium where folds are expressed in synclines, anticlines, arches, and monoclines present in the area (Nelson 1995; Anderson 1988). The Paleozoic bedrock strata, consisting of Pennsylvanian and older rocks, have a southwestern regional dip of approximately 15 to 30 feet per mile due to the effects of the anticlinorium. Variations to the bedrock dip occur in areas where there are local structures. The anticlinorium has subparallel anticlines, domes, monoclines, and synclines, which can change local dip and strike of bedrock units (Nelson, 1995).

2.4.3 Seismic Setting

The Sandwich Fault Zone is located approximately 35 miles northeast of the Site (Figure 5). Vertical displacement on the Sandwich Fault Zone ranges from 150 to 800 feet. The fault zone is downthrown to the northeast. Due to the depth of burial by Quaternary sediments and the lack of well or seismic data, detailed information about the fault zone is unavailable. Although depicted as a single fault on this map, evidence from surrounding counties indicates that the Sandwich Fault Zone is a complex configuration of many faults of varying direction and amount of displacement (Kolata, 1976).

The Plum River Fault Zone is a 112-mile long, east-west trending zone of high-angle faulting in east-central Iowa and northwest Illinois, roughly 60 miles northwest of the Site. The north side of the fault zone is downthrown, with documented net vertical displacements of Silurian strata up to 270 feet. The physical relationships of Pennsylvanian deposits to the Plum River Fault Zone are not known with sufficient precision to preclude up to 33 feet of post-Pennsylvanian displacement. Historic data are inadequate to evaluate the potential for seismic hazard associated with the Plum River Fault Zone (Bunker, B.J., G.A. Ludvigson, B.J. Witzke, 1985). United States Geological Survey (USGS) seismic hazard maps show no enhanced ground acceleration in the Plum River Fault Zone vicinity.

2.5 UNLITHIFIED DEPOSITS GEOLOGY

2.5.1 General Unlithified Geology

The unlithified geologic deposits covering bedrock in the region surrounding the East Ash Pond System are derived from recent river deposition (alluvium), glacial outwash, and glacial till deposits. Total unlithified (drift) thickness ranges from 50 to 200 feet, generally becoming thicker with distance from the Illinois River southward from the impoundment. The geologic history of the Illinois River Valley was described in detail by Willman (1973), Hansel (1996), and Frankie (2002).

The Illinoian and Wisconsinan glaciers repeatedly moved over the area. The Illinois River established its present position during the Woodfordian substage of Wisconsinan glaciation, which covered the area as far south as Peoria. Wisconsinan drift lies directly on bedrock as a result of repeated Woodfordian glacial episodes eroding earlier deposits of loess and glacial drift.

During the glacial retreats from the Hennepin area, numerous moraines were deposited across the Illinois Valley. Large areas between these moraines and/or the glaciers subsequently flooded from meltwaters. One such lake was glacial Lake Illinois, which formed behind the Bloomington Moraine, crossing the Illinois River valley near Peoria. Rapid melting and drainage from this area (Kankakee Flood) deepened and widened the valley, cutting an extensive terrace at an elevation of 500 to 550 feet about 14,500 years ago. These deposits (Henry Formation) are mostly fine gravel and pebbly sand and may be as much as 150 to 200 feet thick in the large terrace on which the city of Hennepin is located (areas shown as 'gh' on Figure 6), along with the eastern (i.e., East Ash Pond System) and southeastern portion of the Hennepin Power Station property.

Another major flooded area formed behind the Tinley Moraine creating Lake Chicago. During downcutting of the Lake Chicago outlet about 3,000 years ago, the Chicago Outlet River deposited coarse gravel in bars on the eroded surfaces. The lower river terrace that underlies the Ash Pond No. 2 includes deposits of the Chicago Outlet River. These deposits commonly occur about 20 to 40 feet above the Illinois River and may be up to about 50 feet in thickness. They are generally coarser and more uniformly sorted than the higher terrace deposits that occur immediately south of the Site.

The Illinois River is currently shallowly entrenched in glacial outwash and the Chicago Outlet River deposits. Lateral erosion by the river has developed a floodplain and deposited alluvium (Cahokia Alluvium) in abandoned channels. Alluvial deposits of the modern Illinois River consist largely of clayey silt and sandy silt with lenses of sand and gravel. The alluvium, where present, is 20 to 40 feet thick, overlying thick deposits of sand and gravel of the Henry Formation. These areas (shown as 'al' on Figure 6), occur between the northernmost portion of the East Ash Pond System and the river.

2.5.2 Site Lithology

Based on stack-unit maps of geologic materials in the Site vicinity (Berg and Kempton, 1988), local stratigraphy is characterized by the following downward sequence of unlithified deposits:

- Cahokia Alluvium: These are the alluvial sediments deposited in abandoned channels from relatively recent lateral erosion by the Illinois River. These deposits extend to depths of less than 20 feet and consist largely of sandy silts and clays interbedded with sands and gravels.

- Henry Formation: These are the glacial outwash deposits comprising the low-level terraces, up to about 40 feet above the Illinois River. The deposits extend to depths greater than 20 feet and are dominated by gravelly soils. Beneath the pond berms and the surficial veneer of clay, granular deposits were encountered for nearly the full depth of all borings on the Site. These granular deposits are primarily gravel containing sand and lesser amounts of boulders, cobbles and fines.

The Henry Formation deposits are underlain by shale bedrock.

Three continuously sampled boring were drilled to confirm the local stratigraphy and hydrogeologic setting information. These borings fully penetrated the Cahokia Alluvium and Henry Formation into the shale bedrock. Boring 08D extended 30 feet below the bottom of the Henry Formation, which comprises the uppermost aquifer. The bedrock surface is relatively flat and was encountered between elevations 400 and 410, about 85 to 90 feet below ground surface.

3 REGIONAL AND LOCAL HYDROGEOLOGY

3.1 BEDROCK – REGIONAL AND LOCAL

The Pennsylvanian rocks in the region are not considered a municipal or subdivision water supply source (Gibb, 1979). Water-bearing openings are extremely variable from place to place and are best developed near the surface in thin limestones and sandstones, when present within the predominantly shale formation. In the bedrock upland areas away from the Illinois River, farm and domestic water supplies are obtained locally from sandstone and creviced limestone in the upper 250 feet of these rocks (Woller, 1976). When present, the limestone and sandstone units yield less than 10 gallons per minute (gpm) (Visocky et. al, 1985). Water quality within the bedrock varies considerably and it becomes highly mineralized with increasing depth. As a result, the Pennsylvanian bedrock is not a reliable source of groundwater.

The Pennsylvanian rocks generally have low porosity and hydraulic conductivity. The porosity of shale typically ranges from 1 to 20 percent (Walton, 1988). Representative horizontal hydraulic conductivity for shale typically ranges from $5x10^{-6}$ to $5x10^{-10}$ centimeters per second (cm/s). Representative vertical hydraulic conductivity ranges for shale are $5x10^{-8}$ to $5x10^{-12}$ cm/s (Walton, 1988).

Recharge to the Pennsylvanian rocks is derived locally from vertical leakage through the glacial drift and other unlithified materials that are in turn recharged from precipitation.

Deeper bedrock units beneath the Pennsylvanian rocks and their water-bearing properties (Woller, 1976) are as follows:

- Silurian dolomite, which may provide water to wells in moderate quantities from cracks and crevices, but is too mineralized for most uses.
- Maquoketa Group of Ordovician age composed of nonwater-bearing shales and acts as an aquitard between the Silurian dolomite and deeper water-bearing units.
- Cambrian-Ordovician Aquifer (a/k/a Midwest Bedrock Aquigroup), composed of the Ironton-Galesville aquifer at the base of this group up through the Glenwood-St. Peter Sandstones. These formations are the major bedrock aquifer and principal water producing zones in the region capable of yielding moderate quantities of groundwater (Visocky et. al, 1985).

In the region surrounding the site, these bedrock aquifers provide municipal water supply sources. The villages of Granville and Standard, about five miles southeast of the Site, both obtain their water supply from the Galena-Platteville Dolomite and Glenwood-St. Peter Sandstone, with wells ranging in depth from 1,740 to 1,793 feet. Pumping rates range from about 60 to 150 gpm.

As noted earlier, the Pennsylvanian-age Carbondale Formation defines the base of the unlithified deposits (and uppermost aquifer) underlying the East Ash Pond System and is regarded as the first confining unit beneath the uppermost aquifer. Water well logs at the power plant indicate shale bedrock at an elevation of roughly 350. In the vicinity of the Hennepin Power Station the Pennsylvanian rocks have an estimated thickness of approximately 300 to 400 feet. The Pennsylvanian rocks of this area contain little or no usable water and are seldom considered for even domestic water supply purposes due to generally low effective porosity and hydraulic conductivity (Gibb, 1979).

3.2 UNLITHIFIED DEPOSITS – REGIONAL

Regional groundwater flow in the unlithified deposits above the shale bedrock discharges into the Illinois River. Depth to the water table is typically greater than 20 feet below ground surface around the site. The water table elevation can vary significantly, depending on the river stage. During flood stages, exfiltration from the river may temporarily recharge groundwater close to the river and the water table beneath the East Ash Pond System and adjacent areas of the floodplain may rise to levels mimicking river elevations.

The Henry Formation deposits have high hydraulic conductivity compared to the underlying bedrock. Pump test and specific capacity data were obtained for five high capacity industrial and municipal wells screened in the unlithified deposits along the Illinois River within several miles of the Hennepin Power Station (ISWS, 1989). Hydraulic conductivity of the Henry Formation sand and gravel ranged from 5 x 10 2 cm/s to 3 x 10^{-1} cm/s, with a median of 1 x 10^{-1} cm/s. Pumping rates ranged from 125 to 1,570 gallons per minute and the tests were conducted over periods ranging from 30 minutes to 24 hours. Effective porosity typically ranges from 20 to 35 percent for poorly sorted sand and gravel alluvial deposits (Walton, 1988; Fetter, 1980).

Hydraulic conductivity of the alluvial deposits, generally consisting of lower permeability materials (i.e., silt, silty sand, and clay), will typically be several orders of magnitude lower than the more permeable outwash sand and gravel deposits of the Henry Formation. However, no published regional data is available specifically for the shallow alluvial deposits. Silt, clay, and mixtures of sand, silt, and clay typically have horizontal hydraulic conductivity ranging from 10^{-4} to 10^{-7} cm/s (USDI, 1981; Fetter, 1980).

3.3 UNLITHIFIED DEPOSITS – SITE SPECIFIC

3.3.1 Site Stratigraphy

The stratigraphy within and immediately surrounding the Site consists of fill, unlithified river alluvium, and Pleistocene-age glacial outwash deposits overlying Pennsylvanian-age shale bedrock. Surficial soils encountered at most boring locations at the site are coal ash fill and man-made berms constructed of a variety of locally available materials, primarily sand, gravel, and coal ash. Where undisturbed or partially excavated, the surficial soils at the Site (Figure 3) are poorly drained, moderately permeable Moundprairie Silty Clay Loam, Wet (#1480) formed in alluvium on floodplains.

Geologic cross-sections across of the study area (shown on Figures 7 and 8) include three southwest-northeast lines and two northwest-southeast lines. Ash Pond No. 2 is located over the original narrow lower terrace between the Illinois River and the uplands. The original lower terrace is approximately 10 to 20 feet above normal river level of 441 feet (see Figure 7 cross-section A-A’, Figure 8 cross-section D-D’). The East Ash Pond, Polishing Pond and Ash Pond No. 4 were constructed on the upper terrace at an elevation of approximately 500 to 505 feet, or 60 to 65 feet above normal river level (see Figure 8 cross-sections D-D’ and E-E’).

There are two hydrogeologic units present at the site: alluvium and Henry Formation sands and gravels. The river is immediately adjacent to the lower terrace, east of the site, and there is minimal alluvium between the Site and the river. The highly permeable Henry Formation sands and gravels make up the upper and lower terraces, and fill the valley beneath the alluvium. The sand and gravels of the two terraces are indistinguishable, consisting of a heterogeneous mixture of silty-sandy gravel, with cobble zones and with boulders up to several feet in diameter. The Henry formation is more than 100 feet thick in the river valley and at least 130 feet thick on the upper terrace.

The Henry Formation and alluvium comprise the uppermost aquifer at the Site and extend from the water table to the bedrock. This uppermost aquifer extends about 7,000 feet upgradient from the site to the south where clay-rich glacial till is encountered. Glacial tills such as this typically yield little water.

The Pennsylvanian-age bedrock consists of interbedded layers of shale with thin limestone, sandstone, and coal beds. The shale bedrock unit has low hydraulic conductivity and defines the lower boundary of the uppermost aquifer.

3.3.2 Water Table Elevation and Groundwater Flow

Monitoring wells installed at the East Ash Pond System are shown on Figure 9. Well construction details are provided in Appendix A and summarized on Table 1.

3.3.2.1 Horizontal Groundwater Flow

Groundwater elevations have been measured quarterly since 2008. The Illinois River is the regional groundwater discharge area. Under normal conditions at the Site, groundwater flows from south to north discharging into the river as shown on Figure 10. Appendix B provides additional water table contour maps prepared for the Closure Work Plan Annual Reports during the years 2011 through 2016.

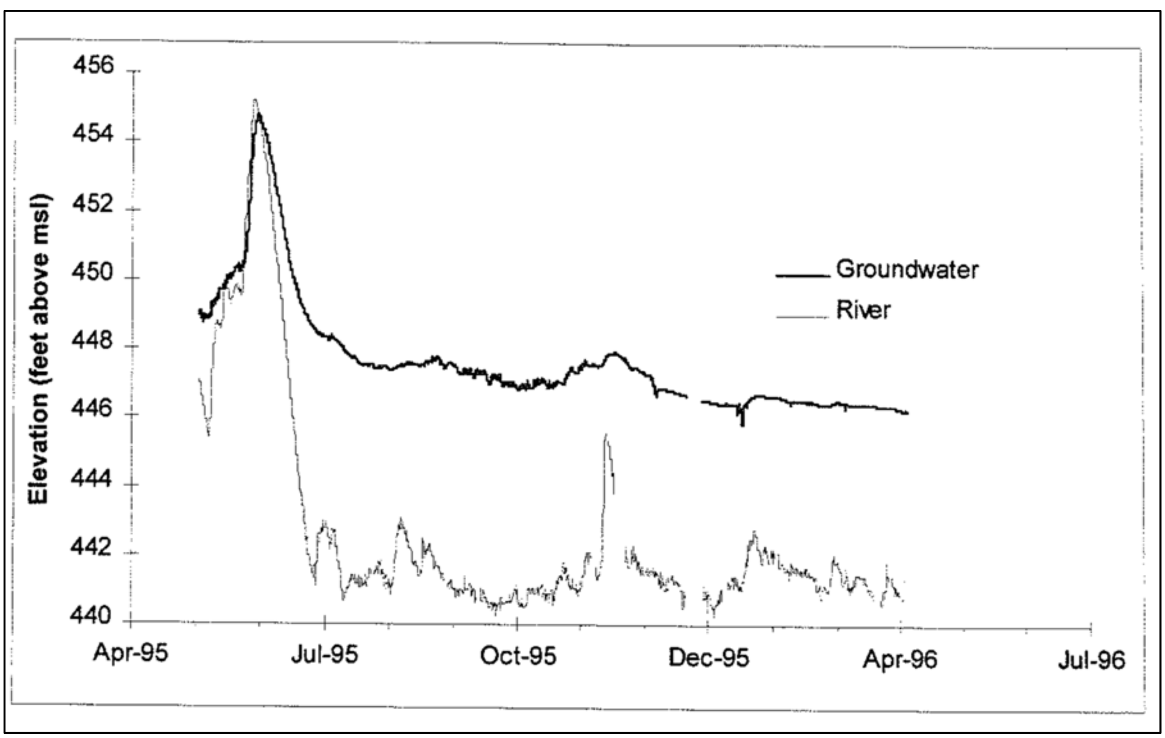
Horizontal hydraulic gradients are moderate (0.002 to 0.004) as groundwater approaches the site south of the East Ash Pond and Polishing Pond. The horizontal gradient becomes virtually flat beneath the East Ash Pond and Polishing Pond as well as the Site before steepening between the Site and the river. The flattening of the horizontal gradient is attributed to the highly permeable sand and gravel that runs continuously along the south perimeter of the East Ash Pond System, as illustrated in cross sections B-B', C-C' and D-D' (Figures 7 and 8).

Horizontal groundwater flow at the base of the uppermost aquifer also moves from south to north toward the Illinois River, based on hydraulic head measurements in monitoring wells 08D, 18D, and 19D. Horizontal gradients at depth are somewhat lower than at the water table, averaging 0.0003.

3.3.2.2 Impact of River Stage on Groundwater Flow

The river basin experiences annual spring flooding during the months of March, April, May, and sometimes June, while lesser flooding occasionally occurs during autumn. River stage during high precipitation and/or flood events seasonally rises above adjacent groundwater elevations and groundwater gradients will temporarily reverse in response to the river temporarily recharging the aquifer. Groundwater gradient reversals are observed on the quarterly groundwater elevation contour maps for December 29, 2008, March 16, 2010 and June 22-23, 2015. The contour map for June 2015 is attached as Figure 11. During these events, the groundwater flow direction reverses, moving south to southeasterly across the Site at moderate to steep horizontal gradients of about 0.01. Groundwater flow at depth also reverses but at a much lower horizontal gradient of 0.00006. The groundwater flow reversals are typically limited in duration and extent.

The figure below compares the groundwater hydrograph recorded at former well 14 with the river hydrograph recorded at the power plant (STMI, June, 1996). Well 14 was located adjacent to wells 12 and 13 between the CCR Landfill and East Ash Pond (Figure 9). This graph shows that groundwater elevations respond rapidly to major flood events where river elevations rise above adjacent groundwater levels. It also indicates that groundwater levels, at least as far as the south side of Ash Pond No. 2, can be expected to rise in response to river flooding to elevations consistent with those observed at the river.



Comparison of Illinois River and Monitoring Well 14 Hydrographs in 1995

3.3.2.3 Vertical Hydraulic Gradient

Vertical hydraulic gradients were calculated at nested well locations in September and December 2015 and are shown on Table 2. Vertical gradients in upgradient well nest 08/08D were consistently flat or moderately upward at about 0.01. Well nests adjacent to the river (18S/18D and 19S/19D) were inconsistent (0.01 downward to 0.007 upward) and showed no correlation with the Illinois River recharging the aquifer or receiving groundwater discharge. Based on these observations and the physical characteristics of the uppermost aquifer, vertical groundwater gradients do not appreciably affect the horizontal migration of dissolved constituents.

3.3.2.4 Impact of Existing Ponds

The existing ponds immediately south of the site do not appear to be altering groundwater flow direction. The East Ash Pond and Polishing Pond are lined as described in Section 1.3. The flat horizontal groundwater gradient beneath this area and the small and inconsistent upward/downward vertical gradients at well nest 12/13 suggests there is no mounding of the water table occurring due to leakage from the ponds.

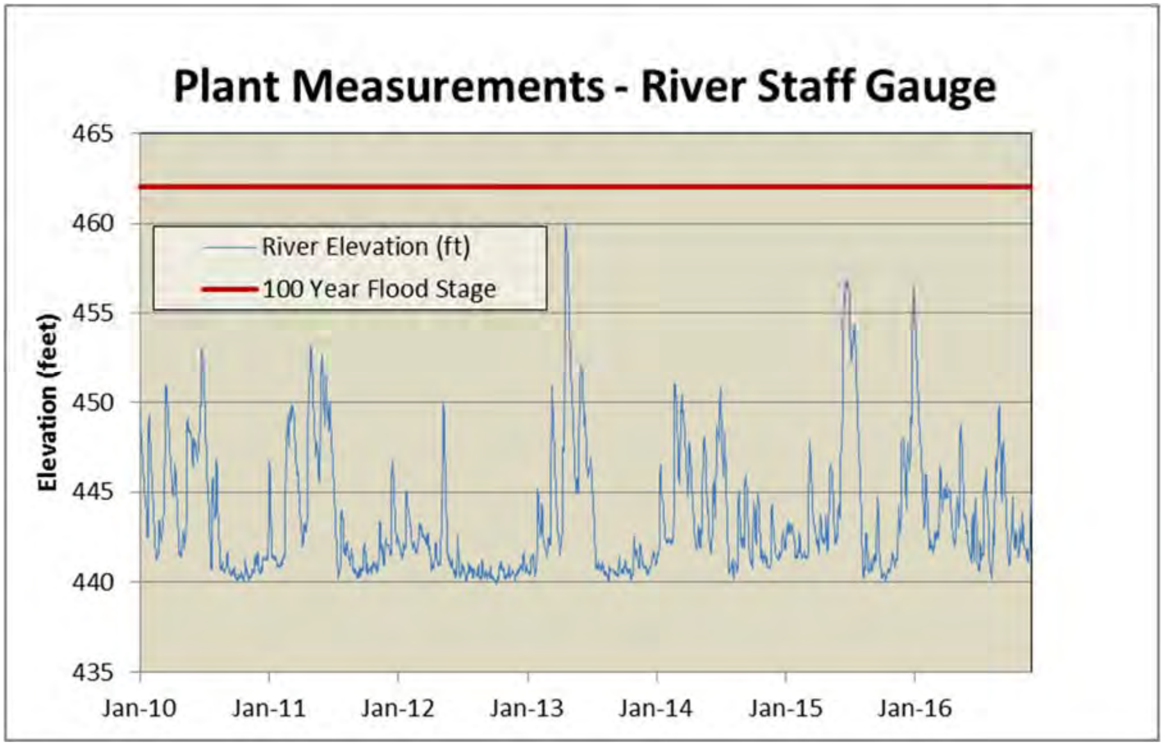
3.3.2.5 Groundwater Velocity

Groundwater flow velocity ranged from approximately 0.5 to 0.7 feet per day (ft/day) as groundwater flowed from south to north of the Hennepin East Ash Pond in September and December 2015 during periods of normal flow conditions (i.e. no flow reversals). As groundwater flowed from south to north of Hennepin Ash Pond No. 2, the flow velocity was slightly higher and ranged from approximately 0.9 to 1.5 ft/day in September and December 2015. Groundwater velocity was lowest, approximately 0.02 to 0.03 ft/day, as groundwater flowed from south to north of Hennepin Landfill in September and December 2015. September and December 2015 groundwater flow velocities are summarized in Table 3.

3.3.3 Ash Saturation

Soil boring logs performed within Ash Pond No. 2 indicate the base grade elevation of ash is as low as 451 feet (Appendix C). Groundwater elevations measured quarterly between the period of September 2007 and December 2015 showed typical groundwater elevations in wells surrounding Ash Pond No. 2 below 450 feet. However, as discussed in Section 3.3.2.2, groundwater elevations respond rapidly to river flood events that recharge the aquifer. Groundwater elevations measured at well 14 on the south berm of Ash Pond No. 2 appeared to closely mimic river elevations during major flooding events when river elevations rise above groundwater.

Daily river staff gauge elevations taken at the Hennepin Power Station crib house from January 2010 through December 2016 are shown on the time-series graph below. Based on the above, it appears a portion of the ash within Ash Pond No. 2 may occasionally become partially saturated for short periods during high precipitation and/or flood events when river elevations exceed an elevation of at least 451 feet.



3.3.4 Hydraulic Conductivity

3.3.4.1 Field Hydraulic Conductivity

The Henry Formation sands and gravels at the site are highly permeable with measured hydraulic conductivity ranging from 3 x 100 cm/s to 1 x 10^{-4} cm/s and a geometric mean of 5.6 x 10^{-2} cm/s (Table 4). At several monitoring well locations, water levels recovered as fast as the slug was removed and no drawdown recovery measurements could be made by the transducer. These values are consistent with pump test data from area high capacity wells screened in the unlithified deposits which ranged from 5 x 10^{-2} to 3 x 10^{-1} cm/s. The hydraulic conductivity test analysis and results are provided in Appendix D1.

Pump test data from the fire well installed at the power plant in 1968 was also available to estimate the permeability of the Henry Formation. This fire well is located at the southwest corner of the plant and was drilled to a depth of 112 feet, terminating on shale. The lower 30 feet of the well is screened within unlithified deposits. The well log is contained in 'Water Well Survey' (Kelron/NRT; June 3, 2009). The pump test hydraulic conductivity result reported by Mathes (1983) was 1.3 x 10^{-1} cm/s.

No vertical hydraulic conductivity pattern was discerned from the slug test data. Horizontal hydraulic conductivity appears consistently higher, on the order of 10^{-0} to 10^{-1} in an east-west trending line under the East Ash Pond and Polishing Pond. These high hydraulic conductivities coincide with a very flat hydraulic gradient.

A moderately steep horizontal gradient between wells 07 and 08 suggests that the hydraulic conductivity upgradient of the site in the upper terrace may be locally somewhat lower, based on the occurrence of finer-grained materials noted in the boring log for well 07.

3.3.4.2 Laboratory Hydraulic Conductivity

Test results for one sample collected by AECOM on the north berm of Ash Pond No. 2 for laboratory hydraulic conductivity (ASTM D 5084) were as follows:

Sample Location	Sample Depth (ft bgs)	Description	Hydraulic Conductivity (cm/sec)
HEN-B023	27.0'-29.0'	Very dark gray fly ash with sand and gravel	1.0 x 10^{-5}

Laboratory hydraulic conductivity test results are provided in Appendix D2. Other geotechnical test results on soil samples are provided in Appendix E.

3.3.5 Groundwater Classification

Per Illinois Administrative Code (IAC) Title 35, Section 620.210, groundwater within the Uppermost Aquifer at the East Ash Pond System meets the definition of a Class I, Potable Resource Groundwater based on the following criteria:

- Groundwater in the uppermost aquifer extends 10 feet or more below the land surface
- Hydraulic conductivity exceeds the 1 x 10^{-4} cm/s criterion (Table 4)

3.4 SURFACE WATER HYDROLOGY

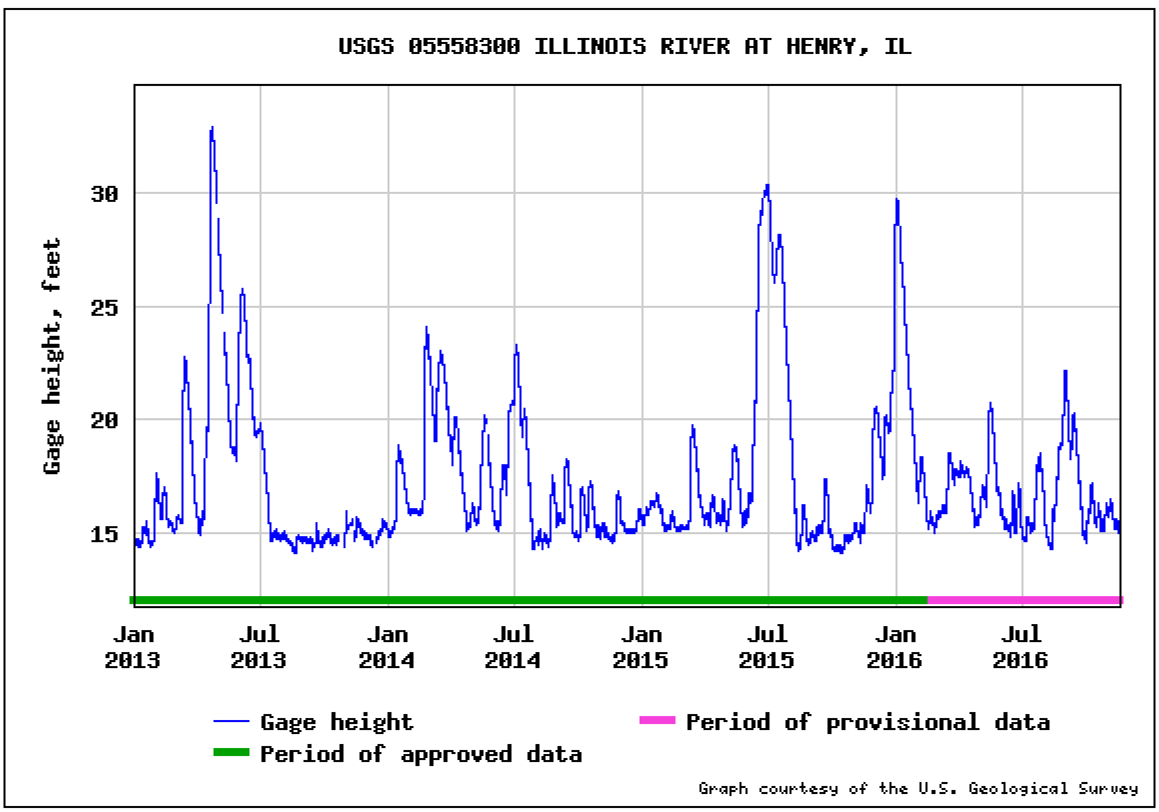
3.4.1 Climate

The climate in Hennepin is humid and annual precipitation generally exceeds evapotranspiration. Illinois State Water Survey records from 1962 through 2006 at the Hennepin Power Station indicate precipitation averages 34.45 inches per year. Monthly precipitation averages higher than 3 inches from April through September, and 1 to 3 inches in October through March. On average 16 inches of precipitation occur as snowfall.

State Water Survey temperature records show average daily temperatures for 1971 to 2000 ranging from above 70 degrees Fahrenheit in June, July, and August to below freezing in December, January, and February.

3.4.2 Surface Waters

The predominant surface water body in the region is the Illinois River and associated lowland backwater lakes. The Illinois River is located directly adjacent to and down-gradient from the East Ash Pond System. A United States Geological Survey (USGS) stream gage (#05558300) for the Illinois River at Henry, Illinois is located 15 river miles south (downstream) of the Hennepin Power Station. The gage datum elevation is 425.88 feet (NGVD 29). Daily gage heights for the periods of January 1, 2013 to November 18, 2016 are shown in the following graph (USGS, 2016). The gage height of 15 feet, representing approximate base flow, occurs at elevation of about 441.



Bordering the north perimeter of the East Ash Pond System, the river has a normal pool elevation of about 441 feet. River elevations measured at the USGS Henry, Illinois stream gage (#05558300) appear to be within about 1 foot of the elevations taken at the Hennepin Power Station crib house.

Other surface waters in the vicinity include various ponds on property to the east created by sand and gravel extraction as well as the East Ash Pond and Polishing Pond associated with the Hennepin Power Station.

A FEMA Flood Insurance Rate Map for Putnam County (Map No. 17155C0015E; Effective Date: February 4, 2011) is attached in Appendix F and can also be viewed online at:
http://www.illinoisfloodmaps.org/DFIRMpdf/putnam/putnam_fin_0025.jpg

None of the impoundment berms within the East Ash Pond System occur below the base flood elevation value of 462 feet identified on the 2011 FEMA map. The berms of Ash Pond No. 2 were raised in 1989 to an elevation of 494 feet. The flood hazard areas shown on the map are defined as those areas subject to inundation by the 1% annual chance flood (i.e., 100-year flood), also known as the base flood, that has a 1% chance of being equaled or exceeded in any given year.

3.5 WATER WELL SURVEY

A comprehensive water well survey was conducted by NRT and Kelron (2009a) for a 2,500-foot radius around the entire Hennepin Power Station property boundary, inclusive of the East Ash Pond System (Appendix G). Based on State of Illinois records obtained from the Illinois EPA, Illinois State Geological Survey (ISGS), and Illinois State Water Survey (ISWS) there are nine wells located outside of the Hennepin Power Station property boundary within 2,500 feet of the East Ash Pond System. These included six industrial-commercial wells, two farm/domestic wells, and one Non-Community Water Supply (non-CWS) on property identified as Exolon (now known as Washington Mills). The Exolon non-CWS well has a 1,000 foot well head protection area (WHPA). The Exolon non-CWS WHPA is located south of and does not intersect the Hennepin Power Station property boundary. Each of the nine identified offsite water walls are upgradient of the Hennepin Power Station property or not in the prevailing direction of groundwater flow.

Within the plant property boundary, there are four wells owned by DMG, all of which are non-potable and non-contact industrial wells. One well is used exclusively for irrigation of the coal pile.

Kelron/Natural Resource Technology (2009b) performed an assessment of the potential for impact to water supply wells identified in the water well survey within 2,500 of the Hennepin Power Station property boundary. The assessment concluded there are no existing off-site water wells, potable or non-potable, that are likely to be impacted by groundwater from the HPS property.

4 GROUNDWATER QUALITY

4.1 SUMMARY OF GROUNDWATER MONITORING ACTIVITIES

Groundwater sampling at the East Ash Pond System was initiated in 1994 around Ash Pond No. 2. The monitoring network was expanded with the subsequent construction of the additional ponds. All existing well locations are shown on Figure 9. A summary of the monitoring activities performed at each well is shown below:

Well No.	Sampling Start Date	Sampling End Date	Current Sampling Frequency	CCR Unit Currently Monitored
2	Mar-95	NA	Quarterly	None
3R	Mar-15	NA	Quarterly	Ash Pond No 2
4R	Mar-15	NA	Quarterly	None
5R	Mar-15	NA	Quarterly	Landfill
5DR	Mar-15	NA	Quarterly	Landfill
6	Dec-94	NA	Quarterly	Ash Pond No 2
7	Dec-94	NA	Quarterly	Upgradient/Background Monitoring Well
8	Mar-95	NA	Quarterly	Upgradient/Background Monitoring Well
8D	Jun-09	NA	Quarterly	Upgradient/Background Monitoring Well
10	May-95	NA	Quarterly	None
11	May-95	Jun-06	Not Sampled	None
12	May-95	NA	Quarterly	East Ash Pond
13	May-95	NA	Quarterly	East Ash Pond
15	May-95	NA	Quarterly	None
16	May-95	NA	Quarterly	None
17	May-95	NA	Quarterly	None
18S	Jun-09	NA	Quarterly	Ash Pond No 2
18D	Jun-09	NA	Quarterly	Ash Pond No 2
19S	Jun-09	NA	Quarterly	None
19D	Jun-09	NA	Quarterly	None
40S	Mar-11	NA	Quarterly	Landfill
45S	Dec-15	NA	Quarterly	Ash Pond No 2
46	Dec-15	NA	Quarterly	East Ash Pond
47	Dec-15	NA	Quarterly	East Ash Pond
48	Dec-15	NA	Quarterly	Landfill

Wells 3, 4, 5 and 5D were abandoned and replaced in August 2014.

4.1.1 Illinois EPA Program Monitoring

Between 1994 and 2001, Ash Pond No 2 downgradient wells 03 and 06 were monitored for alkalinity, total dissolved solids (TDS), calcium, magnesium, sodium, potassium, chloride, sulfate, boron, iron, manganese, and field parameters (including pH). Based on the absence of exceedances of groundwater quality standards, subsequent sampling events through October 2008 monitored only boron and field parameters.

An expanded background groundwater quality monitoring program was initiated in 2008 in conjunction with the development of the CCR Landfill Phase I (Mathes, 1983), Phase II (STMI, 1996) and Phase III (NRT/Kelron, 2010). Monitoring wells were sampled over a period of six consecutive quarters between December 2008 through March 2010 for analytical parameters per 35 IAC Part 811. The monitoring well network consisted of 14 water table monitoring wells (02 through 08, 10, 12, 15, 16, 17, 18S and 19S), two intermediate depth piezometers (11 and 13), and three deep piezometers (08D, 18D and 19D) installed just above the bedrock.

Samples were analyzed for general chemistry parameters (total and/or dissolved), metals (total and dissolved), and organic parameters. Based on the results of the first two quarterly rounds of groundwater sampling and analysis, and after evaluating leach-testing data from the CCR to be placed in the landfill, the organic constituents are not expected in coal ash leachate and are monitored biennially at upgradient wells 08, 08D, 10, 12, 13 and wells 05, 05D, 40S, which are downgradient of the CCR Landfill Phase 1 cell.

The CCR Landfill became active in February 2011 with the placement of bottom ash into the Phase I cell in order to protect the geomembrane liner (see Section 1.3). Quarterly detection groundwater monitoring was initiated during the 1st Quarter of 2011 pursuant to DMG's Initial Facility Report (NRT/Kelron, 2010) prepared for the CCR Landfill, which calls for an annual report providing the following: an assessment of groundwater quality data for background wells 08, 08D, 10, 12, 13 and downgradient wells 05, 05D, and 40S; and, a waste management summary. In addition, the annual reports prepared from 2011 through 2016 have included groundwater monitoring results for entire East Ash Pond System, including Ash Pond No. 2. The East Ash Pond groundwater quality assessment utilizes the following 18 monitoring wells: upgradient wells 02, 07, 08, 08D, 16, 17; mid-gradient wells 10, 12, 13, and 15; and downgradient wells 03, 04R, 05R, 06, 18S, 18D, 19S, and 19D.

Of the 25 monitoring wells located at the East Ash Pond System in 2016, 20 are actively monitoring all of the CCR ponds, non-CCR ponds, and former ponds under Illinois EPA permit or IFR requirements (Landfill, Ash Pond No. 2 and East Ash Pond as well as the non-CCR units [Polishing Pond, Leachate Pond and former Ash Pond No. 4]). As a result of slope re-grading activities along the north side of Ash Pond No. 2, wells 03, 04, and 05 were sealed and properly abandoned on August 27, 2014 and replaced following completion of construction activities. During construction, which continued from September through December 2014, three additional monitoring wells (05D, 18S, and 18D) were inadvertently damaged. All sealed or damaged monitoring wells were replaced or repaired in January 2015 and were sampled in the 1st Quarter of 2015.

4.1.2 CCR Rule Program Monitoring

In August 2015, NRT began an assessment of the existing monitoring well network(s) at the East Ash Pond System with respect to the existing CCR units. Included in the assessment was a review of the current placement and number of monitoring wells with respect to individual and contiguous CCR units as well as potential locations for new monitoring wells, as appropriate.

Based on this review, NRT completed monitoring well installations at four additional locations as part of the CCR monitoring network. Well 45S was installed to supplement the monitoring network at Ash Pond No. 2. Well 45S is intended to replace existing well 06, which was drilled in 1982 and is located approximately 300 feet beyond the Ash Pond No. 2 berm (Figure 9). However, well 06 is continuing to be monitored under an existing Illinois EPA permit. Wells 46 and 47 were installed at the East Ash Pond. Well 48 was installed as part of the CCR monitoring network at the Landfill. The boring logs, well construction forms and other related monitoring well forms are provided in Appendix A3.

The 40 CFR Part 257 monitoring well network locations for the CCR units are shown on Figure 9. The well network consists of three upgradient/background wells (07, 08, 08D) and twelve monitoring wells installed in the uppermost aquifer adjacent to the Landfill (40S, 05R, 05DR and 48), Ash Pond No. 2 (03R, 18S, 18D and 45S), and the East Ash Pond (12, 13, 46 and 47). Sampling of these wells commenced December 2015.

All 25 existing wells at the East Ash Pond System are monitored for groundwater elevations, which are used to produce groundwater flow maps.

4.2 GROUNDWATER MONITORING RESULTS AND ANALYSIS

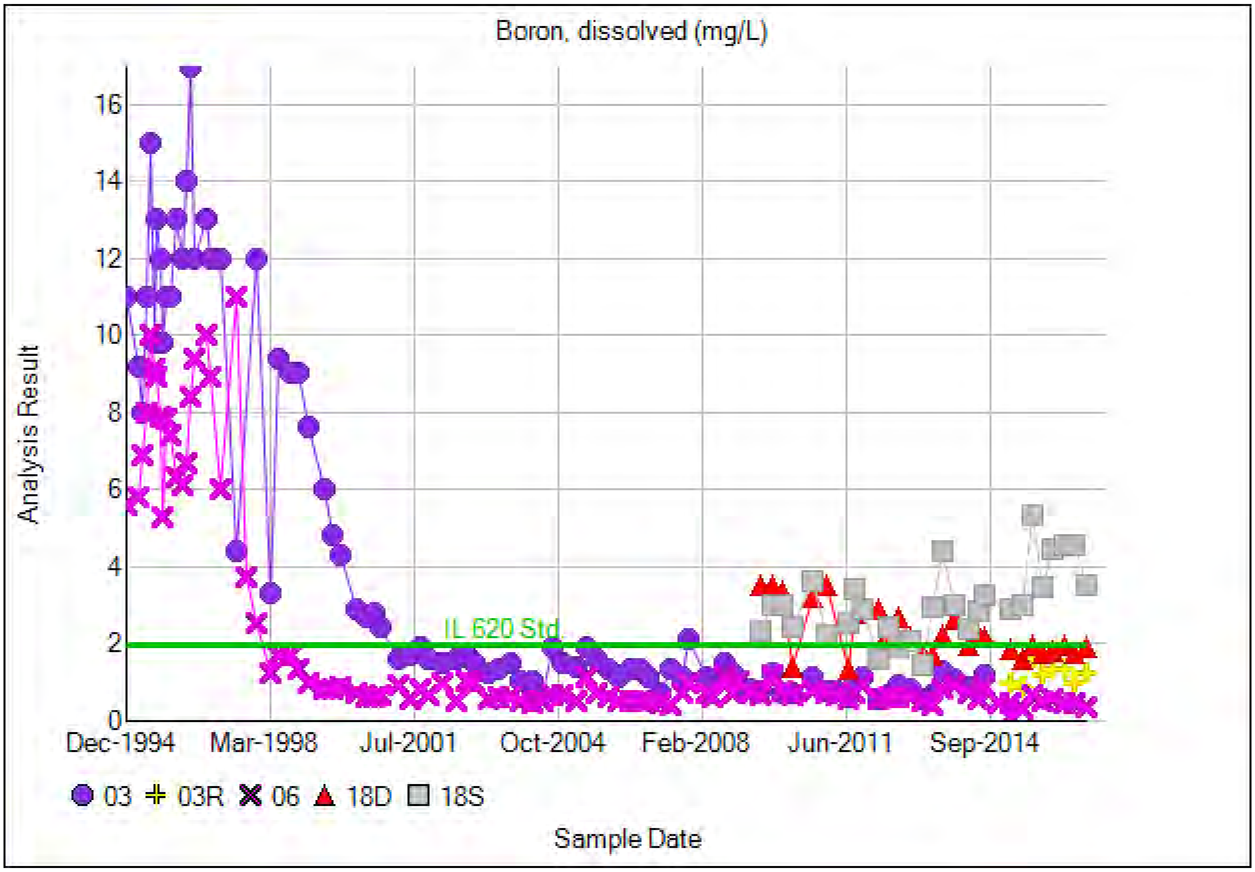
4.2.1 Illinois EPA Program Monitoring Results

The following discusses groundwater quality data collected specific to Ash Pond No. 2 under the Illinois EPA monitoring between 2008 through 2016. Summary tables of the inorganic groundwater quality data are provided in Appendix H1. The groundwater quality standards that apply to Class I Potable Resource

Groundwater are listed in 35 IAC 620.410 or background concentrations based on statistical analyses, as described in the Groundwater Monitoring Plan (NRT, 2017).

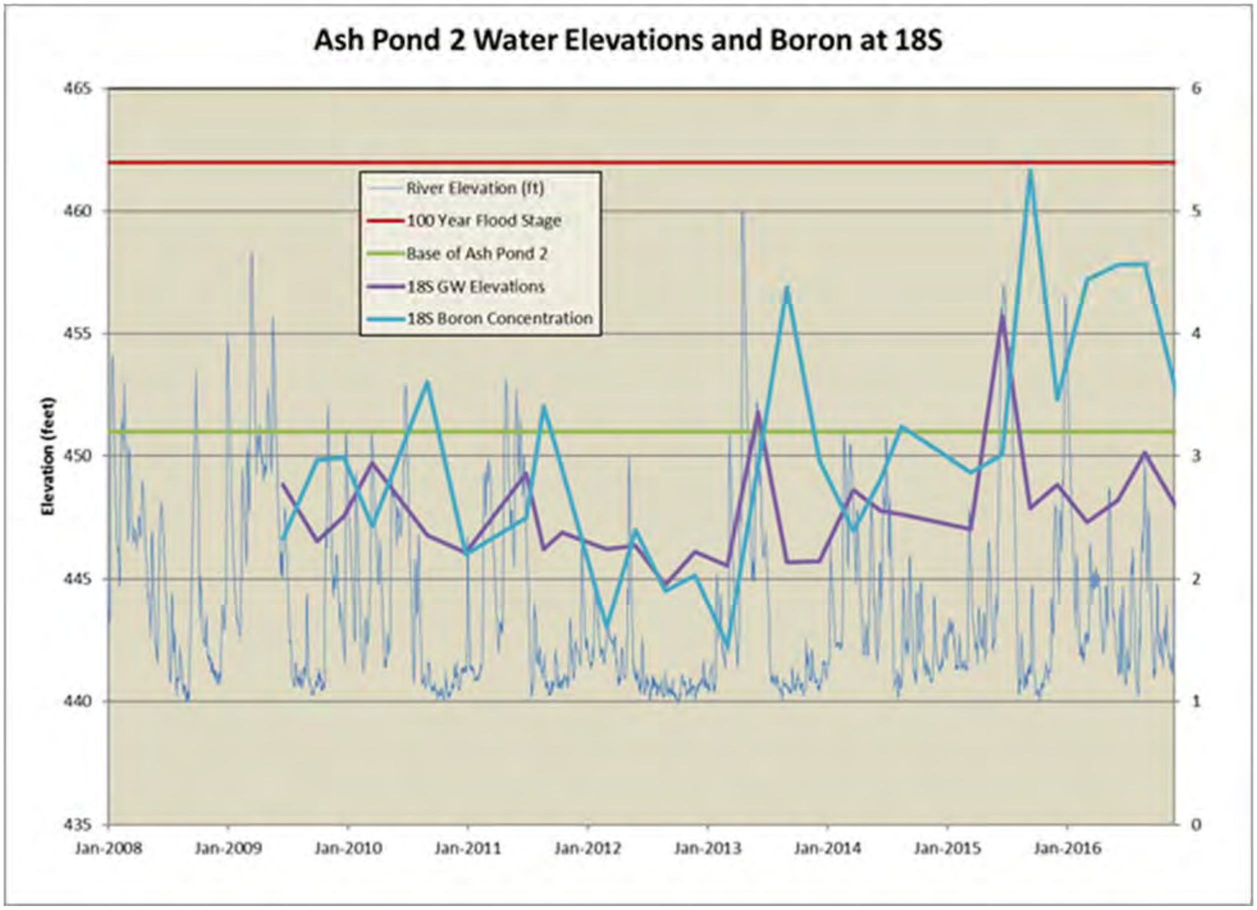
4.2.1.1 General Inorganic Constituents

Boron is a primary indicator parameter for CCR leachate impacts on groundwater quality. Boron concentrations in downgradient monitoring wells are shown in the graph below.



Boron concentrations have significantly decreased in wells 03 and 06 since Ash Pond No. 2 was removed from service and unwatered in 1996. Concentrations in 18D have also decreased and remain below the Illinois Class I groundwater standard (2.0 mg/L) since March 2015.

As discussed in Section 3.3.3, a portion of the ash within Ash Pond No. 2 may occasionally become partially saturated for short periods during high precipitation and/or flood events when river elevations exceed an elevation of at least 451 feet. These high precipitation/flood events and the partial saturation of the ash coincide with increases in boron concentrations at well 18S, as shown in the graph below.



Boron concentrations appear to typically fall in the range of 1.5 mg/L to 3 mg/L during normal river elevations. Boron concentrations rise above 3 mg/L following events when the river elevation rises above 451 feet (green line). Further, it also appears that the concentration rise is related to the magnitude and duration of the precipitation/flood event above the 451-foot river elevation. The elevation of boron concentrations is also likely attributed to the increased precipitation percolating through Ash Pond No. 2 that occurs with these events.

The increase in boron concentrations in downgradient groundwater at 18S can occur a month or two after the high river stage event due to several processes:

- During high precipitation/flood events, the river recharges the aquifer and the direction of groundwater flow will temporarily reverse. The increase in boron concentrations will not be observed in 18S until normal baseflow conditions toward the river resume.
- The ash has a lower hydraulic conductivity, so even though sampling may occur a month or two after the high river stage event, the leachate drains out of the saturated ash at a slower rate than the groundwater elevation subsides within the highly permeable sand and gravel aquifer.

The above trends observed at well 18S appear to be associated with this particular area downgradient from Ash Pond No. 2. The deeper monitoring well 18D at this location does not have similarly high boron concentrations and all other downgradient wells are currently below the Class I standard for boron.

Summary statistics for samples collected between March 2008 and December 2015 for other inorganic parameters are shown on the table below:

	Nitrate nitrogen, total	Cyanide, total	Chloride, dissolved	Sulfate, dissolved	Fluoride, dissolved	Iron, total	Iron, dissolved	Manganese, total	Manganese, dissolved	pH	Total Dissolved Solids
Class I Standard	10	2	200	400	4	5	5	0.15	0.15	6.5-9	1,200
Downgradient Wells (03, 06, 18S, 18D)											
No. of Exceedances	22	0	0	0	0	2	0	4	17	1	0
Minimum	0.27	0.005	11	40	0.077	0.034	0.02	0.005	0.005	6.4	252
Maximum	18	0.17	130	238	0.39	8.90	0.09	0.83	0.66	8.0	930
Samples Analyzed	118	122	110	110	117	20	118	20	118	128	118
Upgradient Wells (07, 08, 08D)											
No. of Exceedances	24	0	30	0	0	1	0	2	1	5	6
Minimum	2.60	0.005	18	49	0.07	0.02	0.02	0.005	0.003	6.3	504
Maximum	17	0.1	351	218	0.16	5.48	0.071	0.40	0.21	7.8	1,420
Samples Analyzed	93	96	85	85	93	28	91	16	91	102	93

There were no exceedances of groundwater quality standards for cyanide, sulfate or fluoride in upgradient or downgradient wells. Exceedances of groundwater standards for nitrate were distributed across the site and occurred sporadically in all monitoring wells, indicating that the concentrations reflect background variability from upgradient sources.

Chloride periodically exceeded groundwater quality standards only in upgradient wells 08 and 08D. Chloride was significantly lower in upgradient well 07, typically less than 40 mg/L, compared to wells 8 and 8D. Chloride is a major component of Total Dissolved Solids (TDS), which exhibited similar trends but fewer Class I exceedances. Elevated concentrations of chloride and TDS, above their respective Class I standards, are attributed to road salting off-site to the south of wells 08 and 08D.

Iron exceedances occurred in three unfiltered (total) samples. These detections were anomalously high values compared to all other analytical results and may have been related to sample turbidity. Exceedances of groundwater standards for manganese were associated with downgradient well 18D, suggesting differences in groundwater chemistry occur at depth rather than from Ash Pond No. 2 leachate. Detailed discussions of the manganese geochemistry in wells at the Hennepin Power Station are provided in the EPRI manganese research report submitted to the Illinois EPA on November 6, 2002 (EPRI, 2002).

There have been several seemingly random exceedances of the lower groundwater standard for pH (6.5 units) that appear in multiple wells. There have been no exceedances in the upper or lower pH standards at any monitoring wells since 2010.

4.2.1.2 Trace Metals

The following metals were not detected in upgradient or downgradient wells:

Antimony (total and dissolved)	Lead (dissolved)	Silver (total and dissolved)
Beryllium (total and dissolved)	Mercury (total and dissolved)	Thallium (total and dissolved)

The following metals were detected sporadically in less than 5 percent of the samples collected in the upgradient and downgradient wells:

Arsenic (total and dissolved)	Lead (total)
Chromium (total and dissolved)	Vanadium (total and dissolved)

There were no exceedances of the groundwater standards for arsenic, chromium and vanadium. Lead exceeded the Class I groundwater standard (0.0075 mg/L) on one sampling event at a concentration of 0.008 mg/L.

The following metals were frequently detected in the upgradient and downgradient wells but there were no exceedances of their respective groundwater quality standards:

Barium (total and dissolved)	Copper (total and dissolved)	Zinc (total and dissolved)
Cobalt (total and dissolved)	Selenium (total)	

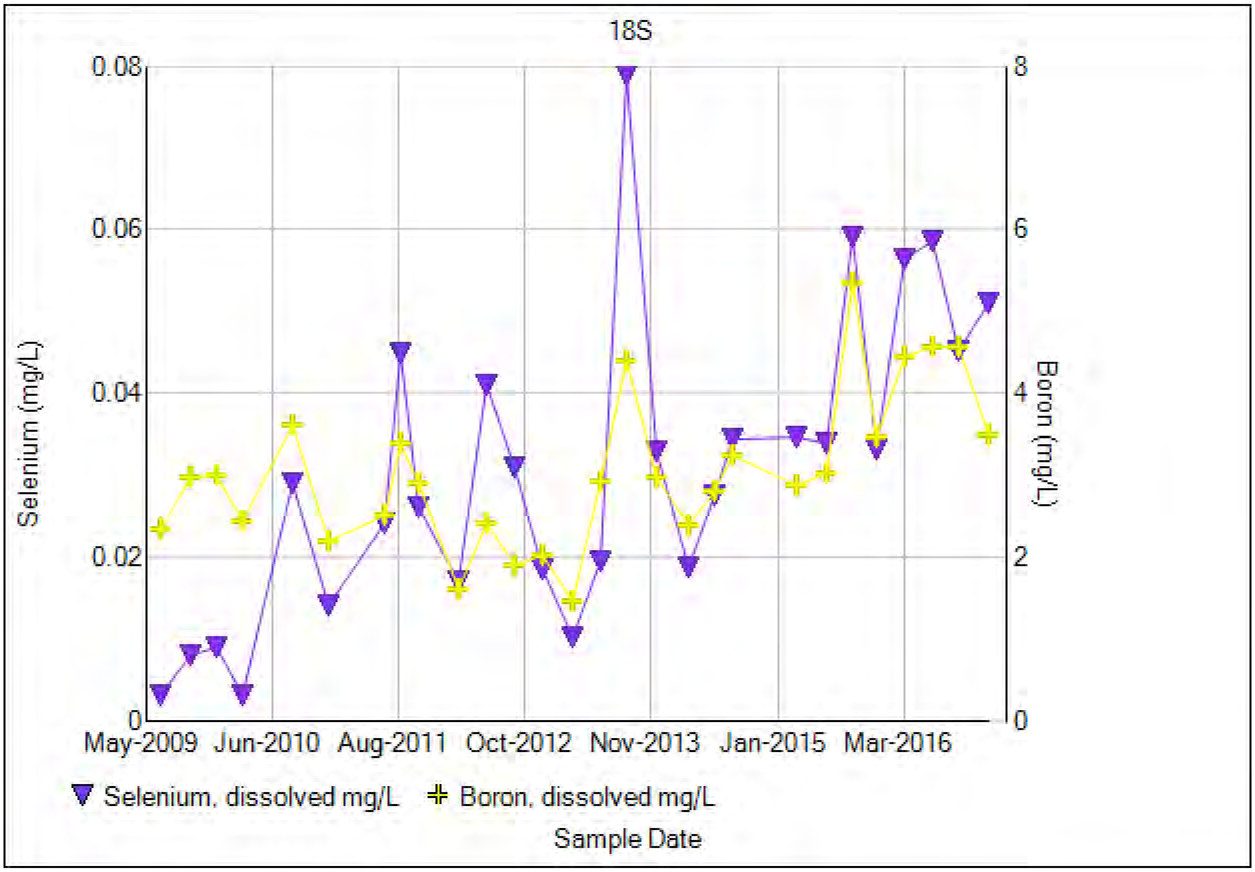
Other metals that were observed at concentrations exceeding Class I groundwater quality standards on one or more occasions included the following:

Cadmium (total and dissolved)	Nickel (total and dissolved)	Selenium (dissolved)

Total and dissolved cadmium has been frequently detected in the shallow downgradient wells 03, 06 and 18S above the groundwater standard (0.005 mg/L). No exceedances have been observed, however, since the March 2015 sampling event. Cadmium is consistently below detection limits in the upgradient wells. Leaching from Ash Pond No. 2 does not appear to be a significant source of cadmium to groundwater.

Total and dissolved nickel is consistently detected in all downgradient monitoring wells but only exceeded the Class I groundwater standard (0.10 mg/L) at well 06 in one sampling event. Dissolved nickel has been frequently detected in upgradient wells 08 and 08D since 2013, exceeding the standard at concentrations up to 0.23 mg/L. The observed distribution of nickel concentrations appears to reflect background variability in groundwater from an upgradient source.

Exceedances of the groundwater standards for dissolved selenium (0.05 mg/L) have been limited to well 18S in five sampling events since September 2013. As shown in the graph below, dissolved selenium appears to mimic the recent increases in boron concentrations and may be related to ash saturation during high precipitation/flood events.



4.2.1.3 Organic Parameters

Organic parameters were analyzed at wells 02 through 08 and 16, 17 in December 2008 and March 2009 during the IFR for the new CCR Landfill. The parameters included volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), organochlorine pesticides, chlorinated herbicides, general solvents (1-propanol, isopropyl alcohol, ethanol), endothall, EDB, DBCP and PCBs.

Two organic constituents were detected at concentrations above the method detection limit:

- Pentachlorophenol (PCP), a pesticide commonly used for wood treating, was observed in well 07 at 0.00025 mg/L in March 2009. The Class I groundwater standard is 0.001 mg/L.
- Picloram, a herbicide typically used for control of woody plants, was observed at well 08 at a concentration of 0.0011 mg/L in March 2009. The Class I groundwater standard is 0.5 mg/L.

Wells 07 and 08 are upgradient wells at the site and the closest wells to other industrial facilities in the area.

VOCs are analyzed biannually at upgradient wells 08, 08D, 10, 12, 13 and wells 05, 05D, 40S which are downgradient of the CCR Landfill. Phenols are monitored quarterly. These results were submitted with the May 2012 and June 2014 annual reports per the IFR and in accordance with Illinois EPA Part 815 rules. Constituents detected at concentrations above the method detection limit included the following:

- Acetone is occasionally detected in both background wells 08 and 10, and downgradient wells 05 and 40S, at concentrations less than 0.010 mg/L. Acetone is a common laboratory contaminant and has also been detected in a field blank. The Class I groundwater standard for acetone is 6.3 mg/L.

- Phenol has been occasionally detected in background wells 08, 8D, 12, and 13, and downgradient wells 05 and 05D, below the Class I groundwater standard (0.1 mg/L). Observed concentrations are typically less than 0.01 mg/L.

Organic constituents are not expected in coal ash leachate and all of the above detections are not related to CCRs.

4.2.2 CCR Rule Groundwater Monitoring Results

The following discusses groundwater quality data collected specific to Ash Pond No. 2 under the CCR Rule monitoring program based on four quarters of sampling from December 2015 through September 2016 for the USEPA 40 CFR 257 Appendix III and IV parameters. Summary tables of the groundwater quality results are provided in Appendix H2 for upgradient wells 07, 08, and 08D, and downgradient wells 03R, 18S, 18D, and 45S. All samples were analyzed as totals. The groundwater quality standards that apply for each monitored parameter are the greater of either the Class I Potable Resource Groundwater Standards as listed in 35 IAC 620.410 or background concentrations based on statistical analyses, as described in the Groundwater Monitoring Plan (NRT, 2017).

4.2.2.1 Appendix III Parameters

Sampling events for CCR monitoring coincided with monitoring performed under the Illinois EPA program. The findings reported above for the Illinois EPA monitoring are consistent with the CCR monitoring program results for boron, chloride, fluoride, sulfate, TDS and pH. The groundwater monitoring results at the additional CCR well 45S were consistent with other shallow Ash Pond No. 2 downgradient wells and there were no exceedances of Class I groundwater standards.

Calcium concentrations ranged from 82 to 299 mg/L and values were generally higher in upgradient wells. There is no Class I groundwater standard for calcium

4.2.2.2 Appendix IV Parameters

The analysis of Appendix IV parameters was also generally consistent with the Illinois EPA monitoring results with respect to constituents not detected (beryllium, mercury) as well as constituents detected below Class I groundwater quality standards. The Appendix IV parameters detected that did not exceed groundwater standards included the following:

Parameter	Groundwater Standard (mg/L)	Highest Concentration Detected (mg/L)
Antimony	0.006	0.0006
Arsenic	0.010	0.0007
Barium	2.0	0.16
Cadmium	0.005	0.0023
Chromium	0.10	0.0029
Cobalt	--	0.011
Fluoride	4.0	0.34
Lead	0.015	0.0007
Lithium	--	0.081
Molybdenum	--	0.35
Thallium	0.002	0.0004
Radium 226/228	5	2.45

Cadmium, which has historically exceeded the groundwater standard prior to March 2015 under Illinois EPA monitoring, was observed below the standard in all CCR monitoring events at all well locations from December 2015 through September 2016. Selenium was the only constituent exceeding its groundwater standard (0.05 mg/L). The exceedances occurred at well 18S during the March and June 2016 sampling events at concentrations of 0.0596 mg/L and 0.0506 mg/L, respectively.

5 POTENTIAL IMPACTS TO THE ILLINOIS RIVER

As discussed previously in this report, groundwater flows north during baseflow conditions and groundwater from below the Hennepin East Ash Pond No. 2 discharges to the Illinois River (Figure 2). During baseflow, the groundwater discharging to the Illinois River has the potential to impact the river, increasing concentrations of CCR indicators, boron and sulfate. Calculations for the potential impact from groundwater discharge to the Illinois River are provided in the tables below for boron and sulfate, respectively. The 7-day, 10-year low flow event (i.e. 7Q10) was used to estimate flow volume in the river and a mixing zone of 50 feet was used to determine dilution of the groundwater concentrations.

Conservative assumptions were used to calculate the resulting change in concentration to the Illinois River. Based on the calculations, groundwater discharge to the Illinois River could potentially increase concentrations of boron by 0.0066 mg/L and sulfate by 0.29 mg/L. Both concentrations are below their respective detection limits reported by the laboratory, indicating that changes in concentration would not likely be detected and impacts would be negligible.

Mixing Calculation Showing Effect of Boron Loading on Illinois River Quality at Low Flow

Baseflow		3515 cfs	Source: NPDES Permit IL0001554
	=	8.6E+09 L/day	
Boron loading rate			
Maximum Boron Concentration in Groundwater (CAvg)		9.25 mg/L	Maximum Concentration Well 18S - 4/2017
Hydraulic Conductivity (between Ash Complex and River)		0.0161 cm/s	Geometric mean of sand and gravel downgradient (Table 4)
Hydraulic Gradient		0.0040	Maximum included in report (Subsection 3.3.2.1)
Aquifer Thickness		50 ft	Estimated maximum depth of impacts in sand and gravel
Length of Ponds (max length, west to east)		2,100 ft	
Q = KIA			
K = Max Hydraulic Conductivity		5.3E-04 ft/s	
I = Hydraulic Gradient		0.00400	
A = Cross-Sectional Area		105,000 ft^2	
Q (per second)		0.22226 cfs	
Q (per day)		543,788.07 L/day	
Loading Rate (L)		5.0E+06 mg/day	= Cmax * Q
	L =	11.07 lb/day	
Boron concentration increase in Illinois River at low flow due to loading from East Ash Pond No. 2			
	d_B =	5.8E-04 mg/L	= $L/Q_{7,10}$
Boron concentration increase near-shore in Illinois River at low flow due to loading from the East Ash Pond No. 2			
Assumes loading distributed within 75 feet of shoreline		0.0066 mg/L	River is approximately 850 ft wide
Typical boron laboratory detection limit		0.01 mg/L	Source: Teklab Report 3/2016

Conclusion:

The calculated boron concentration increase in the Illinois River at ***low flow*** due to groundwater loading from the East Ash Pond No. 2 is less than the typical boron detection limit, indicating that increases due to impacted discharge would not be detectable. These calculations indicate that the effects of boron loading in groundwater discharge to the Illinois River are negligible.

Mixing Calculation Showing Effect of Sulfate Loading on Illinois River Quality at Low Flow

Baseflow		3515	cfs	Source: NPDES Permit IL0001554
	=	8.6E+09	L/day	
Sulfate loading rate				
Maximum Sulfate Concentration in Groundwater (CAvg)		400	mg/L	Maximum Concentration Well 18S - 4/2017
Hydraulic Conductivity (between Ash Complex and River)		0.0161	cm/s	Geometric mean of sand and gravel (Table 3)
Hydraulic Gradient		0.0040		Maximum included in report (Subsection 3.3.2.1)
Aquifer Thickness		50	ft	Estimated maximum depth of impacts in sand and gravel
Length of Ponds (max length, west to east)		2,100	ft	
Q = KIA				
K = Max Hydraulic Conductivity		5.3E-04	ft/s	
I = Hydraulic Gradient		0.00400		
A = Cross-Sectional Area		105,000	ft^2	
Q (per second)		0.22185	cfs	
Q (per day)		542,776.69	L/day	
Loading Rate (L)		2.2E+08	mg/day	= Cmax * Q
	L =	477.64	lb/day	
Sulfate concentration increase in Illinois River at low flow due to loading from West Ash Pond System				
	d_B =	2.5E-02	mg/L	= $L/Q_{7,10}$
Sulfate concentration increase near-shore in Illinois River at low flow due to loading from the West Ash Pond System				
Assumes loading distributed within 75 feet of shoreline		0.2861	mg/L	River is approximately 850 ft wide
Typical sulfate laboratory detection limit		5	mg/L	Source: Teklab Report 3/2016

Conclusion:

The calculated sulfate concentration increase in the Illinois River at ***low flow*** due to groundwater loading from the East Ash Pond No. 2 is an order of magnitude less than the typical sulfate detection limit, indicating that increases due to impacted discharge would not be detectable. These calculations indicate that the effects of sulfate loading in groundwater discharge to the Illinois River are negligible.

6 CONCLUSIONS

Data acquired from prior investigations and activities at the East Ash Pond System were incorporated into this Hydrogeologic Site Characterization Report to provide a complete physical and chemical evaluation of the impoundments and vicinity. The site characterization findings are summarized below:

- Ash Pond No. 2 originally encompassed approximately 34 acres and was operational from 1958 through 1996. The eastern portion of Ash Pond No. 2 was removed to facilitate construction of the Leachate Pond in 2009. The Phase I cell of the Landfill was constructed adjacent to the Leachate Pond as an overfill above Ash Pond No. 2 in 2010 to 2011, with 7,500 cubic yards of bottom ash placed into the Landfill to protect the liner. No ash has been disposed into the Landfill since the protective layer of bottom ash was placed in 2011.
- The current area of Ash Pond No. 2 remaining to be closed is approximately 18 acres.
- Three hydrogeologic units are present at the site.
  - Fill Unit, the uppermost unit, is comprised of CCRs – fly ash, bottom ash and minor slag. In some areas, such as constructed berms, the Fill Unit is CCR mixed with sand, silt, and clay.
  - The Uppermost Aquifer is comprised of mixed alluvial deposits (clay, silt, and sand) which overlie coarser grained outwash sand and gravel deposits. This unit is the primary groundwater transport pathway.
  - Bedrock Confining Unit is defined by Pennsylvanian age shale with minor layers of limestone, sandstone, and coal. This low permeability unit defines the lower boundary of the Uppermost Aquifer.
- The Illinois River is located directly adjacent to and downgradient from the East Ash Pond System. Flood events typically occur in March, April, May, and sometimes June, while lesser flooding occasionally occurs during autumn. Ash Pond No. 2 is not subject to 100-year flooding at the base flood elevation value of 462 feet.
- The Illinois River is the regional groundwater discharge area and localized groundwater flow under Ash Pond No. 2 occurs in a general northerly orientation. River stage during high precipitation and/or flood events seasonally rises above adjacent groundwater elevations and the river recharges the aquifer, temporarily reversing the direction of groundwater flow to the south.
- High precipitation and/or flood events that recharge the aquifer may result in temporary groundwater elevation increases above the base grade of Ash Pond No. 2. Saturation of a portion of the CCR within Ash Pond No. 2 may occur when river stage exceeds an elevation of at least 451 feet. These events appear to be short in duration but occur on an almost annual basis.
- The Henry Formation sands and gravels (Uppermost Aquifer) which underlie Ash Pond No. 2 are highly permeable with measured hydraulic conductivity ranging from 3 x 100 cm/s to 1 x 10^{-4} cm/s with a geometric mean of 5.6 x 10^{-2} cm/s. These values are consistent with pump test data from area high capacity wells screened in the unlithified deposits, which ranged from 5 x 10^{-2} to 3 x 10^{-1} cm/s. Hydraulic conductivity was not measured in the Bedrock Confining Unit.
- Groundwater within the Uppermost Aquifer, at Ash Pond No. 2 meets the definition of a Class I, Potable Resource Groundwater.
- Of the 25 monitoring wells located at the East Ash Pond System in 2016, 20 are actively monitoring all of the CCR units and ponds (CCR Landfill Phase 1, Ash Pond No. 2 and East Ash Pond as well as the non-CCR units (Polishing Pond, Leachate Pond, and Ash Pond No. 4) under Illinois EPA permits. Groundwater monitoring was initiated to assess compliance with the 35 IAC 620.410 Groundwater Quality Standards for Class I: Potable Resource Groundwater.
- The results of the Illinois EPA groundwater monitoring network at Ash Pond No. 2 upgradient (wells 07, 08, 08D) and downgradient (wells 03R, 06, 18S, 18D) wells indicate the following:

  - There were no exceedances of groundwater quality standards for cyanide, sulfate or fluoride in upgradient or downgradient wells.
  - Parameters observed in groundwater that are likely derived from CCRs and currently exceed Class I standards were boron and selenium. Exceedances of Class I standards for boron and selenium occur only in downgradient monitoring wells 18S and/or 18D, located immediately adjacent to the ash pond. The Class I standard exceedances at these wells appear to be related to partial saturation of the ash for short periods when high precipitation/flood events result in aquifer recharge and groundwater elevation increases above the base grade of Ash Pond No. 2 in the vicinity of these wells.
  - Boron has been monitored since 1994 and concentrations have significantly decreased in downgradient wells 03 and 06 since Ash Pond No. 2 was removed from service in 1996. Boron concentrations in wells 03, 06 and 45S remain below the Class I groundwater standard (2.0 mg/L).
  - Based on the frequency of detection, the parameter distribution and/or anomalous concentrations, iron, manganese, nitrate-N, TDS and pH exceedances of Class I standards are not related to Ash Pond No. 2 or CCR at the East Ash Pond System.
  - The following metals (total and dissolved) were either not detected or were detected sporadically in less than 5 percent of the samples collected in the upgradient or downgradient wells: antimony, beryllium, lead (dissolved), mercury, silver, and thallium. None of these parameters exceeded the Class I groundwater standards.
  - The following metals (total and dissolved) were frequently detected in the upgradient and downgradient wells but there were no exceedances of their respective Class I groundwater quality standards: barium, copper, cobalt, and zinc.
  - Other metals that were observed at concentrations exceeding groundwater quality standards included the following:
    - Total and dissolved cadmium has been frequently detected in the shallow downgradient wells 03, 06 and 18S above the groundwater standard (0.005 mg/L). No exceedances have been observed, however, since the March 2015 sampling event. Cadmium is consistently below detection limits in the upgradient wells.
    - Total lead exceeded the groundwater standard (0.0075 mg/L) on one sampling event at a concentration of 0.008 mg/L. Because dissolved lead has been consistently below detection limits, the exceedance is likely related to sample turbidity.
    - Total and dissolved nickel is consistently detected in all downgradient monitoring wells but only exceeded the groundwater standard (0.10 mg/L) at well 06 in one sampling event. Dissolved nickel has frequently been detected since 2013 in upgradient wells 08 and 08D, exceeding the Class I standard with concentrations up to 0.23 mg/L. The observed distribution of nickel concentrations appears to reflect background variability in groundwater from an upgradient source.
  - Organic constituents detected in conjunction with monitoring the CCR Landfill Phase I cell included PCP, Picloram, acetone and phenol. These constituents were detected below Class I standards and are not related to CCR.
- The results of the CCR Rule groundwater monitoring network initiated in December 2015 at Ash Pond No. 2 upgradient wells (07, 08, and 08D) and downgradient wells (03R, 18S, 18D,and 45S) indicate the following:
  - The findings reported above for the Illinois EPA inorganic monitoring parameters are consistent with the CCR monitoring program Appendix III and IV results with respect to Class I groundwater quality standards.
  - The groundwater monitoring results at the additional CCR well 45S were consistent with other shallow Ash Pond No. 2 downgradient wells. There were no exceedances of Class I groundwater standards at this location.

- An assessment of potable and non-potable water wells for a 2,500-foot radius around the Hennepin Power Station property boundary demonstrated that there is no potential for groundwater impact to existing off-site wells from the East Ash Pond System or Hennepin Power Station.
- An evaluation was completed to determine potential CCR groundwater impacts on the Illinois River. The evaluation determined that the primary CCR indicator parameters for Ash Pond No. 2, boron and sulfate, would have negligible impacts to the Illinois River.

REFERENCES

AECOM, January 12, 2016. 30% Design Data Report for Dynegy Hennepin Power Station; West Polishing Pond, West Ash Pond, East Ash Pond and Ash Pond No. 2 CCR Units.

Berg, R.C. and J.P. Kempton, 1988. Stack-Unit Mapping of Geologic Materials in Illinois to a Depth of 15 Meters. Illinois State Geological Survey Circular 542. Champaign, Illinois.

Bouwer, H. and R.C. Rice, 1976. A slug test for determining conductivity of unconfined aquifers with completely or partially penetrating wells, Water Resources Research, v. 12, no. 3, p. 423-428.

Bunker, B.J., G.A. Ludvigson, B.J. Witzke, 1985. The Plum River Fault Zone and The Structural and Stratigraphic Framework of Eastern Iowa. Iowa Department of Natural Resources, Geological Survey Bureau, Technical Information Series 13, 126 p.

Electric Power Research Institute (EPRI), 2002. Manganese Occurrence Near Three Coal Ash Impoundments in Illinois. Report Number 1005257. Palo Alto, California.

Fetter, C.W., 1980. Applied Hydrogeology. Charles E. Merrill Publishing Co., Columbus, Ohio.

Frankie, W.T. and others, 2002. Guide to the Geology of the Hennepin Area, Putnam, Bureau, and Marshall Counties, Illinois. Illinois State Geological Survey Field Trip, Guidebook 2002A. Champaign, Illinois.

Gibb, J.P., D.C. Noel, W.C. Bogner and R.J. Schicht, 1977. Groundwater Conditions and River-Aquifer Relationships along the Illinois Waterway. Illinois State Water Survey, Urbana, Illinois.

Hansel, A.K. and W.H. Johnson, 1996. Wedron and Mason Groups: Lithostratigraphic reclassification of deposits of the Wiscosinan Episode, Lake Michigan Lobe area. Illinois State Geological Survey, Bulletin 104. Champaign, Illinois.

Illinois State Geological Survey (ISGS), 2001. Questor Data Extraction and Map. Champaign, Illinois.

Illinois State Geological Survey, 2006. Directory of Coal Mines in Illinois: Putnam County. Champaign, Illinois.

Illinois State Water Survey (ISWS), 1989. Aquifer Properties Database for Sand & Gravel and Bedrock Aquifers in Illinois (unpublished). Champaign, Illinois.

John Mathes & Associates, Inc. (Mathes), 1983. Hydrogeologic Study, Existing Ash Ponds, Hennepin Power Plant, Illinois Power Company, Hennepin Illinois. Unpublished report to Dynegy Midwest Generation, Inc.

Kelron Environmental/Natural Resource Technology, 2009a. Water Well Survey, Hennepin Power Station. June 3, 2009.

Kelron Environmental/Natural Resource Technology, 2009b. Assessment of Potential for Groundwater Impact on Identified Water Wells, Hennepin Power Station. August 26, 2009.

Kolata, D.R., T.C. Buschbach, and J.D. Treworgy, 1976. The Sandwich Fault Zone of Northern Illinois. Illinois State Geological Survey Circular 505, 26 p.

Kolata, D.R., 2005. Bedrock Geology of Illinois. Illinois State Geological Survey, Map 14. Champaign, Illinois.

Midwestern Regional Climate Center (MRCC). 2013. NOAA National Climatic Data available on the World Wide Web (Historical Climate 30-Year Average Data from 1981-2010 for the Hennepin, Illinois Climatological Station #114013). Accessed [October 22, 2013], at URL [http://www.isws.uiuc.edu/atmos/statecli/newnormals.htm#stationlist].

Natural Resource Technology and Kelron Environmental; February 2, 2009.Field Implementation Plan, New East Ash Landfill, Hennepin Power Station, Hennepin, Illinois.

Natural Resource Technology, Inc. and Kelron Environmental; July 8, 2009. Prediction of Groundwater Transport: Pond 2 East, Hennepin Power Station, Hennepin, Illinois.

Natural Resource Technology and Kelron Environmental; December 19, 2010. New Coal Combustion Waste (CCW) Landfill, Initial Facility Report, Hydrogeologic Studies and Evaluations, Section 25 Hydrogeological Investigation, Hennepin Power Station, Hennepin, Illinois.

Natural Resource Technology and Kelron Environmental; December 19, 2010. New Coal Combustion Waste Landfill, Initial Facility Report, Hydrogeologic Studies and Evaluations, Section 27 Groundwater Impact Assessment, Hennepin Power Station, Hennepin, Illinois.

Natural Resource Technology and Kelron Environmental; December 19, 2010. New Coal Combustion Waste Landfill, Initial Facility Report, Hydrogeologic Studies and Evaluations, Section 28 Groundwater Monitoring Program, Hennepin Power Station, Hennepin, Illinois.

Natural Resource Technology, Inc., March 13, 2017. 2016 East Ash Pond and Coal Combustion Waste Landfill Annual Report, Hennepin Power Station, Dynegy Operating Company, Hennepin, Illinois.

Nelson, W. J., 1993. Structural Features in Illinois, Plates 1 and 2. Illinois State Geological Survey, Bulletin 100. Champaign, Illinois.

Nelson, W. J., 1995. Structural Features in Illinois. Illinois State Geological Survey, Bulletin 100. Champaign, Illinois.

Petersen, Mark D., Arthur D. Frankel, Stephen C. Harmsen, Charles S. Mueller, Kathleen M. Haller, Russell L. Wheeler, Robert L. Wesson, Yuehua Zeng, Oliver S. Boyd, David M. Perkins, Nicolas Luco, Edward H. Field, Chris J. Wills, and Kenneth S. Rukstales, 2008. Documentation for the 2008 Update of the United States National Seismic Hazard Maps. US Geological Survey Open-File Report 2008–1128. 61 p.

Piskin, K. and R.E. Bergstrom, 1975. Glacial Drift in Illinois: Thickness and Character. Illinois State Geological Survey, Circular 490. Champaign, Illinois.

Soil Conservation Service, 1992. Soil Survey of Putnam County Illinois.

Science and Technology Management, Inc. (STMI), 1996. Investigation of Site Closure Options at Illinois Power Company's Hennepin East Ash Impoundment. Report No. STMI/135/96-02. Brookfield, Wisconsin.

United States Environmental Protection Agency, 2010. 40 CFR Parts 257, 261, 264, 265, 268, 271 and 302. Hazardous and Solid Waste Management System; Identification and Listing of Special Wastes; Disposal of Coal Combustion Residuals from Electric Utilities; Proposed Rule. Federal Register: June 21, 2010, Volume 75, Number 118, pp 35127-35264

U.S. Geological Survey (USGS). 2016. National Water Information System data available on the World Wide Web (Peak Streamflow for Illinois, USGS 05558300, Illinois River at Henry IL). Accessed November 18, 2016 at URL: http://nwis.waterdata.usgs.gov/usa/nwis/uv/?cb_00065=on&format=gif_default&site_no=05558300&period=&begin_date=2013-01-01&end_date=2016-11-18

Visocky, A.P., M.G. Sherrill and K. Cartwright, 1985. Geology, Hydrology and Water Quality of the Cambrian and Ordovician Systems in Northern Illinois. Cooperative Groundwater Report 10. ISGS ISWS, Champaign, Illinois.

Willman, H.B. and others. 1967. Geologic Map of Illinois. Illinois State Geological Survey. Champaign, Illinois.

Willman, H.B. and J.C. Frye. 1970. Pleistocene Stratigraphy of Illinois. Illinois State Geological Survey Bulletin 94. Champaign, Illinois.

Tables

Table 1. Monitoring Well Locations and Construction Details
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East Ash Pond No. 2, Hennepin Power Station

Well	Prior Designation	State Plane North[1]	State Plane East[1]	Gradient Position[1]	Well Top Elevatin	Ground Elevation	Screen Top Elv.	Screen Bot Elv.	Stick Up	Screen Length[2]	Depth to Screen Bottom	Total Boring Depth
02	E-2	1689081	2532172	u	492.00	488.60	444	434	3.4	10	55	57
03R		1690299	2532307	d	481.92	479.38	437	427	2.5	10	52	53
05R		1690521	2533196	d	488.43	485.60	442	432	2.8	10	54	55
05DR		1690520	2533190	d	488.37	485.70	416	411	2.7	5	75	76
06	E-6	1690112	2531833	d	469.58	466.20	438	428	3.4	10	39	40
07	E-7	1687889	2533137	u	518.29	514.60	447	437	3.7	10	78	78
08	E-8	1688880	2533477	u	501.18	499.00	448	438	2.2	10	62	62
08D	- -	1688932	2533463	u	501.45	499.23	416	411	2.2	5	88	120
10	- -	1689661	2532595	u	494.56	495.30	447	437	-0.7	10	59	57
11	- -	1689663	2532598	u	494.61	495.30	429	427	-0.7	2	68	80
12	- -	1689975	2533513	u	494.42	495.20	446	436	-0.8	10	59	60
13	- -	1689977	2533516	u	494.39	495.20	428	426	-0.8	2	69	75
15	- -	1690248	2534147	u	493.79	494.20	444	434	-0.4	10	61	60
16	- -	1689254	2533894	u	501.68	500.20	444	434	1.5	10	66	68
17	- -	1689459	2534510	u	506.96	504.60	447	437	2.4	10	68	68
18S	- -	1690428	2532740	d	484.64	485.22	445	435	-0.6	10	50	52
18D	- -	1690429	2532742	d	484.43	485.22	414	409	-0.8	5	76	95
19S	- -	1690631	2533810	d	483.34	483.86	444	434	-0.5	10	50	52
19D	- -	1690632	2533812	d	483.28	483.86	417	412	-0.6	5	72	85
40S	- -	1690571	2533494	d	487.67	484.76	440	435	2.9	5	50	51
45S	- -	1689994	2531897	d	467.48	465.70	431	421	1.8	10	45	45
46	- -	1690085	2533743	d	498.75	496.44	446	436	2.3	10	60	60
47	- -	1689838	2533053	d	504.32	502.13	452	442	2.2	10	60	60
48	- -	1690546	2533338	d	487.46	485.19	441	431	2.3	10	54	54

Notes:

(O/C: RMW/BGH 9/2009 Revised: EDP,RJK 8/30/17)

1. Gradient position is relative to the Site; u = upgradient, d = downgradient
2. All wells are constructed from 2 inch PVC with 0.01 inch slotted screens.

Table 2. Vertical Gradients - September and December 2015
Hydrogeologic Site Characterization Report
East Ash Pond No. 2, Hennepin Power Station

Date	08 Groundwater Elevation (ft.)	08D Groundwater Elevation (ft.)	Head Change (dH)	Dist. Change (dL)	Vertical Hydraulic Gradient (dH/dL)*	
09/16/2015	448.60	448.24	0.36	28.80	0.01	down
12/08/2015	449.20	447.92	1.28	28.80	0.04	down

Middle of screen elevation (08)	442.5
Middle of screen elevation (08D)	413.7

Date	12 Groundwater Elevation (ft.)	13 Groundwater Elevation (ft.)	Head Change (dH)	Dist. Change (dL)	Vertical Hydraulic Gradient (dH/dL)*	
09/16/2015	448.29	448.30	-0.01	13.60	-0.001	flat
12/08/2015	448.97	449.00	-0.03	13.60	-0.002	up

Middle of screen elevation (12)	440.8
Middle of screen elevation (13)	427.2

Date	18S Groundwater Elevation (ft.)	18D Groundwater Elevation (ft.)	Head Change (dH)	Dist. Change (dL)	Vertical Hydraulic Gradient (dH/dL)*	
09/16/2015	447.90	447.65	0.25	28.50	0.009	down
12/08/2015	448.84	448.78	0.06	28.50	0.002	down

Middle of screen elevation (18S)	440.2
Middle of screen elevation (18D)	411.7

Date	05R Groundwater Elevation (ft.)	05DR Groundwater Elevation (ft.)	Head Change (dH)	Dist. Change (dL)	Vertical Hydraulic Gradient (dH/dL)*	
09/16/2015	448.13	448.03	0.10	23.40	0.004	down
12/08/2015	448.86	448.82	0.04	23.40	0.002	down

Middle of screen elevation (05R)	436.6
Middle of screen elevation (05DR)	413.2

Date	19S Groundwater Elevation (ft.)	19D Groundwater Elevation (ft.)	Head Change (dH)	Dist. Change (dL)	Vertical Hydraulic Gradient (dH/dL)*	
09/16/2015	448.19	448.07	0.12	23.40	0.005	down
12/08/2015	448.90	448.84	0.06	23.40	0.003	down

Middle of screen elevation (19S)	438.9
Middle of screen elevation (19D)	414.4

[OB-JJW 4/27/16, CB-]

Notes:

1. Distance between wells was calculated from midpoint of each well screen, unless the water level was below the midpoint of the screen, then the midpoint of the saturated screen was used.

*: Vertical gradients less than ±0.0015 are considered flat, and they typically have less than 0.02 foot difference between wells

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Table 3. Groundwater Flow Velocities - September and December 2015
Hydrogeologic Site Characterization Report
East Ash Pond No. 2, Hennepin Power Station

September 16, 2015				
	Average Hydraulic Conductivity (cm/s)	**Horizontal Hydraulic Gradient**	**Effective Porosity**	**Velocity (ft/day)**
Well 10 to Well 03R	2E-01	0.0006	0.22	1.5
Well 12 to Well 05R	8E-03	0.0003	0.22	0.03
Well 17 to Well 12	2E-02	0.003	0.22	0.7
December 8, 2015				
	Average Hydraulic Conductivity (cm/s)	**Horizontal Hydraulic Gradient**	**Effective Porosity**	**Velocity (ft/day)**
Well 10 to Well 03R	2E-01	0.0004	0.22	0.9
Well 12 to Well 05R	8E-03	0.0002	0.22	0.02
Well 17 to Well 12	2E-02	0.002	0.22	0.5

Note:

1) cm/sec x 2,835 = feet/day

2) Source of hydraulic conductivity values was the Initial Facility Report for the New Coal Combustion Landfill (Kelron/NRT, December 10, 2010)

Table 4. Summary of Slug Test Results
Hydrogeologic Site Characterization Report
East Ash Pond No. 2, Hennepin Power Station

				Phase II K Tests[5]		Phase III Tests[4*]										All data
Well[1]	Gradient Position[2]	Screen Bot Elv.	Screen Length[3]	K (cm/s)	K Notes	K (cm/s)	K Notes	K (cm/s)	K Notes	K (cm/s)	K Notes	K (cm/s)	K Notes	K (cm/s)	K Notes	Geomean (cm/s)
02	u	433	10	- -	- -	3.1E+00	slug out	3.2E+00	slug in	- -	- -	- -	- -	- -	- -	3.2E+00
03	d	428	15	4.4E-02	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	4.4E-02
04	d	437	15	- -	- -	1.4E-02	slug out	4.6E-02	slug in	1.7E-02	slug out B-R[6]					2.2E-02
05	d	436	10	- -	- -	3.8E-03	slug out	4.4E-03	slug in	- -	- -	- -	- -	- -	- -	4.1E-03
06	d	428	10	3.7E-01	estimated[7]	4.2E-02	slug out	1.4E-02	slug in	- -	- -	- -	- -	- -	- -	5.9E-02
07	u	438	10	- -	- -	4.0E-02	slug out	3.5E-02	slug in	- -	- -	- -	- -	- -	- -	3.7E-02
08	u	438	10	- -	- -	1.0E-02	air 1	1.2E-02	air 2	7.4E-03	slug in QA	1.0E-02	slug out QA	9.2E-03	slug out B-R[6]	9.7E-03
08D	u	411	5	- -	- -	1.7E-01	slug out	1.4E-01	slug in	- -	- -	- -	- -	- -	- -	1.6E-01
10	u	437	10	3.7E-01	estimated[7]	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	3.7E-01
11	u	427	2	2.2E-01	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	2.2E-01
12	u	436	10	1.2E-02	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	1.2E-02
13	u	426	2	2.9E-01	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	2.9E-01
14	u	435	10	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
15	u	434	10	3.7E-01	estimated[7]	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	3.7E-01
16	u	434	10	3.7E-01	estimated[7]	6.9E-01	air 1	4.7E-01	air 2	1.5E+00	slug in QA	1.5E+00	slug out QA	- -	- -	7.6E-01
17	u	437	10	- -	- -	2.8E-02	air 1	2.2E-02	air 2	- -	- -	- -	- -	- -	- -	2.4E-02
18S	d	435	10	- -	- -	5.1E-02	slug out	1.1E-01	slug in	- -	- -	- -	- -	- -	- -	7.6E-02
18D	d	409	5	- -	- -	9.0E-04	air 1	1.4E-05	air 2	- -	- -	- -	- -	- -	- -	1.1E-04
19S	d	434	10	- -	- -	7.0E-02	slug out	5.2E-02	slug in	- -	- -	- -	- -	- -	- -	6.0E-02
19D	d	412	5	- -	- -	3.6E-02	air 1	2.8E-02	air 2	5.7E-02	slug in QA	- -	- -	- -	- -	3.8E-02

Notes:

(O/C: RMW/BGH 5/2009)

1. Monitoring well construction details are summarized in Table 1.
2. gradient position is relative to the Site; u = upgradient, d = downgradient
3. All wells are constructed from 2 inch PVC with 0.01 inch slotted screens.
4. Three of the air slug tested wells were chosen for QA/QC and also had a standard slug test performed for comparison.
5. Phase II aquifer tests were reported in the STMI report (1996).
6. Slug out data was interpreted using both Springer-Gelhar and Bouwer-Rice solution methods for comparison.
7. Well recovered before the transducer could make measurements, so the result was estimated.

* - In all piezometers, air slugs were the preferred method. In each case where air slugs were used, the test was performed twice.

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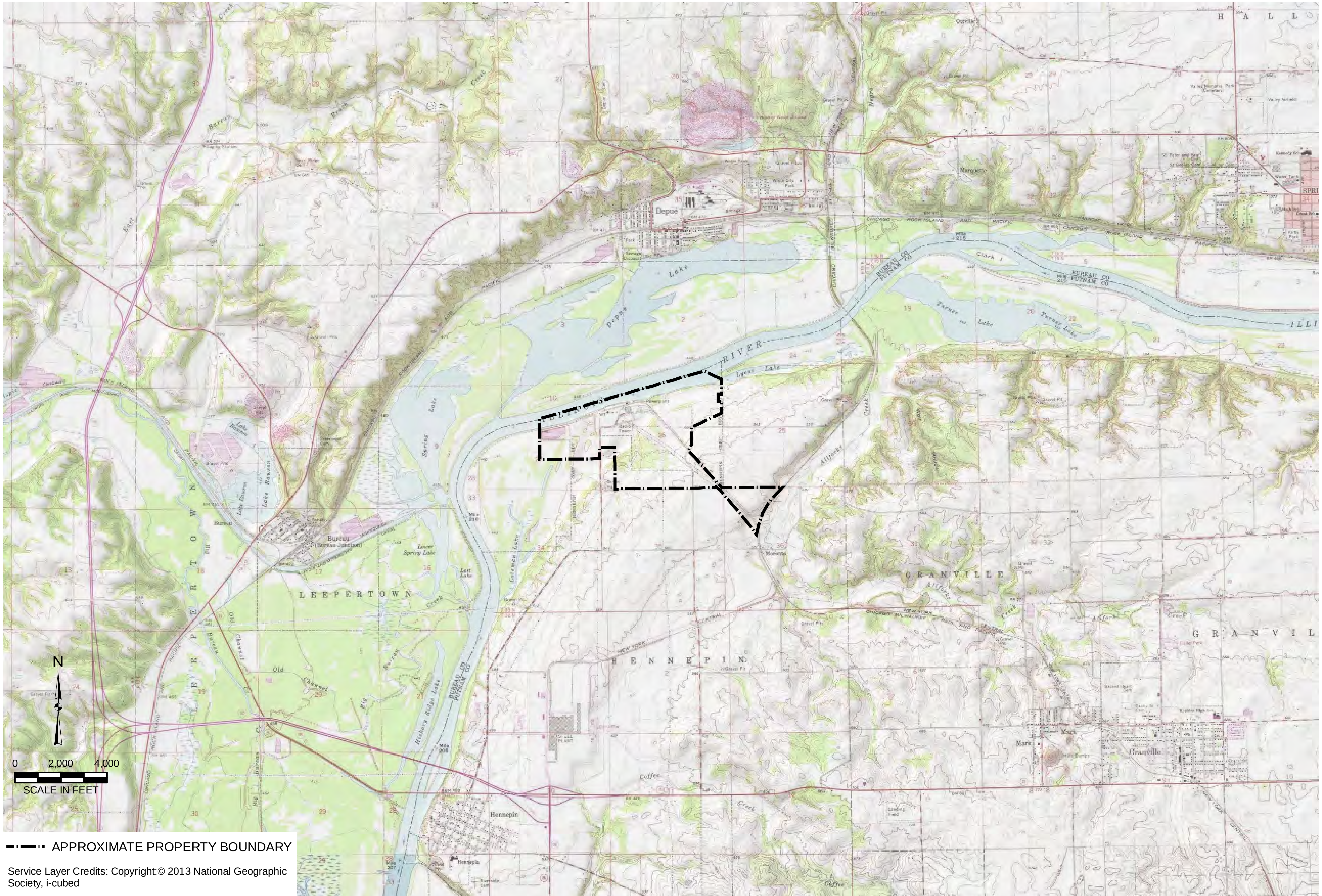
Figures



DRAWN BY/DATE: SDS 8/29/17
REVIEWED BY/DATE: RJK 8/30/17
APPROVED BY/DATE: SJC 9/5/17

SITE LOCATION MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

PROJECT NO: 2414

FIGURE NO: 1

Natural Resource Technology
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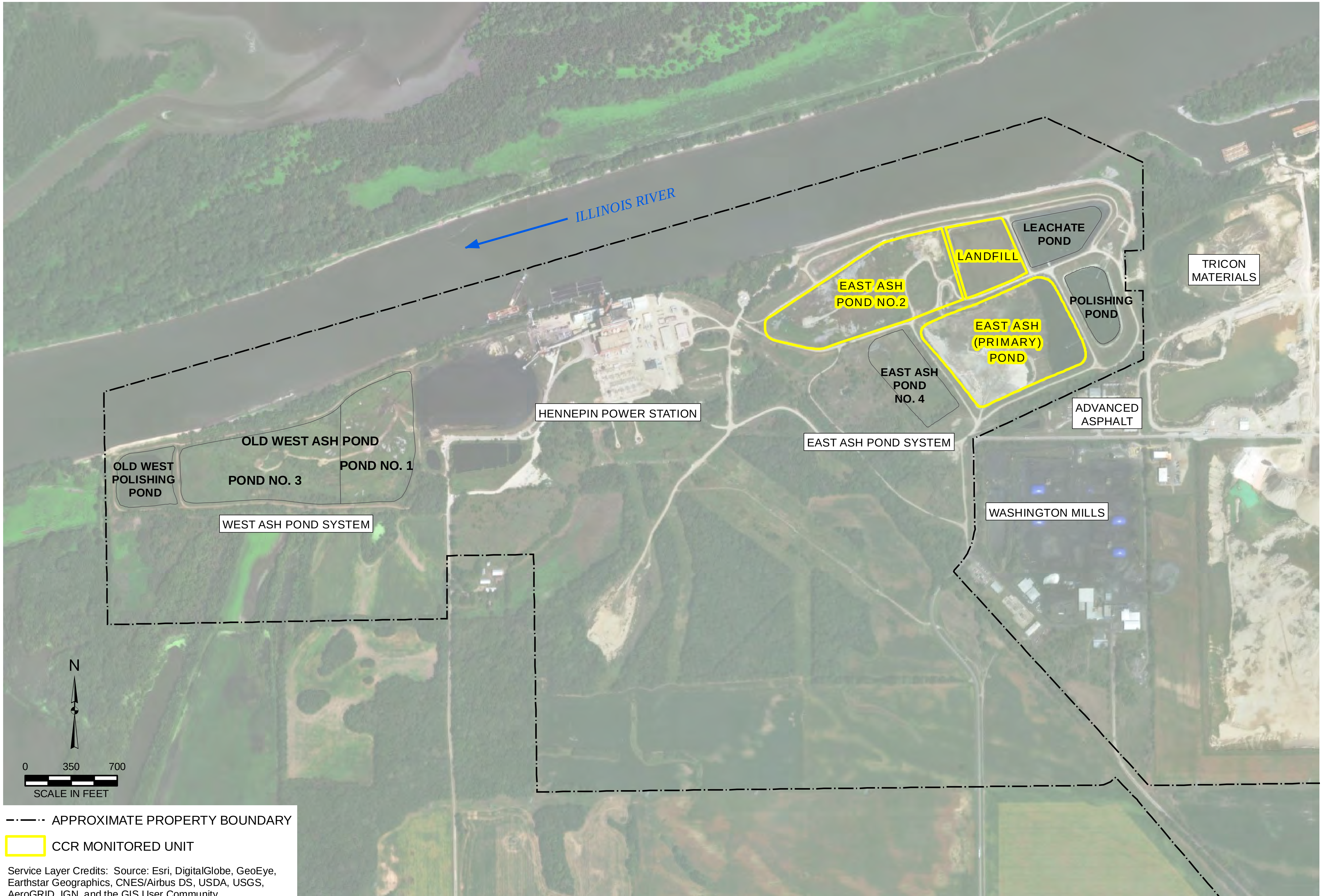
Y:\Mapping\Projects\24\2414\MXD\hgsc\Figure 1_Site Location Map.mxd Author: stolzsd; Date/Time: 1/3/2018, 12:24:44 PM



DRAWN BY/DATE: SDS 8/29/17
REVIEWED BY/DATE: RJK 8/30/17
APPROVED BY/DATE: SJC 9/6/17

ASH IMPOUNDMENT LOCATION MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

PROJECT NO: 2414

FIGURE NO: 2

Natural Resource Technology
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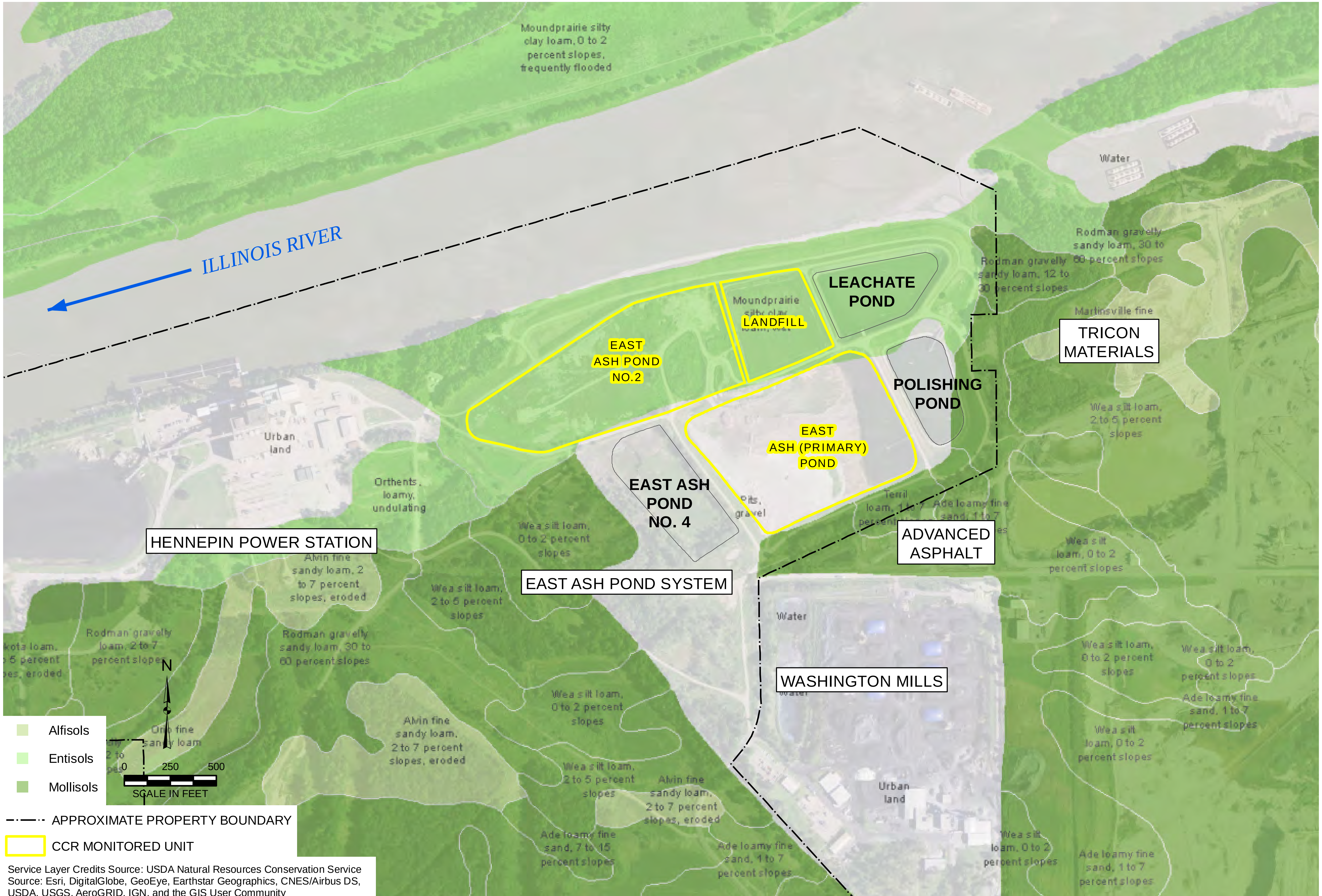
Y:\Mapping\Projects\24\2414\MXD\hgsc\Figure 2_Ash Impound Loc.mxd Author: stolzsd; Date/Time: 1/15/2018, 4:53:53 PM



DRAWN BY/DATE: SDS 8/29/17
REVIEWED BY/DATE: RJK 8/30/17
APPROVED BY/DATE: SJC 9/6/17

SOIL SURVEY MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

PROJECT NO: 2414

FIGURE NO: 3

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SYSTEM or SERIES	HYDROGEOLOGIC UNITS	GRAPHIC LOG	ROCK TYPE	WATER-YIELDING CHARACTERISTICS
PLEIS-TOCENE	Drift (0–300 feet)		Unconsolidated glacial deposits, loess and alluvium (drift).	Water yields variable, largest from thick basal sand and gravel deposits (Sankoty Sand) in bedrock valleys.
PENNSYLVANIAN	(280–475 feet)		Mainly shale with thin sandstone, limestone, and coal beds.	Generally unfavorable as an aquifer. Locally, domestic and farm supplies obtained from thin limestone and sandstone beds. Casing usually required.
SILURIAN	Niagaran-Alexandrian (410–505 feet)		Dolomite; argillaceous near base, lower part cherty.	Generally yields poor quality water.
ORDOVICIAN	Maquoketa (155–240 feet)		Green to blue shale with limestone and dolomite beds.	Not water yielding at most places. Casing required.
	Galena-Platteville (320–380 feet)		Dolomite, with shaly zone near the middle; some limestone in the lower part.	Not important as an aquifer, Creviced dolomite probably yields some water. Water quality good.
	Glenwood-St. Peter (115–135 feet)		Sandstone, white, clean.	Dependable source of groundwater. Water quality good.
	Shakopee (130–150 feet)		Dolomite, with some shale and sandstone.	Not important as aquifer.
	New Richmond (165 feet ±)		Sandstone, with some dolomite.	May yield some water.
	Oneota (215 feet ±)		Dolomite, with some sandstone beds.	Not important as aquifer.

SOURCE NOTE: MODIFIED FROM "MCCOMAS, M.R. (1968), GEOLOGY RELATED TO LAND USE IN THE HENNEPIN REGION FIGURE 2, ILLINOIS STATE GEOLOGICAL SURVEY, CIRCULAR 422, CHAMPAIGN, ILLINOIS.

DRAWN BY/DATE: SDS 8/29/17
REVIEWED BY/DATE: RJK 8/30/17
APPROVED BY/DATE: SJC 9/6/17

GENERALIZED STRATIGRAPHIC COLUMN FOR THE HENNEPIN AREA

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

PROJECT NO: 2414

FIGURE NO: 4

Natural Resource Technology
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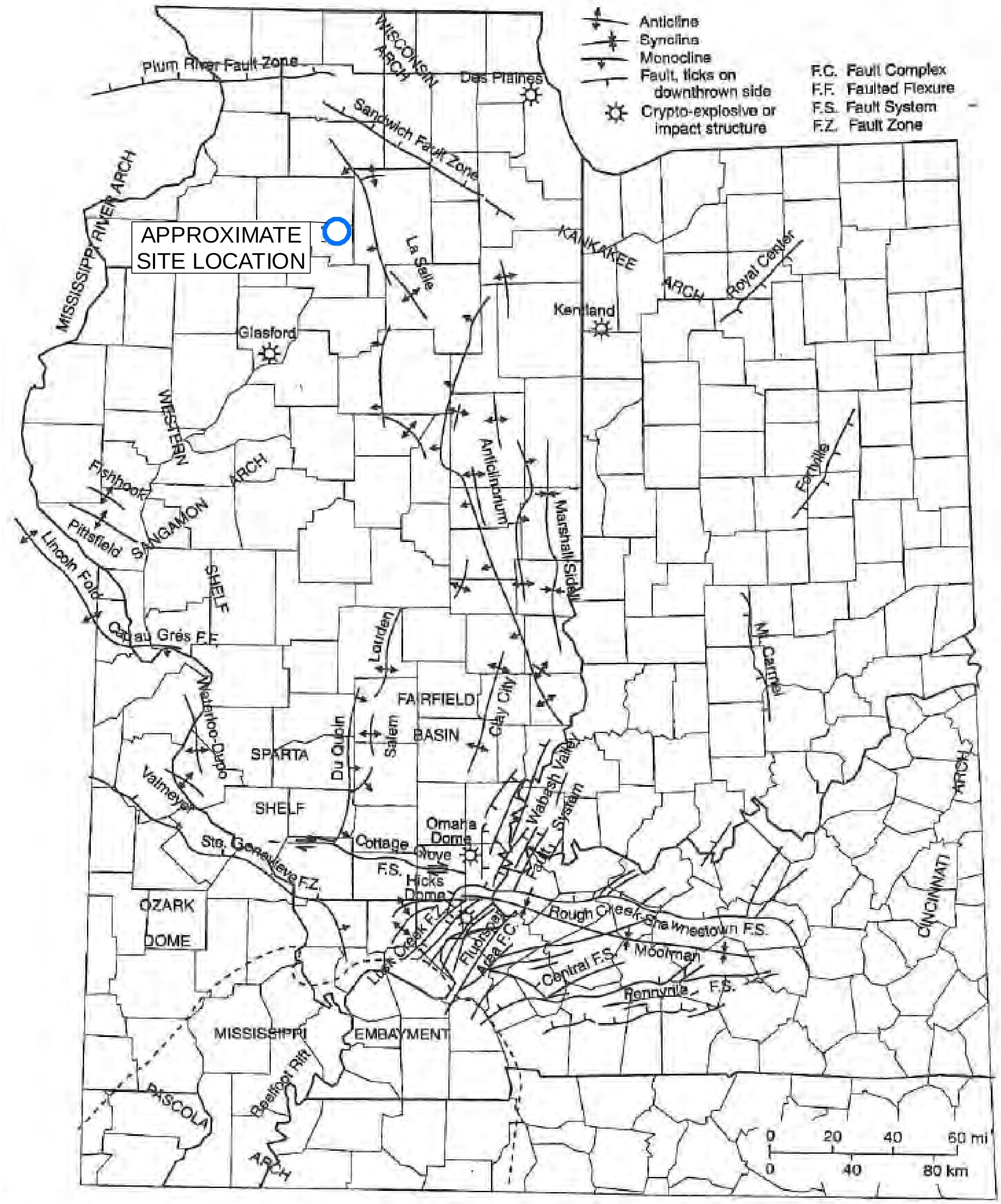
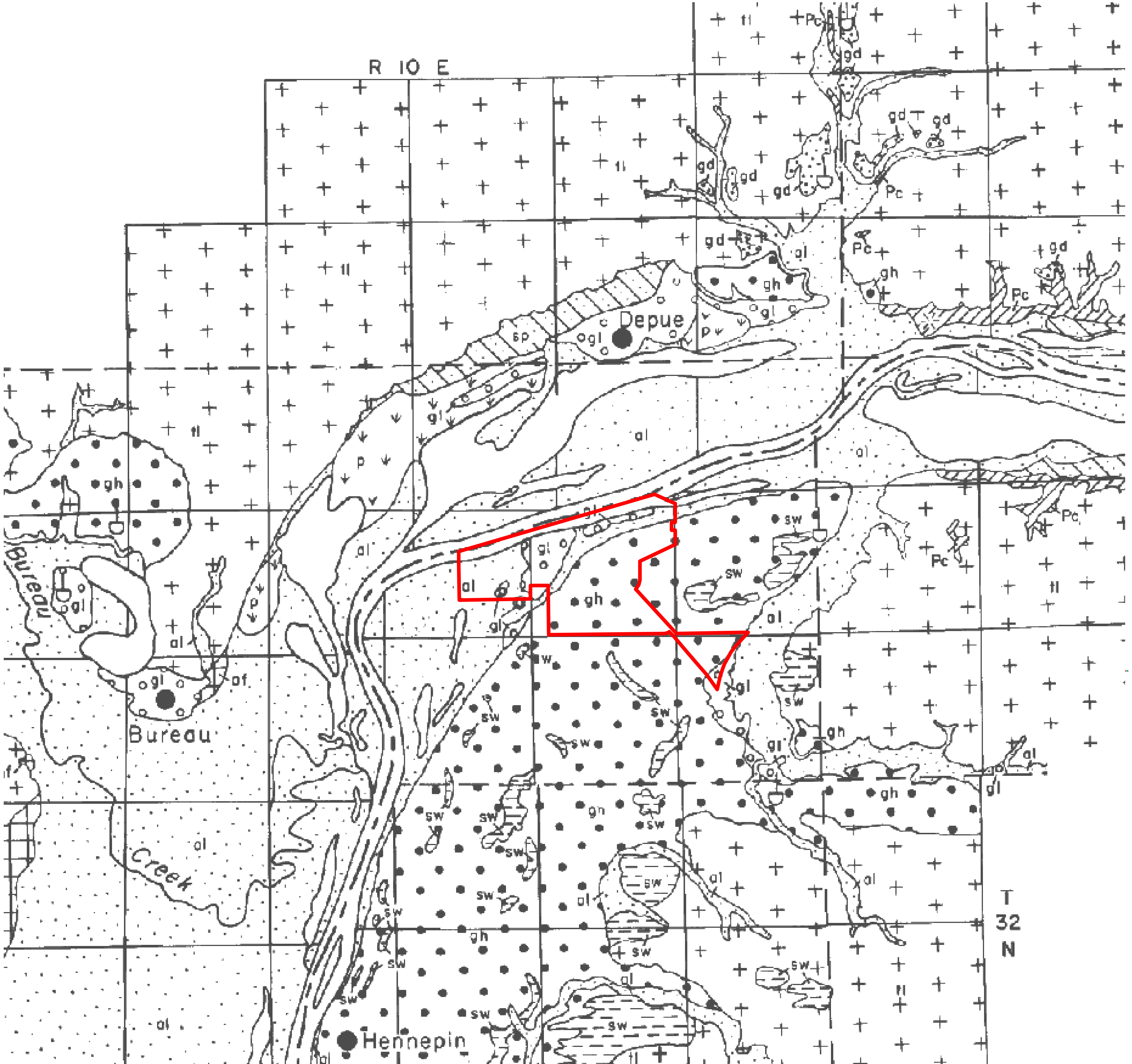


SOURCE NOTE: MODIFIED FROM "NELSON, W.J. 1995, STRUCTURAL FEATURES IN ILLINOIS, ILLINOIS STATE GEOLOGICAL SURVEY, BULLETIN 100, CHAMPAIGN, ILLINOIS.

DRAWN BY/DATE: SDS 8/29/17 REVIEWED BY/DATE: RJK 8/30/17 APPROVED BY/DATE: SJC 9/6/17	MAJOR STRUCTURAL FEATURES OF ILLINOIS HYDROGEOLOGIC SITE CHARACTERIZATION REPORT EAST ASH POND NO. 2 DYNEGY MIDWEST GENERATION, LLC HENNEPIN POWER STATION, HENNEPIN, ILLINOIS	PROJECT NO: 2414 FIGURE NO: 5 Natural Resource Technology AN OBG COMPANY



ALLUVIUM. DEPOSITS OF MODERN RIVERS AND STREAMS IN FLOODPLAINS. LARGELY CLAYEY SILT AND SANDY SILT WITH LENSES OF SAND AND GRAVEL. GENERALLY LESS THAN 20 FEET THICK. IN THE ILLINOIS VALLEY WEST OF STARVED ROCK, IT IS AS MUCH AS 40 FEET THICK AND IT OVERLIES THICK DEPOSITS OF SAND AND GRAVEL OF THE HENRY FORMATION. IN THE ILLINOIS VALLEY EAST OF STARVED ROCK, IT IS LARGELY SAND AND GRAVEL 15–30 FEET THICK UNDER THIN SILT AND IT OVERLIES BEDROCK FORMATIONS. (CAHOKIA ALLUVIUM)

TILL. MOSTLY UNSORTED CALCAREOUS PEBBLY SILTY CLAY DEPOSITED BY GLACIERS. CONTAINS SCATTERED COBBLES AND BOULDERS AND, IN PLACES, LENSES OF SAND AND GRAVEL. GENERALLY 25–50 FEET THICK BUT AS MUCH AS 300 FEET THICK IN DEEP VALLEYS IN THE BEDROCK SURFACE, WHERE IT INCLUDES THE GLASFORD AND BANNER FORMATIONS. THE TILL HAS A THIN COVER OF CLAYEY SILT (RICHLAND LOESS), THE THICKNESS OF WHICH IS SHOWN ON THE SMALL INSET MAP. (WEDRON FORMATION)

HIGH-LEVEL TERRACES UNDERLAIN BY GLACIAL OUTWASH. SURFACES ARE 75–100 FEET ABOVE THE ILLINOIS RIVER. MOSTLY FINE GRAVEL AND PEBBLY SAND, BUT THE UPPER PART IS LOCALLY COARSER AND BOULDERY, AS ALONG ALLFORKS CREEK, NORTHEAST OF HENNEPIN. GENERALLY 10–30 FEET THICK IN THE TRIBUTARY VALLEYS, BUT AS MUCH AS 150–200 FEET THICK IN THE LARGE TERRACE ON WHICH HENNEPIN IS LOCATED. (HENRY FORMATION)

LOW-LEVEL TERRACES UNDERLAIN BY DEPOSITS OF THE CHICAGO OUTLET RIVER. SURFACES ARE COMMONLY 20–40 FEET ABOVE THE ILLINOIS RIVER. MOSTLY FINE TO COARSE GRAVEL, COARSER AND MORE UNIFORMLY SORTED THAN THE HIGH-TERRACE DEPOSITS. LARGELY 20–50 FEET THICK ALONG THE ILLINOIS VALLEY AND 10–20 FEET ALONG TRIBUTARIES. (HENRY FORMATION)

APPROXIMATE PROPERTY BOUNDARY

DRAWN BY/DATE: SDS 8/29/17
REVIEWED BY/DATE: RJK 8/30/17
APPROVED BY/DATE: SJC 9/6/17

SURFICIAL GEOLOGIC DEPOSITS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

PROJECT NO: 2414

FIGURE NO: 6

Natural Resource Technology
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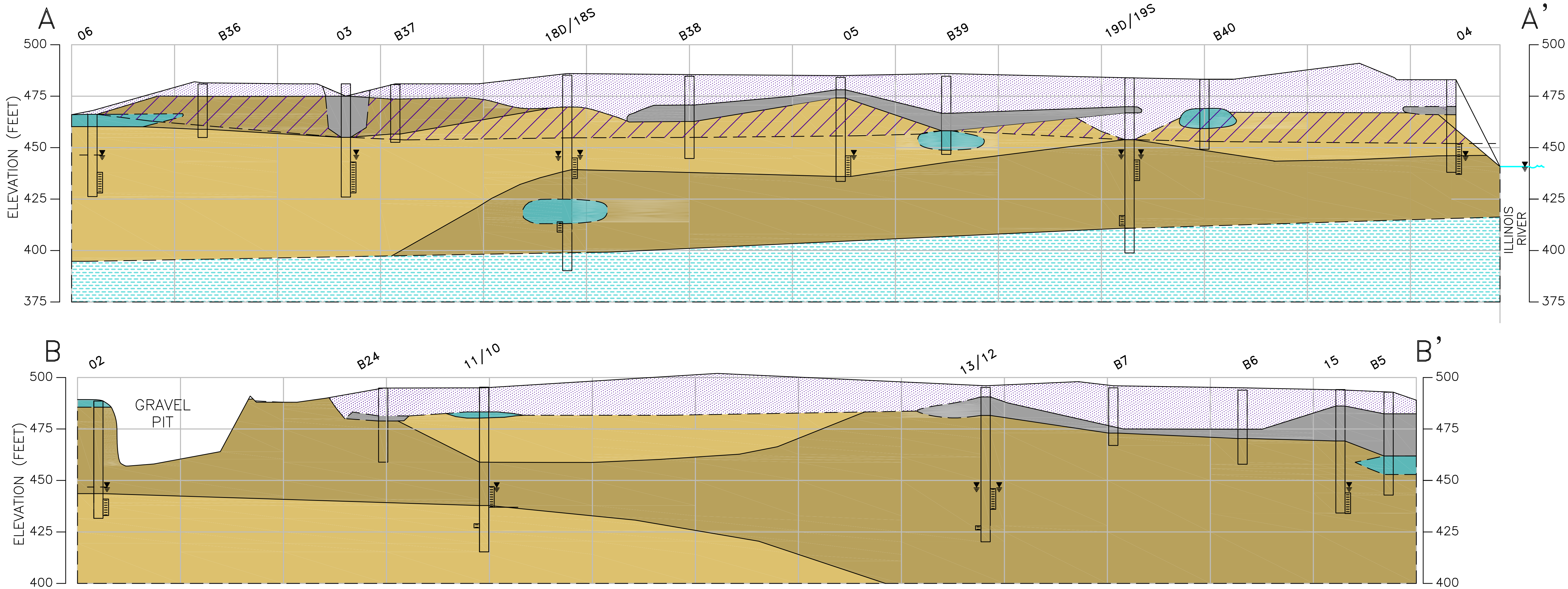
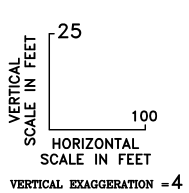
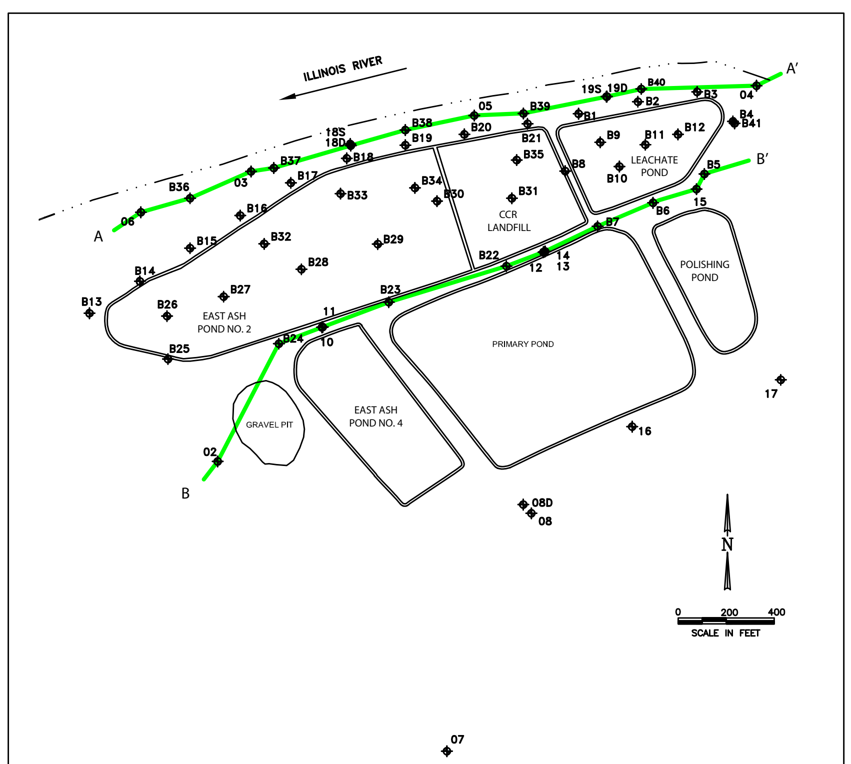


LEGEND

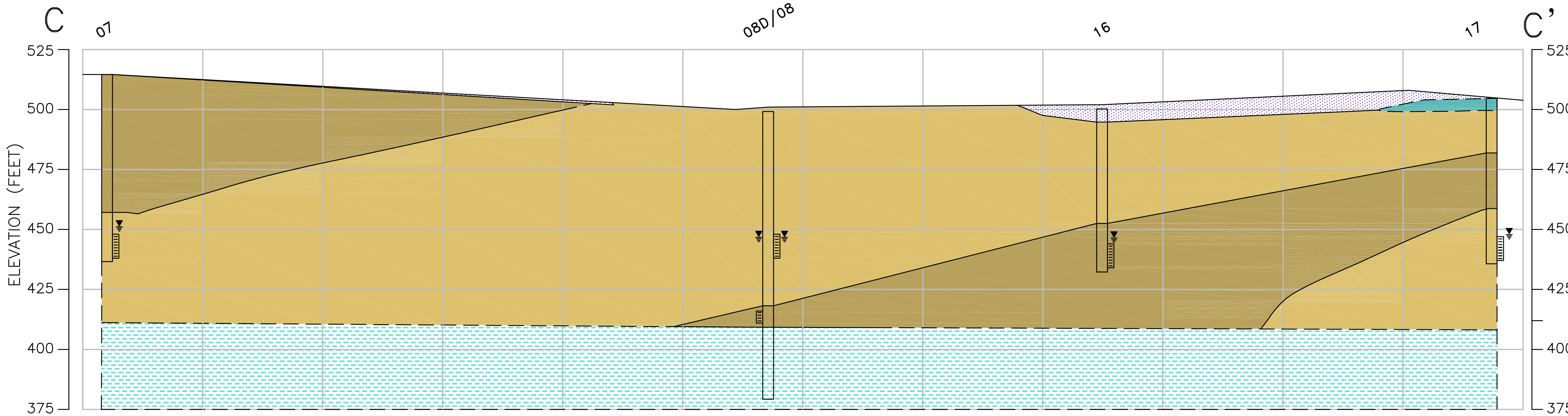
- SEPTEMBER 2009 WATER TABLE ELEVATION
- COAL ASH
- FILL
- PROBABLE FILL
- SAND AND GRAVEL
- SAND AND GRAVEL WITH FINES
- SILT/CLAY
- SHALE





Note: Cross-sections are based on data collected through 2009 and do not represent or include any subsequent changes due to grading, landfill construction, or other site activities. Cross-sections are modified from the following report: Natural Resource Technology and Kelron Environmental; December 19, 2010. New Coal Combustion Waste (CCW) Landfill, Initial Facility Report, Hydrogeologic Studies and Evaluations, Section 25 Hydrogeological Investigation, Hennepin Power Station, Hennepin, Illinois.

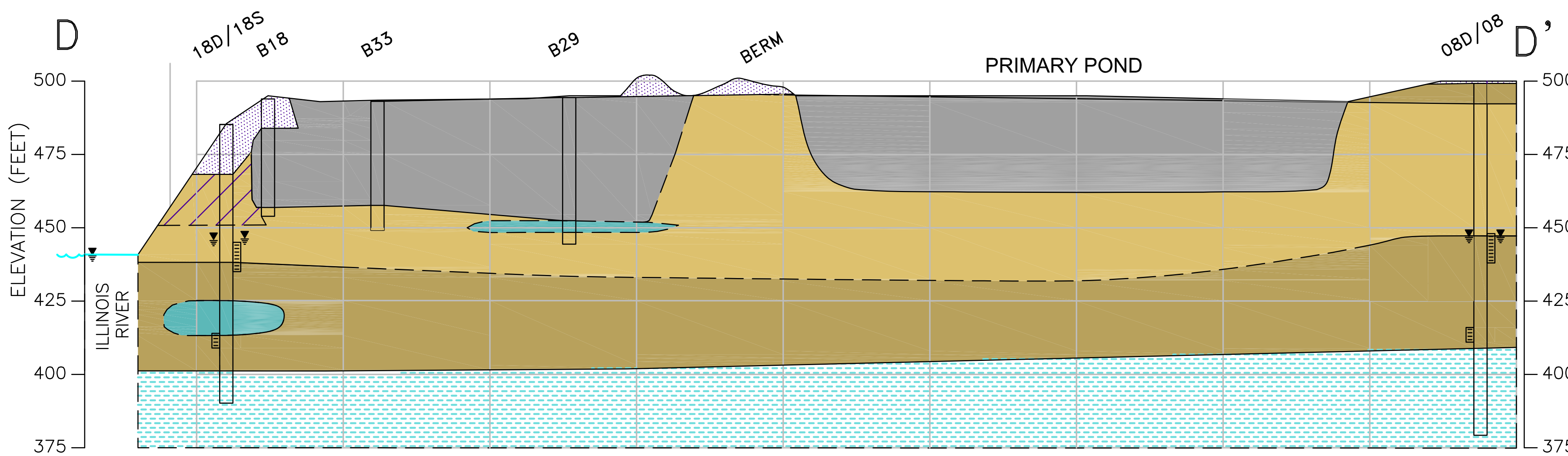
Natural Resource Technology AN OBG COMPANY	PROJECT NO. 1940/3.0	GEOLOGIC CROSS SECTIONS A-A' AND B-B'
	DRAWN BY: KNW 09/27/10	HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
	CHECKED BY: BGH 12/08/10	EAST ASH POND NO. 2
FIGURE NO. 7	APPROVED BY: BRH 12/08/10	DYNEGY MIDWEST GENERATION, LLC HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

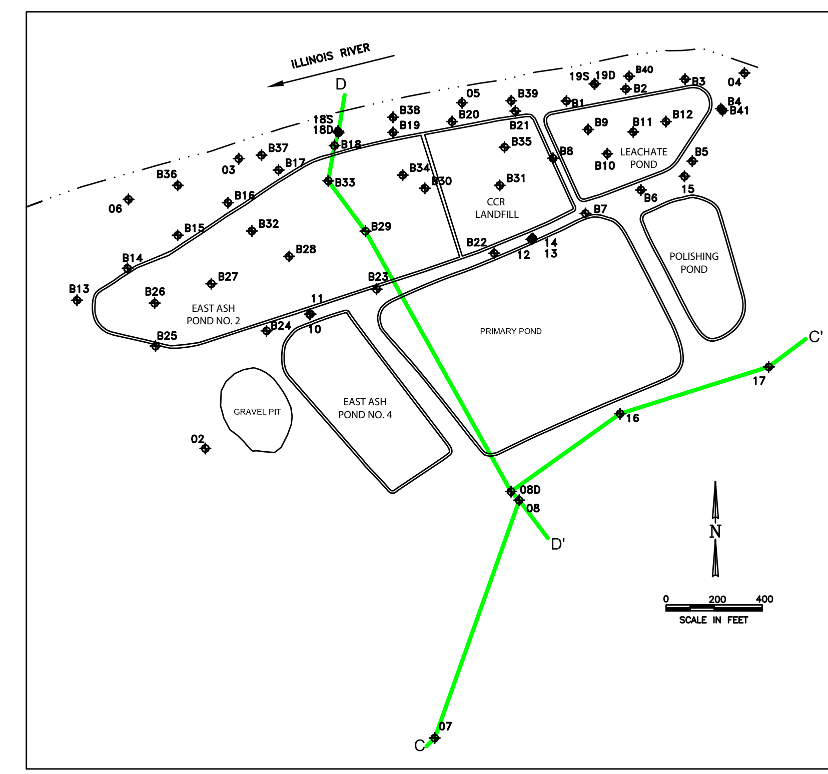


LEGEND

GROUNDWATER ELEVATION SEPTEMBER 2009
COAL ASH
FILL
PROBABLE FILL
SAND AND GRAVEL
SAND AND GRAVEL WITH FINES
SILT/CLAY
SHALE

VERTICAL SCALE IN FEET 25
HORIZONTAL SCALE IN FEET 100
VERTICAL EXAGGERATION = 4





Note: Cross-sections are based on data collected through 2009 and do not represent or include any subsequent changes due to grading, landfill construction, or other site activities. Cross-sections are modified from the following report: Natural Resource Technology and Kelron Environmental; December 19, 2010. New Coal Combustion Waste (CCW) Landfill, Initial Facility Report, Hydrogeologic Studies and Evaluations, Section 25 Hydrogeological Investigation, Hennepin Power Station, Hennepin, Illinois.

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FIGURE NO. 8

PROJECT NO.	1940/3.0
DRAWN BY:	KNW 09/27/10
CHECKED BY:	BGH 12/08/10
APPROVED BY:	BRH 12/08/10

GEOLOGIC CROSS SECTIONS C-C' AND D-D'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

DRAWN BY/DATE: SDS 8/29/17
REVIEWED BY/DATE: RJK 8/30/17
APPROVED BY/DATE: SJC 9/6/17

MONITORING WELL LOCATION MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

PROJECT NO: 2414

FIGURE NO: 9

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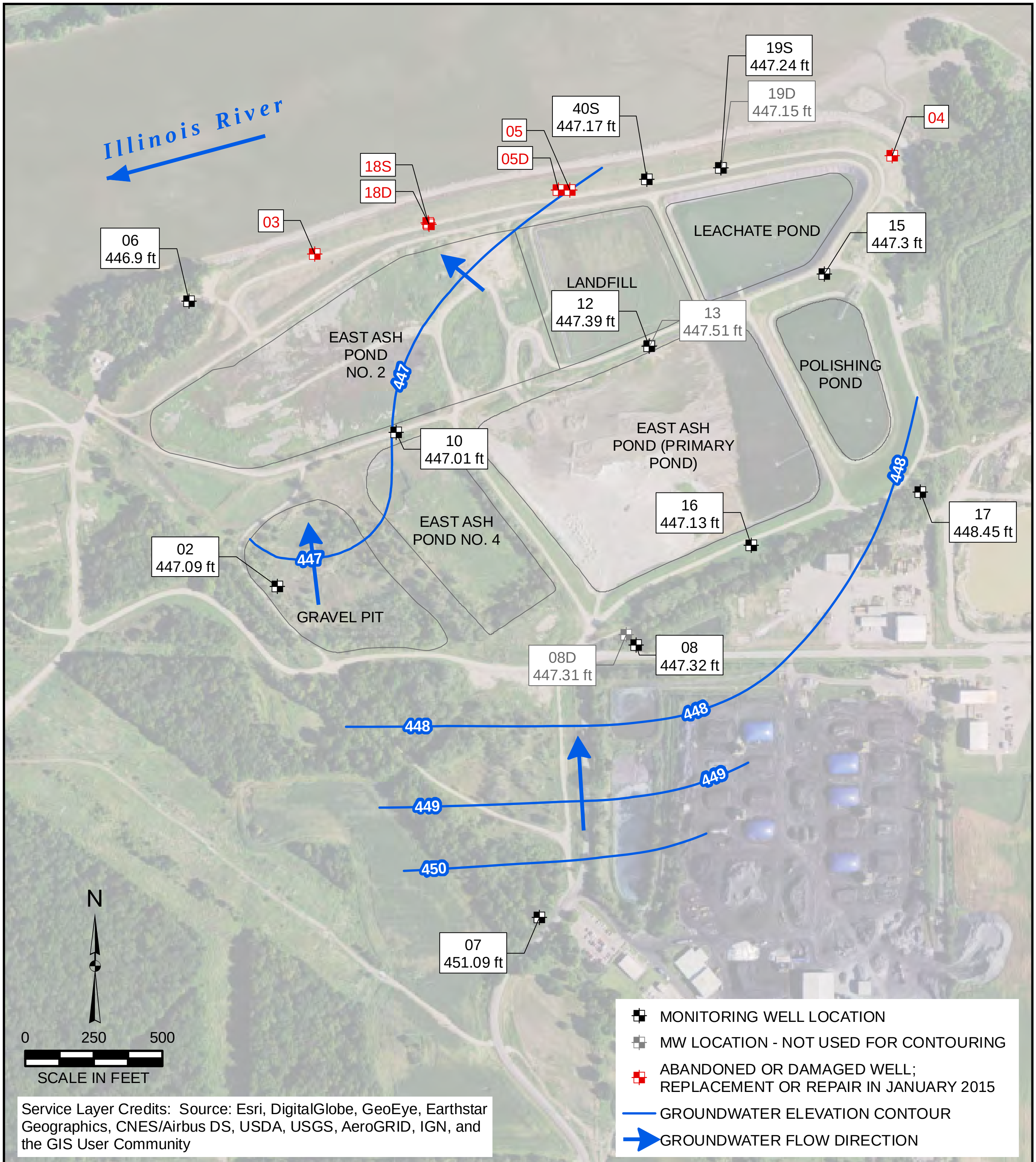
Y:\Mapping\Projects\24\2414\MXD\hgsc\Figure 9_Monitoring Well Location Map.mxd Author: stolzsd; Date/Time: 1/3/2018, 1:15:49 PM



DRAWN BY/DATE:
SDS 8/29/17
REVIEWED BY/DATE:
RJK 8/30/17
APPROVED BY/DATE:
SJC 9/6/17

GROUNDWATER ELEVATION CONTOURS
DECEMBER 9, 2014

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

PROJECT NO: 2414

FIGURE NO: 10

Natural Resource Technology
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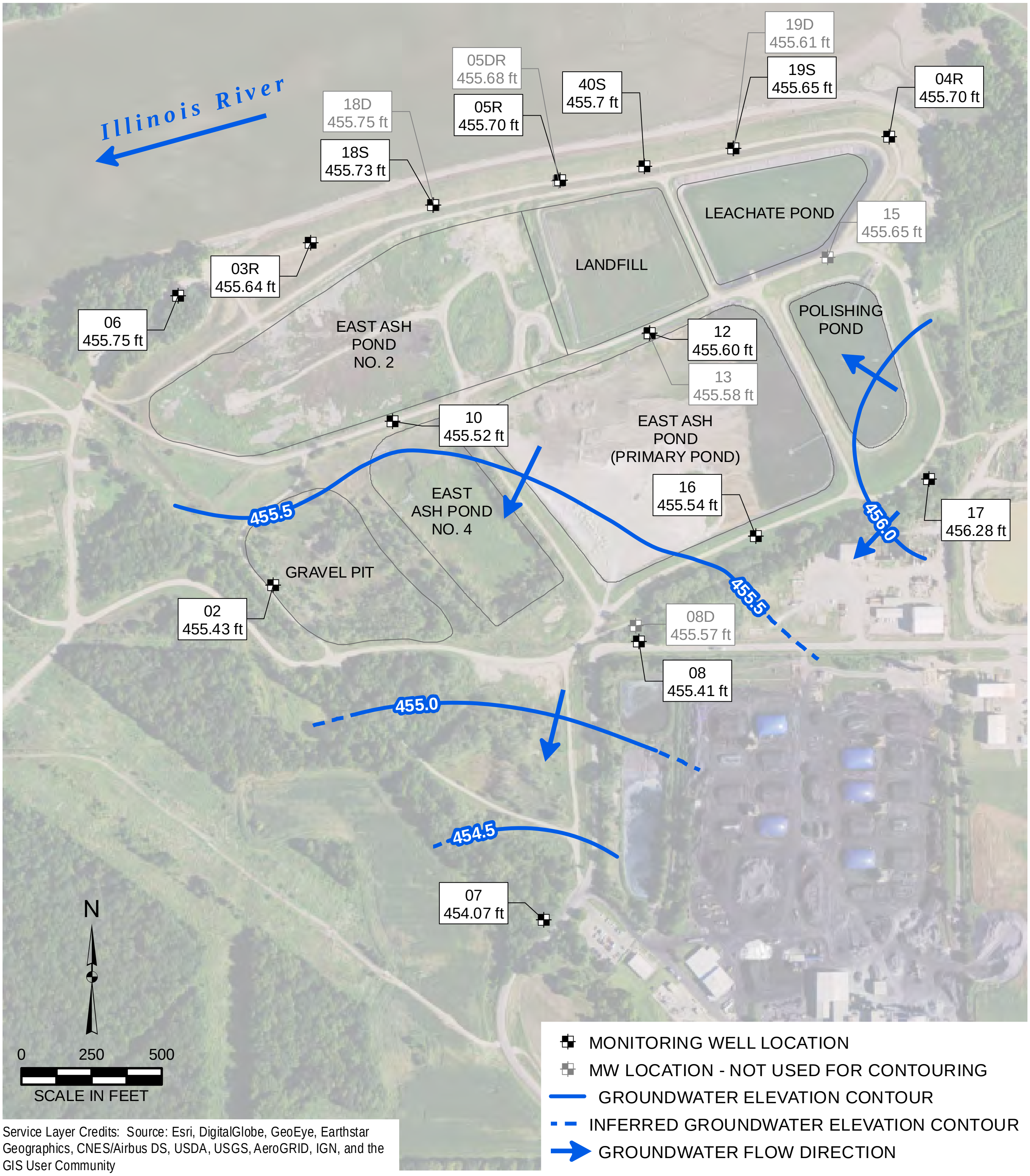


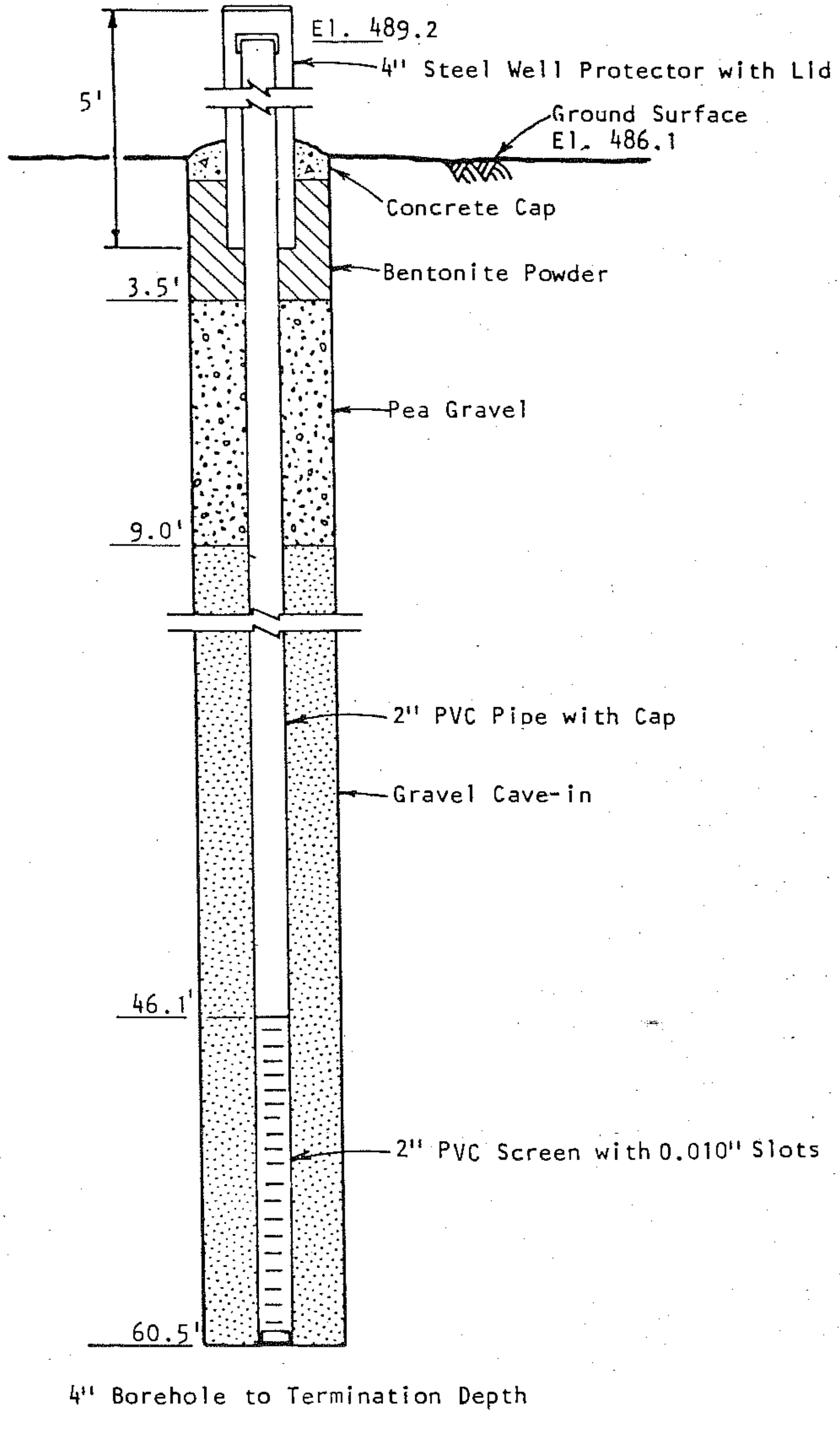
DRAWN BY/DATE: SDS 8/29/17 REVIEWED BY/DATE: RJK 8/30/17 APPROVED BY/DATE: SJC 9/6/17	**GROUNDWATER ELEVATION CONTOURS** **JUNE 22-23, 2015** HYDROGEOLOGIC SITE CHARACTERIZATION REPORT EAST ASH POND NO. 2 DYNEGY MIDWEST GENERATION, LLC HENNEPIN POWER STATION, HENNEPIN, ILLINOIS	PROJECT NO: 2414 FIGURE NO: 11 Natural Resource Technology AN OBG COMPANY

Appendix A

Boring and Well Construction Logs

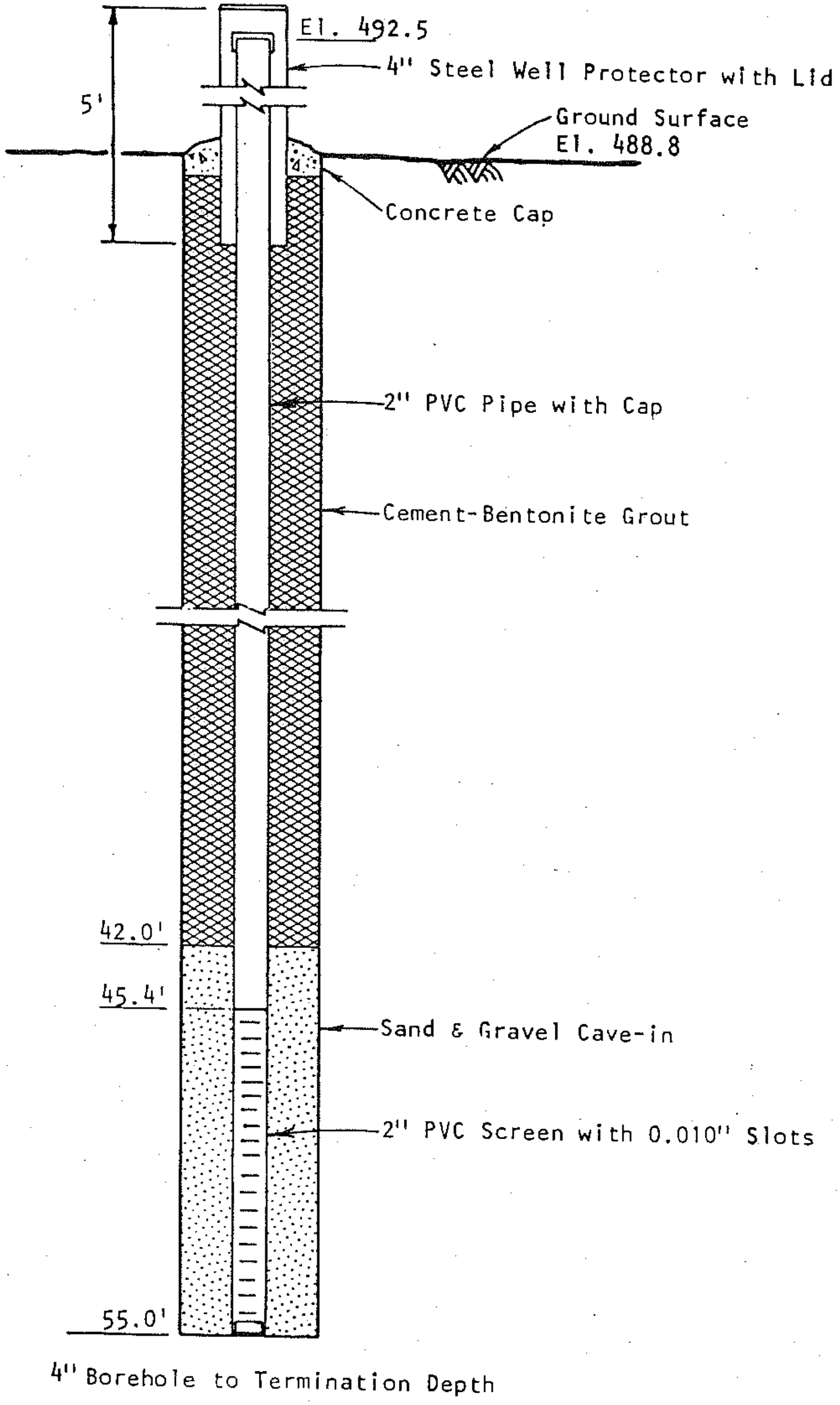
Appendix A1

MATHES Boring Logs and Well Details



Not to Scale

PIEZOMETER E-1



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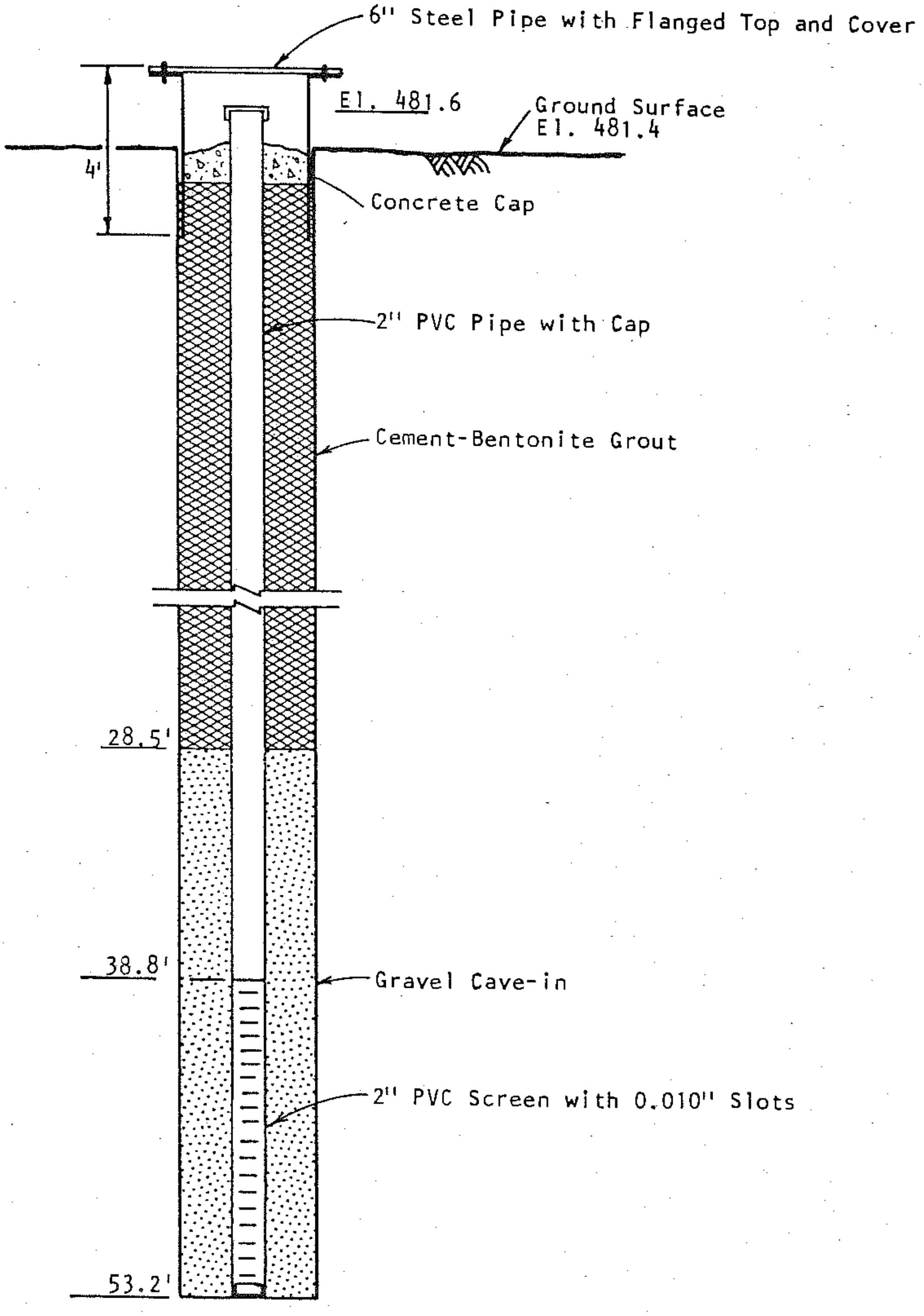
PIEZOMETER E-2

John Mathes & Associates, Inc.

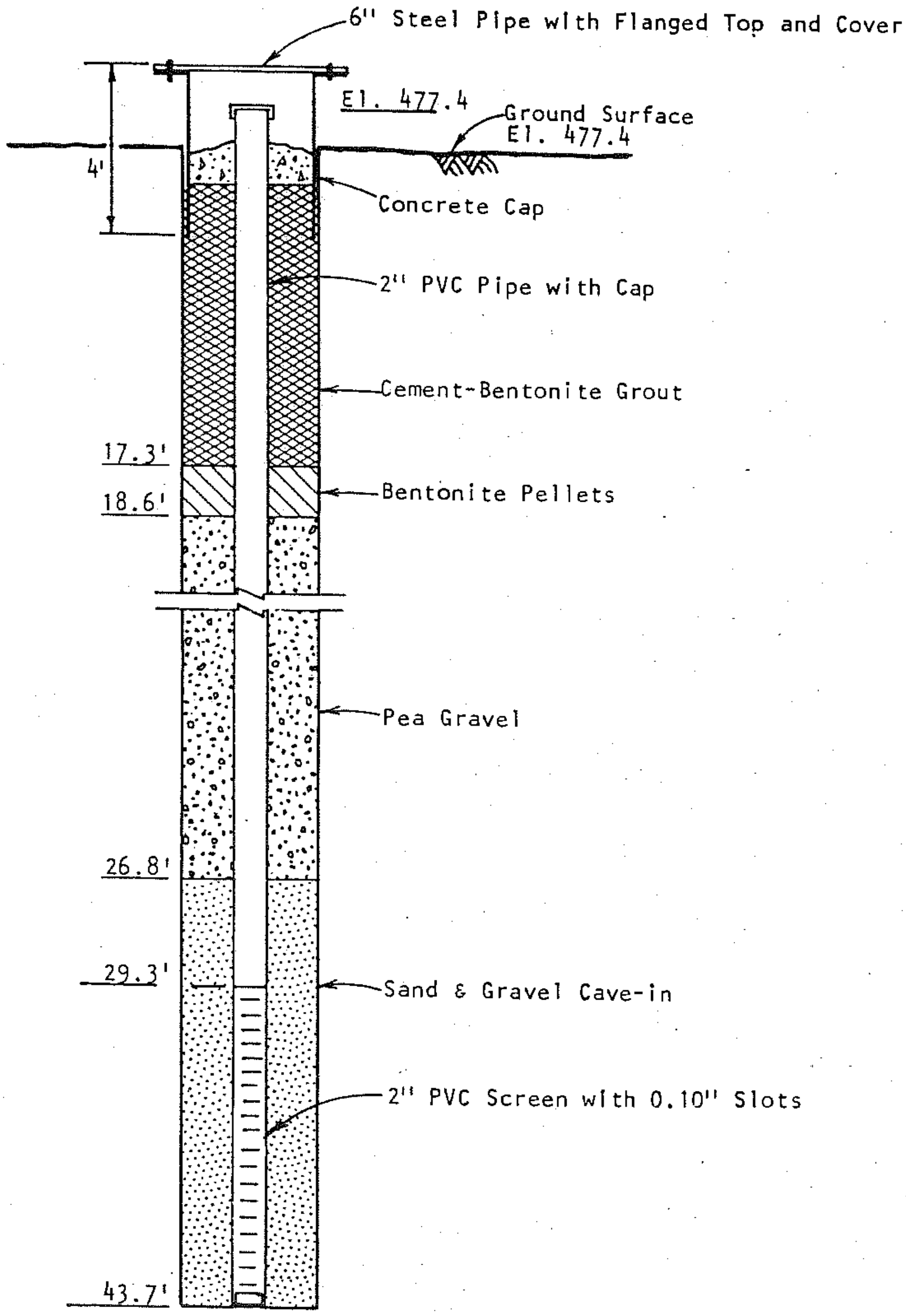


6" Borehole to Termination Depth

Not to Scale

PIEZOMETER E-3

John Mathes & Associates, Inc.

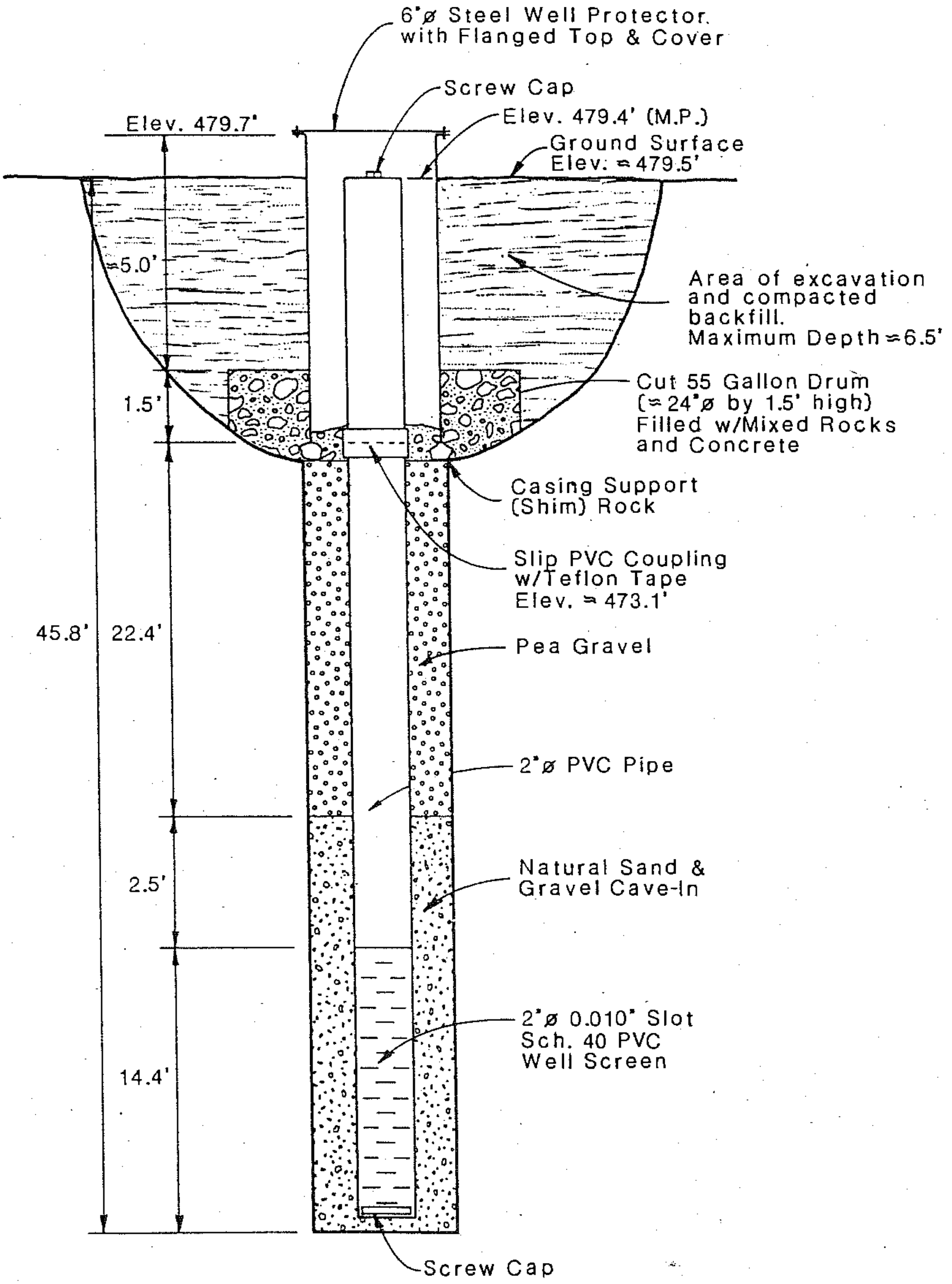


6" Borehole to Termination Depth

Not to Scale

PIEZOMETER E-4

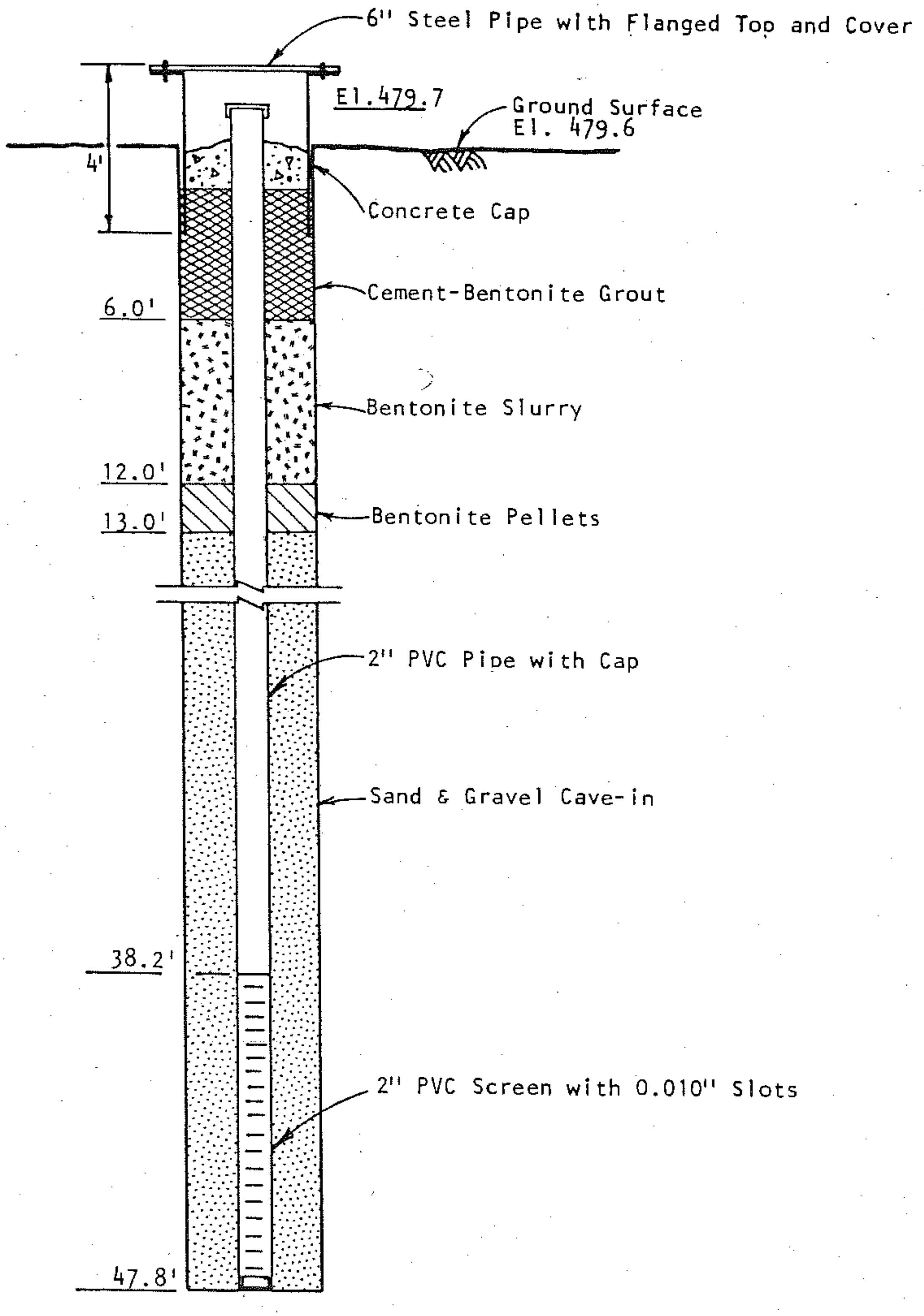
John Mathes & Associates, Inc.



Not To Scale

PIEZOMETER E-4
(Modified)

John Mathes & Associates, Inc.

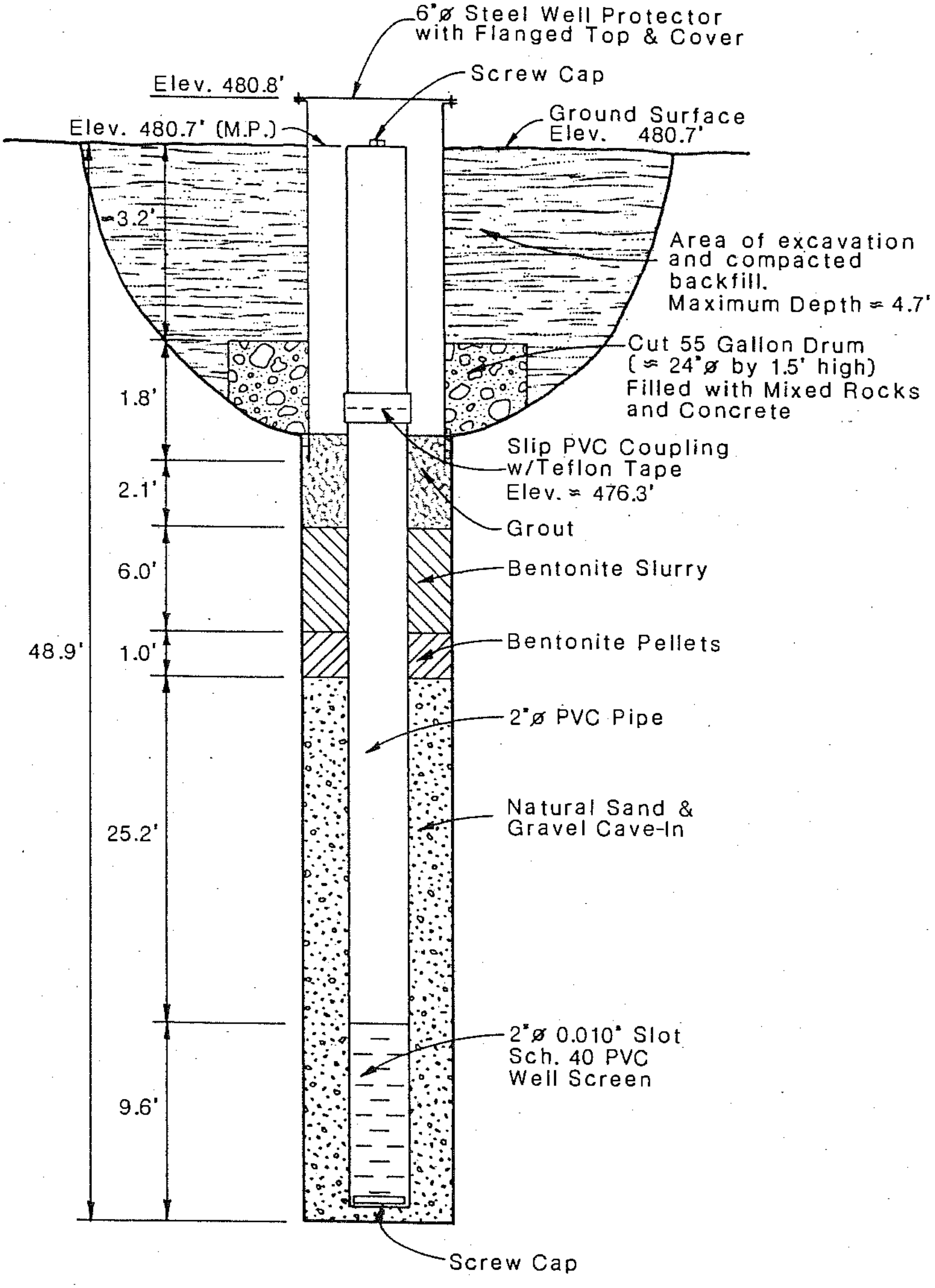


6" Borehole to Termination Depth
Borehole Enlarged to 12" in Upper Zones

Not to Scale

PIEZOMETER E-5

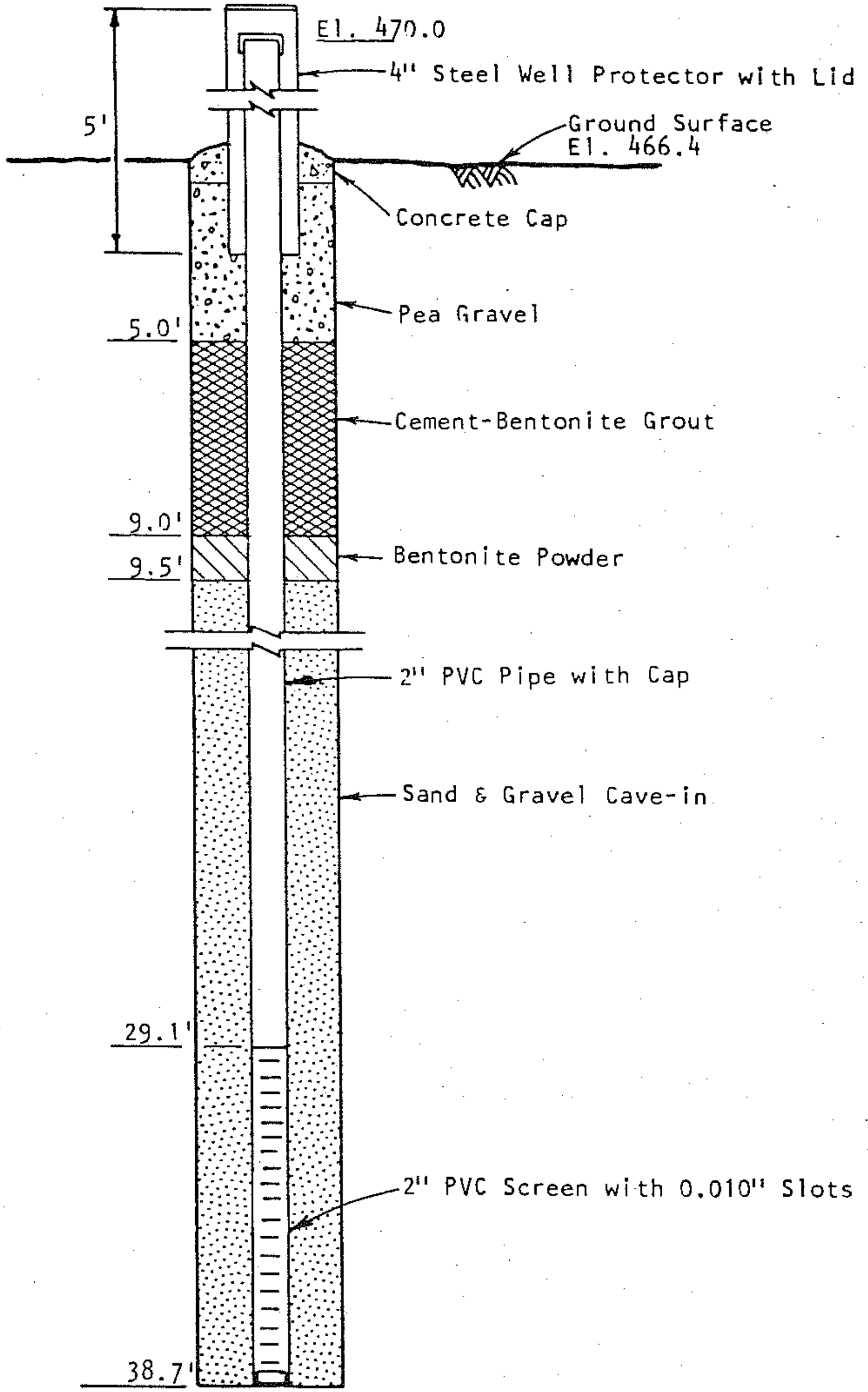
John Mathes & Associates, Inc.



Not To Scale

PIEZOMETER E-5
(Modified)

John Mathes & Associates, Inc.



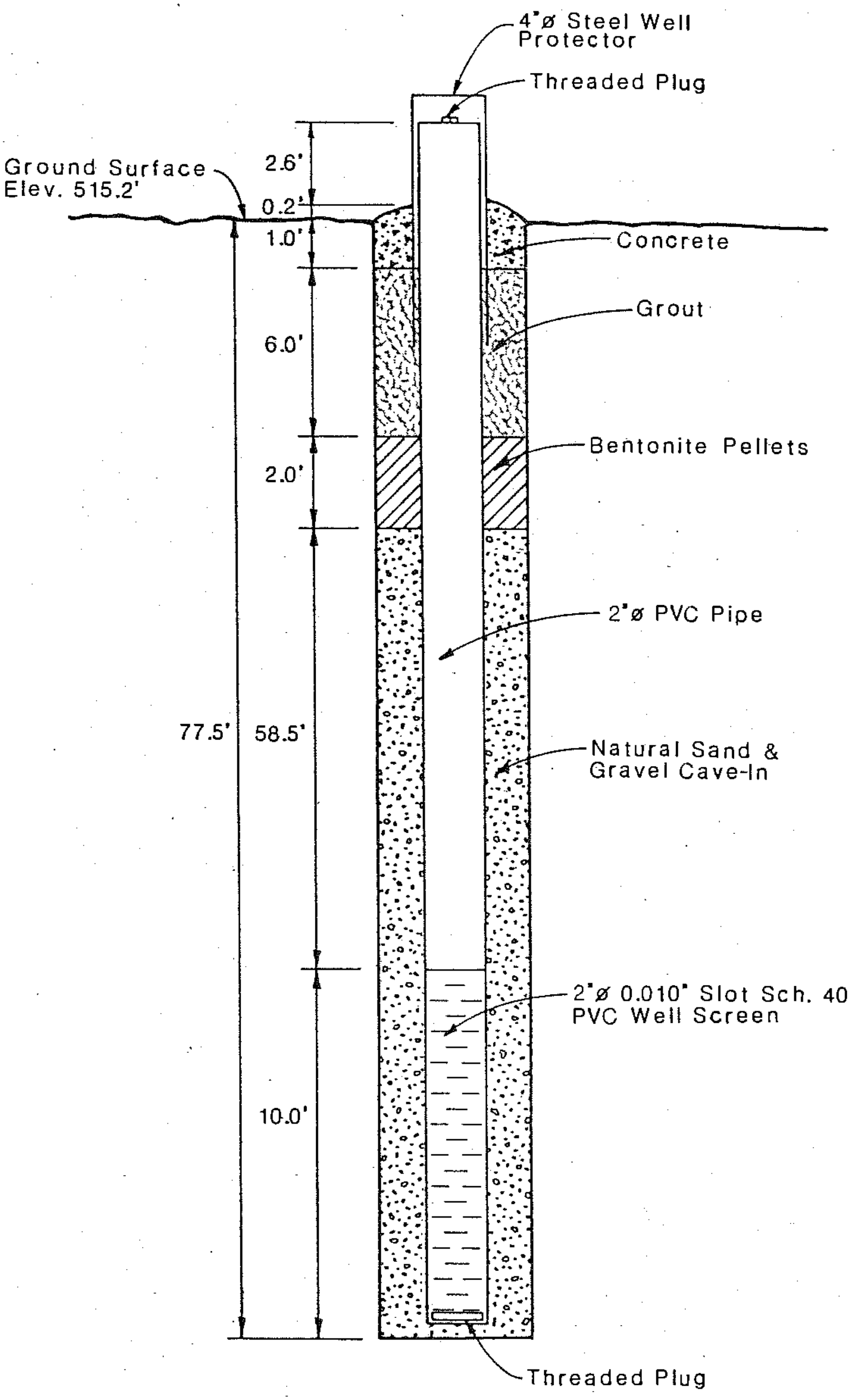
6" Borehole to Termination Depth

Not to Scale

PIEZOMETER E-6

John Mathes & Associates, Inc.

PLATE 14



Not To Scale

PIEZOMETER E-7

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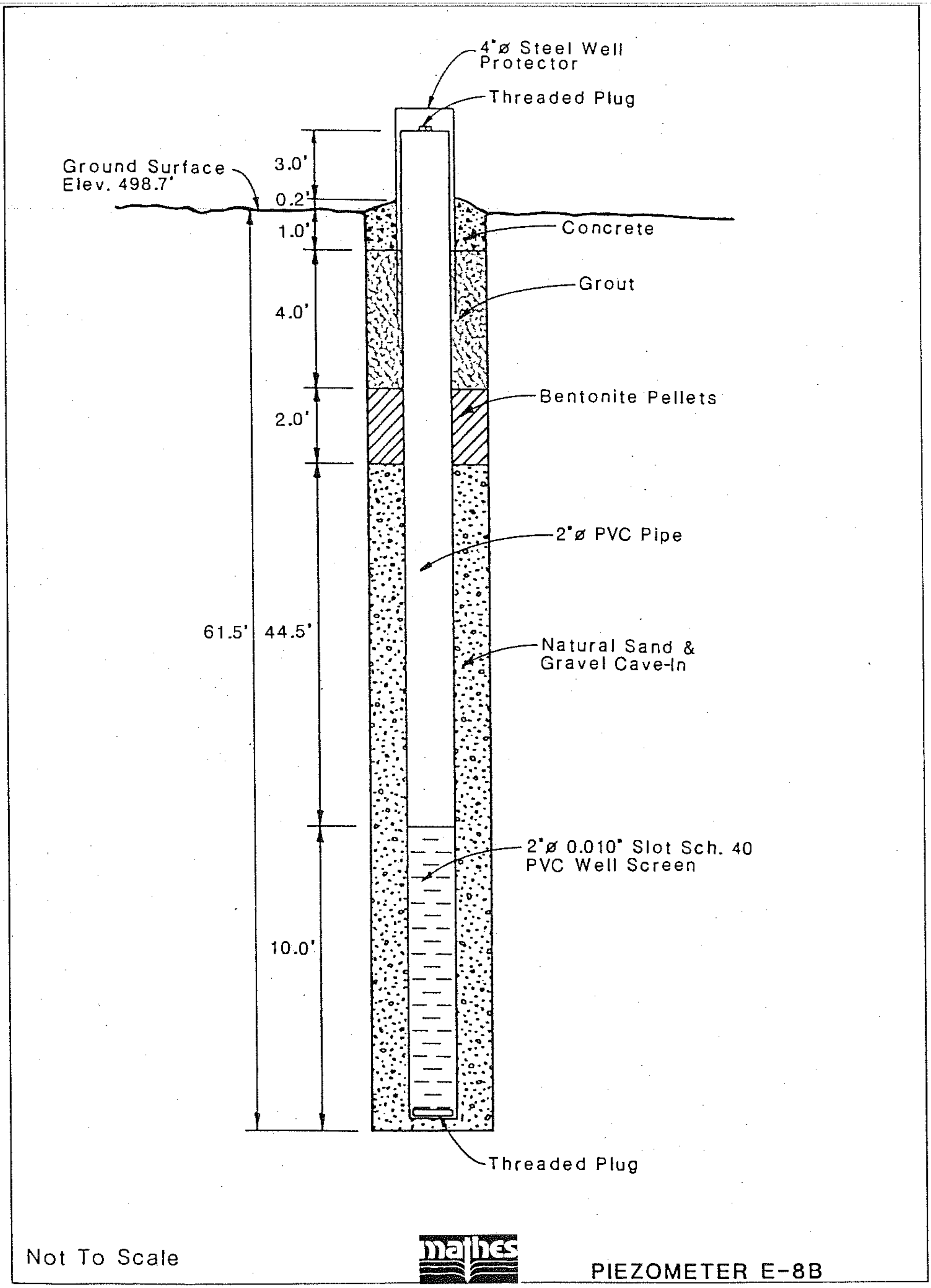

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Hennepin Power Plant

JOB NO. 82-1293

BORING E-1

SHEET 1 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 486.1'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½; PL NMC LL 0 50 100; Rock Quality Designation 0 50 100
					Brown Silty CLAY w/Sand, CL			
					Brown Sandy CLAY w/Silt, Gravel, CL			
5	1	SS	30/20	1	Gray-Brown GRAVEL w/Sand Trace Clay, GP	10-24-34		
10	2	SS	18/12			38-31-14		
15	3	SS	18/5			11-44-36		
20	4	SS	18/13			16-16-17		
					-Sand Seam 22.5-23.5'			
25	5	SS	18/6			9-10-14		
30	6	SS	18/12			10-10-9		
35	7	SS	18/4			9-17-16		

DRILLING METHOD NW Casing Advancer

DATE DRILLED 11/23, 24/82

DRILLED BY Roberts

LOGGED BY Maxeiner

PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at 39.3 Feet

15 Hours after completion 39.7 Feet

22 Days after completion 31.9 Feet

___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

mathes

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant
JOB NO. 82-1293

BORING E-1
SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 486.1'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
	7	SS			Gray-Brown GRAVEL w/Sand Trace Clay, GP			
40	8	SS	18/9			8-11-8		
45	9	SS	18/8			8-9-8		
50	10	SS	18/3			6-17-20		
55	11	SS	18/3			15-19-21		
60	12	SS	15/7		TOB ≈ 426.0'	13-16-100/3"		
65								

Remarks:
1. Sample was driven 30" Blow counts are for the first 3-6" increments.

DRILLING METHOD NW Casing Advancer
DATE DRILLED 11/23, 24/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at 39.3 Feet
15 Hours after completion 39.7 Feet
22 Days after completion 31.9 Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

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RECORD OF SUBSURFACE EXPLORATION

PROJECT: Hydrogeologic Study
Hennepin Power Plant
JOB NO. 82-1293

BORING E-2
SHEET 1 OF 2

DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification)
Soil Classification System: Unified
Surface Elevation: 488.8'

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf / PL NMC LL / Rock Quality Designation
0–2					Brown Silty CLAY, CL			
2–8					Brown GRAVEL w/ Sand, Clay, GC			
5	1	SS	18/4			5-2-22		
8–23					Brown Medium-Coarse SAND w/ Gravel, Clay, SC			
10	2	SS	18/12			10-23-19		
15	3	SS	18/8			15-14-11		
20	4	SS	18/10			8-17-12		
23–30					Gray-Brown GRAVEL w/Sand, GP			
25	5	SS	18/5			49-27-25		
30	6	SS	18/8		Gray-Brown Fine SAND Trace Silt, SP-SM	15-12-9		
35	7	SS	18/14			7-10-13		

DRILLING METHOD: NW Casing Advancer
DATE DRILLED: 11/24, 29/82
DRILLED BY: Roberts
LOGGED BY: Maxeiner
PIEZOMETER: Yes

GROUNDWATER LEVELS
Encountered at ____ Feet
15 Hours after completion 42.1 Feet
17 Days after completion 34.3 Feet
____ after completion ____ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

PROJECT Hydrogeologic Study
Hennepin Power Plant
JOB NO. 82-1293

BORING E-2
SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 488.8'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ OU/2○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
	7	SS	18/14		Gray-Brown Fine SAND Trace Silt, SP-SM	7-10-13		
40	8	SS	18/18		-Clay Seam 40.2-41.1'	5-8-10		
					Brown Silty Fine SAND, SM			
					-Black Peat @ 45.3'			
45	9	SS	18/10		Gray-Brown Sandy GRAVEL Trace Clay, GP	8-9-10		
50	10	SS	18/8			34-29-32		
					Brown Medium SAND Trace Coarse, SP			
55	11	SS	18/6		TOB ~ 433.0'	5-18-16		
60								

DRILLING METHOD NW Casing Advancer
DATE DRILLED 11/24, 29/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at — Feet
15 Hours after completion 42.1 Feet
17 Days after completion 34.3 Feet
— after completion — Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant
JOB NO. 82-1293

BORING E-3
SHEET 1 OF 2

Soil Classification System: Unified
Surface Elevation: 481.4'

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification)	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf / PL NMC LL / Rock Quality Designation
					Brown GRAVEL w/Sand Trace Clay, FILL, GP			
5	1	SS	18/12			7-27-32		
					Dark Gray FLYASH, FILL, ML.			
10	2	SS	18/15			3-5-5		
					Dark Gray Brown Fine SAND w/Flyash, FILL, SP			
15	3	SS	18/4			3-5-10		
					Dark Gray FLYASH w/Bottom Ash, FILL, ML			
20	4	SS	18/15			4-8-14		
25	5	SS	18/16			11-23-19		
					Gray-Brown Sandy GRAVEL, GP			
30	6	SS	18/13			16-30-40		
					Gray-Brown GRAVEL w/Sand Trace Clay, GP-GC			
35	7	SS	18/15			27-49-29		

DRILLING METHOD Hollow Auger
DATE DRILLED 12/1/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at 34.6 Feet
0 Hours after completion 38.0 Feet
15 Days after completion 27.8 Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant
JOB NO. 82-1293

BORING E-3
SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL, Classification) Soil Classification System Unified; Surface Elevation 481.4'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf (SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½); PL + NMC • LL x (0 50 100); Rock Quality Designation (0 50 100)
	7	SS			Gray-Brown GRAVEL w/Sand Trace Clay, GP-GC			
40	8	SS	18/11			12-11-11		
45	9	SS	18/8			6-8-8		
50	10	SS	18/5			6-7-9		
55	11	SS	18/8		TOB ~426.0'	11-10-11		
60								

DRILLING METHOD Hollow Auger
DATE DRILLED 12/1/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at 34.6 Feet
0 Hours after completion 38.0 Feet
15 Days after completion 27.8 Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

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RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant

JOB NO. 82-1293

BORING E-4
SHEET 1 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 477.4'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
	1	AS			Gray-Brown GRAVEL w/Sand Trace Clay, FILL, GP			
5	2	SS	18/18		Dark Gray Silty CLAY Trace Coal, Gravel, FILL, CL	8-12-15		
					Gray-Brown Clayey SILT w/Sand Trace Gravel, FILL, ML			
10	3	SS	18/15			4-6-12		
					Gray GRAVEL w/Silt, Clay Trace FlyAsh, Fill, GC			
15	4	SS	18/15		Gray FLYASH, FILL, ML	19-19-18		
					Brown Fine SAND w/Gravel, SP			
20	5	SS	18/6			3-22-31		
					Gray-Brown Sandy GRAVEL, GP			
25	6	SS	18/13			15-15-15		
					Gray-Brown GRAVEL w/Sand Trace Clay, GP			
30	7	SS	18/18			14-33-38		
					Gray-Brown Sandy GRAVEL, GP			
35	8	SS	18/16			8-28-41		

DRILLING METHOD Hollow Auger
DATE DRILLED 12/23/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at 28.9 Feet
0 Hours after completion 27.0 Feet
13 Days after completion 24.5 Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant
JOB NO. 82-1293

BORING E-4
SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 477.4'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
	8	SS			Gray-Brown Sandy GRAVEL, GP			
					Gray-Brown GRAVEL w/Sand, Silt, GM			
40	9	SS	18/7			5-9-13		
					Gray CLAY, CH			
45	10	SS	15/9		TOB ~432.0'	32-50-50/3"		•
50								

DRILLING METHOD Hollow Auger
DATE DRILLED 12/23/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at 28.9 Feet
0 Hours after completion 27.0 Feet
13 Days after completion 24.5 Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT: Hydrogeologic Study, Hennepin Power Plant
JOB NO. 82-1293

BORING E-5
SHEET 1 OF 2

Soil Classification System: Unified
Surface Elevation: 479.6'

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification)	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Gray-Brown Gravel w/Sand Trace Clay, FILL, GP		
5	1	SS	18/8			5-14-19	
					Gray FLYASH w/Bottom Ash, Fill, ML		
10	2	SS	18/12			4-5-5	
				1	Brown Silty Fine SAND w/Gravel, SM		
15	3	SS	18/13		Gray-Brown Gravel w/Sand, GP	4-14-10	
	3A	AS			Brown Clayey SAND, SC		
					Brown Fine SAND, SP		
20	4	SS	18/3		Gray-Brown Sandy Gravel, GP	8-24-49	
25	5	SS	18/10			6-32-27	
30	6	SS	14/11			8-34-50/2"	
					Gray-Brown Fine-Medium SAND SP		
35	7	SS	18/16		Gray-Brown GRAVEL w/Sand, Silt, GP-GM	12-12-20	

Shear Strength, tsf: SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½
PL + NMC • LL x 0 50 100
Rock Quality Designation 0 50 100

DRILLING METHOD: Hollow Auger
DATE DRILLED: 12/6/82
DRILLED BY: Roberts
LOGGED BY: Maxeiner
PIEZOMETER: Yes

GROUNDWATER LEVELS

Encountered at 27.3 Feet
0 Hours after completion 29.0 Feet
16 Hrs. after completion 23.3 Feet
10 Days after completion 25.7 Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant
JOB NO. 82-1293

BORING E-5
SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 479.6'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf: SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC ● LL x 0 50 100; Rock Quality Designation 0 50 100
	7	SS			Gray-Brown GRAVEL w/Sand, Silt GP-GM			
40	8	SS	18/15		Gray-Brown Silty GRAVEL w/SAND, GM	15-45-16		
45	9	SS	18/11		Brown GRAVEL w/Sand Trace Silt GP-GM	3-9-12		
50	10	SS	18/6		~ 429.0' TOB	2-10-11		
55								

Remarks:
1. Rough Drilling @ 11.5' Boulders could not penetrate offset 7.0' East & Augered to 14.0' without sampling.

DRILLING METHOD Hollow Auger
DATE DRILLED 12/6/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at 27.3 Feet
0 Hours after completion 29.0 Feet
16 Hrs. after completion 23.3 Feet
10 Days after completion 25.7 Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT: Hydrogeologic Study
Hennepin Power Plant

JOB NO. 82-1293

BORING E-6

SHEET 1 OF 2

DESCRIPTION OF MATERIALS (Color Modifier MATERIAL, Classification)

Soil Classification System: Unified

Surface Elevation: 466.4'

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf (SV△ QP/2□ QU/2○: 0 ½ 1 1½ 2 2½); PL + NMC • LL x (0 50 100); Rock Quality Designation (0 50 100)
	1	AS			Dark Brown Silty CLAY w/Sand, CL			
5	2	SS	18/8		Brown Sandy CLAY w/Gravel, CL	3-3-2		
					Gray-Brown Sandy GRAVEL, GP			
10	3	SS	18/9			12-12-13		
15	4	SS	18/10		Gray-Brown GRAVEL w/Sand Trace Clay, GP	9-30-35		
20	5	~~SS~~	4/4			50/4"		
25	6	SS	18/6			5-10-14		
30	7	SS	18/4			3-5-7		
35	8	SS	18/7			5-7-12		

DRILLING METHOD: Hollow Auger
DATE DRILLED: 12/8/82
DRILLED BY: Roberts
LOGGED BY: Maxeiner
PIEZOMETER: Yes

GROUNDWATER LEVELS

Encountered at 18.0 Feet
___ Hours after completion ___ Feet
8 Days after completion 12.4 Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant

JOB NO. 82-1293

BORING E-6
SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 466.4'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
	8	SS			Gray-Brown GRAVEL w/Sand Trace Clay, GP			
40	9	SS	18/6		TOB ~ 426.0'	5-6-6		

DRILLING METHOD Hollow Auger
DATE DRILLED 12/8/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at 18.0 Feet
____ Hours after completion ____ Feet
8 Days after completion 12.4 Feet
____ after completion ____ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

mathes

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RECORD OF SUBSURFACE EXPLORATION

PROJECT: I.P. Hennepin, Hydrogeologic Investigation
BORING: E-7
SHEET 1 OF 3
JOB NO.: 04-1934

Soil Classification System: Unified
Surface Elevation: 515.2'

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL, Classification)	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf (SV△ QP/2□ QU/2○) / PL NMC LL / Rock Quality Designation
					Brown Fine SAND w/Silt, SM			
5	1	SS	18/18			4-6-6		
					Brown Fine SAND w/Coarse Trace Gravel, Silt, SP			
10	2	SS	18/14			7-7-8		
					Brown Gravelly Medium-Coarse SAND w/Fine, Silt, SM			
15	3	SS	18/16			18-35-33		
20	4	SS	18/12			18-34-31		
25	5	SS	18/6			36-48-51		
					Brown Gravelly Fine SAND w/Medium Trace Silt, SP-SM			
30	6	SS	18/-			17-31-44		
					Brown Gravelly Medium-Coarse SAND w/Silt, SM			
35	7	SS	18/-			19-29-37		

DRILLING METHOD: Casing Advancer & NW
DATE DRILLED: 11/13-15/84
DRILLED BY: Maniaci
LOGGED BY: Hebel/Maxeiner
PIEZOMETER: Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

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John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT I.P. Hennepin, Hydrogeologic Investigation
JOB NO. 04-1934

BORING E-7
SHEET 2 OF 3

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 515.2'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf (SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½); PL + NMC • LL x (0 50 100); Rock Quality Designation (0 50 100)
					Brown Gravelly Medium-Coarse SAND w/Silt, SM			
40	8	SS	18/12			10-23-27		
45	9	SS	18/14			12-20-25		
50	10	SS	18/11			14-31-36		
55	11	SS	18/14		- Boulders 55.0-57.0'	16-46-52		
					Gray Fine-Medium SAND Trace Coarse, SP			
60	12	SS	18/3			12-22-30		
65	13	SS	18/12			18-27-43		
70	14	SS	18/12			20-22-34		

DRILLING METHOD Casing Advancer & NW
DATE DRILLED 11/13-15/84
DRILLED BY Maniaci
LOGGED BY Hebel/Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at ______ Feet
____ Hours after completion ____ Feet
____ after completion ____ Feet
____ after completion ____ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT I. P. Hennepin, Hydrogeologic Investigation
BORING E-7
SHEET 3 OF 3
JOB NO. 04-1934

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 515.2'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
					Gr Fi-Med SAND Tr Co, SP			
					Gray Medium SAND w/Fine Trace Gravel, SP			
	15	SS	18/10			15-15-22		
75								
					TOB			
80								
85								
90								
95								
100								
105								

DRILLING METHOD Casing Advancer & NW
DATE DRILLED 11/13-15/84
DRILLED BY Maniaci
LOGGED BY Hebel/Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
__ Hours after completion __ Feet
__ after completion __ Feet
__ after completion __ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

mathes

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT: I. P. Hennepin, Hydrogeologic Investigation
BORING: E-8B
SHEET 1 OF 2
JOB NO.: 04-1934

Soil Classification System: Unified
Surface Elevation: 498.7'

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification)	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf / PL NMC LL / Rock Quality Designation
					Dark Brown Silty CLAY w/Sand Trace Gravel, CL			
5	1	SS	18/14			6-11-13		
					Brown Sandy GRAVEL Trace Clay, Silt, GC-GP			
	2	SS	18/12			11-9-7		
10								
	3	SS	18/12			5-7-8		
15								
	4	SS	18/12			5-5-10		
20								
					Gray Medium-Coarse SAND w/Fine, SP			
	5	SS	18/14			5-6-9		
25								
	6	SS	18/0			11-15-18		
30								
					Brown Fine SAND w/Silt Trace Clay, SM			
	7	SS	18/12			3-10-10		
35								

DRILLING METHOD: Casing Advancer & NW
DATE DRILLED: 11/16-17/84
DRILLED BY: Maniaci
LOGGED BY: Hebel/Maxeiner
PIEZOMETER: Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

mathes

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT I. P. Hennepin, Hydrogeologic Investigation
JOB NO. 04-1934
BORING E-8B
SHEET 2 OF 2

Soil Classification System: Unified
Surface Elevation: 498.7'

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification)	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf / PL NMC LL / Rock Quality Designation
					Brown Fine SAND w/Silt Trace Clay, SM			
	8	SS	18/14			3-7-9		
40								
	9	SS	18/16		-w/Gravel @ 43.0'	4-7-10		
45								
	10	SS	18/14			12-10-12		
50								
	11	SS	18/10		-Trace Gravel @ 53.0'	5-8-11		
55								
					Brown Sandy GRAVEL w/Silt, Clay, GC-GM			
	12	SS	18/10			25-30-33		
60								
					TOB			
65								
70								

DRILLING METHOD Casing Advancer & NW
DATE DRILLED 11/16-17/84
DRILLED BY Maniaci
LOGGED BY Hebel/Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at ___ - ___ Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

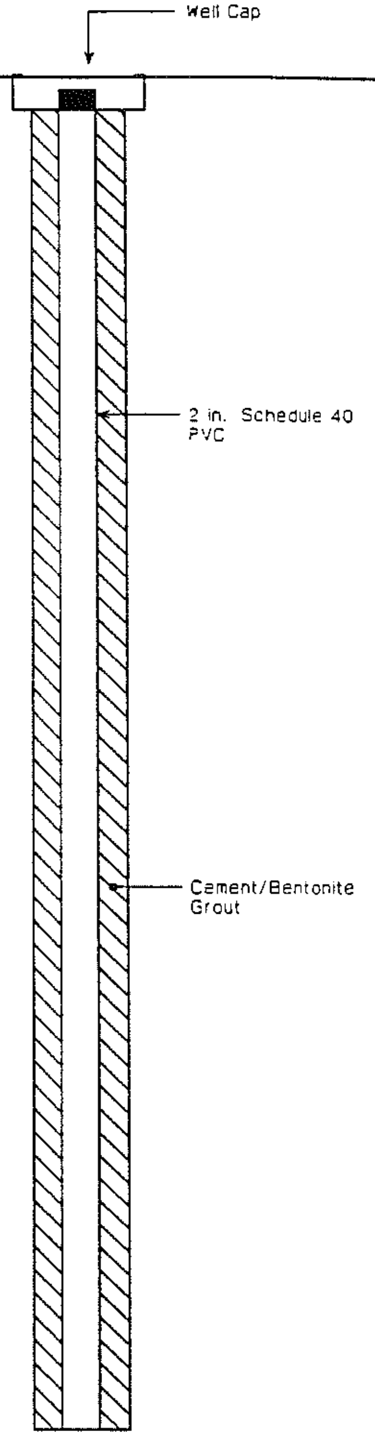
Appendix A2

STMI Boring Logs and Well Details

Monitoring Well No. 10

PROJECT: Hennepin East Ash Impoundment	**DATE:** 03-28-95	**LOGGED BY:** Hensel/Tu
DRILL RIG: Rotosonic Drill	**HOLE DIA.:** 6 in.	**SAMPLER:** Core Barrel
DRILLER: Boart Longyear	**GW DEPTH:** Not Measured ft.	**HOLE ELEV.:** 495.10 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Blind Drilling (Refer to boring log for MW 11 for lithologic descriptions)			0–20			



Depth: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20

STMI

2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:

Sample 10-1 was collected between 45-55 feet

Project No.
135-1.21

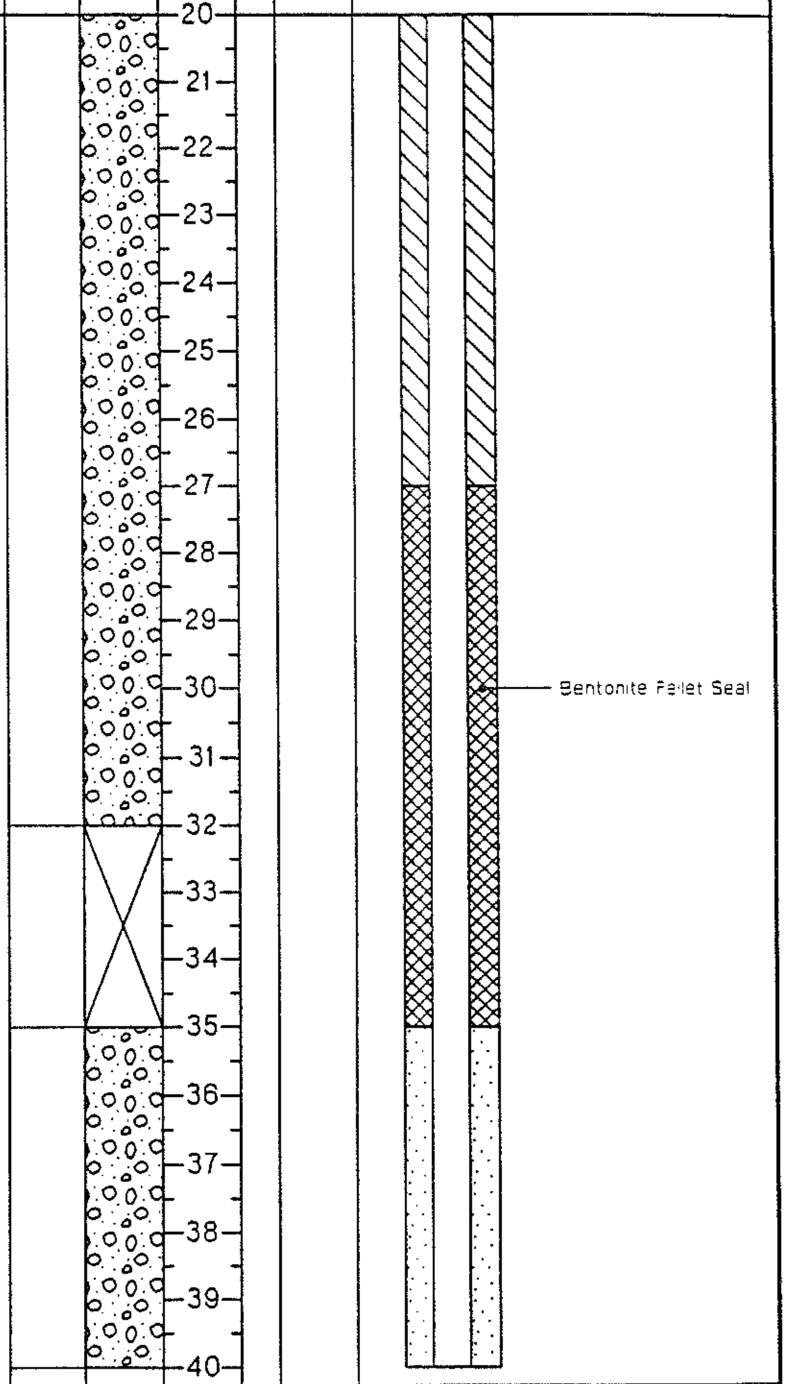
Monitoring Well No. 10

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: Not Measured ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 495.10 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Blind Drilling (Refer to boring log for MW 11 for lithologic descriptions)			20–40			Bentonite Pellet Seal



STMI

2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Sample 10-1 was collected between 45-55 feet

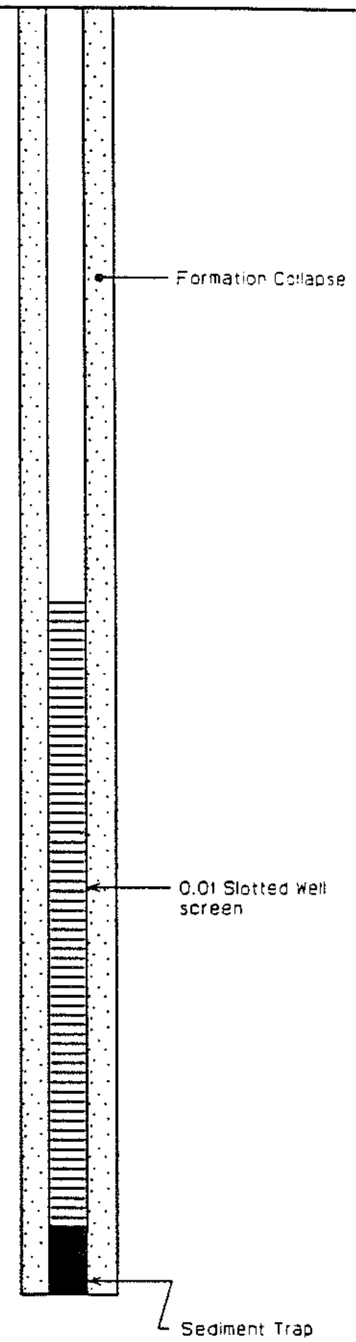
Project No.
135-1.21

Monitoring Well No. 10

PROJECT: Hennepin East Ash Impoundment	**DATE:** 03-28-95	**LOGGED BY:** Hensel/Tu
DRILL RIG: Rotosonic Drill	**HOLE DIA.:** 6 in.	**SAMPLER:** Core Barrel
DRILLER: Boart Longyear	**GW DEPTH:** Not Measured ft.	**HOLE ELEV.:** 495.10 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
			40–45	
Clean, fine to coarse gravels w/ cobbles up to 4" in diameter, well rounded to subangular			45–55	10-1
Blind Drilling (Refer to boring log for MW 11 for lithologic descriptions)			55–59	
			59–60	

WELL CONSTRUCTION DETAIL



STMI

2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:

Sample 10-1 was collected between 45-55 feet

Project No. 135-1.21

Monitoring Well No. 11

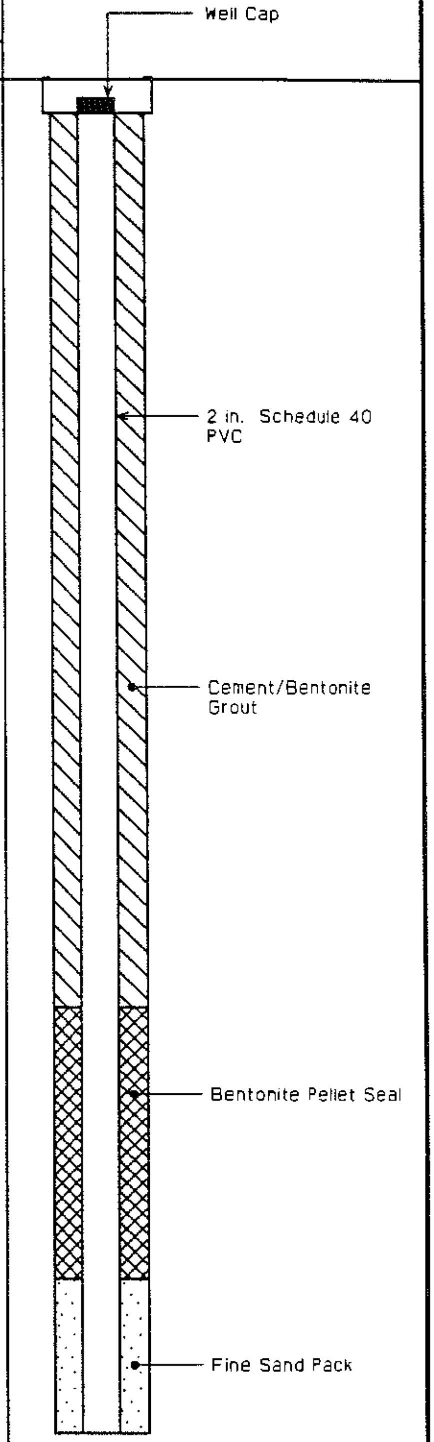
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-27-95
HOLE DIA.: 6 in.
GW DEPTH: 50 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 494.84 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Fill, consisting of poorly sorted sand, gravels (gravels up to 3") and crushed limestone			0–12	
Olive, silty clay w/ gravels up to 2", and some fine sand			12–15	11-1
Dry, brown, med sand to coarse gravel, cobbles up to 4"			15–20	

WELL CONSTRUCTION DETAIL



STMI
2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

Monitoring Well No. 11

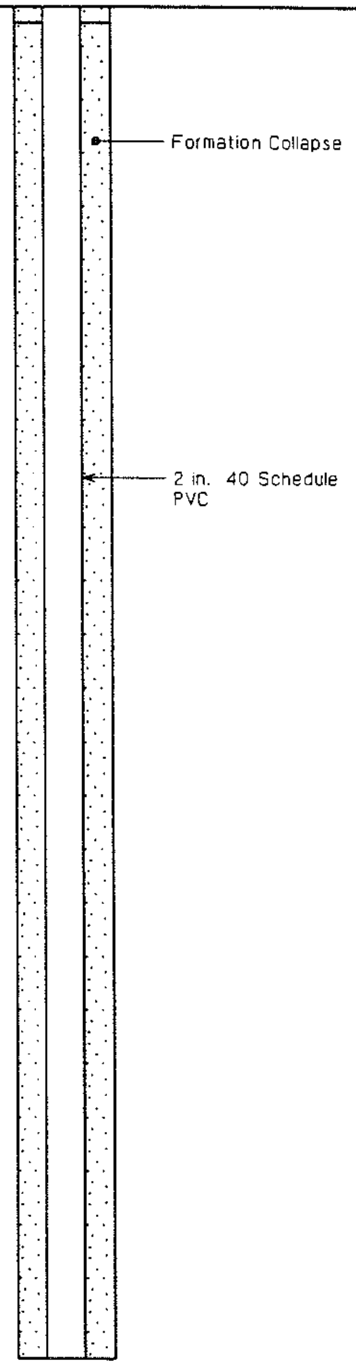
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-27-95
HOLE DIA.: 6 in.
GW DEPTH: 50 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 494.84 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Dry, brown, med. sand to coarse gravel, gravels up to 2" in diameter, subrounded to subangular			20–32	11-2
No sample			32–35	
Brown, dry coarse sand and gravel, some silt, some clay, cobbles up to 4", subangular to rounded			35–40	11-3

WELL CONSTRUCTION DETAIL



STMI

2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:

Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

Monitoring Well No. 11

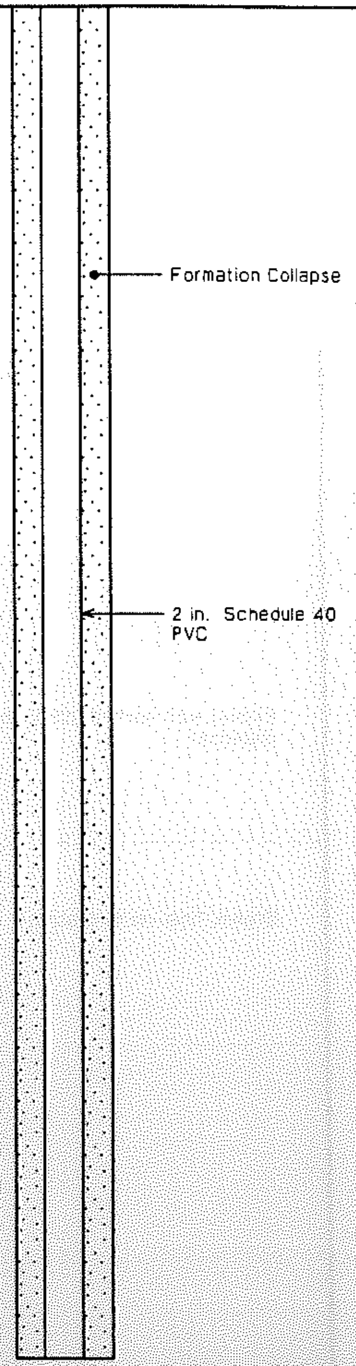
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-27-95
HOLE DIA.: 6 in.
GW DEPTH: 50 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 494.84 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Grading from fine to coarse sand w/ some gravels and fines			40–46	
2' Dark brown, sandy clay w/ gravels			46–48	11-4
Coarse sand and gravel, some silt, gravels to 2", subrounded to subangular, fines may have been washed out during drilling			48–60	
Coarse sand and gravel, some silt; well rounded, gravels up to 2"				
Clean fine to coarse gravel, gravels up to 3"				

WELL CONSTRUCTION DETAIL



STMI
2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No. 135-1.21

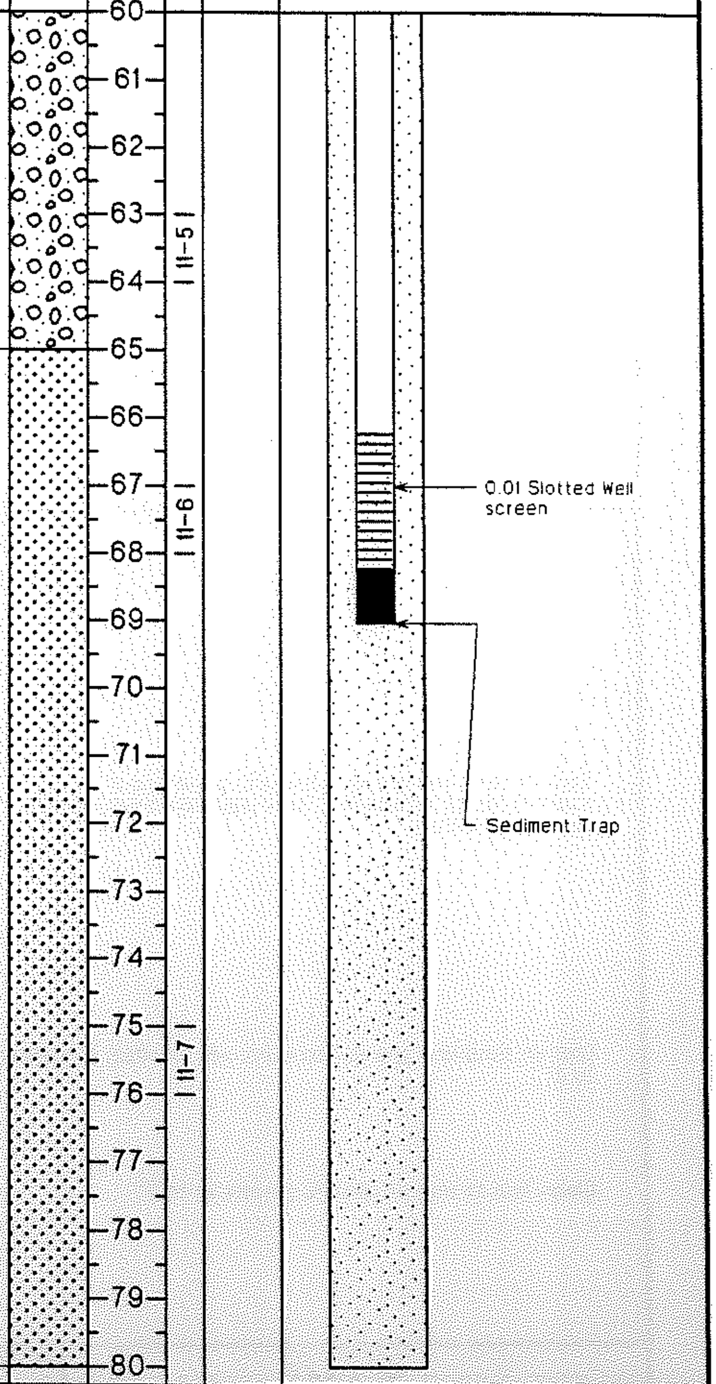
Monitoring Well No. 11

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-27-95
HOLE DIA.: 6 in.
GW DEPTH: 50 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 494.84 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL



Brown, well sorted, clean med. sand w/ small gravels 1" in diameter

Brown, fine uniform sand

STMI

2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:

Continuously sampled bore-hole. Sample numbers refer to saved samples

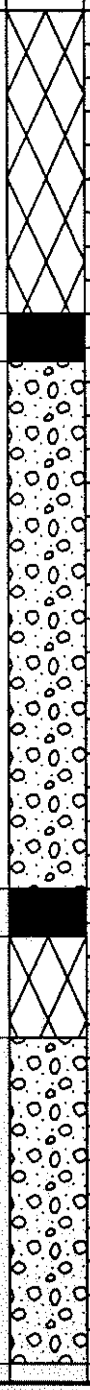
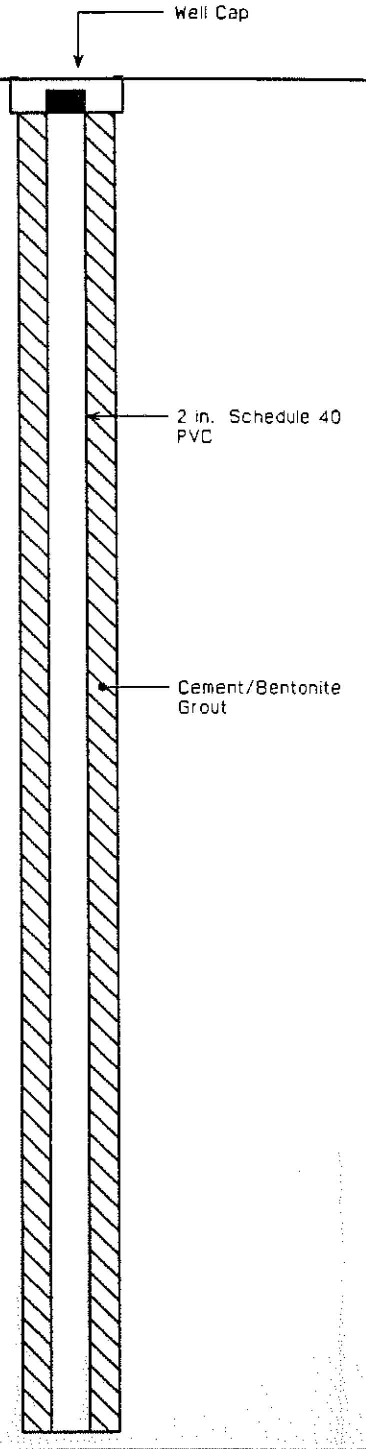
Project No.
135-1.21

Monitoring Well No. 12

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: 48.5 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.84 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE	WELL CONSTRUCTION DETAIL
Blind Drilling (Refer to boring log for MW 13 for lithologic descriptions)			0–20		

STMI
2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
No samples were collected from MW 12

Project No.
135-1.21

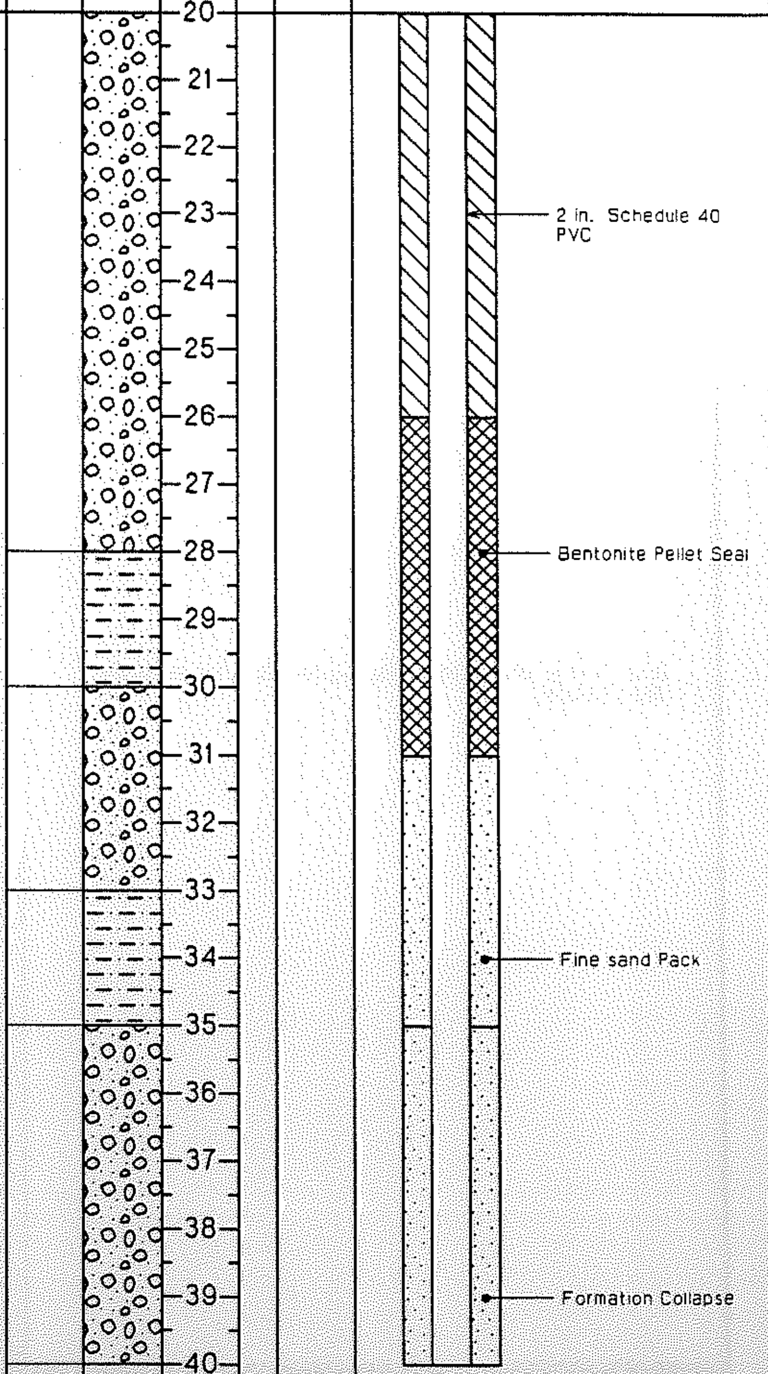
Monitoring Well No. 12

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: 48.5 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.84 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Blind Drilling (Refer to boring log for MW 13 for lithologic descriptions)			20–40			



STMI
2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
No samples were collected from MW 12

Project No.
135-1.21

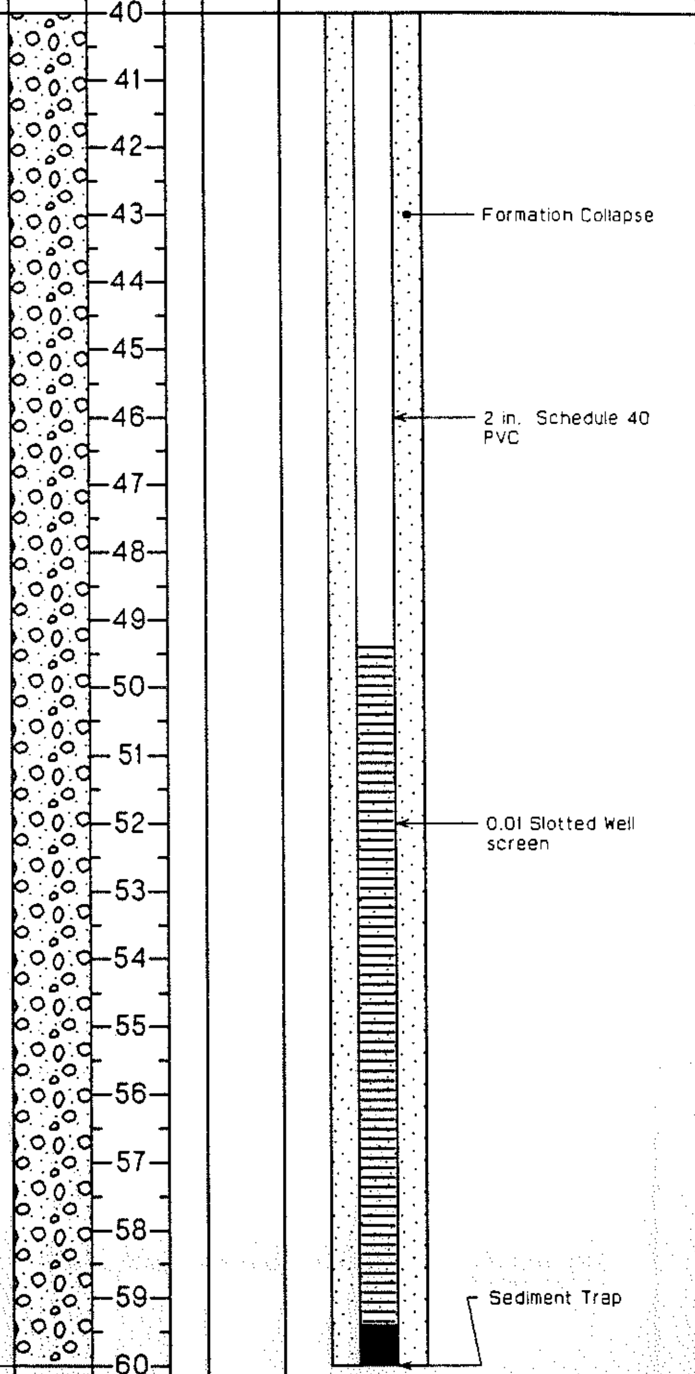
Monitoring Well No. 12

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: 48.5 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.84 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Blind Drilling (Refer to boring log for MW 13 for lithologic descriptions)			40–60			



STMI
2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
No samples were collected from MW 12

Project No. 135-1.21

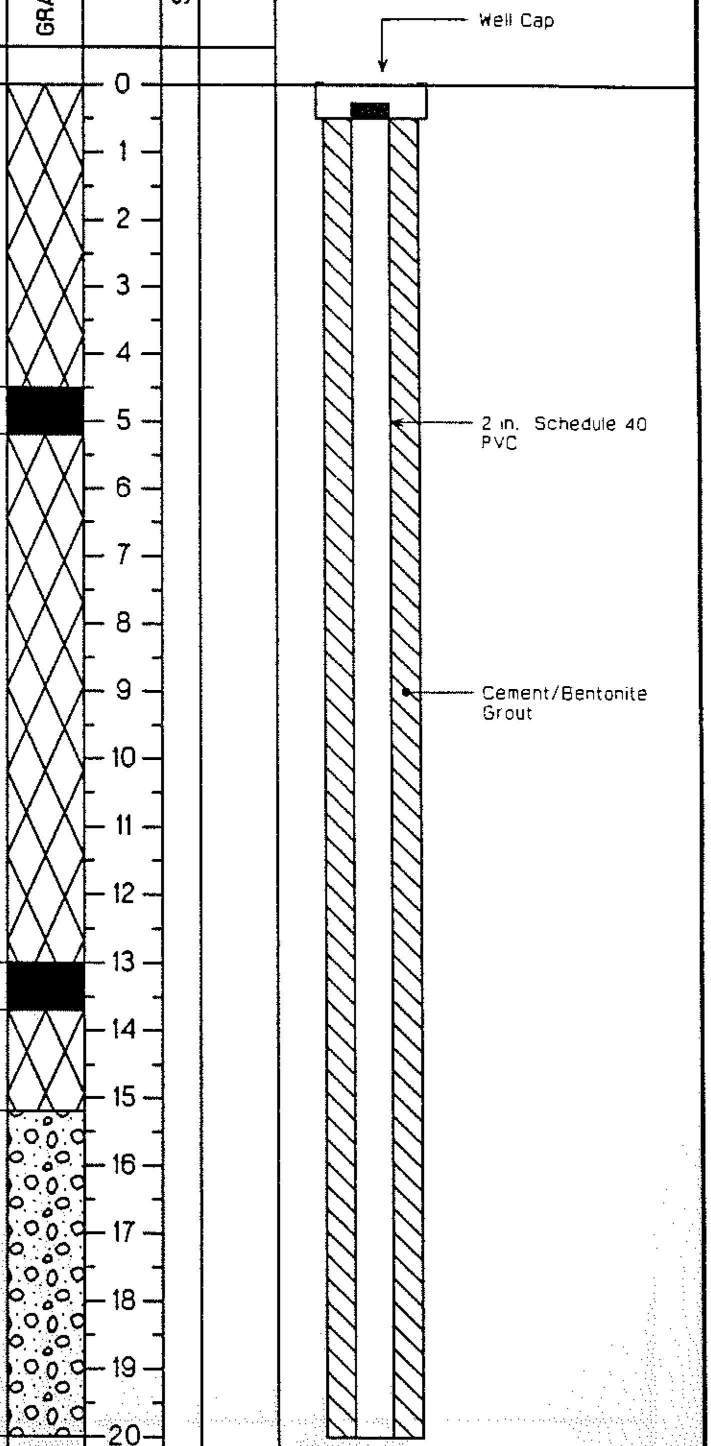
Monitoring Well No. 13

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: 49.5 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.82 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Fill, consisting of olive, silty clay loam, with gravels up 3 in in diameter						
Fly ash						
Brown gravel w/ sand and silt, gravels up to 3", poorly sorted, subrounded to subangular						
Fly ash						
Fill, consisting of fine silty sand, wood chips, gravels up to 1".						
Tan sand and gravel, some silt, gravels up to 3", poorly sorted, rounded						



STMI
2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

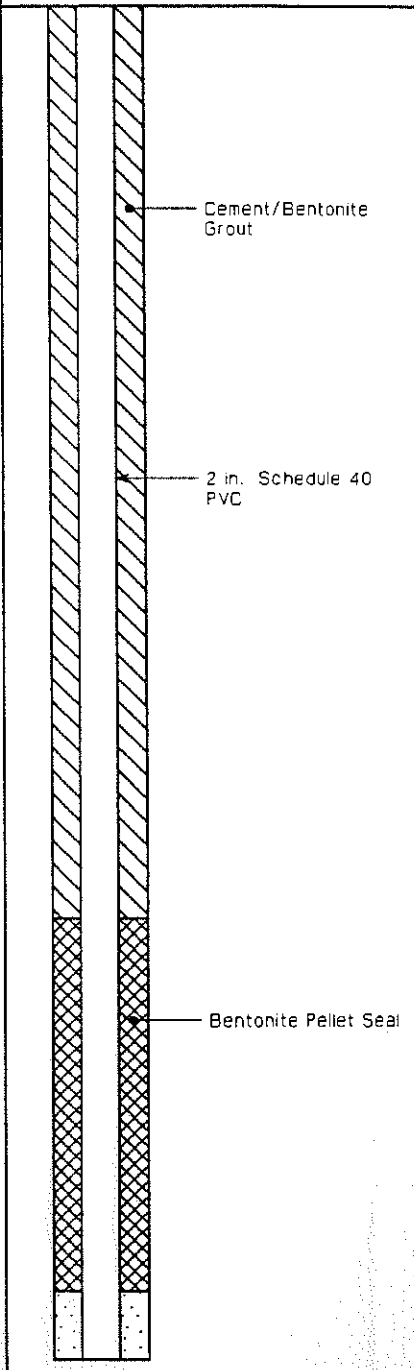
Monitoring Well No. 13

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: 49.5 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.82 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
			20 21 22 23 24 25	13-1		
			26 27 28			
Brown, fine silty, sandy clay w/ gravels (well-rounded)			29 30			
Gray, fine to coarse sand and gravel, well-rounded			31 32 33	13-2		
Red, silty, sandy clay w/ gravels up to 2" in diameter			34			
White, fine sand w/ gravels up to 3"			35			
Brown, coarse sand and gravel with silt, cobbles up to 4"			36 37 38 39 40			



STMI
2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No. 135-1.21

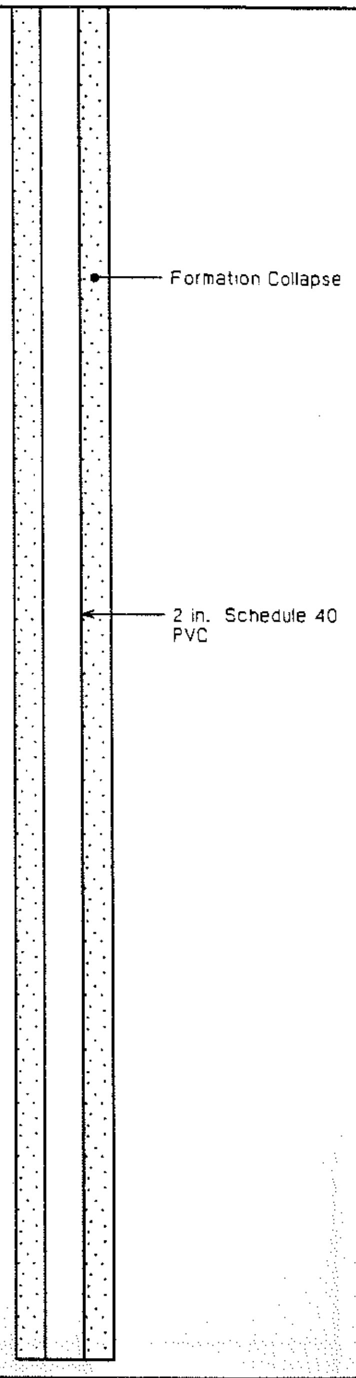
Monitoring Well No. 13

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: 49.5 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.82 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
			40			
			41			
			42	13-3		
			43			
			44			
			45			
			46			
			47			
Brown gravel w/ some sand and silt. cobbles up to 4"			48			
			49			
			50			
			51			
			52	13-4		
			53			
			54			
			55			
			56			
			57			
			58			
			59			
			60			



STMI
2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

Monitoring Well No. 13

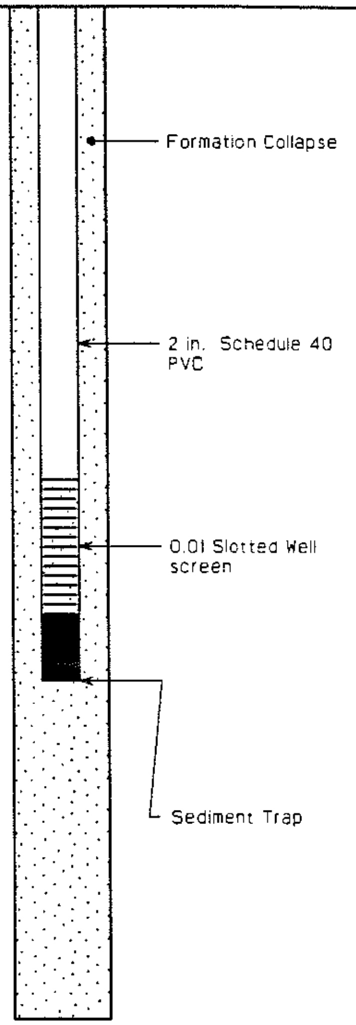
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: 49.5 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.82 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
			60	
			61	
			62	
Gravel becomes finer			63	13-5
			64	
			65	
Brown, fine gravel w/ little silt and sand, well rounded, well sorted			66	13-6
			67	
			68	13-7
			69	
			70	
			71	
Fine, uniform silty sand w/ cobbles up to 3"			72	
Brown, uniform fine to med. sand with some gravel			73	
			74	
			75	
			76	
			77	
			78	
			79	
			80	

WELL CONSTRUCTION DETAIL



STMI
2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No. 135-1.21

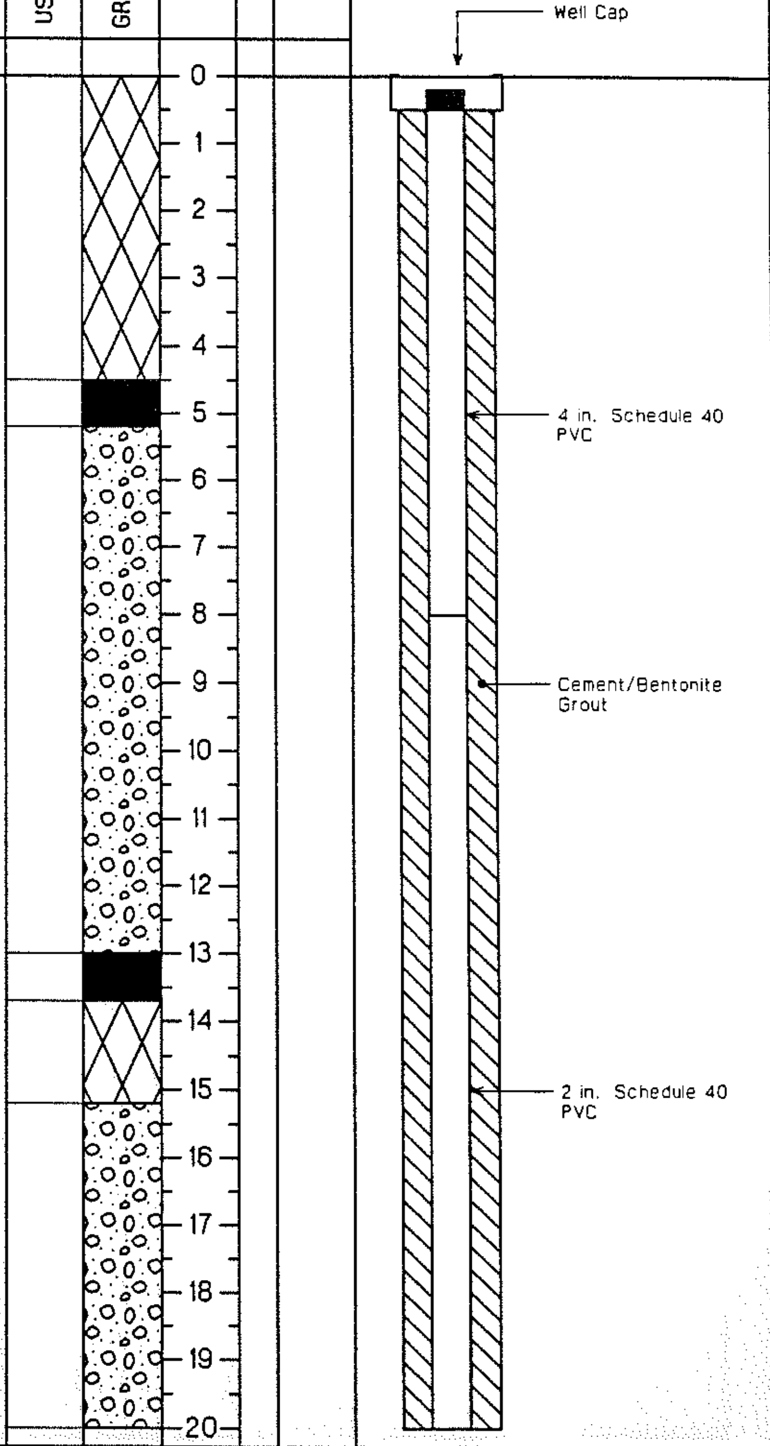
Monitoring Well No. 14

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-29-95
HOLE DIA.: 6 in.
GW DEPTH: Not Measured ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.83 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Blind Drilling (Refer to boring log for MW 13 for lithologic descriptions)			0–20			



STMI
2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
No samples were collected from MW 14

Project No. 135-1.21

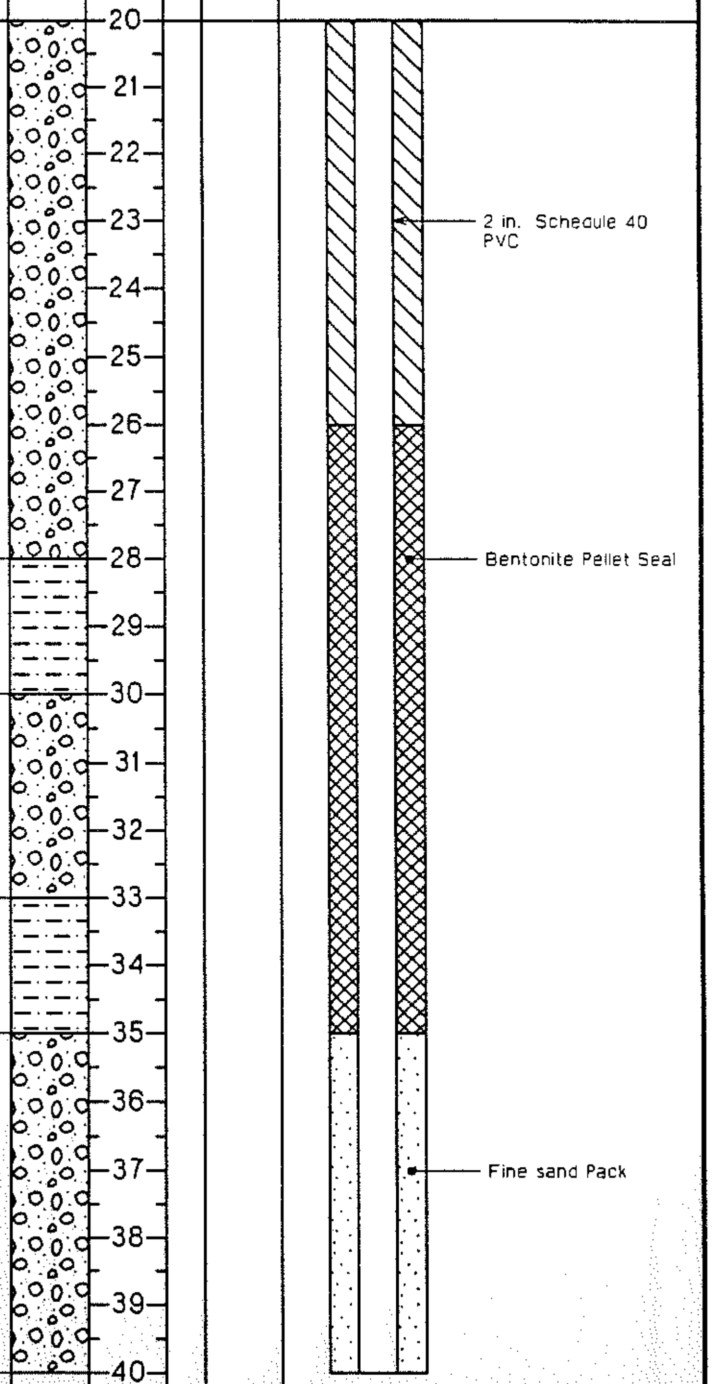
Monitoring Well No. 14

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-29-95
HOLE DIA.: 6 in.
GW DEPTH: Not Measured ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.83 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Blind Drilling (Refer to boring log for MW 13 for lithologic descriptions)			20–40			



STMI

2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
No samples were collected from MW 14

Project No.
135-1.21

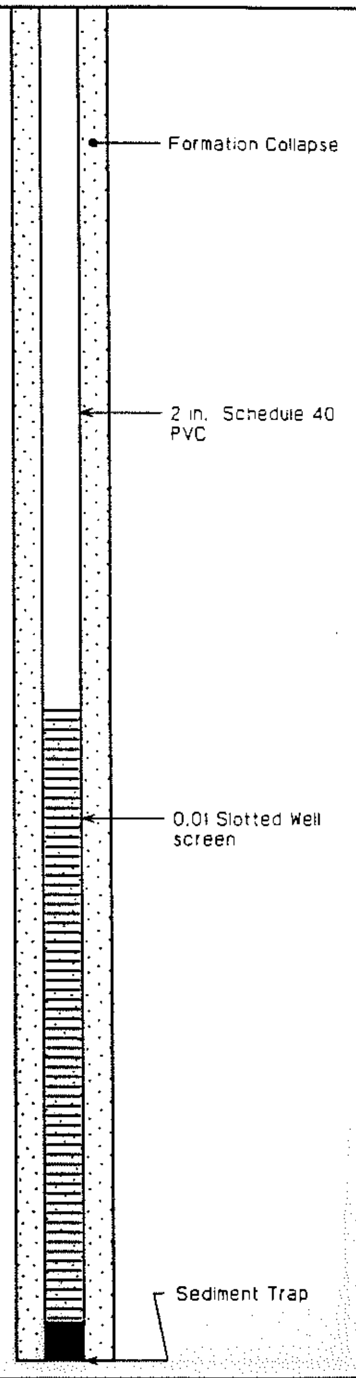
Monitoring Well No. 14

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-29-95
HOLE DIA.: 6 in.
GW DEPTH: Not Measured ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.83 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
			40			
			41			
			42			
			43			
			44			
			45			
			46			
			47			
			48			
			49			
Blind Drilling (Refer to boring log for MW 13 for lithologic descriptions)			50			
			51			
			52			
			53			
			54			
			55			
			56			
			57			
			58			
			59			
			60			



STMI

2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
No samples were collected from MW 14

Project No. 135-1.21

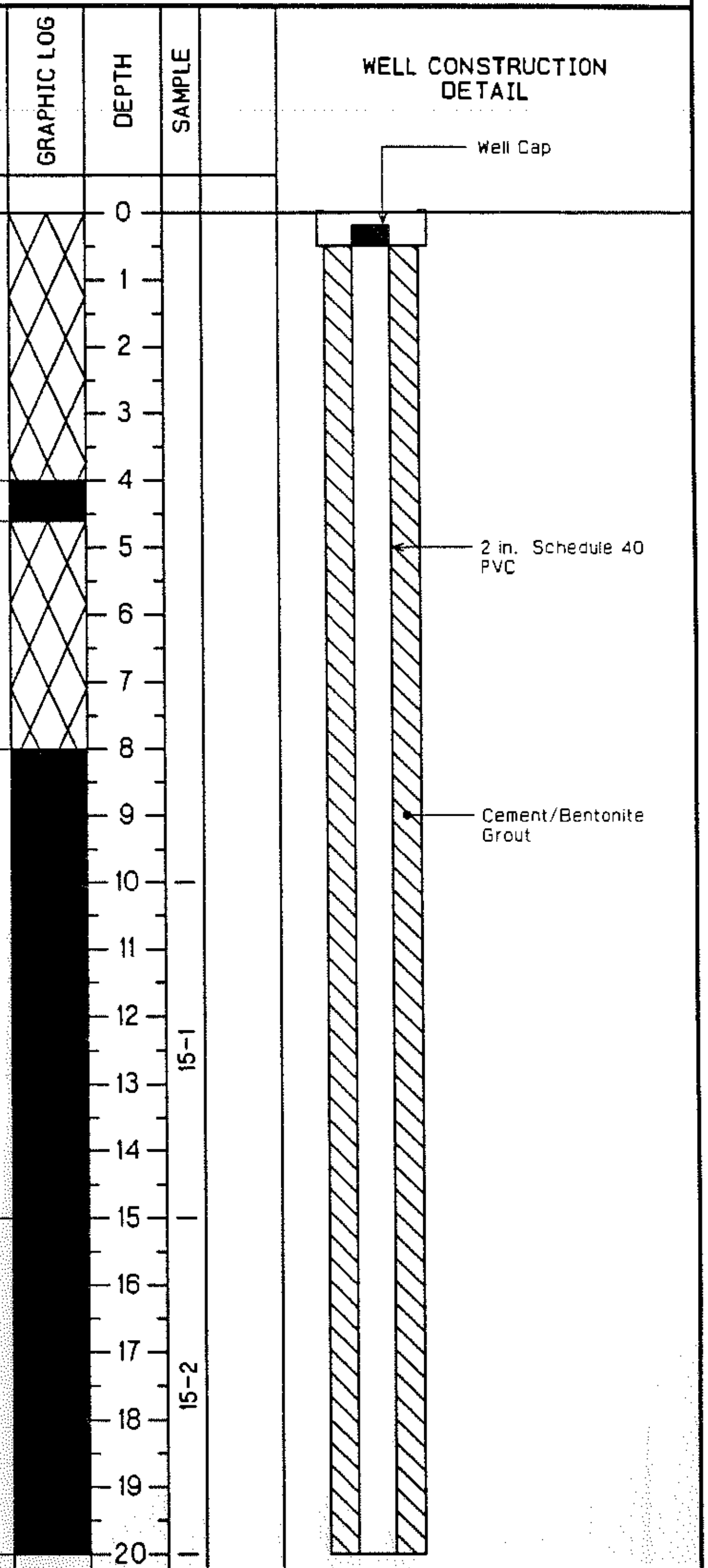
Monitoring Well No. 15

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-29-95
HOLE DIA.: 6 in.
GW DEPTH: Not Measured ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 494.41 ft. MSL

DESCRIPTION	USCS CLASS
Fill, consisting of poorly sorted sand, gravels	
Fly ash	
Fill, consisting of poorly sorted sand, gravels up to 3"	
Bottom ash	
Fly ash	



STMI
2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

Monitoring Well No. 15

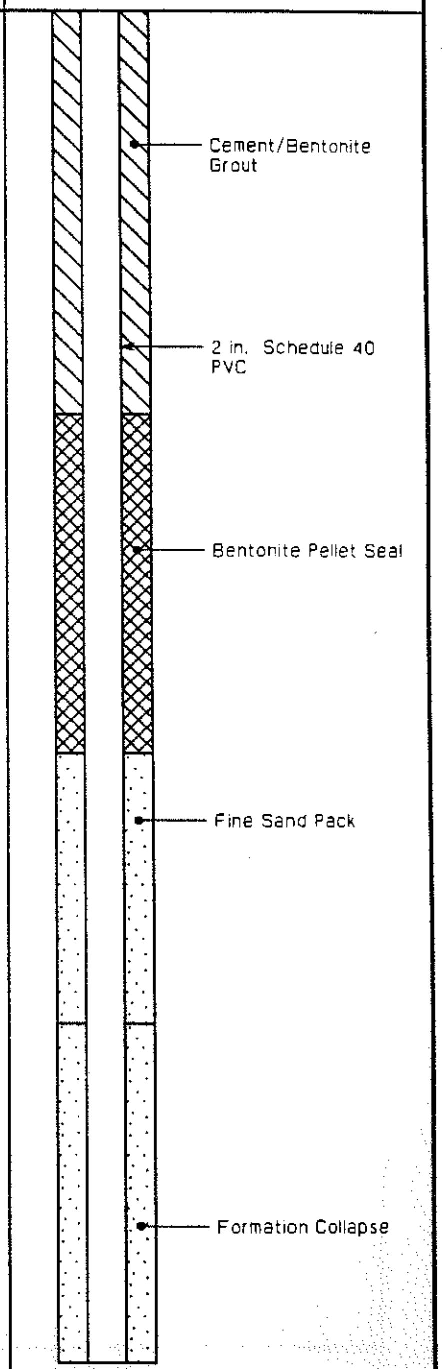
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-29-95
HOLE DIA.: 6 in.
GW DEPTH: Not Measured ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 494.41 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Same as above			20–25	15-2
Brown uniform silt w/ organic matter			25–26	15-3
White gravel w/ sand and gravels up to 1.5"			26–27	15-4
Brown gravel w/ silty, fine-med. sand, rounded to subrounded			27–40	15-5, 15-6

WELL CONSTRUCTION DETAIL



STMI

2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

Monitoring Well No. 15

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

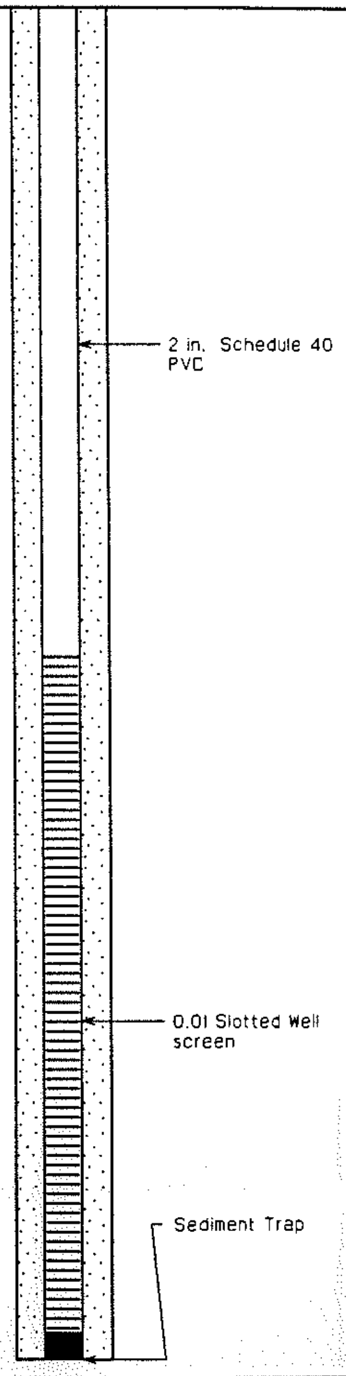
DATE: 03-29-95
HOLE DIA.: 6 in.
GW DEPTH: Not Measured ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 494.41 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Same as above			40–50	15-6
Olive fine sand and silt, platy structure, well sorted			50–51	15-7
Gravel w/ some sand, some silt, generally finer gravel than above			51–60	15-8

Depth scale: 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60

WELL CONSTRUCTION DETAIL



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2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No. 135-1.21

Monitoring Well No. 16

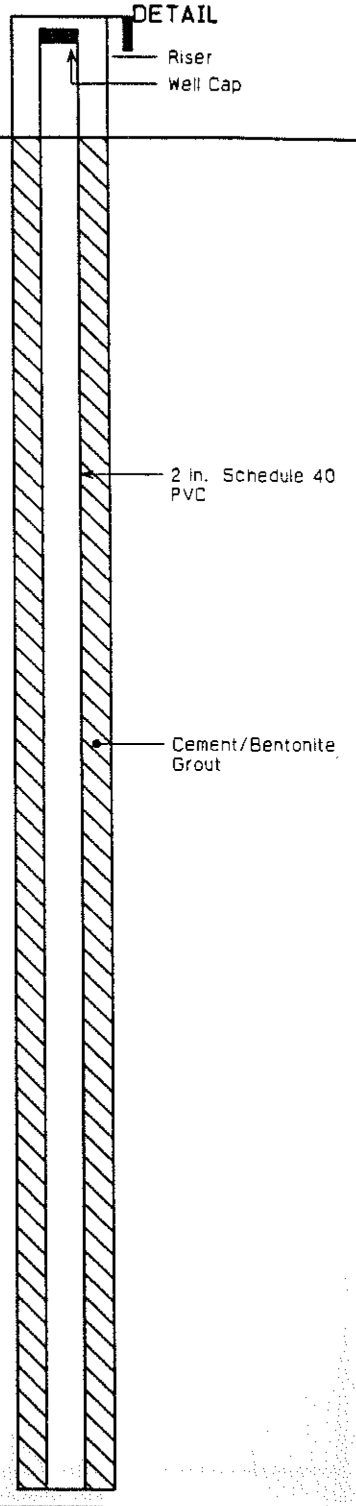
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-30-95
HOLE DIA.: 6 in.
GW DEPTH: 53 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 502.09 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Possible fill, consisting of brown, well-sorted, fine-med. sand			0–3	
Brown, dry gravel w/ fine-coarse sands, gravels up to 2", well-rounded, poorly sorted			3–20	16-1 (5–10)
Same as above, cobbles up to 4", rust stain at 22 ft.				16-2 (15–20)

WELL CONSTRUCTION DETAIL



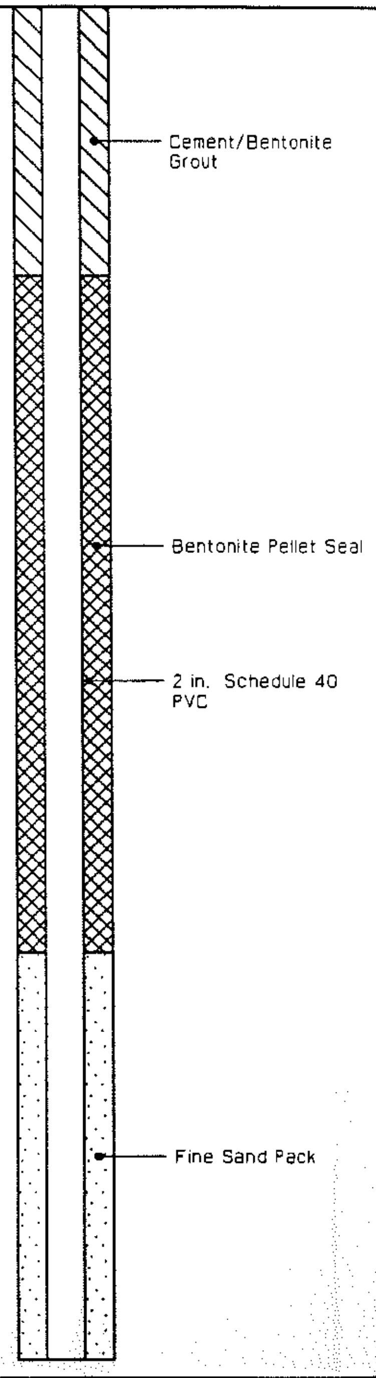
Monitoring Well No. 16

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-30-95
HOLE DIA.: 6 in.
GW DEPTH: 53 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 502.09 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
			20			
			21			
			22			
			23			
			24			
			25			
Same as above			26			
			27	16-3		
			28			
			29			
			30			
			31			
			32			
			33			
			34			
			35			
			36			
Gravel becomes finer at 35'			37	16-4		
			38			
			39			
			40			



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Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

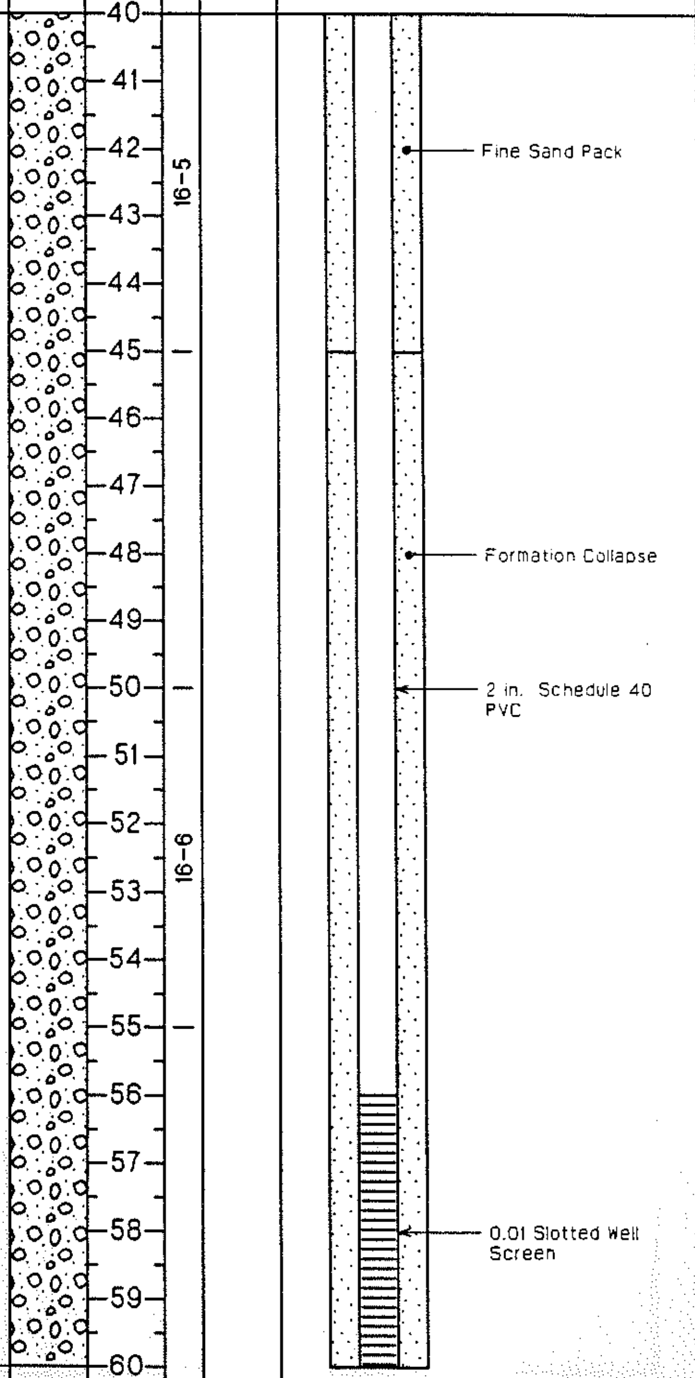
Project No. 135-1.21

Monitoring Well No. 16

PROJECT: Hennepin East Ash Impoundment	**DATE:** 03-30-95	**LOGGED BY:** Hensel/Tu
DRILL RIG: Rotosonic Drill	**HOLE DIA.:** 6 in.	**SAMPLER:** Core barrel
DRILLER: Boart Longyear	**GW DEPTH:** 53 ft.	**HOLE ELEV.:** 502.09 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Brown gravel w/ fine to med. sand and silt (more sand than above), poorly sorted			40–60	16-5 (41–45); 16-6 (50–55)

WELL CONSTRUCTION DETAIL



STMI 2511 N. 124th St. Suite 205 Brookfield, Wisconsin 53005-8208	*Notes:* *Continuously sampled bore-hole. Sample numbers refer to saved samples*	**Project No.** 135-1.21 ***Page 3 of 4***

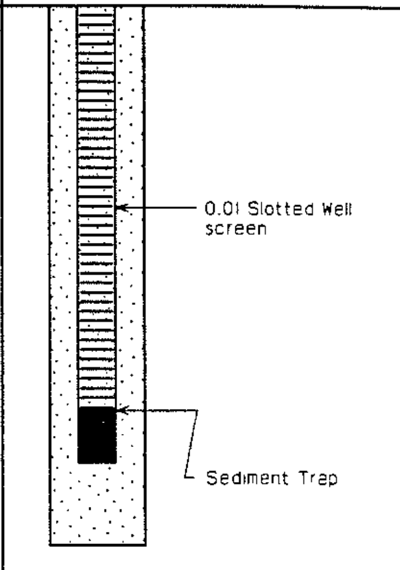
Monitoring Well No. 16

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-30-95
HOLE DIA.: 6 in.
GW DEPTH: 53 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 502.09 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
			60			
			61			
			62			
Same as above w/ more silt			63	16-7		
			64			
			65			
			66			
			67	16-8		
			68			
			69			
			70			
			71			
			72			
			73			
			74			
			75			
			76			
			77			
			78			
			79			
			80			



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Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No. 135-1.21

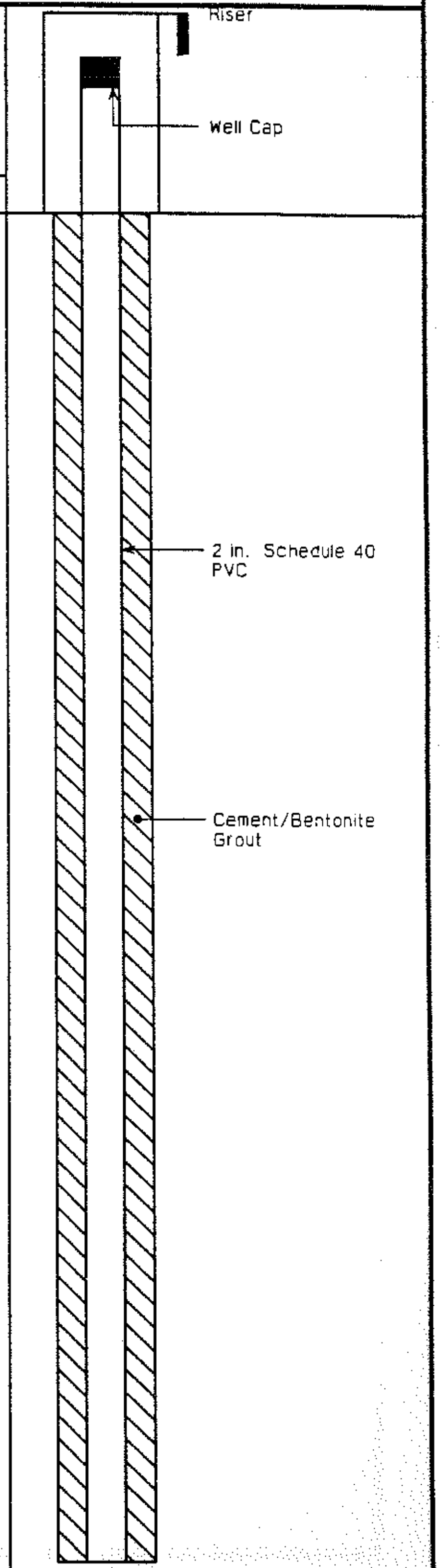
Monitoring Well No. 17

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-30-95
HOLE DIA.: 6 in.
GW DEPTH: 56 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 507.34 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Silt, dark brown, no structure or pebbles, organic material to 2 ft.			0, 1, 2, 3	17-1
Light brown, gravel w/ sand and silt, gravels up to 3", subrounded to angular, poorly sorted			4, 5	
White gravel w/ sand, angular to subangular			6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	17-2



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Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

Monitoring Well No. 17

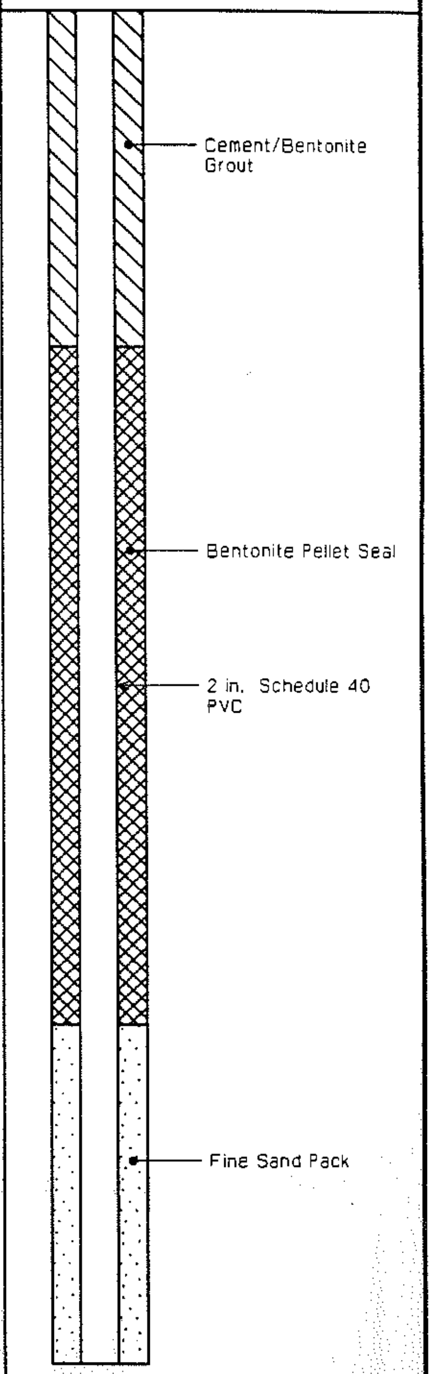
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-30-95
HOLE DIA.: 6 in.
GW DEPTH: 56 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 507.34 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
			20	
			21	
Brown gravel w/ sand, some silt, poorly sorted, subangular to rounded			22	17-3
			23	
			24	
			25	
			26	
			27	
			28	
			29	
			30	
			31	
Same as above w/ more silt			32	17-4
			33	
			34	
			35	
2" lens of gray sand and gravel at 36 ft.			36	17-5
			37	
Brownish-red gravel w/ sand and silt, poorly sorted, gravels up 1.5", rounded			38	17-6
			39	
			40	

WELL CONSTRUCTION DETAIL



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2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

Monitoring Well No. 17

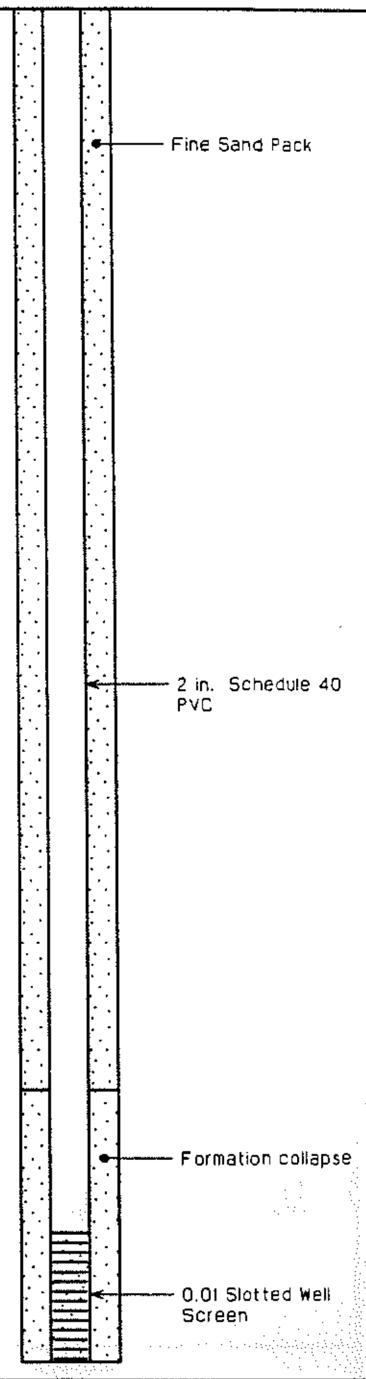
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-30-95
HOLE DIA.: 6 in.
GW DEPTH: 56 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 507.34 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
			40	
			41	17-7
Sequence of black and yellow sand and gravel			42	
			43	17-8
			44	
Brown gravel w/ sand and silt, poorly sorted, gravels up to 1.5"			45	
			46	17-9
			47	
			48	
Brown, med. sand, well-sorted, dry			49	
			50	
			51	17-10
			52	
			53	
			54	
			55	
			56	
Becomes wet at 56 ft. Same as above w/ few gravels			57	17-11
			58	
			59	
			60	

WELL CONSTRUCTION DETAIL



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Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

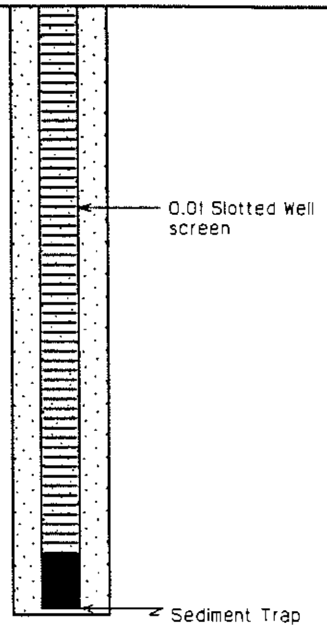
Project No. 135-1.21

Monitoring Well No. 17

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-30-95
HOLE DIA.: 6 in.
GW DEPTH: 56 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 507.34 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Same as above			60–69	17-12		
			69–80			

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

STMI
2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Project No.
135-1.21

Appendix A3

NRT Boring Logs and Well Details

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Hennepin Power Station - New East Ash Landfill		03R

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Randy Redke Cascade	1/15/2015	1/15/2015	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
03R	447.8 Feet (NAVD88)	479.4 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☒) or Boring Location ☒
State Plane 1,690,297 N, 2,532,308 E S / C / (N)
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Putnam	IL	Hennepin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1	30 30		0–5.8	0 - 5.8' **FILL, SILTY CLAY** CL/ML, with gravel and some sand.	(FILL) CL/ML								
2	30 26												
3	120 93		5.8–12	5.8 - 23.9' **FILL, ASH (Coal):** ASH (Coal), trace silt and gravel, dark gray, medium dense.	(FILL) ASH (Coal)								

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

Signature

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

Natural Resource Technology

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13	5.8 - 23.9' **FILL, ASH (Coal):** ASH (Coal), trace silt and gravel, dark gray, medium dense. *(continued)*										
4	120 96		14–23		(FILL) ASH (Coal)									
5	60 44		24–29	23.9 - 52' **POORLY-GRADED SAND WITH GRAVEL:** (SP)g, fine grained sized gravel, trace silt, light brown, loose, dry.	(SP)g									
6	60 54		30–32	31.6' Wet.										

NATURAL RESOURCE TECHNOLOGY

Boring Number 03R

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				23.9 - 52' **POORLY-GRADED SAND WITH GRAVEL:** (SP)g, fine grained sized gravel, trace silt, light brown, loose, dry. *(continued)*										
			33											
			34											
7	120 69		35											
			36											
			37											
			38											
			39											
			40											
			41											
			42		(SP)g									
			43											
			44											
8	84 36		45											
			46											
			47											
			48											
			49											
			50											
			51											
			52											

NATURAL RESOURCE TECHNOLOGY

Boring Number 03R

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				52 - 53' Blind drilled to 53' for well installation.										
			53	53' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Hennepin Power Station - New East Ash Landfill		05R	
Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Randy Redke Cascade	1/15/2015	1/15/2015	Sonic
Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
05R	Feet (NAVD88)	485.6 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☒) or Boring Location ☒
State Plane 1,690,518 N, 2,533,196 E S / C / (N)
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E
Feet ☐ S Feet ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Putnam	IL	Hennepin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–12	0 - 55' See boring 05DR for details.										

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

Signature

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

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number 05R

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32	0 - 55' See boring 05DR for details. *(continued)*										

NATURAL RESOURCE TECHNOLOGY

Boring Number 05R

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0 - 55' See boring 05DR for details. *(continued)*										
			33											
			34											
			35											
			36											
			37											
			38											
			39											
			40											
			41											
			42											
			43											
			44											
			45											
			46											
			47											
			48											
			49											
			50											
			51											
			52											

NATURAL RESOURCE TECHNOLOGY

Boring Number 05R

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53 54	0 - 55' See boring 05DR for details. *(continued)*										
				55.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Hennepin Power Station - New East Ash Landfill		05DR	
Boring Drilled By: Name of crew chief (first, last) and Firm	**Date Drilling Started**	**Date Drilling Completed**	**Drilling Method**
Randy Redke Cascade	1/14/2015	1/14/2015	Sonic
Common Well Name	**Final Static Water Level**	**Surface Elevation**	**Borehole Diameter**
05DR	454.5 Feet (NAVD88)	485.7 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☒) or Boring Location ☒
State Plane 1,690,517 N, 2,533,190 E S / C / (N)
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E
Feet ☐ S Feet ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Putnam	IL	Hennepin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1	60 40		0	0 - 10' **FILL, LEAN CLAY:** CL, with some sand, rounded to subrounded gravel, light brown to dark brown.	(FILL) CL								
2	60 24		5										
3	120 40		10	10 - 22' **FILL, ASH (Coal):** ASH (Coal), fine grained sand sized particles, dark gray, loose, wet.	(FILL) ASH (Coal)								

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

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

Natural Resource Technology

Boring Number 05DR

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12 - 22	10 - 22' **FILL, ASH (Coal):** ASH (Coal), fine grained sand sized particles, dark gray, loose, wet. *(continued)*	(FILL) ASH (Coal)								
4	120 84		20										
			22 - 28.2	22 - 28.2' **SANDY SILT:** s(ML), with little fine grained gravel and coal, dark brown, dense, dry.	s(ML)								
			28.2 - 32	28.2 - 72.7' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, coarse grained sand, little silt, light brown, loose, dry.	(GW)s								
5	72 60		30										
			31.2	31.2' Wet.									

NATURAL RESOURCE TECHNOLOGY

Boring Number 05DR

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33–35	28.2 - 72.7' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, coarse grained sand, little silt, light brown, loose, dry. *(continued)*										
6	108 96		36											
			37–41											
			42		(GW)s									
			43–44											
7	120 86		45											
			46–52											

NATURAL RESOURCE TECHNOLOGY

Boring Number 05DR

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				28.2 - 72.7' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, coarse grained sand, little silt, light brown, loose, dry. *(continued)*										
			53											
			54											
8	60 40		55											
			56											
			57											
			58											
			59											
9	180 144		60											
			61											
			62		(GW)s									
			63											
			64											
			65											
			66											
			67											
			68											
			69											
			70											
			71											
			72											

NATURAL RESOURCE TECHNOLOGY

Boring Number 05DR

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
					(GW)s									
			73	72.7 - 75' **SILT:** ML, little clay and gravel, gray, dense, dry.										
			74		ML									
			75	75 - 76' Blind drilled to 76' for well installation.										
				76' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Hennepin Power Station - New East Ash Landfill		08D	

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Hansen Boart Longyear Company	4/16/2009	4/17/2009	sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
08D	448.4 Feet (Site)	499.2 Feet (Site)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐
State Plane 1,688,932 N, 2,533,463 E S/C/N
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

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

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
CS	60 60			0 - 7' **FILL, SILTY SAND:** SM, very dark brown (7.5YR 2.5/3), well graded, mostly sand [mostly fine, little coarse], few gravel [mostly fine], some silt, moist.	(FILL) SM								Relative Density by visual inspection, not SPT
			2.5										
CS	120 120		5.0										
			7.5	7 - 15' **FILL, WELL-GRADED SAND WITH GRAVEL:** (SW)g, brown (7.5YR 4/4), well graded, mostly sand [mostly medium, few coarse], some gravel [mostly fine], moist, trace brick pieces.	(FILL) (SW)g								
			10.0										
			12.5										
CS	120 120		15.0	15 - 40' **FILL, POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), poorly graded, mostly sand [mostly medium, trace coarse], few subangular gravel [mostly coarse], moist, loose.	(FILL) SP								
			17.5										
			20.0										
			22.5										
CS	120 120		25.0										
			27.5										
			30.0										

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

Signature: Rachel Wilbertz

Firm: Natural Resource Technology, Inc.
23713 W. Paul Road, St D. Pewaukee, WI 53072
Tel: 262.523.9000
Fax: 262.532.9001

Template: SOIL BORING - Project: 1940 GINT.GPJ

NATURAL RESOURCE TECHNOLOGY

Boring Number 08D

Sample								Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			32.5	15 - 40' **FILL, POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), poorly graded, mostly sand [mostly medium, trace coarse], few subangular gravel [mostly coarse], moist, loose. *(continued)*									
CS	120 120		35.0		(FILL) SP								
			37.5										
			40.0	40 - 52' **FILL, POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), poorly graded, mostly sand [mostly medium], few silt, moist, trace bottom ash, loose.									
			42.5										
CS	120 120		45.0	46' wet.	(FILL) SP								
			47.5										
			50.0										
			52.5	52 - 55' **CLAYEY SAND:** SC, yellowish brown (10YR 5/4), well graded, mostly sand [mostly medium, little coarse], few gravel [mostly coarse], some clay.	SC								
CS	120 0		55.0	55 - 65' No Recovery. Some black fine sand on outside of core barrel, possible peat.									
			57.5										
			60.0										
			62.5										
CS	120 120		65.0	65 - 66' **CLAYEY GRAVEL:** GC, dark yellowish brown (10YR 4/6), high plasticity, mostly gravel [mostly fine, few coarse], some clay.	GC								
			67.5	66 - 67' **WELL-GRADED SAND:** SW, dark brown (10YR 3/3), well graded, mostly sand [mostly medium].	SW								
			70.0	67 - 83' **WELL-GRADED GRAVEL WITH CLAY AND SAND:** (GW-GC)s, yellowish brown (10YR 5/6), well graded, some sand [mostly medium], mostly gravel [mostly fine, few coarse], little clay.									
			72.5		(GW-GC)s								
CS	120 120		75.0	75' 12-inch medium sand seam.									
			77.5										
			80.0										

NATURAL RESOURCE TECHNOLOGY

Boring Number 08D

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			82.5		(GW-GC)s									
				83 - 84' **LEAN CLAY**: CL, gray), hard, dry.	CL									
CS	120 120		85.0	84 - 87' **WELL-GRADED GRAVEL WITH CLAY AND SAND**: (GW-GC)s, brownish yellow (10YR 5/8), well graded, some sand [mostly medium], mostly gravel [mostly fine, few coarse], little clay.	(GW-GC)s									
			87.5	87 - 90' **CLAYEY SAND**: SC, yellowish brown), well graded, mostly sand [mostly medium], some clay, medium dense.	SC									
			90.0	90 - 104' **WEATHERED BEDROCK** BDX (SH), gray (7/5B), Weathered Shale. Samples expanded in core sleeve with addition of water.	BDX (SH)									
			92.5											
CS	120 120		95.0											
			97.5											
			100.0											
			102.5											
CORE	60 60		105.0	104 - 120' **SHALE**: BDX (SH), gray (7/5B), drilling more difficult.	BDX (SH)									RQD = 66%
			107.5											
CORE	120 120		110.0											RQD = 63%
			112.5											
			115.0											
			117.5											
			120.0	120' EOB.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Hennepin Power Station - New East Ash Landfill		18D	
Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Hansen Boart Longyear Company	4/14/2009	4/14/2009	sonic
Common Well Name 18D	Final Static Water Level 451.3 Feet (Site)	Surface Elevation 485.2 Feet (Site)	Borehole Diameter 6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐
State Plane 1,690,429 N, 2,532,742 E S/C/N
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E
Feet ☐ S Feet ☐ W

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

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
CS	60 60		1.5	0 - 2' FILL, WELL-GRADED SAND WITH SILT: SW-SM, strong brown (7.5YR 4/6), well graded, mostly sand [mostly medium, few coarse], trace subrounded gravel [mostly medium], some silt, moist.	(FILL) SW-SM								Relative Density by visual inspection, not SPT
			3.0 4.5	2 - 4.5' FILL, WELL-GRADED SAND: SW, dark gray (2.5Y 4/1), well graded, mostly sand [trace fine, little medium, mostly coarse], some gravel [mostly medium], very dense.	(FILL) SW								
CS	120 120		6.0 7.5 9.0	4.5 - 10' FILL, WELL-GRADED GRAVEL WITH SAND: (GW)s, strong brown (7.5YR 4/6), well graded, some sand [some medium, few coarse], mostly gravel [mostly medium, little coarse], trace clay, dry, medium dense.	(FILL) (GW)s								
			10.5 12.0 13.5	10 - 15' FILL, WELL-GRADED SAND WITH SILT: SW-SM, very dark brown (2.5Y 2.5/1), 50% dark olive brown (2.5Y 3/3) mottling, well graded, mostly sand [mostly fine, little coarse], few gravel [mostly medium], some silt, trace bottom ash.	(FILL) SW-SM								
CS	120 120		15.0 16.5	15 - 17' POORLY-GRADED GRAVEL: GP, poorly graded, mostly gravel [mostly coarse], with limestone cobbles (2 - 4 inches diameter).	GP								
			18.0 19.5	17 - 22' WELL-GRADED SAND WITH GRAVEL: (SW)g, very dark grayish brown (2.5Y 3/2), well graded, mostly sand [mostly fine, few coarse], little gravel [mostly medium], moist, medium dense.	(SW)g								

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

Signature

Firm Natural Resource Technology, Inc.
23713 W. Paul Road, St D. Pewaukee, WI 53072
Tel: 262.523.9000
Fax: 262.532.9001

Template: SOIL BORING - Project: 1940 GINT.GPJ

NATURAL RESOURCE TECHNOLOGY

Boring Number 18D

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			21.0		(SW)g									
CS	120 120		22.5–32	22 - 32' **WELL-GRADED SAND:** SW, strong brown (7.5YR 5/6), well graded, mostly sand [mostly fine, some medium, trace coarse].	SW									grain size @ 25'
			32–35	32 - 35' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, strong brown (7.5YR 5/6), well graded, some sand [mostly coarse], mostly gravel [mostly fine, few coarse].	(GW)s									
CS	120 120		35–43	35 - 43' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, strong brown (7.5YR 5/6), well graded, mostly sand [mostly fine], little gravel [little fine, few medium], medium dense, trace cobbles.	(SW)g									
			43–45	43 - 45' **SILT:** ML, very pale brown (10YR 8/2), dry, very loose.	ML									
CS	120 120		45–52.5	45 - 58' **WELL-GRADED GRAVEL WITH CLAY:** GW-GC, yellowish brown (10YR 5/4), very soft, well graded, mostly subrounded gravel [mostly fine, few coarse], little clay, wet, trace cobbles.	GW-GC									grain size @ 45'

Depth scale: 21.0, 22.5, 24.0, 25.5, 27.0, 28.5, 30.0, 31.5, 33.0, 34.5, 36.0, 37.5, 39.0, 40.5, 42.0, 43.5, 45.0, 46.5, 48.0, 49.5, 51.0, 52.5

NATURAL RESOURCE TECHNOLOGY

Boring Number 18D

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
CS	120 120		54.0 – 57.0	45 - 58' **WELL-GRADED GRAVEL WITH CLAY:** GW-GC, yellowish brown (10YR 5/4), very soft, well graded, mostly subrounded gravel [mostly fine, few coarse], little clay, wet, trace cobbles. *(continued)*	GW-GC									grain size @ 55'
			58.5 – 61.5	58 - 62' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), medium toughness, medium plasticity, firm, laminated, PP = 1.5.	CL									PP = Pocket Pen
			63.0 – 64.5	62 - 65' **WELL-GRADED GRAVEL WITH CLAY:** GW-GC, yellowish brown (10YR 5/4), very soft, well graded, mostly subrounded gravel [mostly fine, few coarse], little clay, wet, trace cobbles.	GW-GC									
CS	120 120		66.0 – 69.0	65 - 70' **LEAN CLAY:** CL, dark gray (2.5Y 4/1), medium toughness, medium to high plasticity, soft, PP = 0.5.	CL									
			70.5 – 72.0	70 - 72.5' **POORLY-GRADED SAND:** SP, dark gray (2.5Y 4/1), poorly graded, mostly sand [mostly fine], wet.	SP									
			73.5	72.5 - 75' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), poorly graded, mostly sand [mostly medium].	SP									
CS	120 120		75.0 – 81.0	75 - 82' **CLAYEY GRAVEL:** GC, dark yellowish brown (10YR 3/4), well graded, little sand [mostly coarse], mostly subrounded gravel [mostly medium], some clay, dense. 80' gray (N 5/), Dolomite Boulder.	GC									grain size @ 77'
			82.5	82 - 84' **SILT:** ML, gray (N 5/), dry, medium dense.	ML									
CS	120 120		84.0 – 85.5	84 - 86' **LEAN CLAY WITH GRAVEL:** (CL)g, gray (N 5/), some gravel [mostly coarse], dense, Till.	(CL)g									

NATURAL RESOURCE TECHNOLOGY

Boring Number 18D

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			87.0 88.5 90.0 91.5 93.0 94.5	86 - 95' **WEATHERED BEDROCK** BDX (SH), gray (N 5/), very hard, dry, Weathered Shale. *(continued)*	BDX (SH)									
				95' EOB.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Hennepin Power Station - New East Ash Landfill		18S	
Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Hansen Boart Longyear Company	4/14/2009	4/15/2009	sonic
Common Well Name: 18S	Final Static Water Level: 450.7 Feet (Site)	Surface Elevation: 485.2 Feet (Site)	Borehole Diameter: 6.0 inches
Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐ State Plane 1,690,428 N, 2,532,740 E S/C/N 1/4 of 1/4 of Section , T N, R	Lat ° ' " Long ° ' "	Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W	
Facility ID	County	State: IL	Civil Town/City/ or Village: Hennepin

Sample: Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	0 - 2' SW-SM, Blind Drilled to 52'. See log for 18D.	(FILL) SW-SM								
			2	2 - 4.5' SW.	(FILL) SW								
			4.5	4.5 - 10' (GW)s.	(FILL) (GW)s								
			10	10 - 15' SW-SM.	(FILL) SW-SM								
			15	15 - 17' GP.	GP								
			17	17 - 22' (SW)g.	(SW)g								
			22	22 - 32' SW.	SW								

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

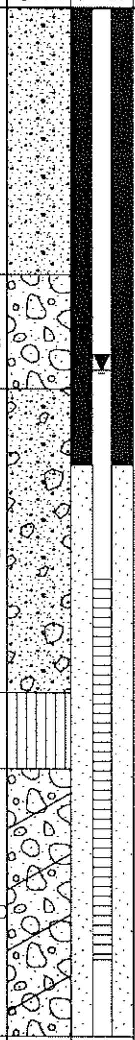
Signature: Rachel Wilberding

Firm: Natural Resource Technology, Inc.
23713 W. Paul Road, St D. Pewaukee, WI 53072
Tel: 262.523.9000
Fax: 262.532.9001

NATURAL RESOURCE TECHNOLOGY

Boring Number 18S

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			26–32	22 - 32' SW. *(continued)*	SW								
			32–35	32 - 35' (GW)s.	(GW)s								
			35–43	35 - 43' (SW)g.	(SW)g								
			43–45	43 - 45' ML.	ML								
			45–52	45 - 52' GW-GC.	GW-GC								
			52	52' EOB.									



NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Hennepin Power Station - New East Ash Landfill		19D	
Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Hansen Boart Longyear Company	4/15/2009	4/15/2009	sonic
Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
19D	450.8 Feet (Site)	483.9 Feet (Site)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐
State Plane 1,690,632 N, 2,533,812 E S/C/N
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E
Feet ☐ S Feet ☐ W

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

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
CS	60 60		0–10	0 - 10' **FILL, WELL-GRADED GRAVEL WITH CLAY AND SAND:** (GP-GC)s, dark yellowish brown (10YR 4/4), well graded, some sand [few medium, mostly coarse], mostly gravel [mostly fine, trace coarse], little clay. 4' 5 - 10% bottom ash to 5'.	(FILL) (GP-GC)s								Relative Density by visual inspection, not SPT
CS	120 120		5										
			10–14	10 - 14' **FILL, WELL-GRADED SAND: SW**, dark yellowish brown (10YR 3/6), 35% black) mottling, well graded, mostly sand [mostly fine], some bottom ash.	(FILL) SW								
			14–17	14 - 17' **FILL, ASH (Coal):** ASH (Coal), fine grained, gray.	(FILL) ASH (Coal)								
CS	120 120		15										
			17–30	17 - 30' **FILL, POORLY-GRADED SAND:** SP, dark yellowish brown (10YR 3/6), poorly graded, mostly sand [mostly fine, few coarse], moist, trace bottom ash, cohesive.	(FILL) SP								

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

Signature Rachel Wilberding

Firm Natural Resource Technology, Inc.
23713 W. Paul Road, St D. Pewaukee, WI 53072
Tel: 262.523.9000
Fax: 262.532.9001

NATURAL RESOURCE TECHNOLOGY

Boring Number 19D

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
CS	120 120		26–30	17 - 30' **FILL, POORLY-GRADED SAND:** SP, dark yellowish brown (10YR 3/6), poorly graded, mostly sand [mostly fine, few coarse], moist, trace bottom ash, cohesive. *(continued)*	(FILL) SP								
			30–35	30 - 35' **WELL-GRADED SAND WITH SILT:** SW-SM, yellowish brown (2.5Y 6/3), well graded, mostly sand [mostly coarse], little angular to subangular gravel [mostly fine, few coarse], some silt, dry, loose.	SW-SM								
CS	120 120		35–37	35 - 37' **WELL-GRADED GRAVEL WITH CLAY AND SAND:** (GW-GC)s, yellowish brown (10YR 5/6), well graded, some sand [mostly coarse], mostly subrounded to rounded gravel [mostly fine, few coarse], little clay, wet, loose.	(GW-GC)s								
			37–66	37 - 73' **CLAYEY SAND WITH GRAVEL:** (SC)g, yellowish brown (10YR 5/6), soft, well graded, mostly sand [few fine, mostly coarse], little gravel [mostly coarse], some clay, wet.	(SC)g								
CS	120 60		45	45' - 55' Poor Recovery.									
CS	120 120		55										
CS	120 120		65										

NATURAL RESOURCE TECHNOLOGY

Boring Number 19D

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
CS	120 120		68 70 72	37 - 73' **CLAYEY SAND WITH GRAVEL:** (SC)g, yellowish brown (10YR 5/6), soft, well graded, mostly sand [few fine, mostly coarse], little gravel [mostly coarse], some clay, wet. *(continued)*	(SC)g									
			74 76 78 80 82	73 - 83' **WEATHERED BEDROCK** BDX (SH), dark gray (N 4/), dry, Weathered Shale.	BDX (SH)									
			84	83 - 85' **SHALE:** BDX (SH), dark gray (N 4/), dry, samples were pulverized, drilling more difficult.	BDX (SH)									
				85' EOB.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Hennepin Power Station - New East Ash Landfill		19S

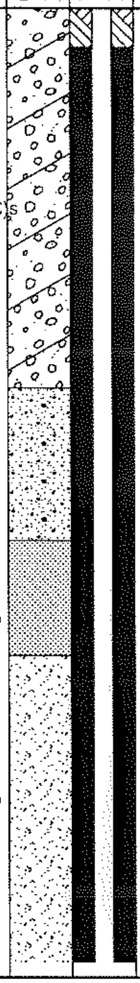
Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Hansen Boart Longyear Company	4/16/2009	4/16/2009	sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
19S	450.6 Feet (Site)	483.9 Feet (Site)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐		Local Grid Location
State Plane 1,690,631 N, 2,533,810 E S/C/N 1/4 of 1/4 of Section , T N, R	Lat ° ' " Long ° ' "	☐ N ☐ E Feet ☐ S Feet ☐ W

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

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 10	0 - 10' (GW-GC)s, Blind drilled to 52'. See log for 19D.	(FILL) (GW-GC)s								
			10 - 14	10 - 14' SW.	(FILL) SW								
			14 - 17	14 - 17' ASH (Coal).	(FILL) ASH (Coal)								
			17 - 30	17 - 30' SP.	(FILL) SP								



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

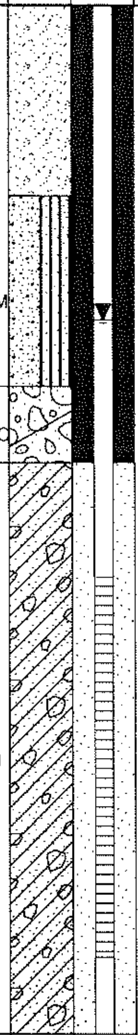
Signature Rachel Wilberding

Firm Natural Resource Technology, Inc.
23713 W. Paul Road, St D. Pewaukee, WI 53072
Tel: 262.523.9000
Fax: 262.532.9001

NATURAL RESOURCE TECHNOLOGY

Boring Number 19S

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			26–30	17 - 30' SP. *(continued)*	(FILL) SP									
			30–35	30 - 35' SW-SM.	SW-SM									
			35–37	35 - 37' GW-GC.	GW-GC									
			37–52	37 - 52' (SC)g.	(SC)g									
			52	52' EOB.										



SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Hennepin Power Station - New East Ash Landfill		40S

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jerry Hancock PSC Drilling	10/25/2010	10/26/2010	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
40S	473.8 Feet (Site)	485.8 Feet (Site)	8.3 inches

Local Grid Origin ☐ (estimated: ☒) or Boring Location ☒
State Plane 1,690,567 N, 2,533,492 E S/C/N
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location
Feet ☐ N ☐ S
Feet ☐ E ☐ W

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

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 42		0–1	0 - 10.5' FILL, WELL-GRADED GRAVEL WITH SAND: (GW)s, brown (7.5YR 5/4), well graded, dry, Gravel is composed of lithics (granite and dolomite). 16-30% lean clay.	(FILL) (GW)s									
2 CS	60 42		5											10-15 ft. dense. A lot of hammer blows
3 CS	60 60		10											15-20 ft. softer. Few hammer blows
			10.5–12	10.5 - 28' FILL, ASH (Coal): ASH (Coal), black (5YR 2.5/1), dry, Coarse like bottom ash to 15 ft.	(FILL) ASH (Coal)									

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

Signature	Firm	
	Natural Resource Technology	Tel: Fax:

NATURAL RESOURCE TECHNOLOGY

Boring Number 40S

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				10.5 - 28' FILL, ASH (Coal): ASH (Coal), black (5YR 2.5/1), dry, Coarse like bottom ash to 15 ft. *(continued)*										
			13											
			14											
4 CS	60 60		15	15' very dark grayish brown (10YR 3/2), Fine like fly ash. Horizontally laminated in alternating layers of fine and coarse ash.										
			16											
			17	17' moist.										
			18											
			19											
5 CS	60 60		20		(FILL) ASH (Coal)									
			21	21' wet, Very soft to 24 ft.										
			22											
			23											
			24	24' moist.										
6 CS	60 52		25	25 - 28' wet, Soft. Very fine ash.										
			26											
			27											
			28	28 - 30' WELL-GRADED SAND: SW, dark yellowish brown (10YR 4/4), moist to wet, Native, buried terrace. Well graded fine to medium sand. 5-10% silt. Trace fine gravel (rounded) and root fibers.	SW									
			29											
7 CS	60 48		30	30 - 33.5' LEAN CLAY WITH SAND: (CL)s, dark grayish brown (2.5Y 4/2), slow dilatency, medium toughness, medium plasticity, moist to wet, 5-10% fine sand. Trace organics (black, woody).	(CL)s									
			31											
			32											

NATURAL RESOURCE TECHNOLOGY

Boring Number 40S

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	30 - 33.5' LEAN CLAY WITH SAND: (CL)s, dark grayish brown (2.5Y 4/2), slow dilatency, medium toughness, medium plasticity, moist to wet, 5-10% fine sand. Trace organics (black, woody). *(continued)*	(CL)s									
8 CS	60 27		34–36	33.5 - 37' WELL-GRADED GRAVEL WITH SAND: (GW)s, strong brown (7.5YR 5/6), well graded, wet, Fine to coarse gravel.	(GW)s									Poor recovery
			37–39	37 - 40' WELL-GRADED GRAVEL: GW, very pale brown (10YR 7/3), well graded, Fine to coarse angular gravel. 5-10% medium sand.	GW									
9 CS	60 27		40–44	40 - 45' WELL-GRADED GRAVEL WITH CLAY: GW-GC, light yellowish brown (10YR 6/4), wet, Fine sand to coarse gravel. 15-25% lean clay. 5-10% sand (well graded). 20% lean clay. Occasionally gravelly layers ~3 in. thick.	GW-GC									
10 CS	60 18		45–50	45 - 50.5' WELL-GRADED GRAVEL WITH SAND: (GW)s, light yellowish brown (10YR 6/4), wet, Fine to coarse gravel. 15-25% well graded sand (fine to coarse). <5% silt.	(GW)s									Poor recovery
				50.5' EOB.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Hennepin Power Station		45S

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	6/23/2015	6/24/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
45S	Feet (NAVD88)	465.70 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,689,993.67 N, 2,531,896.69 E E/W (W circled)
1/4 of 1/4 of Section , T N, R

Lat 41° 18' 13.503"
Long -89° 18' 36.702"

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

Facility ID	County	State	Civil Town/City/ or Village
	Putnam	Illinois	Hennepin

Sample: Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 / 20	2 5 4 3	0 - 2.5	0 - 2.5' **SILT:** ML, very dark grayish brown (10YR 3/2), mostly silt, some very fine sand, trace roots and gravel, cohesive, nonplastic, dry to moist.	ML									
2 SS	24 / 6	2 10 6 4	2.5 - 5.0	2.5 - 5' **SILT WITH SAND:** (ML)s, very dark grayish brown (10YR 3/2) to dark reddish gray (5YR 4/2), trace clay.	(ML)s									
3 ST	18 / 17.5		5.0 - 6.5	5 - 6.5' Shelby Tube.										ST3: 18" at 550 lbs of pressure.
			6.5 - 7.5	6.5 - 7.5' **SILT WITH SAND:** (ML)s, very dark grayish brown (10YR 3/2) to dark reddish gray (5YR 4/2), trace clay.	(ML)s									
4 SS	24 / 18	6 12 20 18	7.5 - 10.5	7.5 - 10.5' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, brown (7.5YR 4/3), subangular gravel, trace clay, moist, top 2" of unit is fine poorly-graded sand. 8.2' thin layer of black material.	(SW)g									
5 SS	24 / 16	7 3 3	10.0 - 10.5											

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

Signature Patrick M Hafle (handwritten)

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

NATURAL RESOURCE TECHNOLOGY

Boring Number 45S

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
		7	11.0, 11.5, 12.0	10.5 - 13.4' **POORLY-GRADED SAND:** SP, brown (7.5YR 5/4), fine sand, trace to little clay, trace silt, cohesive, decreasing cohesiveness and clay content with depth, moist to wet.	SP									
6 SS	24 24	8 19 22 9	12.5, 13.0											
			13.5, 14.0, 14.5	13.4 - 15' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, brown (7.5YR 5/3), subangular to rounded gravel, fine sand, trace clay and silt, wet.	(GW)s									
7 SS	24 19	8 23 40 25	15.0, 15.5	15 - 15.4' **POORLY-GRADED SAND:** SP, brown (7.5YR 5/4), fine sand, trace clay and silt, wet.	SP									
			16.0, 16.5, 17.0	15.4 - 32.5' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, yellowish brown (10YR 5/4), rounded to subangular gravel, fine sand, trace clay and silt, wet.										
8 SS	24 12	2 10 17 15	17.5, 18.0, 18.5, 19.0, 19.5											
9 SS	24 10	10 31 25 3	20.0, 20.5, 21.0, 21.5, 22.0		(GW)s									
10 SS	24 8	9 14 12 13	22.5, 23.0, 23.5, 24.0, 24.5	22.7' brown (7.4YR 4/2), thin layer of poorly-graded fine sand.										
11 SS	24 11	5 8 10 9	25.0, 25.5, 26.0, 26.5, 27.0											
12 SS	24 8	10 11 11	27.5, 28.0	27.5' increase in clay content.										

NATURAL RESOURCE TECHNOLOGY

Boring Number 45S

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
		10	28.5, 29.0, 29.5	15.4 - 32.5' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, yellowish brown (10YR 5/4), rounded to subangular gravel, fine sand, trace clay and silt, wet. *(continued)*									
13 SS	24 19	7 8 6 6	30.0, 30.5, 31.0, 31.5, 32.0		(GW)s								
14 SS	24 8	5 6 11 12	32.5, 33.0, 33.5, 34.0, 34.5	32.5 - 37.5' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, yellowish brown (10YR 5.4), medium to coarse sand, fine subangular to rounded gravel, fine gravel, trace silt and clay, wet.									
15 SS	24 9	4 5 9 11	35.0, 35.5, 36.0, 36.5, 37.0		(SW)g								
16 SS	24 14	7 10 9 9	37.5, 38.0, 38.5, 39.0, 39.5	37.5 - 40.5' **WELL-GRADED SAND:** SW, yellowish brown (10YR 5/4), fine to coarse sand, few to little subangular to subrounded gravel, trace clay, wet, layer of fine sand at top 1" of unit.	SW								
17 SS	24 19	9 6 7 8	40.0, 40.5, 41.0, 41.5, 42.0	40.5 - 42.5' **SILT:** ML, yellowish brown (10YR 5/4), little to some clay, trace medium sand, cohesive, nonplastic, moist.	ML								
18 SS	24 16	3 13 11 13	42.5, 43.0, 43.5, 44.0, 44.5	42.5 - 45' **WELL-GRADED SAND WITH GRAVEL:** to **POORLY-GRADED SAND WITH GRAVEL:** (SW)g, yellowish brown (10YR 5/4), mostly fine sand, subangular to rounded gravel, little to some medium to coarse sand, trace clay and silt, wet.	(SW)g								
			45.0	45' End of Boring.									

SOIL BORING LOG INFORMATION

Natural Resource Technology

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Hennepin Power Station		46

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jason Drabek Cascade Drilling	8/11/2015	8/11/2015	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
46	Feet (NAVD88)	496.44 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,690,085.24 N, 2,533,743.42 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 41° 18' 14.23"
Long -89° 18' 12.5"

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

Facility ID	County	State	Civil Town/City/ or Village
	Putnam	Illinois	Hennepin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 41.5		0–5	0 - 5' **FILL, TOPSOIL:** GM, dark yellowish brown (10YR 4/4), mostly fine to coarse gravel, silt (<50%), roots (<10%). 2' ash (30-50%). 3' - 3.5' fine to coarse gravel layer.	(FILL) GM									
2 CS	60 42		5–11	5 - 11' **FILL, SILT:** ML, yellowish brown (10YR 5/8) mottling, fine to coarse gravel (<40%), clay (<20%), ash (5-15%), ash content increases with depth, dry.	(FILL) ML									
3 CS	30 30		10	10' decrease in fine gravel content (<10%), decrease in ash content (<10%), increase in clay content with depth, low plasticity, moist.										
			11–12.5	11 - 12.5' **FILL, ASH (Coal):** very dark brown (10YR 2/2), clay (30-50%), fine gravel (5-15%), low plasticity, moist.	(FILL)									

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

Signature: Andrea Salus

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

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
4 CS	30 30		12.5 - 15	12.5 - 15' **FILL, LEAN CLAY:** CL, very dark grayish brown (10YR 3/2), silt-sized ash (30-50%), cobbles (15-30%), fine subrounded gravel (10-15%), very fine sand (10-15%), trace silt-sized ash, medium plasticity, cohesive, wet. 14.8' wood fragments (5-15%).	(FILL) CL									
5 CS	60 58		15 - 18	15 - 18' **FILL, SILTY CLAY** CL/ML, very dark gray (10YR 3/1), fine gravel (5-10%), very fine sand (10-15%), cohesive, medium plasticity, soft, wet. 16' - 16.5' dark brown (10YR 3/3). 16.5' - 17.0' mostly silt [very soft, wet].	(FILL) CL/ML									
			18 - 19.9	18 - 19.9' **FILL, CLAYEY SILT** ML/CL, pale brown (10YR 6/3), fine to coarse angular gravel (>15%), fine sand (10-20%), dry.	(FILL) ML/CL									
6 CS	60 60		20 - 23	20 - 23' **FILL, ASH (Coal):** very dark brown (10YR 2/2), clay to silt-sized ash, wood fragments (5-10%), seams of very dark gray (10YR 3/1) material.	(FILL)									
			23 - 30	23 - 30' **CLAYEY SILT** ML/CL, very dark grayish brown (10YR 3/2), fine to medium sand (30-50%), subangular to subrounded gravel (>15%), dry. 24' grayish brown (10YR 5/2).	ML/CL									
7 CS	60 60		25	25' cobbles (15-30%).										
8 CS	60 58		30 - 50	30 - 50' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, grayish brown (10YR 5/2), dark yellowish brown (10YR 4/6), and yellowish brown (10YR 5/8), subangular to subrounded gravel, coarse sand, clay (5-15%), dry.	(GW)s									

NATURAL RESOURCE TECHNOLOGY

Boring Number 46

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			34	30 - 50' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, grayish brown (10YR 5/2), dark yellowish brown (10YR 4/6), and yellowish brown (10YR 5/8), subangular to subrounded gravel, coarse sand, clay (5-15%), dry. *(continued)*										
9 CS	60 23		35											
			36–39											
10 CS	60 54		40	40' clay (5-10%) , clay content increasing with depth, trace silt and very fine sand, moist.										
			41–44		(GW)s									
11 CS	60 54		45	45' increase in clay content (10-15%), trace fine sand.										
			46–49	47.5' - 49.0' pulverized cobble (white, rock flour and gravel-sized fragments).										
12 CS	120 72		50	50 - 60' **WELL-GRADED GRAVEL:** GW, subrounded to rounded gravel, clay (15-20%), trace fine sand and silt, wet.										
			51–54		GW									

NATURAL RESOURCE TECHNOLOGY

Boring Number 46

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			55 56 57 58 59	50 - 60' **WELL-GRADED GRAVEL:** GW, subrounded to rounded gravel, clay (15-20%), trace fine sand and silt, wet. *(continued)* 55' - 56' yellowish brown (10YR 5/5).	GW									
			60	60' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Hennepin Power Station		47

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jason Drabek Cascade Drilling	8/10/2015	8/10/2015	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
47	Feet (NAVD88)	502.13 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,689,837.69 N, 2,533,052.86 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 41° 18' 11.85"
Long -89° 18' 21.579"

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

Facility ID	County	State	Civil Town/City/ or Village
	Putnam	Illinois	Hennepin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 26		0 - 5	0 - 5' **FILL, TOPSOIL:** ML, brown (7.5YR 4/2), silt, trace roots, trace angular to subangular gravel dry. 0.7' grayish brown (10YR 5/2), subangular gravel (5-10%). 1' very dark gray (5YR 3/1), trace rounded to subrounded gravel, trace sand-sized ash, dry.	(FILL) ML								
2 CS	60 43		5 - 10.5	5 - 11.5' **FILL, ASH (Coal):** black (5YR 2.5/1), clay (5-15%), trace subrounded to subangular gravel, moist. 7' very dark brown (7.5YR 2.5/2), cohesive, dry to moist. 8.6' increased clay content.	(FILL)								
3 CS	60 32		10.0	10' increase in clay content (15-25%).									

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

Signature

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

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			11.0	5 - 11.5' **FILL, ASH (Coal):** black (5YR 2.5/1), clay (5-15%), trace subrounded to subangular gravel, moist. *(continued)*	(FILL)									
			11.5	11.5 - 16.3' **FILL, CLAYEY SILT** ML/CL, dark reddish gray (5YR 4/2), gravel (>5%), dry.	(FILL) ML/CL									
4 CS	60 60		15.0											
			16.5	16.3 - 20' **FILL, ASH (Coal):** dark gray (10YR 4/1), mostly silt-sized ash, clay (0-10%), dry to moist.	(FILL)									
5 CS	60 60		20.0	20 - 21.8' **FILL, CLAYEY SILT** ML/CL, dark reddish gray (5YR 4/2), strong brown mottling, gravel (>5%), moist to wet.	(FILL) ML/CL									
			22.0	21.8 - 30' **FILL, SILT:** ML, dark gray (10YR 4/1) to very dark brown (7.5YR 2.5/2), clay, trace sand and gravel-sized bottom ash, moist to wet.	(FILL) ML									
			22.5	22.7' wood chips (<1" layer).										
6 CS	60 60		25.0	25' - 26.6' very dark brown (7.5YR 2.5/2), moist to wet.										
			28.0											

NATURAL RESOURCE TECHNOLOGY

Boring Number 47

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			28.5 29.0 29.5	21.8 - 30' **FILL, SILT:** ML, dark gray (10YR 4/1) to very dark brown (7.5YR 2.5/2), clay, trace sand and gravel-sized bottom ash, moist to wet. *(continued)*	(FILL) ML									
7 CS	60 60		30.0 30.5 31.0 31.5 32.0 32.5 33.0	30 - 33.5' **POORLY-GRADED SAND:** SP, light brown (10YR 5/4), clay (5-15%), subrounded gravel (5-10%), dry. 31.2' - 33.5' white cobble pulverized by drilling method into angular to subangular gravel-sized pieces, dry.	SP									
			33.5 34.0 34.5	33.5 - 35' **SILT WITH GRAVEL:** (ML)g, light brown (10YR 7/3), subangular to subrounded gravel, noncohesive, dry.	(ML)g									
8 CS	60 18		35.0 35.5 36.0 36.5 37.0 37.5 38.0 38.5 39.0 39.5	35 - 40.9' **WELL-GRADED GRAVEL:** GW, very pale brown (10YR 7/3), gravel and cobbles (50%), sand (10-20%), trace clay. 36.5' cobble (>6" diameter) pulverized by drilling method into gravel-sized, sand-sized, and silt-sized pieces.	GW									
9 CS	60 60		40.0 40.5	40' piece of cobble.										
			41.0 41.5 42.0 42.5 43.0 43.5 44.0 44.5	40.9 - 45' **POORLY-GRADED SAND WITH CLAY AND GRAVEL:** (SC)g, sand (20-40%), subangular gravel (25-30%), clay (15-25%). 43.7' - 45' increased clay content.	(SC)g									
10 CS	60 42		45.0 45.5	45 - 55' **CLAYEY SILT** ML/CL, light brown (10YR 5/4), moist.	ML/CL									

NATURAL RESOURCE TECHNOLOGY

Boring Number 47

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			45.0 - 55.0	45 - 55' **CLAYEY SILT** ML/CL, light brown (10YR 5/4), moist. *(continued)* 45.6' - 45.7 ' trace black silt-sized material. 45.8' - 46.7' wet.	ML/CL									
11 CS	60 34													
				51.4' wet.										
12 CS	60 33		55.0 - 60.0	55 - 60' **CLAYEY GRAVEL:** GC, subrounded gravel, clay (5-15%), trace silt and sand, decreasing silt and sand content with depth, wet.	GC									
			60.0	60' End of Boring.										

SOIL BORING LOG INFORMATION

Natural Resource Technology

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Hennepin Power Station		48

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jason Drabek Cascade Drilling	8/11/2015	8/11/2015	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
48	Feet (NAVD88)	485.19 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,690,545.64 N, 2,533,337.84 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 41° 18' 18.816"
Long -89° 18' 17.753"

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

Facility ID	County	State	Civil Town/City/ or Village
	Putnam	Illinois	Hennepin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 60		0 - 1.9	0 - 1.9' **FILL, TOPSOIL:** ML, brown (7.5YR 4/2), gravel (5-10%), trace roots, clay, and sand, dry.	(FILL) ML								
			1.9 - 3.4	1.9 - 3.4' **FILL, SILTY SAND WITH GRAVEL:** (SM)g, very pale brown (10YR 7/3), very fine sand, dry.	(FILL) (SM)g								
			3.4 - 7.9	3.4 - 7.9' **FILL, CLAYEY SILT** ML/CL, very dark brown (7YR 2/2), gravel (>15%), cohesive, dry. 4.2' cobbles.	(FILL) ML/CL								
2 CS	60 42		5.0	5' - 7.9' decreased cobble content. 6.6' ash seam (2" layer, color changes from gray to reddish brown with depth).									

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

Signature [signature]

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

NATURAL RESOURCE TECHNOLOGY

Boring Number 48

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			8.0	7.9 - 11.4' **FILL, SANDY SILT WITH GRAVEL:** s(ML)g, silt (>50%), cobbles (20-40%), sand (10-20%), trace clay, noncohesive, dry.										
			9.5		(FILL) s(ML)g									
3 CS	60 56		10.0											
			11.5	11.4 - 23.4' **FILL, ASH (Coal):** dark gray, (10YR 4/1), cohesive, dry.										
			13.0	13' - 13.4' very dark brown (7.5YR 2.5/2).										
4 CS	60 55		15.0	15' - 20' trace gravel-sized ash.										
			16.0		(FILL)									
			17.0	16.9' moist.										
5 CS	60 60		20.0	20' - 23.4' trace white particles, wet.										
			21.0											

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number 48

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			21.5	11.4 - 23.4' **FILL, ASH (Coal):** dark gray, (10YR 4/1), cohesive, dry. *(continued)*	(FILL)									
			23.0	23.2' white particles (0.2" layer).										
			23.5	23.4 - 24.5' **FILL, SILT:** ML, trace subangular to subrounded gravel, cohesive, dry.	(FILL) ML									
			24.5	24.5 - 25' **FILL, SANDY SILT WITH GRAVEL:** s(ML)g, silt (>50%), gravel (30-40%), very fine sand (5-10%), dry.	(FILL) s(ML)g									
6 CS	60 52		25.0	25 - 40.4' **FILL, SILTY SAND WITH GRAVEL:** (SM)g, very fine sand (30-40%), gravel (20-40%), silt (20-30%), dry.	(FILL) (SM)g									
7 CS	60 36		30.0	30' - 33' decrease in silt content (0-10%), trace clay, dry.										
			32.0	31.9' brown (10YR 4/3), trace ash.										
			34.0											

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number 48

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			34.5	25 - 40.4' **FILL, SILTY SAND WITH GRAVEL:** (SM)g, very fine sand (30-40%), gravel (20-40%), silt (20-30%), dry. *(continued)*										
8 CS	60 36		35.0	35' - 40' clay content increases with depth, iron oxidation.										
			37.5	37.3' wet.	(FILL) (SM)g									
9 CS	120 78		40.0											
			40.5	40.4 - 54' **WELL-GRADED GRAVEL:** GW, brown (10YR 4/3), gravel (>50%), clay (10-30%), increase in clay content (20-40%) with depth, sand (10-20%).										
			44.0		GW									
			47.0											

NATURAL RESOURCE TECHNOLOGY

Boring Number 48

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
10 CS	48 28		47.5 – 54.0	40.4 - 54' **WELL-GRADED GRAVEL:** GW, brown (10YR 4/3), gravel (>50%), clay (10-30%), increase in clay content (20-40%) with depth, sand (10-20%). *(continued)*	GW									
			54.0	54' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Hennepin Power Station		49

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/2/2015	7/6/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
49	Feet (NAVD88)	465.76 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,689,022.19 N, 2,528,297.09 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 41° 18' 4.255"
Long -89° 19' 23.987"

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

Facility ID	County	State	Civil Town/City/ or Village
	Putnam	Illinois	Hennepin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 13	3 4 7 10	0–2	0 - 5.3' **FILL, SILT WITH GRAVEL:** (ML)g, very dark grayish brown (10YR 3/2), trace sand and roots, rounded to subangular fine gravel, noncohesive, nonplastic, dry.										
2 SS	24 10.5	4 6 5 3	2–4	2.5' increase in gravel content and gravel size to fine to coarse, coarse sand (5-15%), dry.	(FILL) (ML)g									
3 SS	24 19	2 3 9 10	5–7	5' moist. 5.3 - 20.2' **FILL, ASH (Coal):** very dark gray (10YR 3/1), mostly silt sized particles, few interbedded sand sized layers, trace coarse ash, noncohesive, nonplastic, moist to wet.										
4 SS	24 22	5 27 30 50 for 5"	7.5–9	7.5' black (10YR 2/1). 8.2' mostly medium sand-sized particles with some coarse sand to fine gravel-sized ash.	(FILL)									
5 SS	24 24	5 11 20 50 for 5"	10–12	10' mostly silt sized particles, trace fine gravel to coarse sand sized ash, trace fine sand sized ash.										
6	24	4 22	12.5–13											

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

Signature [signature]

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

NATURAL RESOURCE TECHNOLOGY

Boring Number 49

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
SS	24	26 24	14	5.3 - 20.2' **FILL, ASH (Coal):** very dark gray (10YR 3/1), mostly silt sized particles, few interbedded sand sized layers, trace coarse ash, noncohesive, nonplastic, moist to wet. *(continued)*									
7 SS	24 22	4 9 38 16	15	15' wet.									
			16, 17	16.4' seam of sand-sized particles (2" thick).	(FILL)								
8 SS	10 7.5	22 50 for 4"	18	17.5' mostly sand sized particles, trace gravel, trace silt.									
			19										
9 SS	24 14	2 2 2 2	20, 21, 22	20.2 - 22.5' **LEAN CLAY:** CL, black (10YR 2/1), cohesive, medium plasticity, wet.	CL								
10 ST	24 0		23, 24	22.5 - 24.5' Shelby Tube Sample. No Recovery.									ST10: 24" push at 150lbs of pressure. No Recovery.
11 SS	24 2	4 4 4 4	25, 26, 27	24.5 - 27.8' **LEAN CLAY:** CL, Low Recovery, trace gravel, cohesive, low plasticity, wet.	CL								
12 SS	24 21.5	1 1 4 7		27.5' very dark gray (10YR 3/1).									
			28, 29	27.8 - 30' **SILTY SAND:** SM, mostly fine sand, coarse to fine gravel (5-15%), wet.	SM								
13 SS	24 14	6 15 18 14	30, 31	30 - 45' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, yellowish brown (10YR 5/4), fine to medium sand, fine to coarse rounded to subangular gravel, silt decreasing to trace silt with depth (5-15%), trace clay, wet.	(SW)g								
14 SS	24 15	16 16 14 12	32, 33	33.2' piece of gravel (2" diameter).									
15 SS	24 5	8 3 2	34	34' fine to coarse sand.									

NATURAL RESOURCE TECHNOLOGY

Boring Number 49

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
		5	35	30 - 45' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, yellowish brown (10YR 5/4), fine to medium sand, fine to coarse rounded to subangular gravel, silt decreasing to trace silt with depth (5-15%), trace clay, wet. *(continued)*										
16 SS	24 9	3 3 4 11	36	36' increased gravel content with depth. 36.3' - 36.4' layer of increased clay content [15-30%].										
			37											
17 SS	24 18	11 10 8 22	38	38.3' trace very dark brown silt nodules (10YR 2/2).										
			39											
18 SS	24 14.5	9 16 15 16	40	40' trace very dark brown (10YR 2/2) and light brown (7.5YR 6/3) mottling.	(SW)g									
			41											
19 SS	24 17.5	12 21 21 17	42	42' no light brown (7.5YR 6/3) mottling.										
			43											
20 SS	12 9.5	10 14	44											
			45	45' End of Boring.										

Appendix A4

AECOM Boring Logs and Well Details

EXPLORATION METHOD (B=BORING, C=CPT, P=PIEZOMETER)

XXX–X###

ID NUMBER

STATION ABBREVIATION

LEGEND

PROPOSED BORING LOCATION

PROPOSED CPT LOCATION

PROPOSED PIEZOMETER LOCATION

PROPOSED CROSS SECTION LOCATION

CCR UNIT BERM ALIGNMENT

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

DRAFT

0 200

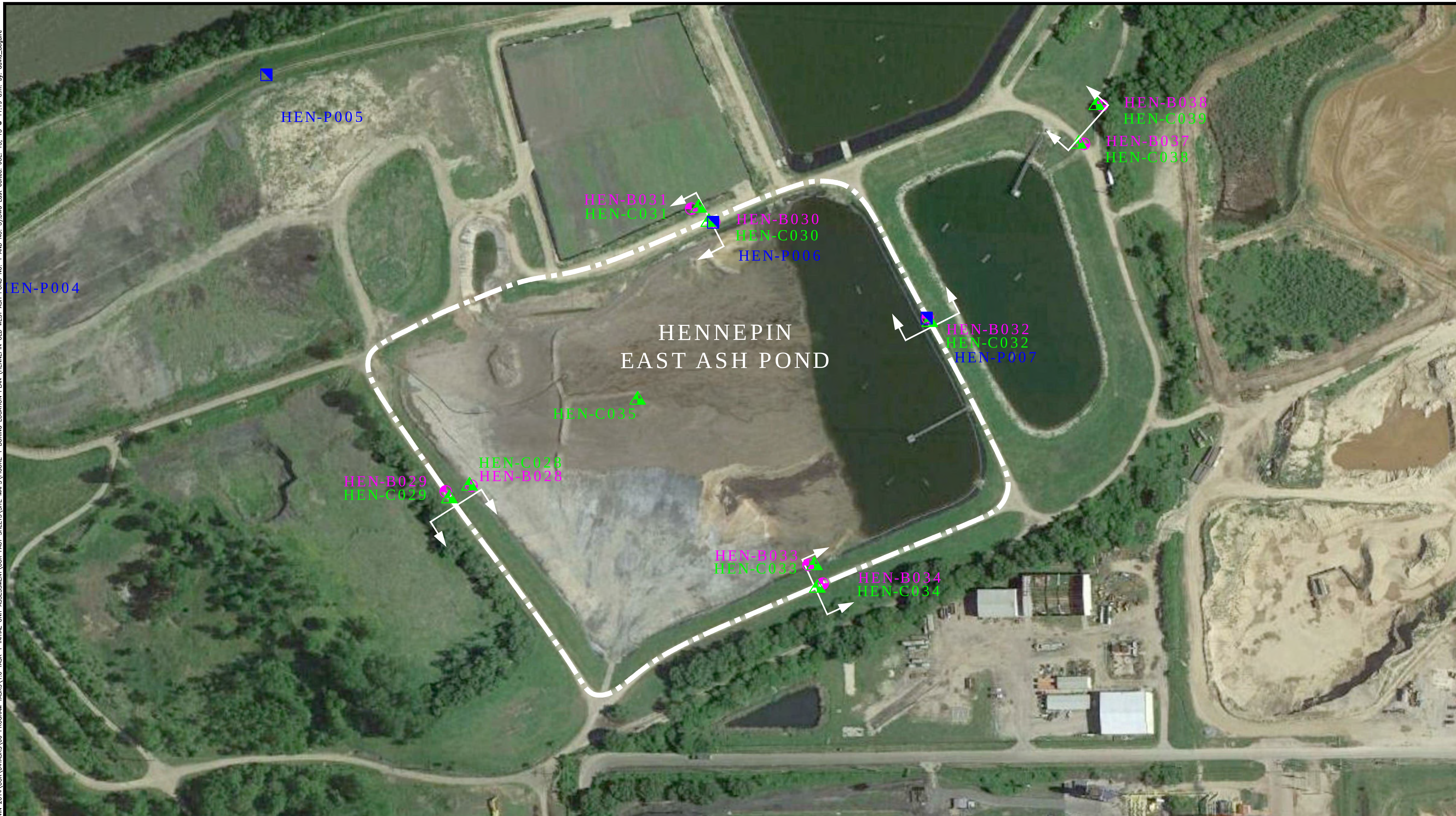
APPROXIMATE SCALE FEET

N

DYNEGY, INC	PROJECT NO. 60428794
AECOM	

DRN. BY: djd July 2015 DSGN. BY: eg CHKD. BY: eg	Hennepin Ash Pond No. 2 Field Investigation Plan	FIG. NO. D-01

File: P:\PROJECTS\GEOTECH\DYNEGY – BALDWIN 2014\CCR\04TASKS\00 PROGRAM TASKS\1.0 TASK 1 INITIAL UNIT ASSESSMENT\CCR FACT SHEETS\SITE MAPS\FIGURE 1 BORING LOCATION PLAN (HENNEPIN OLD WEST ASH POND NO. 1 AND NO. 3).DWG Last edited: JUL. 15, 15 @ 11:19 a.m. by: david_deguire



File: P:\PROJECTS\GEOTECH\DYNEGY – BALDWIN 2014\CCR\04TASKS\00 PROGRAM TASKS\1.0 TASK 1 INITIAL UNIT ASSESSMENT\CCR FACT SHEETS\SITE MAPS\FIGURE 1 BORING LOCATION PLAN (HENNEPIN OLD WEST ASH POND NO. 1 AND NO. 3).DWG Last edited: JUL. 15, 15 @ 11:19 a.m. by: david_deguire

XXX–X### — EXPLORATION METHOD (B=BORING, C=CPT, P=PIEZOMETER); ID NUMBER; STATION ABBREVIATION

LEGEND

- PROPOSED BORING LOCATION
- PROPOSED CPT LOCATION
- PROPOSED PIEZOMETER LOCATION
- PROPOSED CROSS SECTION LOCATION
- CCR UNIT BERM ALIGNMENT

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

7

DRAFT

N

0 200
APPROXIMATE SCALE FEET

DYNEGY, INC	PROJECT NO. 60428794
AECOM	
DRN. BY: djd July 2015 DSGN. BY: eg CHKD. BY: eg	Hennepin East Ash Pond Field Investigation Plan	FIG. NO. D-02

PRIVILEGED & CONFIDENTIAL - ATTORNEY CLIENT PRIVILEGED

Project: Hennepin Power Station

Project Location: Hennepin, Illinois

Project Number: 60439752

Log of Boring HEN-B020

Date(s) Drilled	10/01/2015 to 10/02/2015	Logged By	Robert Weseljak	Checked By	AJW
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	41.5 ft
Drill Rig Type	Mobile 50 Truck Mounted	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Portland Cement and Grout	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	MATERIAL DESCRIPTION	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0						0.0								
	SS	SS-1	19 17 13	56	Gravel (GP).	0.3								
					Lean CLAY (CL), trace fine to coarse gravel.	2.5								
	SS	SS-2	6 8 7	67	Medium dense, moist, brown, clayey fine to coarse GRAVEL (GC).	5.0					0.0 1.0			
5	SS	SS-3	6 8 7	83	Stiff, moist, sandy lean CLAY (CL), trace fine to coarse gravel.						1.5			
	SS	SS-4	1 3 4	78							1.0			
10	ST	ST-5		52		15.0								*Pushed shelby tube from 9.5 to 11.5 feet*
15	SS	SS-6	5 3 7	6	Loose, brown well graded GRAVEL (GW).	20.0								*17.0 feet: Drillers Note - cobbles from 17.0 to 20.0 feet*
20	SS	SS-7	30 48 50/5"	72	Dry, brown with some rust and black, well graded SAND (SW) with gravel [Fill].	25.0								
25	SS	SS-8	22 33 29	67	Very dense, dry, brown clayey GRAVEL (GC), little sand.									
30														

Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30		SS-9	27 19 22	78											
35		SS-10	19 27 20	78											
40		SS-11	15 16 41	56											*Less fines in Sample 11*
						End of Boring at 41.5 ft	41.5								*Boring backfilled with 94 pounds of Portland Cement and 25 pounds of bentonite*
45															
50															
55															
60															
65															

Project: Hennepin Power Station

Project Location: Hennepin, Illinois

Project Number: 60439752

Log of Boring HEN-B021

Date(s) Drilled	10/01/2015 to 10/02/2015	Logged By	Robert Weseljak	Checked By	AJW
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	45.1 ft
Drill Rig Type	Mobile 57 Truck Mounted	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Portland Cement and Grout	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	MATERIAL DESCRIPTION	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0	SS	SS-1	80/6"	17	Topsoil, lean CLAY (CL).	0.0								
	SS	SS-2	6 5 4	44	Stiff, brown, sandy lean CLAY (CL), trace fine to coarse gravel.	2.5					<0.5			
5	ST	ST-3									2.0			*Pushed shelby tube from 5.0 to 6.0 feet*
	SS	SS-4	10 61	83	Very dense, dry, brown, silty GRAVEL (GM).	8.3								
10	SS	SS-5	14 14 12	67	Medium dense, moist, brown, clayey GRAVEL (GC).	10.0								
15	SS	SS-6	20 15 19	44	Stiff, moist, dark brown to gray and black, medium plastic cohesive lean CLAY (CL).	15.0					<0.5			
20	SS	SS-7	9 12 9	100	Very stiff, moist, gray to black, sandy SILT (ML) with Ash [Fill].	20.0					1.0			
	ST	ST-8		72										*Pushed shelby tube from 22.0 to 24.0 feet*
25	SS	SS-9	6 20 32	100							<0.5			
30														

Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30	SS-10	11 20 24	94							0.5			*Less sand in Sample 10*
35	SS-11	4 8 10	100		35.0 Stiff, moist, black, lean CLAY (CL) with Ash, trace to little sand [Fill].					2.5			
40	SS-12	5 6 5	100		40.0 Medium dense, moist to wet, brown, silty SAND (SM).								
45	SS-13	50/2"	0		45.1 End of Boring at 45.1 ft								*45.0 feet: Drillers Note - hit rock Boring backfilled with 94 pounds of Portland Cement and 25 pounds of bentonite*
50													
55													
60													
65													

Report: GEO_SOIL; File K:\PROJECTS\60439752_DYNEGY CCR HENNEPIN\400-TECHNICAL\BORING LOGS\60439752_HENNEPINDYNEGYBORINGLOGS.GPJ; 12/18/2015 9:43:01 AM

AECOM

Project: Hennepin Power Station

Project Location: Hennepin, Illinois

Project Number: 60439752

Log of Boring HEN-B022

Date(s) Drilled	09/23/2015 to 09/23/2015	Logged By	Robert Weseljak	Checked By	AJW
Drilling Method	Hollow-Stem Auger	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	21.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Drill Cuttings and Bentonite Chips	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	MATERIAL DESCRIPTION	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0	SS	SS-1	1 1 1	100	Very soft, moist, brown to dark gray, sandy SILT (ML).	0.0					0.0 0.5			*0.0 feet: Trace roots from 0.0 ot 0.5 feet*
	ST	ST-2		71										*Pushed shelby tube from 2.5 to 4.5 feet*
5	SS	SS-3	2 2 2	100	Soft, moist, dark gray, SILT (ML).	5.0					0.5			
					Stiff, dry, dark gray, silty SAND (SM) with Ash [Fill].	6.3								
	ST	ST-4		100										*Pushed shelby tube from 7.5 to 9.5 feet*
10	SS	SS-5	5 5 6	67							0.0 0.5			
15	SS	SS-6	21 25 20	100	Dense, dry, dark brown to black, silty SAND (SM) with Ash [Fill].	15.0					0.0 0.75			
20	SS	SS-7	3 4 5	100	Stiff, moist, brown, sandy lean CLAY (CL).	20.0					1.0 1.25			
					End of Boring at 21.5 ft	21.5								*Boring backfilled with 75 pounds of bentonite chips and soil cuttings*
25														
30														

AECOM

Project: Hennepin Power Station

Project Location: Hennepin, Illinois

Project Number: 60439752

Log of Boring HEN-B023

Date(s) Drilled	09/22/2015 to 09/23/2015	Logged By	Robert Weseljak	Checked By	AJW
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	76.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Portland Cement and Grout	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	MATERIAL DESCRIPTION	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0	Split spoon	SS-1	7 11 15	100	Dense, moist, brown, fine to medium sandy silty GRAVEL (GM) [Fill]	0.0								
	Split spoon	SS-2	8 15 18	100	Stiff to hard, moist, sandy silty CALY (CL) with medium to coarse gravel [Fill]. Grades with medium brown sand in occasional lenses. Grades with zones of high plastic clay.	2.0					4.5			
5	Split spoon	SS-3	10 27 18	100							3.5 4.25			
	Split spoon	SS-4	7 17 20	100							4.5			
10	Split spoon	SS-5	13 12 10	83	Medium dense, moist, brown clayey silty fine to medium SAND (SM) [Fill].	9.5					4.5			
					Hard, moist, brown, silty sandy CLAY (CL) with fine to medium gravel [Fill].	11.0								
					Medium dense, moist, brown fine to medium GRAVEL with sand and clay lenses [Fill].	13.0								
15	Split spoon	SS-6	22 32 52	83										
					Moist, dark gray to black, silt to fine gravel sized fly / bottom ASH [Fill].	18.0								
20	Split spoon	SS-7	51 39 26	94										
					Moist to wet, dark gray, silt sized fly ash with some sand to small gravel sized FLY ASH particles [Fill].	23.0								
25	Split spoon	SS-8	4 6 5	83							0.0 0.25			
	Thin walled tube	ST-9		63										
30														

Depth (feet)	Type / Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30	SS-10	15 11 11	100								0.25 0.5			
					Medium dense to dense, moist, dark gray to black, silty sand to small gravel sized bottom ASH [Fill].	33.0								
35	SS-11	20 36 53	100								0.5 3.5			
40	SS-12	14 11 12	100		Medium dense, moist to wet, dark gray to black, silty SAND (SM), trace gravel and ash [Fill].	40.0					0.5 1.3			
					Very stiff, wet, brown, sandy lean CLAY (CL) with fine to coarse gravel.	44.0								
45	SS-13	7 4 14	33								0.5			
50	SS-14	34 52	83		Very dense, wet, brown, clayey fine to coarse angular GRAVEL (GC) with sand.	50.0								
55	SS-15	18 11 8	78											
60	SS-16	11 7 8	17											
65						65.0								

Project: Hennepin Power Station

Project Location: Hennepin, Illinois

Project Number: 60439752

Log of Boring HEN-B023

Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
		SS-17	6 4 5	67		Loose, wet, brown, silty fine to coarse GRAVEL (GM).										
70		SS-18	19 19 13	67		Dense, wet, brown, silty fine to coarse GRAVEL (GM) with fine sand.		70.0								*70.6 feet: Sand seam from 70.6 to 71.0 feet*
75		SS-19	18 17 9	33		Medium dense, wet, silty fine to coarse GRAVEL (GM).		75.0								
						End of Boring at 76.5 ft		76.5								*Boring backfilled with 94 pounds of Portland Type I Cement*
80																
85																
90																
95																
100																

Project: Hennepin Power Station

Project Location: Hennepin, Illinois

Project Number: 60439752

Log of Boring HEN-B024

Date(s) Drilled	09/22/2015 to 09/22/2015	Logged By	Andrew Wilding	Checked By	AJW
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	62.7 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Portland Cement and Grout	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	Depth (feet)	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0		SS-1	14 15 15	100		0.0	Dense, moist, brown fine to medium silty GRAVEL [Fill].								
		SS-2	19 23 18	100											
5		SS-3	5 7 15	100		4.5	Stiff, moist, brown silty CLAY with some medium gravel and sand [Fill].					3.5			
						5.8	Medium dense, moist, brown, silty medium SAND, trace organics [Fill].								
		SS-4	4 15 23	78		7.0	Medium stiff, moist, brown, silty SAND, with some small to medium gravel [Fill].					2.25 3.0			
10		SS-5	10 12 16	78		9.5	Medium stiff, moist, dark gray, clayey SILT with medium to coarse sand, some gravel (presumably fly ash) and seams of brown silty clay [Fill].					4.0 4.5			
15		SS-6	13 20 29	94		13.0	Dense, moist, dark gray to black fine to coarse sand sized bottom ASH with some fine gravel [Fill].								
							Grades with fine gravel.								
20		SS-7	75/0.3'	38											
25		SS-4	3 2 3	100		22.0	Very soft, moist to wet, dark gray silt to fine sand sized FLY ASH [Fill].								
		ST-9		57											*Pushed shebly tube from 27.0 to 29.0 feet Shelby tube refusal at 29.2*
30															

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Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30	SS	SS-10	1 3 2	100												
						Grades with thin, hard cemented layers.										
35	SS	SS-11	5 9 12	100									0.5			
						Medium dense, wet, sandy silty fine to coarse GRAVEL (GM).		39.0								
40	SS	SS-12	55/6"	50												
45	SS	SS-13	22 27 21	78												
50	SS	SS-14	15 18 15	50		Grades with ~1" silty clay layers and zones of silty clay matrix (silty clay, brownish gray, soft to medium stiff, moist).										
55	SS	SS-15	55/0.2'	0												
						Medium dense, moist, silty SAND (SM) with trace to fine medium gravel.		58.0								
60	SS	SS-16	20 22 13	78												
						Wet, sandy fine to medium, rounded GRAVEL (GP).		62.0								
	SS	SS-17	80/0.1'	17		End of Boring at 62.7 ft		62.7								*Boring backfilled with Portland Type I cement*
65																

Project: Hennepin Power Station

Project Location: Hennepin, Illinois

Project Number: 60439752

Log of Boring HEN-B025

Date(s) Drilled	10/01/2015 to 10/01/2015	Logged By	Robert Weseljak	Checked By	AJW
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	56.5 ft
Drill Rig Type	Mobile 50 Truck Mounted	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Portland Cement and Grout	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	Sample Type / Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	MATERIAL DESCRIPTION	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0	SS-1	23 19 22	56	Medium dense, dry, brown, silty SAND (SM) with gravel [Road Fill].	0.0								
	SS-2	5 7 9	72	Stiff, dry, brown, lean CLAY (CL).	2.5					3.0			
5	SS-3	14 26 19	78	Dense, dry, silty GRAVEL (GM) with sand [Fill].	5.0								
	SS-4	2 2 2	89	Soft, gray with some black SILT (ML) to very fine silty SAND (SM).	7.5					<0.5			
10	SS-5	2 3 4	33							0.5			*Pushed shelby tube from 10.5 to 14.0 feet*
	ST-6		100							1.0			
15	SS-7	2 3 2	56							<0.5			
20	SS-8	9 5 3	56	Stiff, moist to wet, gray with some black layering, sandy SILT (ML).	20.0					<0.5			
25	ST-9		100										*Pushed shelby tube from 25.0 to 27.0 feet*
	SS-10	4 4 5	56							1.0			
30													

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Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30	SS	SS-11	3 4 5	67							<0.5			
35	SS	SS-12	5 7 7	72							1.0			
40	SS	SS-13	6 12 11	61							1.1			
45	SS	SS-14	6 7 8	83							1.0			
50	SS	SS-15	7 8 10	89							0.5 1.5			
55	SS	SS-16	10 12 13	94		55.0 Very stiff, moist to wet, black, gray and some dark brown, sandy SILT (ML). 56.5					3.5 4.0			
						End of Boring at 56.5 ft								*Boring backfilled with 94 pounds of Portland Cement and 25 pounds of bentonite*
60														
65														

Report: GEO_SOIL; File K:\PROJECTS\60439752_DYNEGY CCR HENNEPIN\400-TECHNICAL\BORING LOGS\60439752_HENNEPINDYNEGYBORINGLOGS.GPJ; 12/18/2015 9:43:23 AM

Project: Hennepin Power Station

Project Location: Hennepin, Illinois

Project Number: 60439752

Log of Boring HEN-B026

Date(s) Drilled	09/23/2015 to 09/23/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	12.0 ft
Drill Rig Type	Diedrich D-26 Barge Mounted	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Portland Cement and Grout	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	SAMPLES Type	SAMPLES Number	SAMPLES Sampling Resist. OR Core RQD (%)	SAMPLES Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0.0						Barge.								
1.5						Water.								
4.0		SS-1	4 5 7	56		Dark brown fine to coarse SAND and GRAVEL (SP-GP).								
4.5						Dark gray to brown gravelley CLAY (GC), trace sand.								
		SS-2	8 4 9											
11.5						End of Boring at 12 ft								*11.5 feet: Drillers Note - hard drilling from 11.5 to 12.0 feet* *12.0 feet: Possible boulder or obstruction* *Boring backfilled with bentonite grout*

Depth scale: 0, 5, 10, 15, 20, 25, 30

Project: Hennepin Power Station

Project Location: Hennepin, Illinois

Project Number: 60439752

Log of Boring HEN-B026A

Date(s) Drilled	09/23/2015 to 09/23/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	26.5 ft
Drill Rig Type	Diedrich D-26 Barge Mounted	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Portland Cement and Grout	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0						0.0 Blind drill - see HEN-B026.								*Blind drilled to 10.0 feet*
10	SS	SS-1	7 6 7	11		10.0 Brown gravelly CLAY (GC), trace sand.								
	SS	SS-2	25 42 13	0										
	SS	SS-3	6 7 5	33										*Large rock in Sample 3*
	SS	SS-4	5 5 9	11										
20	SS	SS-5	7 8 6	11		20.0 Brown GRAVEL (GP) with sand and clay.								
25	SS	SS-6	8 9 6	33		25.0 Brown fine to coarse SAND (SP) and GRAVEL (GP), trace silt and clay.								
						26.5 End of Boring at 26.5 ft								*Boring backfilled with bentonite grout*
30														

AECOM

Project: Hennepin Power Station

Project Location: Hennepin, Illinois

Project Number: 60439752

Log of Boring HEN-B027

Date(s) Drilled	09/22/2015 to 09/22/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	31.5 ft
Drill Rig Type	Diedrich D-26 Barge Mounted	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Portland Cement and Grout	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	MATERIAL DESCRIPTION	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0					Barge.	0.0								
					Water.	1.5								
					Dark brown SAND (SP) and GRAVEL (GP).	7.0								
	Split spoon	SS-1	2 3 3 WOH	78	Dark gray, silty CLAY (CL), trace sand.	7.5					1.5			
10	Thin walled tube	ST-2		72							2.5			*Pushed shelby tube from 10.0 to 12.0 feet*
	Split spoon	SS-3	3 4 7	61	Dark gray to brown, silty CLAY (CL) with some gravel and sand.	12.0					1.5 2.0			
15	Split spoon	SS-4	4 5 7	22							1.75			
20	Split spoon	SS-5	3 5 4	33	Brown gravelly CLAY (GP) with some sand.	20.0								
25	Split spoon	SS-6	7 8 12	22	Brown to gray clayey SILT (ML) with some sand and gravel.	25.0								
					Fine to coarse SAND (SP) and GRAVEL (GP).	28.0								*28.0 feet: Cave in*
30														

AECOM

Project: Hennepin Power Station	**Log of Boring HEN-B027**
Project Location: Hennepin, Illinois	Sheet 2 of 2
Project Number: 60439752	

Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30		SS-7	8 9 8	56				31.5								
						End of Boring at 31.5 ft										*Boring backfilled with bentonite grout*
35																
40																
45																
50																
55																
60																
65																

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AECOM

Project: Hennepin Power Station

Project Location: Hennepin, Illinois

Project Number: 60439752

Log of Boring HEN-B029

Date(s) Drilled	10/01/2015 to 10/01/2015	Logged By	Robert Weseljak	Checked By	AJW
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	41.5 ft
Drill Rig Type	Mobile 57 Truck Mounted	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Portland Cement and Grout	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	Sample Type	Sample Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0		SS-1	24 28 34	100		0.0 Very dense, dry, brown, silty GRAVEL (GM) [Road Fill].								
		SS-2	10 6 11	100		2.5 Stiff to very stiff, dry, lean CLAY (CL).					4.5			
5		ST-3		100							4.5			*Pushed shelby tube from 5.0 to 7.0 feet*
		SS-4	12 14 17	100							4.0			
10		ST-5		100							2.5			*Pushed shelby tube from 10.0 to 12.0 feet*
15		SS-6	4 6 8	83		15.0 Stiff, dark brown with trace rust, lean CLAY (CL), trace fine to coarse gravel.					1.5			
20		SS-7	6 12 20	78		20.2 Dense, dry, brown, clayey GRAVEL (GC).					1.5			
25		SS-8	17 17 43	56										
30														

Report: GEO_SOIL; File K:\PROJECTS\60439752_DYNEGY CCR HENNEPIN\400-TECHNICAL\BORING LOGS\60439752_HENNEPINDYNEGYBORINGLOGS.GPJ; 12/18/2015 9:43:40 AM

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Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30	SS	SS-9	29 50/5"	22										*Less fines in Sample 9*
35	SS	SS-10	20 25 28	61										
40	SS	SS-11	16 14 15	6		41.5								
						End of Boring at 41.5 ft								*Boring backfilled with 94 pounds of Portland Cement and 25 pounds of bentonite*
45														
50														
55														
60														
65														

Report: GEO_SOIL; File K:\PROJECTS\60439752_DYNEGY CCR HENNEPIN\400-TECHNICAL\BORING LOGS\60439752_HENNEPINDYNEGYBORINGLOGS.GPJ; 12/18/2015 9:43:40 AM

AECOM

Project: Hennepin Power Station

Project Location: Hennepin, Illinois

Project Number: 60439752

Log of Boring HEN-B030

Date(s) Drilled	09/29/2015 to 09/30/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Hollow-Stem Auger	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	11.0 ft
Drill Rig Type	Mobile 57 Truck Mounted	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Portland Cement and Grout	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	9.0 ft on 9/29/2015		

Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0		SS-1	22 17 37	83		0.0 Brownish gray sand, gravel, and clay [Fill].								
		SS-2	15 17 15	67		2.5 Brown fine to coarse sand and gravel with some clay [Fill].								
5		SS-3	18 20 30	83										
		SS-4	4 5 6	100		7.5 Dark gray with trace gravel, sand, and clay, with ASH [Fill].								9.0 feet: Wet
10		ST-5		33		10.0 Black ASH with gravel [Fill].								Pushed shelby tube from 10.0 to 11.0 feet 10.0 feet: Switch to mud rotary Boring backfilled with Portland Type I cement
						11.0 End of Boring at 11 ft								
15														
20														
25														
30														

AECOM

Project: Hennepin Power Station

Project Location: Hennepin, Illinois

Project Number: 60439752

Log of Boring HEN-B032

Date(s) Drilled	09/30/2015 to 09/30/2015	Logged By	Robert Weseljak	Checked By	AJW
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	41.5 ft
Drill Rig Type	Mobile 57 Truck Mounted	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Portland Cement and Grout	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0		SS-1	32 29 20	67		0.0 Very dense, dry, brown, fine to coarse well graded GRAVEL (GW) with silt and sand [Fill].					4.5			
						1.0 Hard, dry, black, lean CLAY (CL), trace fine to medium gravel.								
		SS-2	6 18 17	100							3.5			
5		ST-3		79							4.5			Pushed shelby tube from 5.0 to 7.0 feet
		SS-4	8 12 16	100							3.5			
10		SS-5	8 16 20	44							0.5			10.0 feet: Coarse gravel
15		SS-6	19 39 43	72		15.0 Very dense, moist, brown and black, clayey fine to coarse GRAVEL (GC).								
20		SS-7	18 36 50/3"	61										
25		SS-8	98 35 50/4"	78										24.5: Drillers Note - boulder from 24.5 to 25.2 feet
30						30.0								

AECOM

Project: Hennepin Power Station

Project Location: Hennepin, Illinois

Project Number: 60439752

Log of Boring HEN-B032

Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30		SS-9	18 11 30	100		Hard, moist, brown, fine to coarse gravelly lean CLAY (CL).							3.0 4.5			
35		SS-10	41 28 40	67		Very dense, moist, brown and black, clayey fine to coarse GRAVEL (GC).		35.0								
40		SS-11	12 18 50/4"	72												
						End of Boring at 41.5 ft		41.5								*Boring backfilled with 94 pounds of Portland Cement and 25 pounds of bentonite*
45																
50																
55																
60																
65																

Report: GEO_SOIL; File K:\PROJECTS\60439752_DYNEGY CCR HENNEPIN\400-TECHNICAL\BORING LOGS\60439752_HENNEPINDYNEGYBORINGLOGS.GPJ; 12/18/2015 9:43:48 AM

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Project: Hennepin Power Station	**Log of Boring HEN-B034**
Project Location: Hennepin, Illinois	
Project Number: 60439752	Sheet 1 of 2

Date(s) Drilled	09/30/2015 to 10/01/2015	Logged By	Robert Weseljak	Checked By	AJW
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	41.5 ft
Drill Rig Type	Mobile 57 Truck Mounted	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Portland Cement and Grout	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	Elevation (feet)	MATERIAL DESCRIPTION	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0								0.0								
		SS-1	25 19 21	100			Very dense, dry, brown, silty SAND (SM) [Fill].	0.5					1.5 2.5			
							Hard, dry, black, gravelly lean CLAY (CL) [Fill].									
		SS-2	7 8 11	100									3.5 4.5			
5							Dense, dry, brown, silty SAND (SM).	5.0								
		SS-3	17 28 32	100			Very dense, brown to gray, silty fine to coarse GRAVEL (GM) with sand.	5.5								
		SS-4	11 18 32	100												
10		SS-5	27 35 18	56			Very dense, moist, brown, clayey GRAVEL (GC).	10.0								
15		SS-6	21 24 25	44												
20		SS-7	10 11 9	44			Medium dense, dry, silty fine to coarse GRAVEL (GM).	20.0								
25		SS-8	11 13 16	6												
30								30.0								

AECOM

Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30		SS-9	14 14 12	22		Medium dense, moist to wet, brown, well graded GRAVEL (GW).								
35		SS-10	9 11 10	67										
40		SS-11	10 8 9	17		41.5								
						End of Boring at 41.5 ft								*Boring backfilled with 94 pounds of Portland Cement and 25 pounds of bentonite*
45														
50														
55														
60														
65														

Project: Hennepin Power Station

Project Location: Hennepin, Illinois

Project Number: 60439752

Log of Boring HEN-B037

Date(s) Drilled	09/23/2015 to 09/24/2015	Logged By	Robert Weseljak	Checked By	AJW
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	41.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Portland Cement and Grout	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	Sample Type	Sample Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Elevation (feet)	Depth (feet)	Material Description	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	Remarks
0		SS-1	12 15 21	100		0.0	Dense, dry, brown, silty SAND (SM) with fine to coarse gravel [Road Fill].								
		SS-2	12 17 20	100		2.0	Dense, dry, poorly graded SAND (SP), trace fine to medium gravel [Fill].								
5		SS-3	12 19 26	100		5.0	Dense, dry, brown, silty SAND (SM) with fine to coarse gravel [Fill].								
		SS-4	10 8 12	94		8.0	Very stiff, dark gray to black, lean CLAY (CL), trace fine to coarse gravel [Fill].								
10		SS-5	12 33 31	100		10.0	Dry to moist, dark brown, clayey fine to coarse GRAVEL (GC) with sand.								*11.3 feet: Rusty in color* *13.0 feet: 100% water loss*
15		SS-6	10 43 40	67		15.0	Very dense, moist, light brown, fine to coarse clayey GRAVEL (GC) with sand.								
20		SS-7	10 14 22	94											
25		SS-8	19 21 16	56											
30															

AECOM

Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30		SS-9	21 14 19	83		Hard, moist, dark greenish gray, fine to coarse, rounded to angular gravelly lean CLAY (CL).	30.5					1.25			
35		SS-10	7 12 18	83		Very stiff, moist, brown, clayey fine to coarse GRAVEL (GC).	35.0								
40		SS-11	13 20 21	67											
						End of Boring at 41.5 ft	41.5								*Boring backfilled with Portland Type I Cement*
45															
50															
55															
60															
65															

Report: GEO_SOIL; File K:\PROJECTS\60439752_DYNEGY CCR HENNEPIN\400-TECHNICAL\BORING LOGS\60439752_HENNEPINDYNEGYBORINGLOGS.GPJ; 12/18/2015 9:43:59 AM

AECOM

Project: Hennepin Power Station

Project Location: Hennepin, Illinois

Project Number: 60439752

Log of Boring HEN-B038

Date(s) Drilled	09/23/2015 to 09/23/2015	Logged By	Robert Weseljak	Checked By	AJW
Drilling Method	Hollow-Stem Auger	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	21.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Drill Cuttings and Bentonite Chips	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

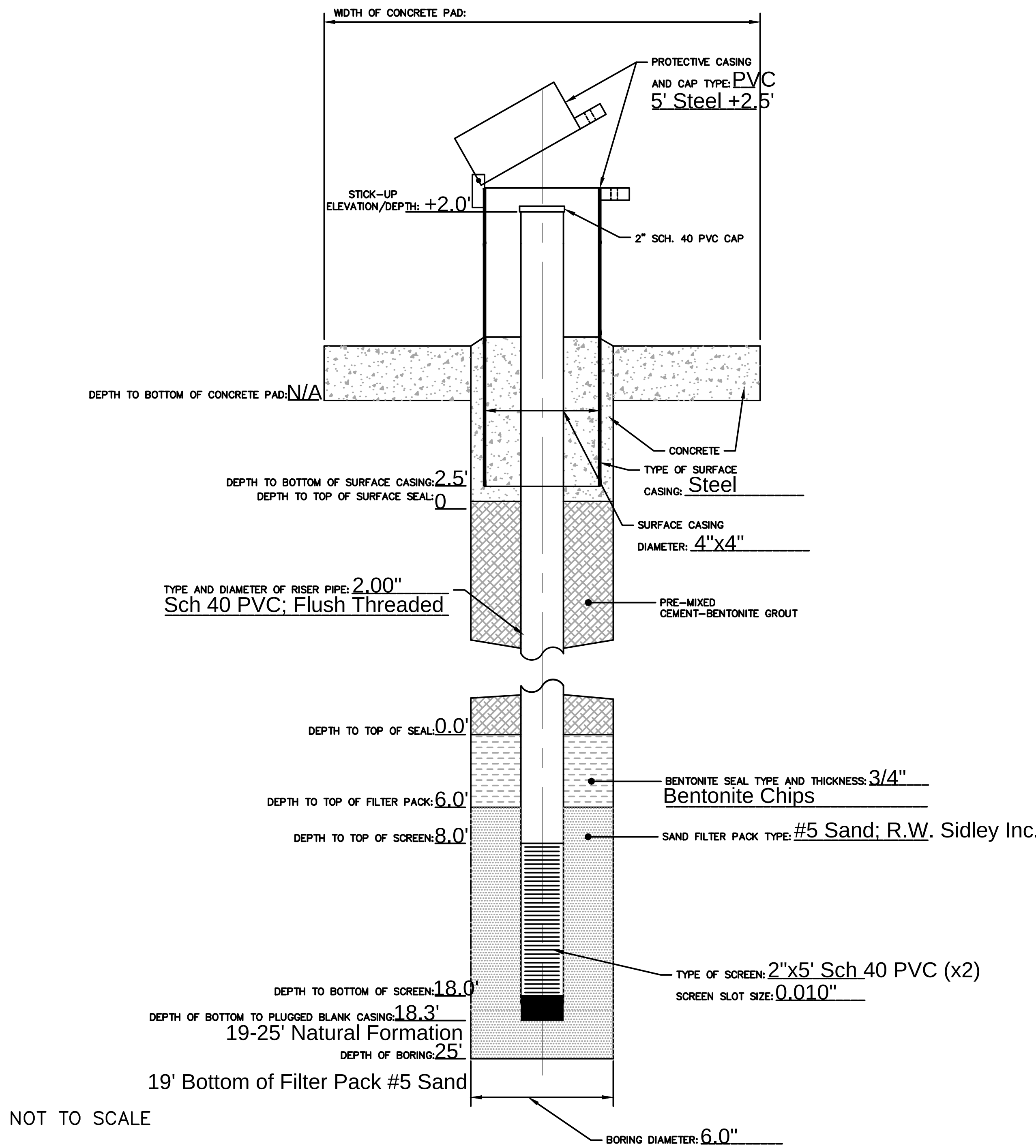
Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	MATERIAL DESCRIPTION	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0		SS-1	12 18 22	89	Dense, dry, dark brown, well graded GRAVEL with CLAY (GW-GC) [Road fill]	0.0								
		SS-2	16 30 50/5.5"	97	Very dense, dry, gray, well graded fine to coarse GRAVEL (GW) [Fill].	3.0								
5		SS-3	37 50/5"	50										
		SS-4	5 6 31	94	Stiff, moist, black and brown, lean CLAY (CL), trace sand and fine gravel [Fill].	8.1								
					Very dense, dry, brown, well graded GRAVEL (GW) [Fill].	8.6								
10		SS-5	6 10 12	100	Very stiff, dry, greenish gray, lean CLAY (CL) [Fill].	10.5					6.0			
15		SS-6	15 15 24	100	Dense, moist, brown, clayey GRAVEL (GC) with sand [Fill].	15.0								
20		SS-7	7 17 13	94										
					End of Boring at 21.5 ft	21.5								*Boring backfilled with 75 pounds of bentonite chips and soil cuttings*
25														
30														

Report: GEO_SOIL; File K:\PROJECTS\60439752_DYNEGY CCR HENNEPIN\400-TECHNICAL\BORING LOGS\60439752_HENNEPINDYNEGYBORINGLOGS.GPJ; 12/18/2015 9:44:04 AM

AECOM

Project: Dynegy	Log of Piezometer
Project Location: Hennepin, IL	
Project Number: 60439752	Sheet 1 of 1

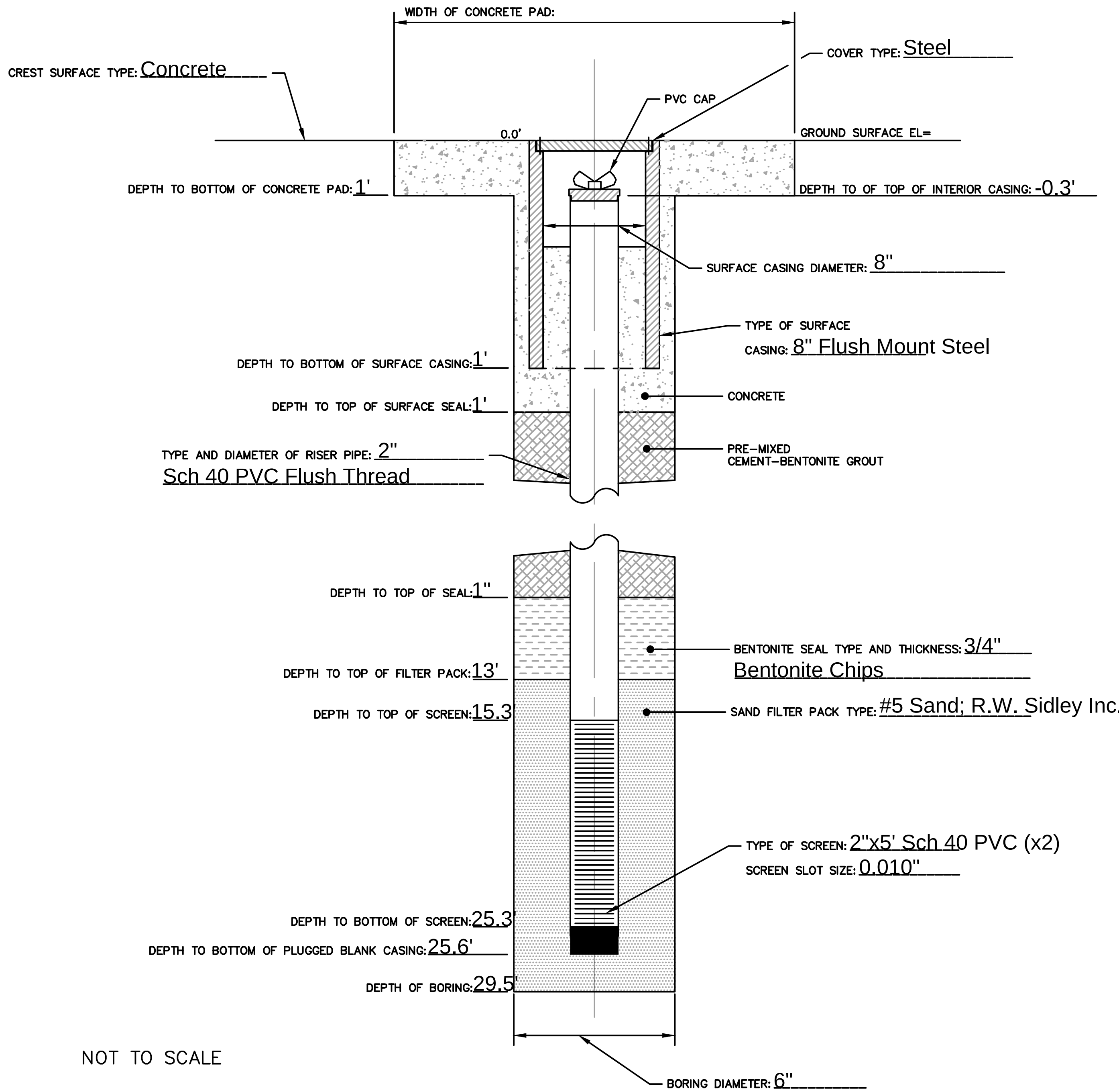
Piezometer Location	P001	Date Installed	10/15/15	Time	9:10 A.M.
Installed By	Scott Komen	Observed By	R. Weseljak	Total Depth	25'
Method of Installation	6" Solid Flight Auger	Drilling Contractor	Strata	Surface Elevation	
Screened Interval	8-18'	Completion Zone	Silts and Clays		
Remarks		Groundwater Level(s)	13.33' T.O.C.		



AECOM

Project: Dynegy Project Location: Hennepin, IL Project Number: 60439752	Log of Piezometer Sheet 1 of 1

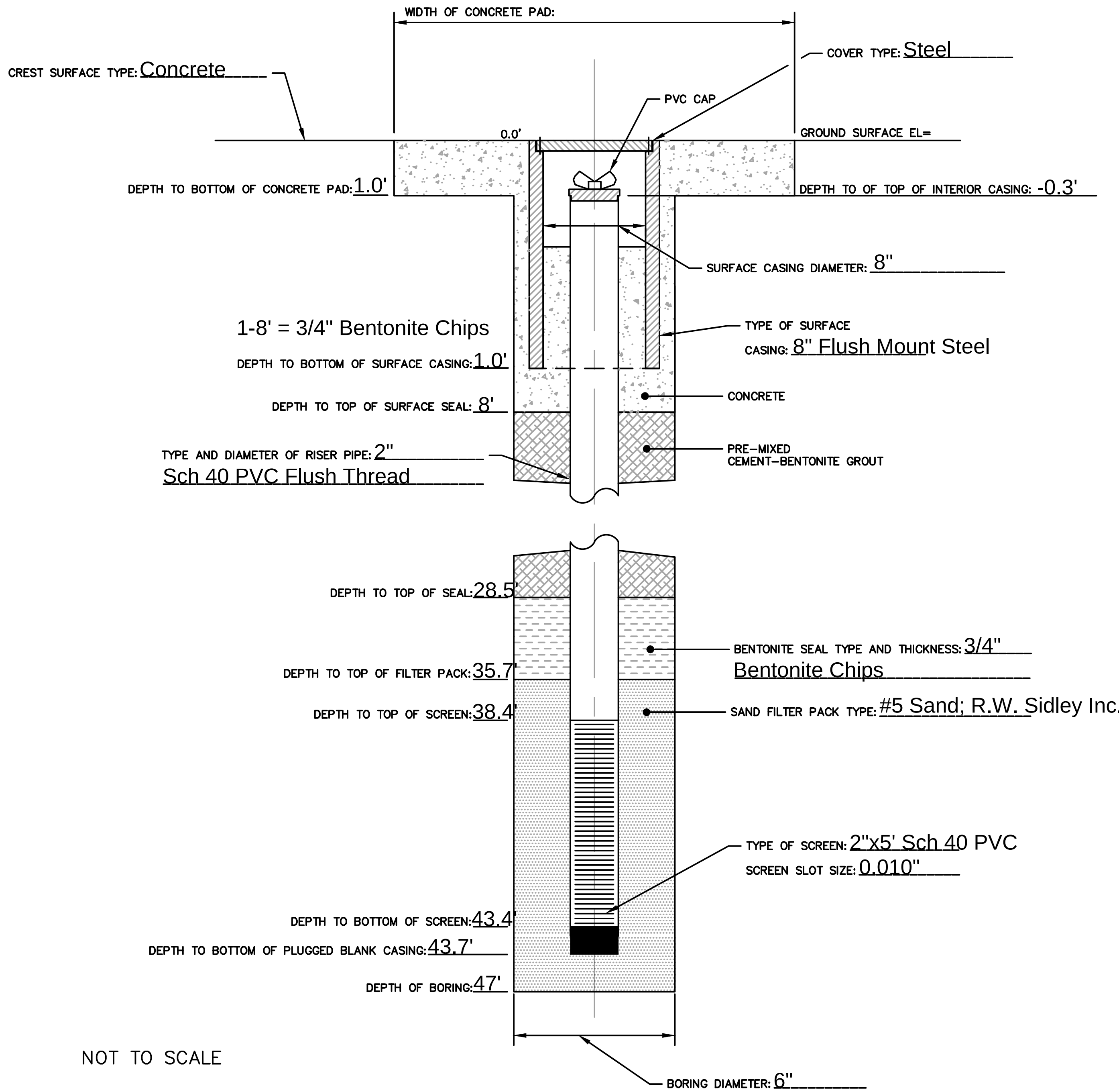
Piezometer Location P002	Date Installed 10/15/15	Time 11:10 A.M.
Installed By Scott Komen	Observed By R. Weseljak	Total Depth 29.5'
Method of Installation 6" Solid Flight Auger	Drilling Contractor Strata	Surface Elevation
Screened Interval 15.3-25.3'	Completion Zone Sands	
Remarks	Groundwater Level(s) 15.90' T.O.C.	



AECOM

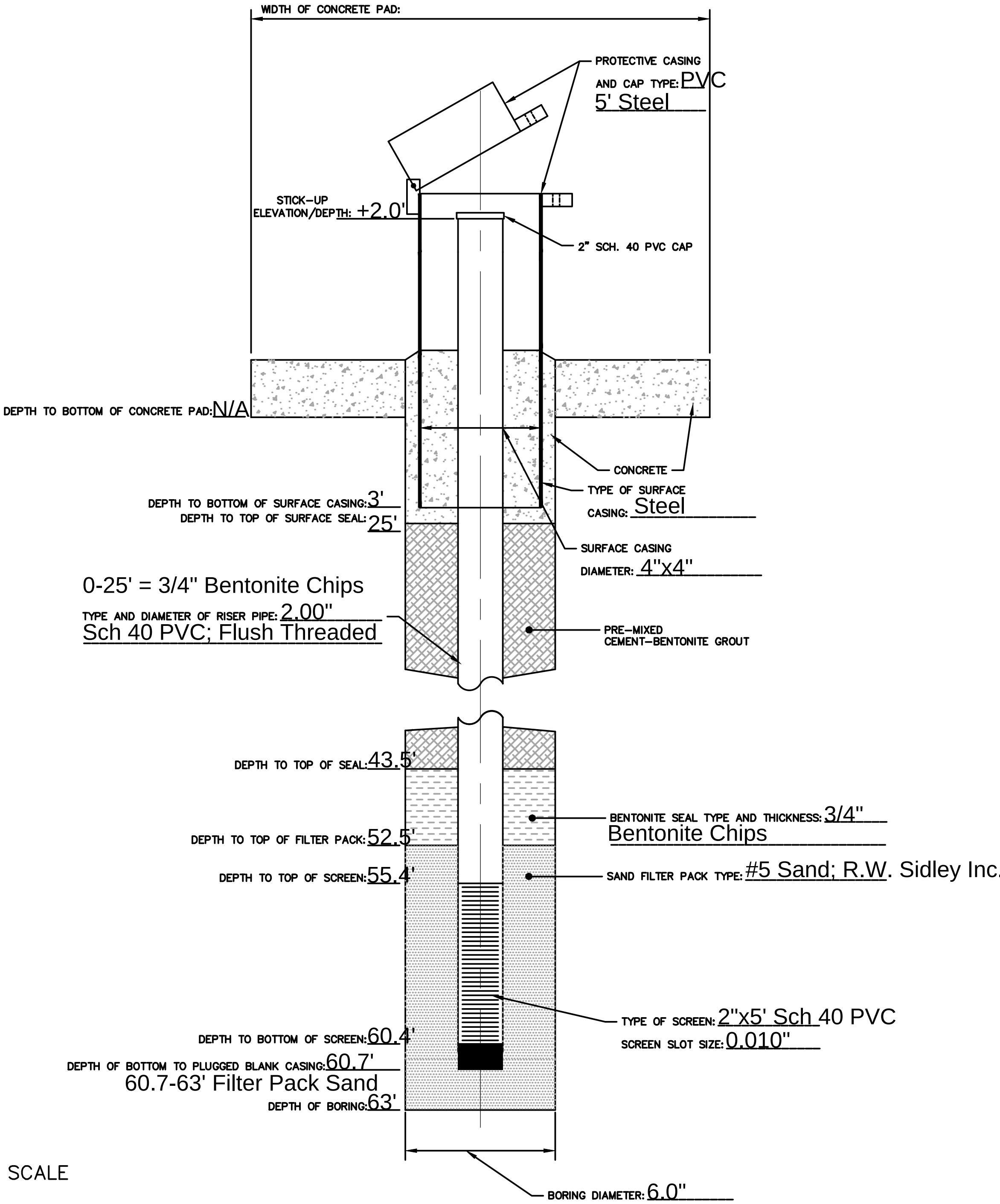
Project: Dynegy	Log of Piezometer
Project Location: Hennepin, IL	
Project Number: 60439752	Sheet 1 of 1

Piezometer Location P003	Date Installed 10/14/15	Time 9:45 A.M.
Installed By Scott Komen	Observed By R. Weseljak	Total Depth 47'
Method of Installation 6" Mud Rotary/ 6" Casing	Drilling Contractor Strata	Surface Elevation
Screened Interval 38.4'-43.4'	Completion Zone Gravels	
Remarks	Groundwater Level(s) 17.15' T.O.C.	



Project: Dynegy Project Location: Hennepin, IL Project Number: 60439752	Log of Piezometer Sheet 1 of 1

Piezometer Location P004	Date Installed 10/16/15-10/19/15	Time 8:00 A.M.
Installed By Scott Komen	Observed By R. Weseljak	Total Depth 63'
Method of Installation 6" Mud Rotary with 6' Casing	Drilling Contractor Strata	Surface Elevation
Screened Interval 55.4-60.4'	Completion Zone Gravels	
Remarks	Groundwater Level(s) 48.65' T.O.C.	



NOT TO SCALE

AECOM

Project: Dynegy

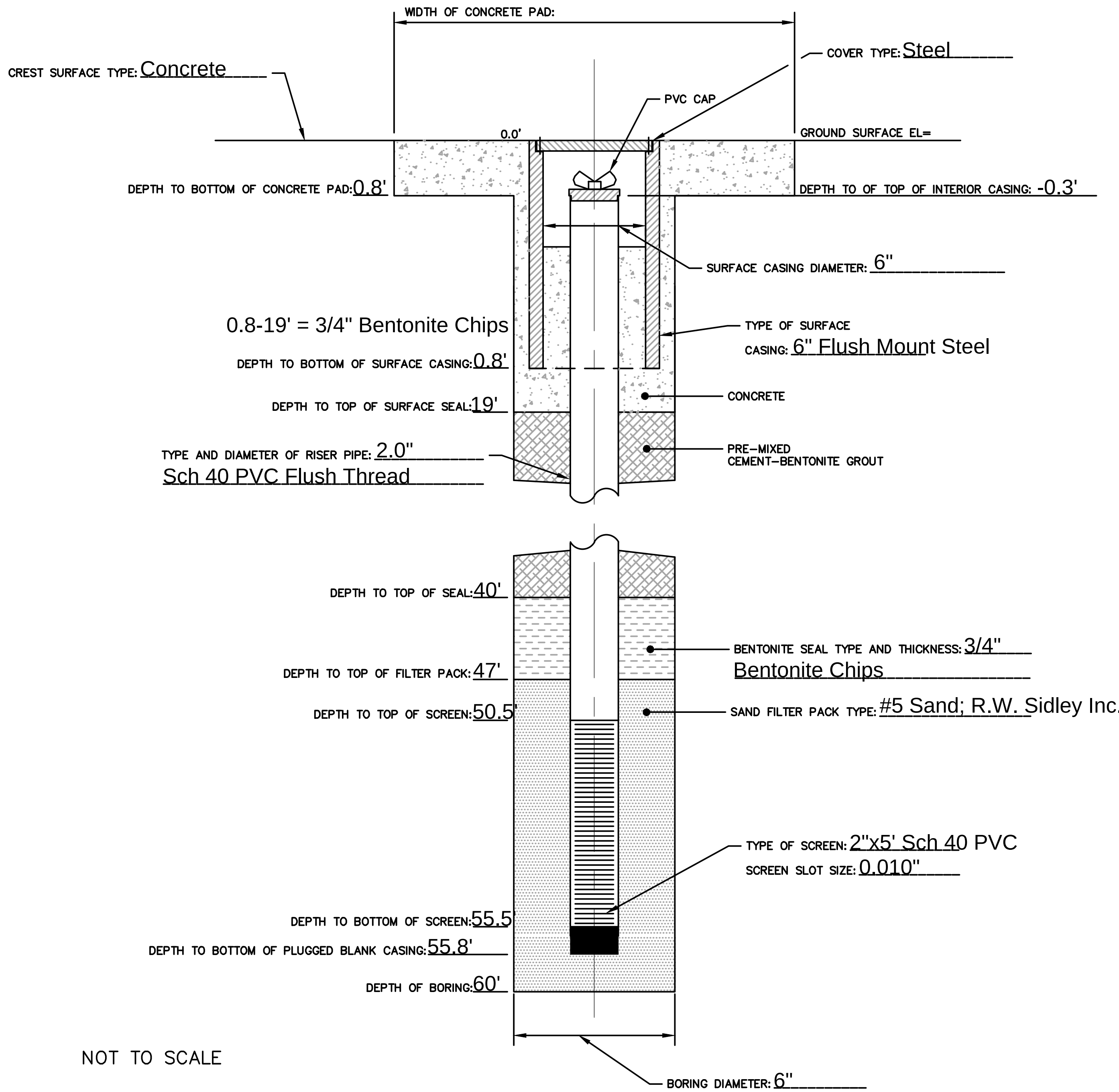
Project Location: Hennepin, IL

Project Number: 60439752

Log of Piezometer

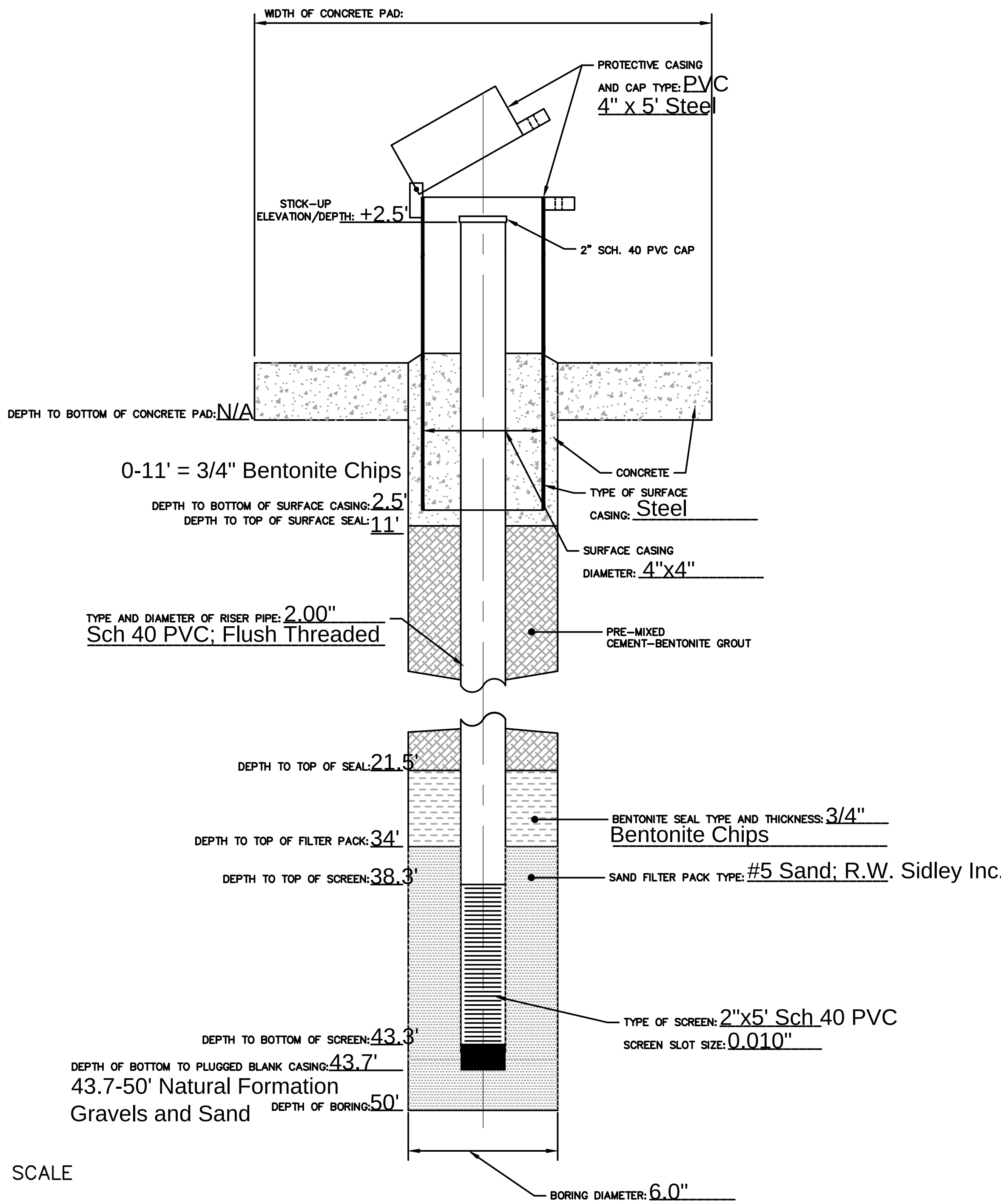
Sheet 1 of 1

Piezometer Location: P005	Date Installed: 10/20/15	Time: 4:30 P.M.
Installed By: Scott Komen	Observed By: R. Weseljak	Total Depth: 60'
Method of Installation: 6" Tricone Mud Rotary	Drilling Contractor: Strata	Surface Elevation:
Screened Interval: 50.5-55.5'	Completion Zone: Gravels and Sands	
Remarks:	Groundwater Level(s): 45.80' T.O.C.	



Project: Dynegy Project Location: Hennepin, IL Project Number: 60439752	Log of Piezometer Sheet 1 of 1

Piezometer Location: P006	Date Installed: 10/20/15	Time: 11:20 A.M.
Installed By: Scott Komen	Observed By: R. Weseljak	Total Depth: 50'
Method of Installation: 6" Tricone Mud Rotary	Drilling Contractor: Strata	Surface Elevation:
Screened Interval: 38.3-43.3'	Completion Zone: Gravel	
Remarks:	Groundwater Level(s): 45.74' T.O.C.	

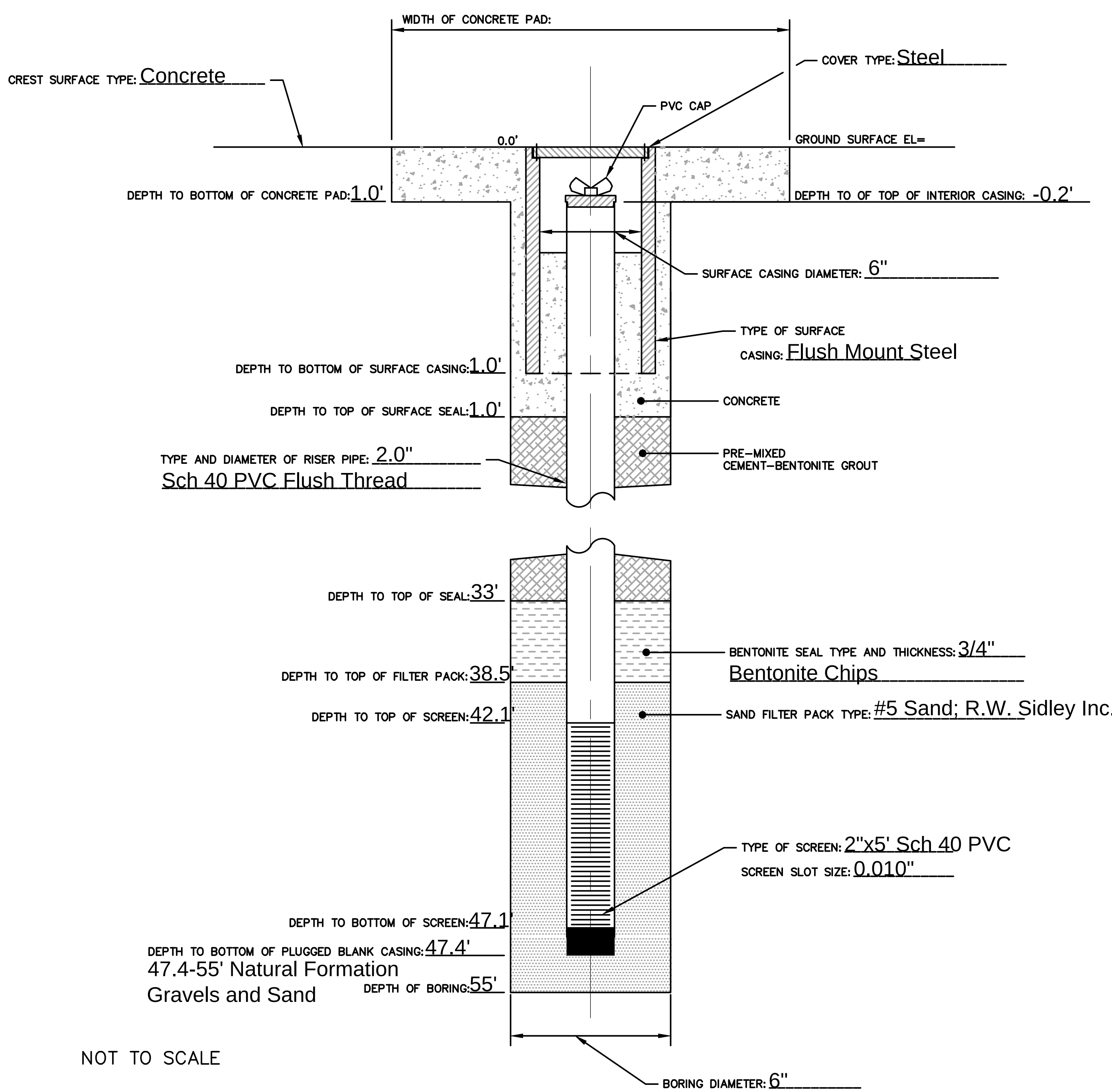


NOT TO SCALE

AECOM

Project: Dyngegy	Log of Piezometer
Project Location: Hennepin, IL	
Project Number: 60439752	Sheet 1 of 1

Piezometer Location: P007	Date Installed: 10/21/15	Time: 5:00 P.M.
Installed By: Scott Komen	Observed By: R. Weseljak	Total Depth: 55'
Method of Installation: 6" Tricone Mud Rotary	Drilling Contractor: Strata	Surface Elevation:
Screened Interval: 42.1-47.1'	Completion Zone: Gravels	
Remarks:	Groundwater Level(s): 44.65' T.O.C.	



Appendix A5

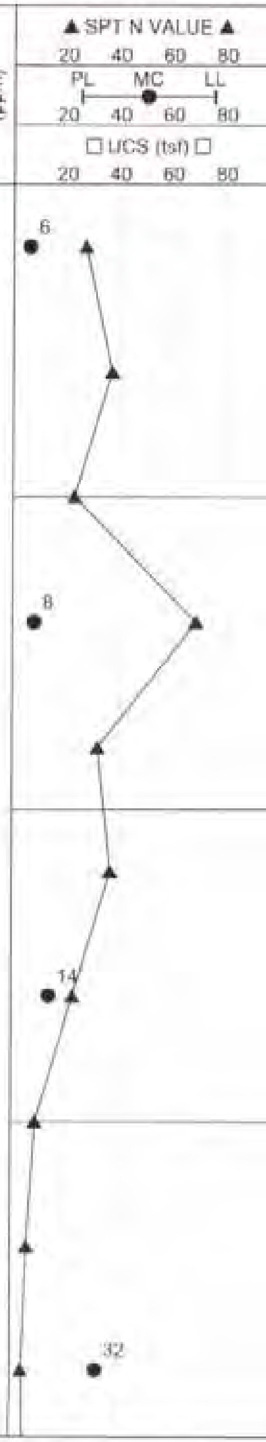
CEC Boring Logs and Well Details

Civil & Environmental Consultants, Inc
3041 Woodcreek Dr Suite 210
Downers Grove, IL 60510

BORING NUMBER B-1

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 2/23/09 **COMPLETED** 2/23/09
GROUND ELEVATION 494.2 ft **BACKFILL** Cement Grout
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING 46.0 ft / Elev 448.2 ft
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING NA
NOTES
AFTER DRILLING NA

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)
		Brown gravelly CLAY, some sand, moist, medium stiff, large limestone rounded and angular, **(BERM FILL)**	0	SS 1	84	28 18 9 10	1.0	
				SS 2	88	13 22 15 10	1.0	
490		Less gravelly	5	SS 3	75	10 15 8 10	--	
				SS 4	65	15 25 44 15	--	
485				SS 5	50	8 20 12 14	--	
		Dark brown silty CLAY, with light brown SAND, trace gravel, moist, stiff, **(BERM FILL)**	10					
		Dark gray sandy SILT, trace small gravel, moist, medium dense, **(ASH)**		SS 6	100	8 15 22 25	1.0	
				SS 7	60	18 18 5 7	NP	
480			15	SS 8	70	6 5 4 2	NP	
		Light gray SILT, trace coal pieces, trace sand, dry to moist, loose, **(ASH)**		SS 9	100	4 3 3 3	NP	
475			20	SS 10	100	3 2 2 3	NP	



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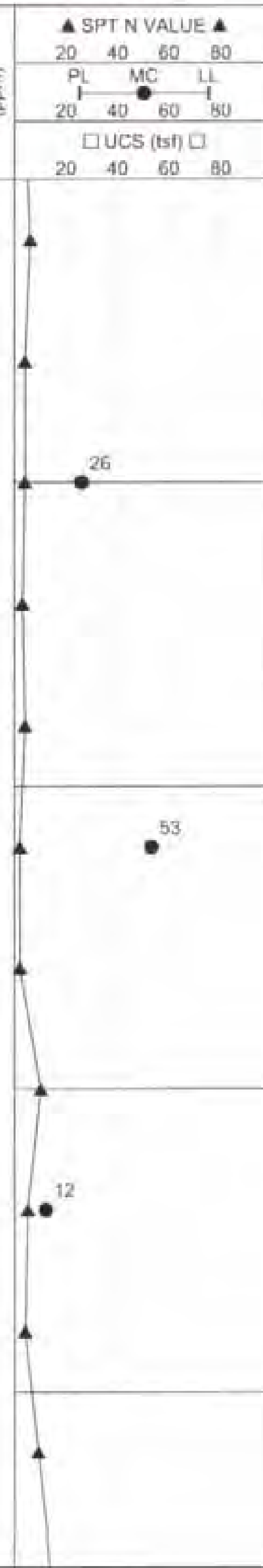
CLIENT Dynegy - Hennepin Power Station **PROJECT NAME** Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255 **PROJECT LOCATION** Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)
		Light gray SILT, trace coal pieces, trace sand, dry to moist, loose, **(ASH)** *(continued)*	20	SS 11	100	2 3 3 2	NP	
				SS 12	90	2 2 2 2	NP	
470			25	SS 13	95	3 2 2 1	NP	
		Moist to wet		SS 14	85	2 2 1 1	NP	
465				SS 15	90	1 1 3 4	NP	
		Grades to Wet. Gr - 0.0%, Sa - 12.%, Si - 73.7%, Cl - 13.9%.	30	SS 16	100	3 1 1 1	NP	
				SS 17	100	0 0 2 4	NP	
460		Reddish brown silty SAND, trace small gravel, moist, loose, poorly graded, **(STREAM TERRACE DEPOSIT)**	35	SS 18	100	3 4 6 8	NP	
				SS 19	13	4 3 2 2	NP	
455				SS 20	80	0 2 2 1	NP	
			40	SS 21	90	6 4 5 5	NP	
		Large gravel				4		



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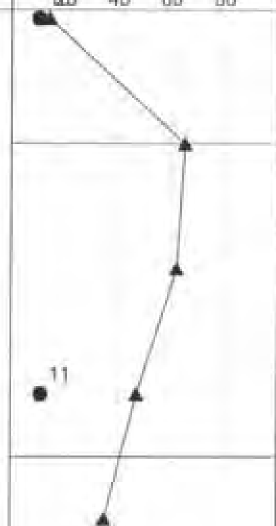
Downers Grove, IL 60510

BORING NUMBER B-1

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)
				SS 22	60	7 7 33	NP	
450		Brown gravelly SAND, trace silt, dry to moist, very dense, poorly graded, **(GLACIAL OUTWASH)**	45	SS 23	60	40 30 35	NP	
		Brown medium SAND, trace fine gravel, moist to wet, very dense, poorly graded, **(GLACIAL OUTWASH)**		SS 24	75	30 30 32 26	NP	
445			50	SS 25	59	13 20 27 30	NP	
				SS 26	70	30 20 15 25	NP	
		End of Borehole at 52.0 feet.						

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ UCS (tsf) ☐
20 40 60 80



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BORING NUMBER B-2

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 2/25/09 COMPLETED 2/25/09
GROUND ELEVATION 493.2 ft BACKFILL Cement Grout
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING 21.5 ft / Elev 471.7 ft
CEC REP CAC CHECKED BY MDJ
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)	SPT N VALUE / PL MC LL / UCS (tsf)
	Dark brown gravelly CLAY, trace sand, moist, **(BERM FILL)**	0				0.5		
	Brown gravelly SAND, trace clay, moist, medium dense, poorly graded, **(BERM FILL)**		SS 1	75	3 8 8 10	NP		
490			SS 2	70	7 12 15 18	NP		6
		5	SS 3	90	10 13 18 18	NP		
	Gray gravelly CLAY, some sand, medium dense, **(BERM FILL)**		SS 4	80	8 13 13 12	NP		
485	Brown silty CLAY, trace sand and gravel, moist, stiff, **(BERM FILL)**		SS 5	70	4 5 10 12	1.6		17
		10	SS 6	65	9 8 10 12	1.6		
480	Dark gray SAND, trace silt, trace gravel, dry, dense, poorly graded, **(ASH)**		SS 7	80	15 28 22 18	NP		
		15	SS 8	50	6 5 5 4	NP		10
	Gray SILT, **(ASH)**		ST 9	100		NP		5
475	Gray SANDY SILT, dry to moist, loose, laminated, **(ASH)**		SS 10	90	2 3 3 2	NP		
		20						

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Downers Grove, IL 60510

BORING NUMBER B-2

CLIENT Dynegy - Hennepin Power Station

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)	MC (SPT N VALUE / PL MC LL / UCS (tsf))
	Gray SANDY SILT, dry to moist, loose, laminated, **(ASH)** *(continued)* ∇	20	SS 11	100	3 2 2 2	NP		23
470	Moist to wet		SS 12	100	3 2 2 2	NP		
	Becoming darker gray.	25	SS 13	100	3 2 2 2	NP		
	Gray Silt, **(ASH)**		ST 14	100		NP		56
465			SS 15	100	1 2 1 1	0.75		66
	Gray SILT, with brown sand, trace roots, moist, very loose, laminate sand/silt layers, **(ASH)**	30	SS 16	100	1 1 2 3	NP		
460	Gray SILT, moist to wet, very loose, intermittent layers, **(ASH)**		SS 17	100	1 1 1 1	NP		46
	Brown silty CLAY, **(STREAM TERRACE DEPOSIT)**	35	ST 18	100		1.0 2.0		20 15
	Dark brown to reddish brown clayey SAND, trace silt, fine gravel, moist, loose, **(STREAM TERRACE DEPOSIT)**		SS 19	100	2 3 3 4	0.75		17
455			SS 20	100	1 1 3 3	0.5		17
	Brown medium to coarse SAND, trace gravel, moist, loose to medium dense, poorly graded, **(GLACIAL OUTWASH)**	40	SS 21	100	2 4 5 5	NP		
					2			

(Continued Next Page)

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Downers Grove, IL 60510

BORING NUMBER B-2

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80; PL MC LL 20 40 60 80; □ UCS (tsf) □ 20 40 60 80
450		Brown medium to coarse SAND, trace gravel, moist, loose to medium dense, poorly graded, **(GLACIAL OUTWASH)** *(continued)*		SS 22	50	2 3 3	NP		
			45	SS 23	55	3 5 7 6	NP		
		Brown gravelly SAND, moist to wet, dense, **(GLACIAL OUTWASH)**		SS 24	65	8 16 24 18	NP		
445			50	SS 25	60	6 18 25 20	NP		
		End of Borehole at 50.0 feet							

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BORING NUMBER B-3

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 2/18/09 COMPLETED 2/18/09
GROUND ELEVATION 494.0 ft BACKFILL Cement Grout
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ WHILE DRILLING 47.0 ft / Elev 447.0 ft
CEC REP D. KORTH CHECKED BY MDJ
AT END OF DRILLING ---
NOTES East-Northeast Corner of Ash Pond on Berm
AFTER DRILLING ---

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ / PL MC LL / □ UCS (tsf) □
		Brown clayey SAND AND GRAVEL, trace silt, moist, medium dense to dense, poorly graded, **(BERM FILL)**	0	SS 1	80	3 5 7 6	NP		8
490				SS 2	75	3 6 9 16	NP		
			5	SS 3	60	20 20 20 12	NP		
		Dark yellowish brown LEAN CLAY, trace sand and gravel, moist, very stiff to hard, **(BERM FILL)**		SS 4	90	8 10 8 15	4.0		9
485		Very dark brown mottled with dark yellowish brown sandy lean CLAY, moist, very stiff, **(BERM FILL)**	10	SS 5	80	5 5 8 9	2.0		
				SS 6	100	3 7 10 12	2.6		
480		Very dark gray silty SAND, with gravel, trace coal fragments, moist, dense, **(ASH)** Gr = 21.2%, Sa = 62.8%, Si = 13.2%, Cl = 2.9%		SS 7	90	12 20 18 18	NP		13
		Grades to loose	15	SS 8	60	1 4 4 5	NP		
		Gray SILT, trace fine sand, wet, loose, **(ASH)**		SS 9	65	5 4 2 1	NP		
475			20	SS 10	95	1 1 0 1	1.0 0.25		57

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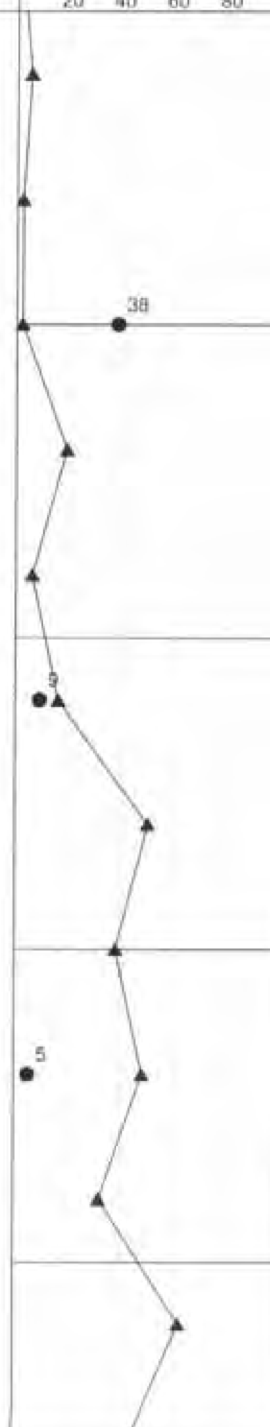
Downers Grove, IL 60510

BORING NUMBER B-3

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)
	Dark grayish brown SILT, moist, very loose to loose, **(ASH)**	20	SS 11	85	1 3 2 1	2.5	
470			SS 12	85	2 1 1 1	2.5	
	Dark olive gray SILT, moist to wet, very loose, **(ASH)**	25	SS 13	80	1 1 1 1	0.5	
	Dark reddish brown SILT AND GRAVEL, moist, **(STREAM TERRACE DEPOSIT)**		SS 14	30	25 12 7 4	NP	
465	Dark reddish brown sandy CLAY, moist, stiff, **(STREAM TERRACE DEPOSIT)**		SS 15	75	4 3 3 3	1.5	
		30	SS 16	50	8 8 8 7	1.25	
	Dark yellowish brown SAND AND GRAVEL, moist, dense, poorly graded, **(GLACIAL OUTWASH)**		SS 17	50	60 38 12 12	NP	
460		35	SS 18	65	18 20 18 12	NP	
			SS 19	60	16 20 28 28	NP	
455			SS 20	55	10 12 20 18	NP	
		40	SS 21	75	12 30 32 38	NP	
					18		

▲ SPT N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
☐ UCS (tsf) ☐ 20 40 60 80



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BORING NUMBER B-3

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen (tsf)	PID (ppm)	▲ SPT N VALUE ▲ / PL MC LL / ☐ UCS (tsf) ☐
450		Dark yellowish brown SAND AND GRAVEL, moist, dense, poorly graded, **(GLACIAL OUTWASH)** *(continued)*		SS 22	70	20 22 40	NP		
			45	SS 23	60	18 20 28 15	NP		
		Grades moist to wet. ∇		SS 24	70	12 35 35 25	NP		
445			50	SS 25	45	40 35 25 20	NP		12
		End of Borehole at 50.0 feet.							

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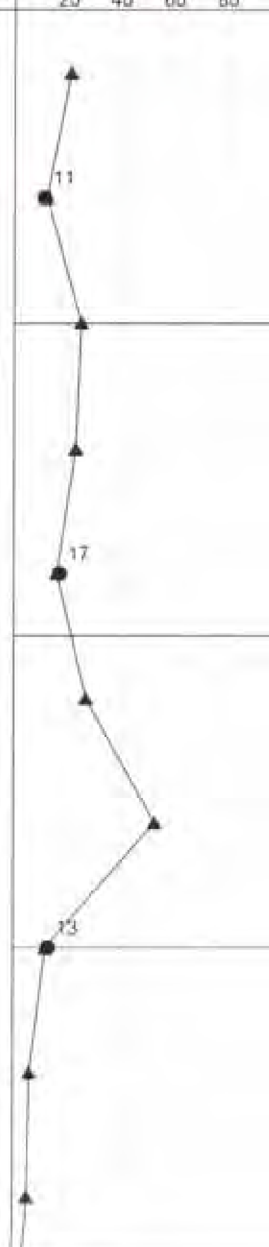
Downers Grove, IL 60510

BORING NUMBER B-4

CLIENT Dynegy - Hennepin Power Station		**PROJECT NAME** Dry Ash Landfill Feasability Study	
PROJECT NUMBER 082-255		**PROJECT LOCATION** Hennepin, Illinois	
DATE STARTED 2/17/09	**COMPLETED** 2/18/09	**GROUND ELEVATION** 494.0 ft	**BACKFILL** Cement Grout
DRILLING CONTRACTOR Groff Testing		**GROUND WATER LEVELS:**	
DRILLING METHOD Hollow Stem Auger		∇ **WHILE DRILLING** 47.0 ft / Elev 447.0 ft	
CEC REP D. KORTH	**CHECKED BY** MDJ	**AT END OF DRILLING** ---	
NOTES East End of Ash Pond on Berm		**AFTER DRILLING** ---	

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / □ UCS (tsf) □ 20 40 60 80
		Brown clayey SAND AND GRAVEL FILL, moist, medium dense, poorly graded, **(BERM FILL)**	0	SS 1	65	3 10 11 12	NP / 2.5		
490		Brown sandy CLAY FILL, trace gravel, moist, very stiff, **(BERM FILL)**		SS 2	80	8 6 6 7	3.0		11
		Brown clayey SAND AND GRAVEL FILL, moist, dense, poorly graded, **(BERM FILL)**	5	SS 3	85	5 9 16 16	NP		
		Very dark brown silty CLAY, moist, very stiff, **(BERM FILL)**		SS 4	85	20 15 8 9	3.5		
485			10	SS 5	75	4 6 10 10	3.75		17
				SS 6	50	7 11 16 20	--		
480		Very dark gray sandy SILT, trace coal fragments, moist, dense to medium dense, **(ASH)**		SS 7	60	17 28 25 15	NP		
		Gr - 0.0%, Sa - 4.6%, Si - 81.2%, Cl - 14.2%	15	SS 8	50	7 7 5 5	NP		13
				SS 9	50	3 3 3 1	NP		
475			20	SS 10	50	3 3 2 3	NP		



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BORING NUMBER B-4

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)	MC (%)
	Gray SILT, laminated, moist, loose, **(ASH)**	20	SS 11	100	1 1 1 1	NP		30
			SS 12	90	1 2 1 1	NP		
470	Wet 24.0 between 24.5 feet.	25	SS 13	90	1 1 2 2	NP		
	Grades to wet at 26 feet		SS 14	90	0 0 0 1	NP		53
465	Dark olive brown SILT, wet, very loose, **(ASH)**		SS 15	90	0 0 0 0	NP		
	Gray SILT, moist to wet, loose, Laminated with an organic interval from 30.7 to 30.9 feet., **(ASH)**	30	SS 16	100	0 1 1 1	NP		
460			SS 17	100	1 2 2 2	NP		40
	Grades to wet at 35 feet	35	SS 18	95	1 0 1 2	NP		
			SS 19	100	0 0 1 1	NP		
455	Dark yellowish brown sandy CLAY, trace fine gravel, moist, dense, **(STREAM TERRACE DEPOSIT)**		SS 20	100	0 5 18 50	>4.5		83
		40	SS 21	50	75 50	2.5		
	Dark yellowish brown poorly graded SAND AND GRAVEL, moist, **(GLACIAL OUTWASH)**							

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BORING NUMBER B-4

CLIENT Dynegy - Hennepin Power Station

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ UCS (tsf) ☐ 20 40 60 80
450		Dark yellowish brown poorly graded SAND AND GRAVEL, moist, **(GLACIAL OUTWASH)** *(continued)*		SS 22	50	50 50	NP		
			45	SS 23	80	100	NP		8
		Grade to wet at 47.0 feet		SS 24	80	100	NP		
445				SS 25	50	20 80	NP		
			50	SS 26	30	70 50	NP		12

End of Borehole at 52.0 feet

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BORING NUMBER B-5

CLIENT: Dynegy - Hennepin Power Station
PROJECT NAME: Dry Ash Landfill Feasability Study
PROJECT NUMBER: 082-255
PROJECT LOCATION: Hennepin, Illinois
DATE STARTED: 2/17/09 COMPLETED: 2/17/09
GROUND ELEVATION: 492.9 ft BACKFILL: Cement Grout
DRILLING CONTRACTOR: Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD: Hollow Stem Auger
WHILE DRILLING: 45.1 ft / Elev 447.8 ft
CEC REP: D. KORTH CHECKED BY: MDJ
AT END OF DRILLING: NA
NOTES: Southeast Corner of Ash Pond on Berm
AFTER DRILLING: NA

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)	MC (%)
	Brown poorly graded SAND AND GRAVEL FILL, moist, medium dense to dense. **(BERM FILL)**	0	SS 1	50	13 8 26 20	NP		
490			SS 2	55	8 10 9 25	NP		
	Dark yellowish brown clayey SAND AND GRAVEL, to sandy CLAY, trace gravel, moist, medium dense, poorly graded. **(BERM FILL)**	5	SS 3	75	8 8 9 10	NP		8
	Very dark brown silty CLAY, moist, hard. **(BERM FILL)**		SS 4	85	4 4 8 7	4.5		
485			SS 5	75	4 8 10 10	4.5		
	Very dark gray sandy SILT, moist, medium dense to dense. **(ASH)**	10	SS 6	80	8 15 30 25	NP		15
480			SS 7	65	8 9 6 6	NP		
		15	SS 8	60	3 3 2 3	NP		
	Gray SILT, moist to wet, loose. **(ASH)** Wet between 17.0 and 18.0 feet		SS 9	85	2 2 1 1	NP		44
475		20	SS 10	50	2 1 1 1	NP		

▲ SPT N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
□ UCS (tsf) □ 20 40 60 80

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BORING NUMBER B-5

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ UCS (tsf) ☐ 20 40 60 80
	Gray SILT, moist to wet, loose, **(ASH)** *(continued)*	20	SS 11	90	1 1 1 1	NP		
470	Grades to wet below 23.0 feet.		SS 12	75	1 1 1 1	NP		47
	Dark grayish brown SILT, wet, very loose, laminated, **(ASH)**	25	SS 13	95	1 1 1 1	NP		
			SS 14	100	0 0 1 1	NP		
465			SS 15	100	0 1 1 1	NP		43
		30	SS 16	90	1 1 2 8	NP		
	Dark reddish brown SILT, trace sand and gravel, trace plant matter, moist, stiff, **(STREAM TERRACE DEPOSIT)**							
460			SS 17	35	5 5 7 6	NP		
		35	SS 18	65	3 4 4 6	1.75		17
	Dusky red silty CLAY, trace sand and gravel, moist, very stiff, **(STREAM TERRACE DEPOSIT)**		SS 19	100	2 5 12 10	2.25		
455			SS 20	100	2 5 12 10	2.25		
	Dark yellowish brown SAND AND GRAVEL, moist, medium dense, poorly graded, **(GLACIAL OUTWASH)**	40	SS 21	50	5 8 13 10	NP		
					10			

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BORING NUMBER B-5

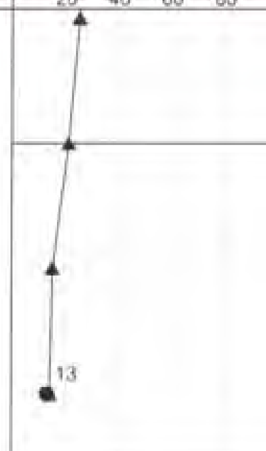
CLIENT Dynegy - Hennepin Power Station

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / □ UCS (tsf) □ 20 40 60 80
450		Dark yellowish brown SAND AND GRAVEL, moist, medium dense, poorly graded, **(GLACIAL OUTWASH)** *(continued)*		SS 22	60	12 13 14	NP		
		Grades to wet at 45.1 feet	45	SS 23	75	9 10 11 12	NP		
				SS 24	0	4 6 9 16	NP		
445				SS 25	45	3 7 7 10	NP		13
		End of Borehole at 50.0 feet	50						



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BORING NUMBER B-6

CLIENT Dynegy - Hennepin Power Station	PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255	PROJECT LOCATION Hennepin, Illinois
DATE STARTED 2/26/09 COMPLETED 2/26/09	GROUND ELEVATION 494.5 ft BACKFILL Cement Grout
DRILLING CONTRACTOR Groff Testing	GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger	WHILE DRILLING Dry
CEC REP CAC CHECKED BY MDJ	AT END OF DRILLING ---
NOTES	AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)	MC (%)
	Brown sandy GRAVEL, trace clay, medium sand, moist, medium dense, poorly graded, **(BERM FILL)**	0	SS 1	75	7 4 9 11	NP		
	Brown gray gravelly CLAY, some sand, moist, stiff, low to no plasticity, **(BERM FILL)**		SS 2	80	6 6 8 10	2.0		7
490	Coarse gravel	5	SS 3	70	5 8 7 6	1.3		
	Dark gray to black silty CLAY, trace coarse gravel, to cobbles, moist, very stiff, low plasticity, **(BERM FILL)**		SS 4	100	11 13 6 13	3.75		
			SS 5	100	4 6 8 10	3.5		21
485	Dark gray sandy SILT, trace coal pieces, coarse sand, dry to moist, dense, non-plastic, **(BERM FILL)**	10	SS 6	100	8 15 26 18	2.5		
			SS 7	0	5 5 6 6	-		
480	Dark gray to black silty CLAY, trace coarse gravel, with cobbles, moist, low plasticity, **(BERM FILL)**	15	SS 8	70	7 4 5 4	-		
			SS 9	50	5 4 5 10	-		18
475	Gray sandy SILT, moist to wet, **(ASH)**		SS 10	100	5 4 3 2	NP		32
		20						

▲ SPT N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
☐ UCS (tsf) ☐ 20 40 60 80

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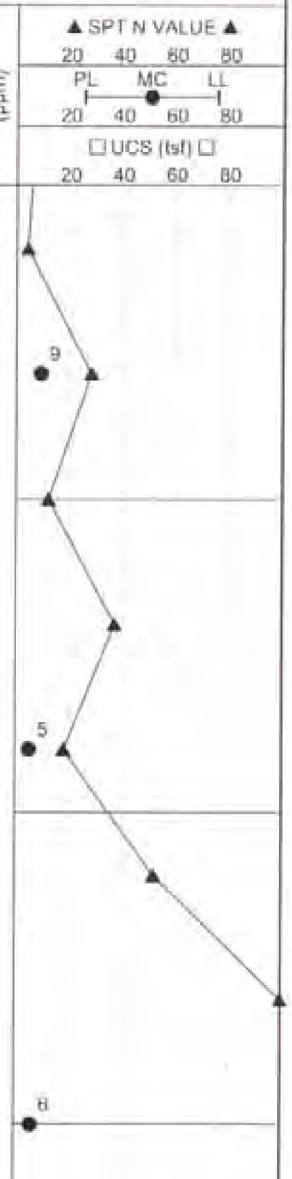
BORING NUMBER B-6

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION
	Gray sandy SILT, moist to wet, **(ASH)** *(continued)*
	Brown gravelly CLAY, moist, medium dense, low plasticity, poorly graded, **(STREAM TERRACE DEPOSIT)**
470	Tan medium SAND, trace fine gravel, dry to moist, medium dense, poorly graded, **(STREAM TERRACE DEPOSIT)**
	Brown gravelly SAND, dry to moist, medium dense, non-plastic, poorly graded, **(STREAM TERRACE DEPOSIT)**
465 / 460	Sandy GRAVEL, dry, poorly graded, **(GLACIAL OUTWASH)**
	End of Borehole at 36.0 feet

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)	MC
20	SS 11	0	2-2-2-3	NP		
	SS 12	70	8-9-19-10	NP		9
25	SS 13	60	6-6-6-6	NP		
	SS 14	25	20-22-15-10	NP		
	SS 15	50	11-7-11-10	NP		5
30	SS 16	50	11-12-40-40	NP		
	SS 17	75	18-30-70	NP		
35	SS 18	50	100	NP		6



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BORING NUMBER B-7

CLIENT Dynegy - Hennepin Power Station	**PROJECT NAME** Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255	**PROJECT LOCATION** Hennepin, Illinois
DATE STARTED 2/27/09 **COMPLETED** 2/27/09	**GROUND ELEVATION** 475 ft **BACKFILL** Cement Grout
DRILLING CONTRACTOR Groff Testing	**GROUND WATER LEVELS:**
DRILLING METHOD Hollow Stem Auger	**WHILE DRILLING** ---
CEC REP CAC **CHECKED BY** MDJ	**AT END OF DRILLING** ---
NOTES	**AFTER DRILLING** ---

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ UCS (tsf) ☐ 20 40 60 80
475		Brown - gray clayey GRAVEL, with sand, roots, coarse gravel, moist, low plasticity, poorly graded, **(BERM FILL)**	0	SS 1	100	5 8 12 14	NP		
		Gr = 33.8%, Sa = 25.7%, Si = 19.8%, Cl = 20.6%		SS 2	85	9 11 6 11	NP		6 16 39
470		Brown silty CLAY, with cobbles, some sand, moist, stiff, low plasticity, **(BERM FILL)**	5	SS 3	80	7 8 10 12	1.75		
				SS 4	9	12 9 8 10	–		
465		Dark brown silty CLAY, trace coarse gravel, trace sand, soft, low plasticity, **(BERM FILL)**	10	SS 5	50	3 5 8 10	0.5		12
		Trace coarse gravel, crushed limestone, trace sand, stiff		SS 6	100	4 7 9 11	2.5		
				SS 7	17	5 6 9 14	NP		
460		Brown silty CLAY, with silt layers, trace coarse gravel, dry to moist, very stiff, low plasticity, **(BERM FILL)**	15	SS 8	75	9 14 38 12	2.5 3.0		14
		Crushed limestone GRAVEL, dry, dense, non-plastic, poorly graded, **(BERM FILL)**							
		Dark brown silty CLAY, with gravel, trace wood chips, sand, cobbles to coarse gravel. **(BERM FILL)**		SS 9	60	6 6 12 15	–		
				SS 10	75	10 8 5 3	–		
455			20						

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BORING NUMBER B-7

CLIENT Dynegy - Hennepin Power Station

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / □ UCS (tsf) □ 20 40 60 80
455			20						
		Gray SILT, trace fine sand, moist to wet, loose, **(ASH)** *(continued)*		SS 11	90	2 1 1 5	NP		35
		SAND AND GRAVEL, limestone fragments, dry, medium dense to dense, non-plastic, **(GLACIAL OUTWASH)**		SS 12	70	14 14 14 12	NP		
450			25	SS 13	50	50 30 20	NP		
				SS 14	50	65 35	NP		9
		End of Borehole at 28.0 feet.							

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BORING NUMBER B-8

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 2/24/09 **COMPLETED** 2/24/09
GROUND ELEVATION 487.4 ft **BACKFILL** Bentonite Chips
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING 42.0 ft / Elev 445.4 ft
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / □ UCS (tsf) □ 20 40 60 80
		Dark gray SILT, trace coal pieces and fine sand, moist, very loose. **(ASH)**	0	SS 1	100	6 2 1 1	NP		30
485				SS 2	90	4 4 4 3	NP		
			5	SS 3	95	1 1 1 1	NP		
480				SS 4	80	0 0 1 1	NP		45
		Moist to wet. Grades to finer, blockier silt Gr - 4.0%, Sa - 7.4%, Si - 77.9%, Cl - 14.8%		SS 5	70	1 2 5 5	NP		
		Dark gray SILT, some sand, dry to moist, very loose. **(ASH)**	10	SS 6	100	2 1 1 1	NP		
475				SS 7	100	2 2 2 2	NP		6
			15	SS 8	100	2 1 1 1	NP		
470				SS 9	90	2 1 2 2	NP		
				SS 10		2 2 1 1	NP		27
			20						

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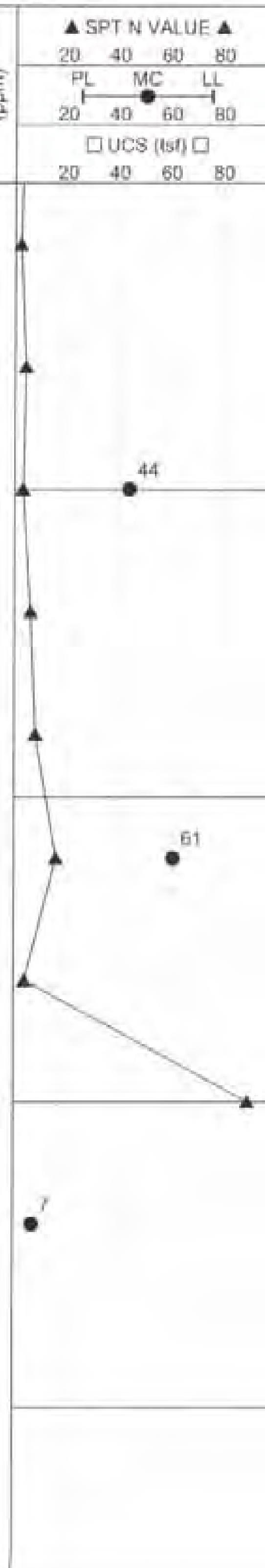
BORING NUMBER B-8

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)
	Dark gray SILT, trace sand, coal pieces, moist, very loose, non plastic, **(ASH)**	20	SS 11	95	2 1 1 1	-	
465			SS 12	90	2 2 2 3		
	Wet, loose	25	SS 13	100	2 2 1 5		
460	Moist to wet, low plasticity when wet		SS 14	100	5 3 3 3		
		30	SS 15	85	5 3 5 4		
			SS 16	100	2 5 11 10		
455			SS 17	90	3 2 2 4		
	Dark brown to reddish brown fine SAND, trace silt, fine gravel, moist, very dense, non plastic, poorly graded, **(STREAM TERRACE DEPOSIT)**						
	Brown gravelly SAND, coarse gravel, medium sand, moist, very dense, poorly graded, **(GLACIAL OUTWASH)**	35	SS 18	100	15 50 40	NP	
450			SS 19	88	40 60	NP	
		40	SS 20	52	100	NP	
	Grades to wet		SS 21	92	30 70	NP	
	End of Borehole at 42.0 feet						



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BORING NUMBER B-9

CLIENT: Dynegy - Hennepin Power Station
PROJECT NAME: Dry Ash Landfill Feasability Study
PROJECT NUMBER: 082-255
PROJECT LOCATION: Hennepin, Illinois
DATE STARTED: 2/24/09 COMPLETED: 2/24/09
GROUND ELEVATION: 482.3 ft BACKFILL: Bentonite Chips
DRILLING CONTRACTOR: Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD: Hollow Stem Auger
WHILE DRILLING: 38.0 ft / Elev 444.3 ft
CEC REP: CAC CHECKED BY: MDJ
AT END OF DRILLING: ---
NOTES:
AFTER DRILLING: ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen (tsf)	PID (ppm)	SPT N VALUE / PL MC LL / UCS (tsf)
	Dark gray SILT, trace roots and sand, moist, very loose, **(ASH)**	0	SS 1	100	3 1 1 1	NP		8
480			SS 2	100	2 1 1 1	NP		
		5	SS 3	100	2 1 1 1	NP		40
475			SS 4	100	3 2 3 2	NP		
			SS 5	100	2 2 2 1	NP		11
		10	SS 6	100	1 1 1 1	NP		37
470			SS 7	95	2 1 2 1	NP		
	Wet at 15 feet	15	SS 8	90	1 1 1 1	NP		
465			SS 9	100	0 1 2 5	NP		37
		20	SS 10	100	3 4 5 5	NP		

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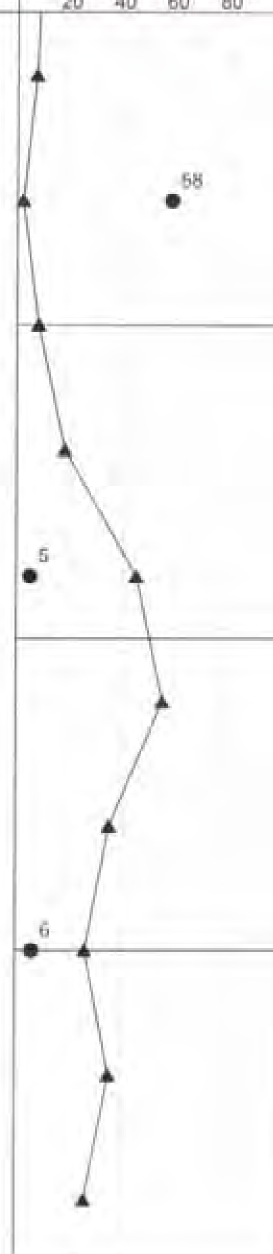
BORING NUMBER B-9

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen (tsf)	PID (ppm)	MC
	Dark gray SILT, trace roots and sand, moist, very loose. **(ASH)** *(continued)*	20	SS 11	90	2 3 4 4	NP		
460	Trace fine gravel, wet		SS 12	85	0 1 1 1	NP		58
	Trace crushed gravel, moist to wet	25	SS 13	95	1 2 6 7	NP		
455	Reddish brown medium SAND, trace coarse gravel, moist, medium dense, poorly graded, **(STREAM TERRACE DEPOSIT)**		SS 14	100	6 8 10 7	NP		
	Light brown gravelly SAND, dry to moist, dense, **(GLACIAL OUTWASH)**		SS 15	75	5 20 25 15	NP		5
		30	SS 16	80	11 25 30 20	NP		
450			SS 17	75	50 20 15 20	NP		
	Sandy GRAVEL, wet, dense, poorly graded, **(GLACIAL OUTWASH)**	35	SS 18	65	14 12 14 18	NP		6
445			SS 19	60	25 18 17 15	NP		
	Grades to wet.		SS 20	60	11 15 11 18	NP		
	End of Borehole at 40.0 feet.	40						



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BORING NUMBER B-10

CLIENT Dynegy - Hennepin Power Station	**PROJECT NAME** Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255	**PROJECT LOCATION** Hennepin, Illinois
DATE STARTED 2/23/09 **COMPLETED** 2/23/09	**GROUND ELEVATION** 481.6 ft **BACKFILL** Bentonite Chips
DRILLING CONTRACTOR Groff Testing	**GROUND WATER LEVELS:**
DRILLING METHOD Hollow Stem Auger	∇ **WHILE DRILLING** 28.5 ft / Elev 453.1 ft
CEC REP CAC **CHECKED BY** MDJ	**AT END OF DRILLING** ---
NOTES	**AFTER DRILLING** ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen (tsf)	PID (ppm)	MC (%)
	Dark gray SILT, trace sand, moist to wet, very loose, **(ASH)**	0	SS 1	50	4 2 1 1	NP		
480			SS 2	50	0 0 1 1	NP		44
		5	SS 3	75	1 2 4 4	NP		
475	Grades to wet		SS 4	70	4 3 2 2	NP		
		10	SS 5	100	2 1 1 1	NP		
470			SS 6	80	1 1 1 1	NP		40
			SS 7	80	1 2 2 1	NP		
		15	SS 8	100	1 1 2 1	NP		41
465			SS 9	95	0 2 1 1	NP		
		20	SS 10	100	1 1 1 2	NP		

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CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)
		Dark gray SILT, trace sand, moist to wet, very loose, **(ASH)** *(continued)*	20					
460				SS 11	100	1 2 2 4	NP	
				SS 12	85	2 2 3 3	NP	
		Grades to medium dense	25	SS 13	100	5 12 14 10	NP	
455		Dark brown sandy SILT, moist, very dense, **(STREAM TERRACE DEPOSIT)**		SS 14	100	15 26 60	NP	
		▽		SS 15	68	22 80	NP	
		Brown SAND AND GRAVEL, medium to coarse sand, fine to coarse gravel, moist, very dense, **(GLACIAL OUTWASH)**	30	SS 16	76	60 40	NP	
450				SS 17	89	26 30 55	NP	
			35	SS 18	100	100	NP	
		End of Borehole at 36.0 feet						

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BORING NUMBER B-11

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 2/20/09 COMPLETED 2/20/09
GROUND ELEVATION 479.8 ft BACKFILL Bentonite Chips
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING 34.0 ft / Elev 445.8 ft
CEC REP D. KORTH CHECKED BY MDJ
AT END OF DRILLING NA
NOTES East End of Ash Pond
AFTER DRILLING NA

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)	SPT N VALUE / PL MC LL / UCS (tsf)
		Gray SILT, wet, loose, laminated, **(ASH)**	0	SS 1	85	2-2-1-1	NP		34
				SS 2	75	1-1-1-1	NP		
475		Grades to moist	5	SS 3	80	2-2-1-1	NP		
				SS 4	75	1-1-2-1	NP		46
470		Grades to wet	10	SS 5	65	0-0-1-2	NP		
				SS 6	75	0-1-1-1	NP		
		Dark grayish brown to dark olive brown SILT, wet, loose, **(ASH)**		SS 7	75	2-2-1-1	NP		34
465			15	SS 8	85	1-1-1-1	NP		
				SS 9	100	2-3-3-3	NP		
460			20	SS 10	100	1-2-2-2	NP		58

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BORING NUMBER B-11

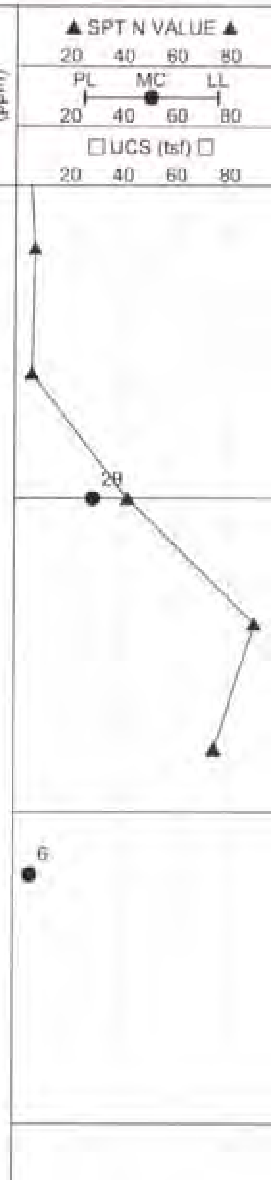
CLIENT Dynegy - Hennepin Power Station

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen (tsf)	PID (ppm)
		Dark grayish brown to dark olive brown SILT, wet, loose, **(ASH)** *(continued)*	20	SS 11	95	3 3 4 5	NP	
				SS 12	100	2 3 3 6	NP	
		Grayish brown laminated with brown SILT AND LEAN CLAY, moist, loose, **(STREAM TERRACE DEPOSIT)**						
455		Dark yellowish brown fine SAND, trace gravel, moist, dense, poorly graded, **(GLACIAL OUTWASH)**	25	SS 13	100	13 20 22 25	NP	
		Dark yellowish brown SAND AND GRAVEL, moist, dense, poorly graded, **(GLACIAL OUTWASH)**		SS 14	67	32 65 25	NP	
450			30	SS 15	53	25 30 45	NP	
				SS 16	20	75 25	NP	
				SS 17	25	50 50	NP	
445		Grades to wet at 34.0 feet.	35	SS 18	80	70 30	NP	
		End of Borehole at 36.0 feet.						



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BORING NUMBER B-12

CLIENT Dynegy - Hennepin Power Station	**PROJECT NAME** Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255	**PROJECT LOCATION** Hennepin, Illinois
DATE STARTED 2/20/09 **COMPLETED** 2/20/09	**GROUND ELEVATION** 479.5 ft **BACKFILL** Bentonite Chips
DRILLING CONTRACTOR Groff Testing	**GROUND WATER LEVELS:**
DRILLING METHOD Hollow Stem Auger	**WHILE DRILLING** 32.5 ft / Elev 447.0 ft
CEC REP D. KORTH **CHECKED BY** MDJ	**AT END OF DRILLING** ---
NOTES East End of Ash Pond	**AFTER DRILLING** ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ / PL MC LL / □ UCS (tsf) □
	Gray SILT, laminated with sandy silt, with a few black coal laminations, moist to wet, very loose, **(ASH)**	0	SS 1	50	3-1-2-2	NP		
			SS 2	90	0-1-3-4	NP		
475		5	SS 3	65	0-0-1-1	NP		40
			SS 4	75	0-0-0-1	NP		
470	Very dark grayish brown SILT, trace little fine sand laminations, wet, very loose, **(ASH)**		SS 5	90	0-1-2-2	NP		
		10	SS 6	100	0-0-1-1	NP		12
			SS 7	95	0-0-1-1	NP		
465		15	SS 8	85	0-0-1-1	NP		42
	Very dark grayish brown SANDY SILT, laminated, wet, very loose, **(ASH)**							
	Dark olive brown SILT TO SILT WITH SAND, laminated, wet, very loose, **(ASH)**		SS 9	95	1-1-2-2	NP		
460	Gr = 0.0%, Sa = 7.7%, Si = 85.2%, Cl = 7.2%	20	SS 10	90	0-1-1-1	NP		36

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BORING NUMBER B-12

CLIENT Dynegy - Hennepin Power Station
PROJECT NUMBER 082-255
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)	MC
	Dark gray SILT WITH SAND, with fine sand, wet, loose to medium dense, **(ASH)**	20	SS 11	100	5 6 16 18	NP		
	Brown sandy SILT, moist to wet, **(STREAM TERRACE DEPOSIT)**		SS 12	95	3 4 7 10	NP		
455	Dusky red sandy SILT, trace fine gravel, moist, dense, **(STREAM TERRACE DEPOSIT)**							
	Dark yellowish brown GRAVEL WITH SAND, moist, dense to very dense, poorly graded, **(GLACIAL OUTWASH)**	25	SS 13	70	15 40 40 25	NP		31
			SS 14	25	45 62	NP		
450			SS 15	60	75 40	NP		
		30	SS 16	60	60 50	NP		39
	Dark yellowish brown SAND WITH GRAVEL, moist to wet, very dense, poorly graded, **(GLACIAL OUTWASH)** Grades to wet at 32.5		SS 17	100	65	NP		
445		35	SS 18	100	100	NP		
	End of Borehole at 36.0 feet.							

▲ SPT N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
☐ UCS (tsf) ☐ 20 40 60 80

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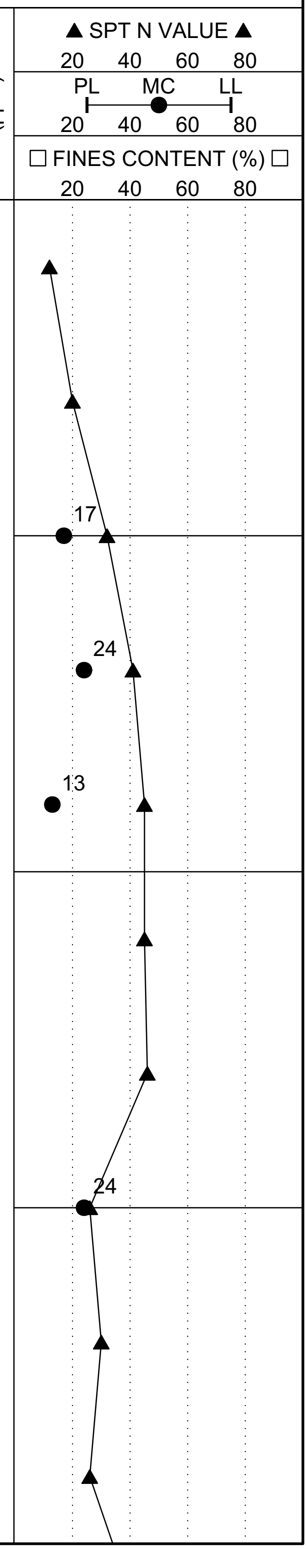
BORING NUMBER B-13

CLIENT	Dynegy - Hennepin Power Station	**PROJECT NAME**	Dry Ash Landfill Feasability Study
PROJECT NUMBER	082-255	**PROJECT LOCATION**	Hennepin, Illinois
DATE STARTED	2/17/09 **COMPLETED** 3/17/09	**GROUND ELEVATION**	482.7 ft **BACKFILL** Cement Grout
DRILLING CONTRACTOR	Groff Testing	**GROUND WATER LEVELS:**	
DRILLING METHOD	Hollow Stem Auger	∇ **WHILE DRILLING**	34.0 ft / Elev 448.7 ft
CEC REP	D. KORTH **CHECKED BY** MDJ	**AT END OF DRILLING**	---
NOTES	West end of Ash Pond on North Perimeter Road	**AFTER DRILLING**	---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	MC (%)
	Yellowish brown GRAVEL WITH SAND, some inter-layered clayey gravel, moist, medium dense, **(BERM FILL)**	0	SS 1	55	3 6 6 12	NP		
480	Dark yellowish brown SAND WITH GRAVEL, fine to coarse sand with fine to coarse gravel, trace silt, moist to wet, **(BERM FILL)**		SS 2	80	6 7 13 20	NP		
	Very dark grayish brown to very dark gray SILT WITH SAND, interbedded with sand lenses, trace coal fragments, moist, medium dense to dense, **(ASH/ML)**	5	SS 3	85	13 16 16 20	NP		17
475	Gravel ~ 0% Sand ~ 21.1% Silt ~ 60.5% Clay ~ 18.4%		SS 4	85	14 16 25 20	NP		24
			SS 5	75	16 20 25 20	NP		13
	Grades moist to wet.	10	SS 6	95	18 20 25 16	NP		
470			SS 7	90	25 26 20 18	NP		
		15	SS 8	80	10 13 13 15	NP		24
465			SS 9	75	5 12 18 30	NP		
		20	SS 10	80	13 13 13 12	NP		



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CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	MC (%)
	20	Very dark grayish brown to very dark gray SILT WITH SAND, interbedded with sand lenses, trace coal fragments, moist, medium dense to dense, **(ASH/ML)** *(continued)*	SS 11	80	15-20-22-25	NP		23
460		Very dark brown SILTY SAND WITH GRAVEL, fine to coarse grained, moist, dense, **(ASH/SM)**	SS 12	100	22-25-26-23	NP		
	25	Gravel ~ 17.4% Sand ~ 60.1% Silt ~ 19.4% Clay ~ 3.2% Grades to wet.	SS 13	90	17-16-14-12	NP		19
455			SS 14	70	12-11-10-10	NP		17
	30	Very dark brown SILT, laminated with fine sand, trace fine to medium grained coal fragments, moist, **(ASH)**	SS 15	85	15-10-8-7	NP		23
		Dark brown to dark yellowish brown SAND WITH CLAY, trace fine to medium grained gravel, moist, very loose, poorly graded, **(STREAM TERRACE DEPOSIT)**	SS 16	65	3-2-2-3	NP		
450		Dark yellowish brown SILTY SAND WITH GRAVEL, moist to wet, loose to medium dense, poorly graded, **(GLACIAL OUTWASH/SM)**	SS 17	50	3-3-5-10	NP		12
	35	Gravel ~ 30.1% Sand ~ 46.7% Silt ~ 18.1% Clay ~ 5.1%	SS 18	95	5-8-12-20	NP		10

End of Borehole at 36.0 feet.

▲ SPT N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
☐ FINES CONTENT (%) ☐ 20 40 60 80

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BORING NUMBER B-14

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/19/09 **COMPLETED** 3/19/09
GROUND ELEVATION 494.5 ft **BACKFILL** Cement Grout
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING 43.5 ft / Elev 451.0 ft
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	MC (%)
	Brown and gray SAND AND GRAVEL, moist, dense, poorly graded, **(BERM FILL)**	0	SS 1	34	20 25 18 15	NP		7
490	Dark brown to black clayey SAND, trace roots, gravel, moist, stiff, **(BERM FILL)**	5	SS 2	100	20 15 10 10	2.0		
	Brown medium SAND, some gravel, moist, dense, poorly graded, **(BERM FILL)**		SS 3	100	15 17 16 20	NP		
485	Dark brown and gray clayey GRAVEL, some sand, moist, very dense, poorly graded, **(BERM FILL)**	10	SS 4	50	18 12 30 35	NP		6
480	Brown and gray sandy GRAVEL, dry to moist, very dense, poorly graded, **(BERM FILL)**	15	SS 5	80	18 20 40 35	NP		
475	Dark brown-dark gray coarse SAND, dry to moist, medium dense, poorly graded, **(BERM FILL)**	20	SS 6	90	0 5 5	NP		32

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BORING NUMBER B-14

CLIENT Dynegy - Hennepin Power Station **PROJECT NAME** Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255 **PROJECT LOCATION** Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	MC (%)
	Dark brown-dark gray coarse SAND, dry to moist, medium dense, poorly graded, **(BERM FILL)** *(continued)*	20			6			
	Gray SILT TO SANDY SILT, trace coal pieces, dry to moist, very loose, **(ASH)**							
470		25	SS 7	42	1 1 0 1	NP		
			SS 8	38	2 1 2 2	NP		14
465		30	SS 9	90	2 3 8 20	NP		
	Grades to dense.		SS 10	90	25 23 18 18	NP		14
460		35	SS 11	100	15 15 25 35	NP		
			SS 12	95	20 30 25 22	NP		18
455	Dark brown medium SAND, moist, medium dense, poorly graded, **(STREAM TERRACE DEPOSIT)**	40	SS 13	100	6 6 7 5	NP		
	Brown medium clayey SAND, some gravel, moist to wet, loose, poorly graded, **(STREAM TERRACE DEPOSIT)**		SS 14	85	1 1 4 3	0.5 / 1.5		16

▲ SPT N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
☐ FINES CONTENT (%) ☐ 20 40 60 80

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BORING NUMBER B-14

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
		∇ Brown medium clayey SAND, some gravel, moist to wet, loose, poorly graded, **(STREAM TERRACE DEPOSIT)** *(continued)*							
450		Grades to wet.	45	SS 15	50	3 3 3 2	NP		▲
		End of Borehole at 45.5 feet.							

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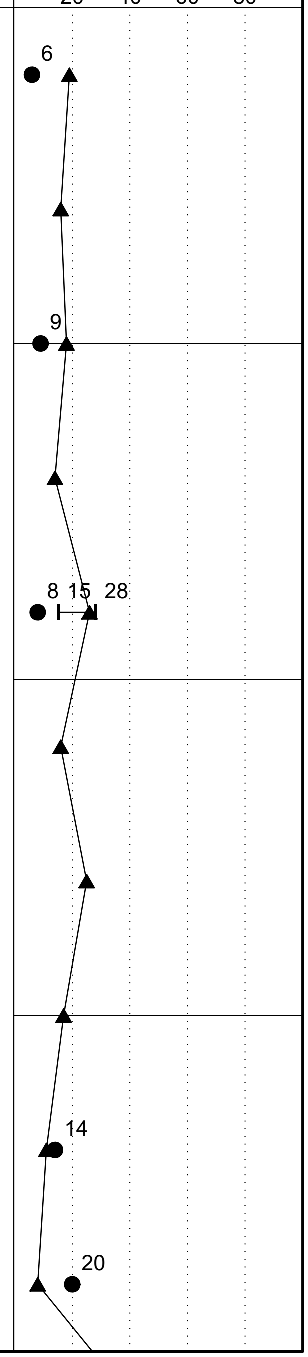
BORING NUMBER B-15

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/18/09 **COMPLETED** 3/18/09
GROUND ELEVATION 495.1 ft **BACKFILL** Cement Grout
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ **WHILE DRILLING** 44.0 ft / Elev 451.1 ft
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
495		Brown and gray clayey to sandy GRAVEL, moist, medium dense, poorly graded, **(BERM FILL)**	0	SS 1	50	4 8 11 14	1.25	
				SS 2	75	8 8 8 12	NP	
		Brown gravelly SAND, moist, medium dense, poorly graded, **(BERM FILL)**						
490			5	SS 3	95	6 8 10 10	NP	
		Dark brown clayey SAND, some gravel, moist, poorly graded, **(BERM FILL)**						
		Gravel ~ 41.3%		SS 4	75	5 7 7 8	NP	
		Sand ~39.0% Silt ~ 10.6% Clay ~ 9.2%		SS 5	100	11 12 14 11	1.0	
485		Sandy CLAY between 10 - 12 feet.	10	SS 6	100	6 5 11 22	NP	
				SS 7	0	18 14 11 22	NP	
		Dark brown to dark gray coarse SILTY SAND, dry to moist, medium dense, poorly graded, **(BERM FILL/SM)**						
480			15	SS 8	100	8 8 9 12	NP	
		Gravel ~ 8.5%		SS 9	100	6 5 6 4	NP	
		Sand ~68.6% Silt ~ 20.5% Clay ~ 2.3%		SS 10	90	2 2 6 13	NP	
			20					

▲ SPT N VALUE ▲ (20 40 60 80); PL MC LL (20 40 60 80); □ FINES CONTENT (%) □ (20 40 60 80)



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BORING NUMBER B-15

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CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
475			20						
		Dark gray SILT, some sand laminations, trace coal pieces, moist, dense, **(ASH)**		SS 11	95	9 16 30 20	NP		
				SS 12	100	3 4 5 5	NP		
470			25	SS 13	90	6 6 4 4	NP		43
		Grades moist to wet.		SS 14	80	2 4 5 8	NP		
				ST 15	0		--		
465		Grades to wet between 30 - 32 feet.	30	SS 16	100	4 4 2 6	NP		54
				SS 17	100	5 7 25 20	NP		42
460		Grades moist to wet.	35	SS 18	90	5 9 10 10	NP		43
				SS 19	100	1 3 2 5	NP		
				SS 20	100	2 3 5 9	NP		
455		Dark brown - dark gray coarse SAND WITH SILT, trace gravel and cobbles, moist to wet, very dense, poorly graded, **(GLACIAL OUTWASH)**	40	SS 21	90	8 20 25 28	NP		14
						6			

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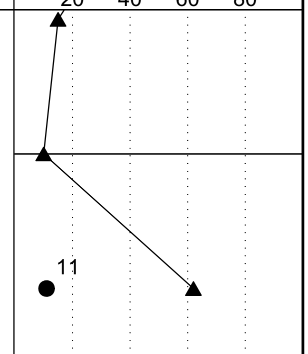
BORING NUMBER B-15

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
		Dark brown - dark gray coarse SAND WITH SILT, trace gravel and cobbles, moist to wet, very dense, poorly graded, **(GLACIAL OUTWASH)** *(continued)*		SS 22	80	8 7 6	NP		
450		Grades to wet.	45	SS 23	13	3 4 6 4	NP		
		Brown and gray gravelly SAND, wet, dense, poorly graded, **(GLACIAL OUTWASH)**		SS 24	80	11 32 30 18	NP		11



End of Borehole at 48.0 feet.

BORING NUMBER B-16

Civil & Environmental Consultants, Inc.
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CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/18/09 **COMPLETED** 3/18/09
GROUND ELEVATION 494.3 ft **BACKFILL** Cement Grout
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING 48.5 ft / Elev 445.8 ft
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	MC (%)
	Brown and gray clayey GRAVEL, some sand, moist, medium dense, poorly graded, **(BERM FILL)**	0						
			SS 1	80	10 13 14 14	NP		7
490		5	SS 2	75	8 8 12 12	1.25		
			SS 3	100	20 20 20 12	NP		7
485	Dark brown sand CLAY, trace cobbles, moist, very stiff, low plasticity, **(BERM FILL)**	10	SS 4	70	12 9 9 8	3.0		
480	Dark brown to dark gray coarse SAND, trace coal pieces, dry to moist, dense to very dense, poorly graded, **(BERM FILL)**	15	SS 5	100	22 20 22 18	NP		9
475		20	SS 6	100	25 40	NP		7

SPT N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
☐ FINES CONTENT (%) ☐ 20 40 60 80

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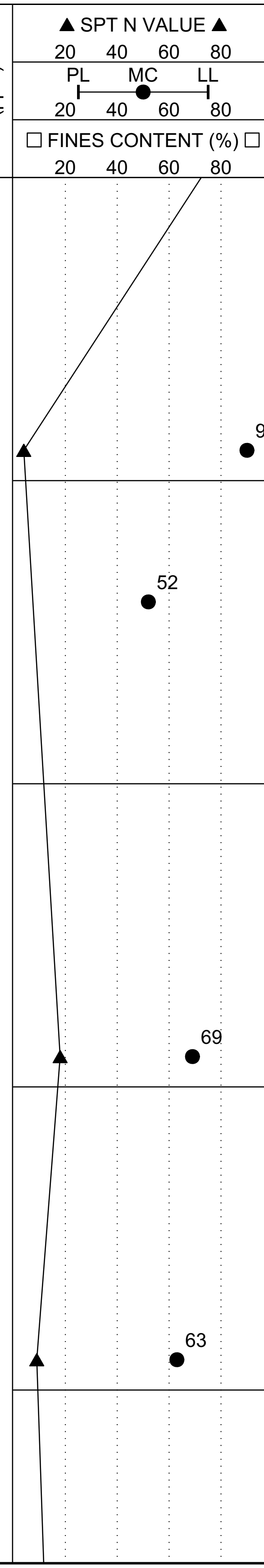
BORING NUMBER B-16

CLIENT Dynegy - Hennepin Power Station **PROJECT NAME** Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255 **PROJECT LOCATION** Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
	Dark brown to dark gray coarse SAND, trace coal pieces, dry to moist, dense to very dense, poorly graded, **(BERM FILL)** *(continued)*	20			40		
	Gray fine SILT, with sand laminations, moist to wet, very loose, **(ASH/ML)**						
470		25	SS 7	100	3 2 2 2	<0.5	
	Grades to wet.						
465	Gravel ~ 0% Sand ~ 13.4% Silt ~73.5% Clay ~ 13.1%	30	ST 8	100		1.0	
460	Grades to medium dense; moist with brown and black sand laminations	35	SS 9	85	16 8 10 12	NP	
455		40	SS 10	95	6 5 4 6	0.75	
	Dark brown clayey SAND, trace gravel, moist to wet, loose to medium stiff, **(STREAM TERRACE DEPOSIT)**						



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BORING NUMBER B-16

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	SPT N VALUE
450	Dark brown clayey SAND, trace gravel, moist to wet, loose to medium stiff, **(STREAM TERRACE DEPOSIT)** *(continued)*	45	SS 11	65	2 5 8 10	0.75		11
	Brown and gray SAND AND GRAVEL, with cobbles, moist, medium dense, poorly graded, **(GLACIAL OUTWASH)**					NP		
445	Grades to wet.	50	SS 12	80	11 15 10 8	NP		21
	End of Borehole at 50.5 feet.							

SPT N VALUE: 20 40 60 80
PL MC LL: 20 40 60 80
FINES CONTENT (%): 20 40 60 80

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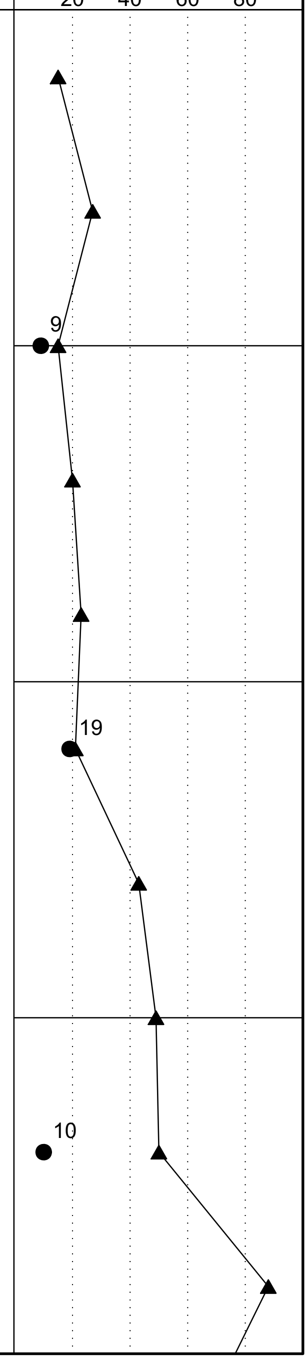
BORING NUMBER B-17

CLIENT Dynegy - Hennepin Power Station **PROJECT NAME** Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255 **PROJECT LOCATION** Hennepin, Illinois
DATE STARTED 3/11/09 **COMPLETED** 3/11/09 **GROUND ELEVATION** 494.3 ft **BACKFILL** Cement Grout
DRILLING CONTRACTOR Groff Testing **GROUND WATER LEVELS:**
DRILLING METHOD Hollow Stem Auger **WHILE DRILLING** ---
CEC REP CAC **CHECKED BY** MDJ **AT END OF DRILLING** ---
NOTES **AFTER DRILLING** ---

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION
		Brown and gray SAND AND GRAVEL, dry to moist, medium dense, poorly graded, **(BERM FILL)**
490		Brown clayey SAND, some gravel, moist, medium dense, poorly graded, **(BERM FILL)**
		Grades with brown SAND lenses
485		Black to dark brown gravelly CLAY, some sand, and cobbles, moist, very stiff, **(BERM FILL)**
		Gray GRAVEL, trace sand, dry to moist, very dense, poorly graded, **(BERM FILL)**
480		Brown to black coarse SAND, trace fine gravel, dry to moist, very dense, poorly graded, **(BERM FILL)**
		Trace coal pieces
475		

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
0	SS 1	70	3 6 9 14	NP	
	SS 2	90	11 15 12 9	NP	
5	SS 3	95	7 5 10 13	2.0	
	SS 4	100	8 10 10 15	NP	
	SS 5	90	6 9 14 14	2.5	
10	SS 6	80	4 9 12 10	3.5	
	SS 7	85	6 13 30 32	NP	
15	SS 8	100	16 23 26 27	NP	
	SS 9	90	14 20 30 32	NP	
20	SS 10	75	20 28 60	NP	

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80



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Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

BORING NUMBER B-17

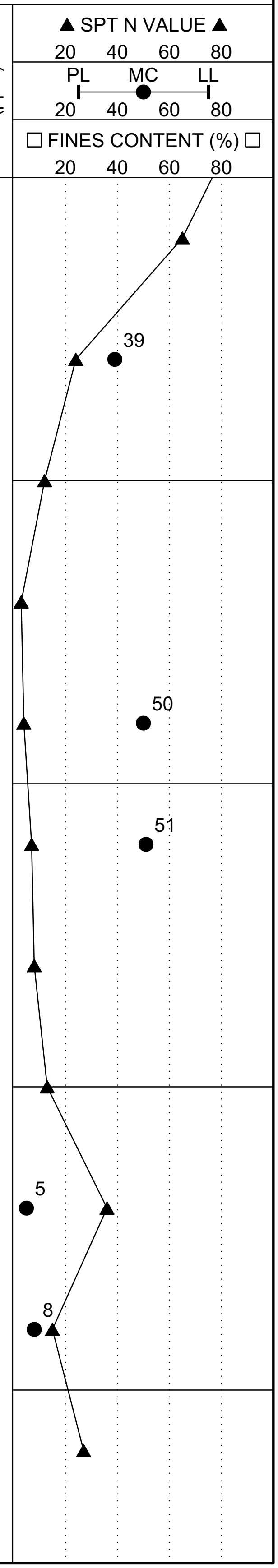
CLIENT Dynegy - Hennepin Power Station

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
	Brown to black coarse SAND, trace fine gravel, dry to moist, very dense, poorly graded, **(BERM FILL)** *(continued)* Dark brown to gray SILT, with fine sand laminations, dry to moist, dense, **(ASH FILL)**	20	SS 11	100	22 35 30 35	NP	
			SS 12	100	6 9 15 10	NP	
470		25	SS 13	100	7 7 5 4	NP	
	Grades to loose with red, black and/or brown sand lenses		SS 14	100	0 2 1 1	NP	
465	Gray SILT, moist to wet, loose, **(ASH)**	30	SS 15	100	1 1 3 3	NP	
	Grades to wet.		SS 16	100	2 4 3 10	NP	
	Brown medium SAND, trace gravel, dry to moist, medium dense, poorly graded, **(STREAM TERRACE DEPOSIT)**		SS 17	100	3 1 7 14	NP	
460		35	SS 18	100	6 6 7 7	NP	
	Brown and gray SILTY SAND WITH GRAVEL, dry to moist, dense, poorly graded, **(GLACIAL OUTWASH/SM)**		SS 19	90	12 20 16 18	NP	
455	Gravel ~ 39.0% Sand ~ 44.8% Silt ~ 11.6% Clay ~ 4.6%	40	SS 20	90	7 7 8 10	NP	
			SS 21	80	7 12 15 12	NP	
	End of Borehole at 42.0 feet.						

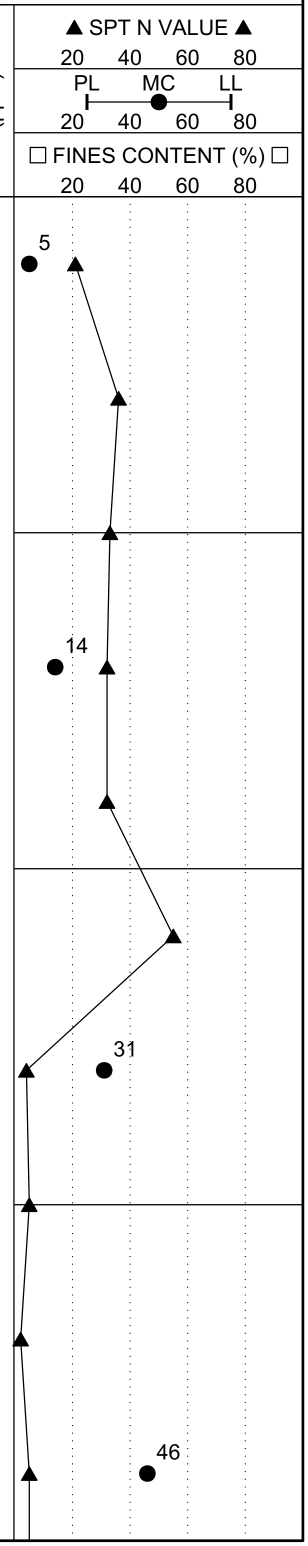


BORING NUMBER B-18

Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/6/09 **COMPLETED** 3/6/09
GROUND ELEVATION 493.9 ft **BACKFILL** Cement Grout
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING ---
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
	Brown and gray SAND AND GRAVEL, moist, medium dense to dense, poorly graded, **(BERM FILL)**	0	SS 1	50	3 6 15 20	NP	
490			SS 2	70	17 18 18 10	NP	
	Brown sandy CLAY, trace gravel, moist, medium stiff, **(BERM FILL)**						
	Brown and gray clayey SAND AND GRAVEL, moist, dense, poorly graded, **(BERM FILL)**	5	SS 3	90	4 17 16 10	NP	
			SS 4	100	5 12 20 15	NP	
485	Three inch sand seam at 8.5 feet.		SS 5	65	10 17 15 20	NP	
	Dark brown to gray SILTY SAND, trace coal pieces, dry to moist, poorly graded, **(ASH)**	10	SS 6	90	5 20 35 25	NP	
	Dark gray SILT, with fine sand laminations, moist to wet, loose, **(ASH/ML)**		SS 7	95	2 2 2 4	NP	
480		15	SS 8	100	4 3 2 2	NP	
	Grades moist to wet.		SS 9	90	2 1 1 2	NP	
475		20	SS 10	100	2 2 3 3	NP	



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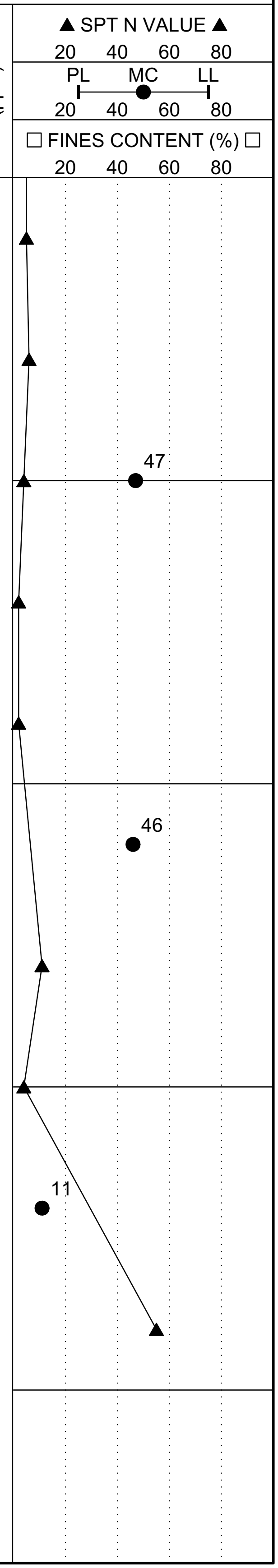
BORING NUMBER B-18

Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	MC / FINES CONTENT (%)
	Dark gray SILT, with fine sand laminations, moist to wet, loose, **(ASH/ML)** *(continued)*	20	SS 11	100	3 3 2 2	NP		
470			SS 12	100	3 3 3 2	NP		
	Grades moist to wet.	25	SS 13	90	3 2 2 1	NP		47
			SS 14	90	2 1 1 2	NP		
465			SS 15	90	2 1 1 1	NP		
	Grades to moist. Gravel ~ 0% Sand ~ 13.4% Silt ~ 73.5% Clay ~ 13.1%	30	ST 16	100		NP		46
460			SS 17	100	3 6 5 9	NP		
	Grades to wet.	35	SS 18	100	2 1 3 6	NP		
	Brown and gray SILTY SAND, dry to moist, very dense, poorly graded, **(GLACIAL OUTWASH/SM)** Gravel ~ 4.0% Sand ~ 79.1% Silt ~10.9% Clay ~ 6.1%		ST 19	50		NP		11
455		40	SS 20	85	16 20 35 25	NP		

End of Borehole at 40.0 feet.



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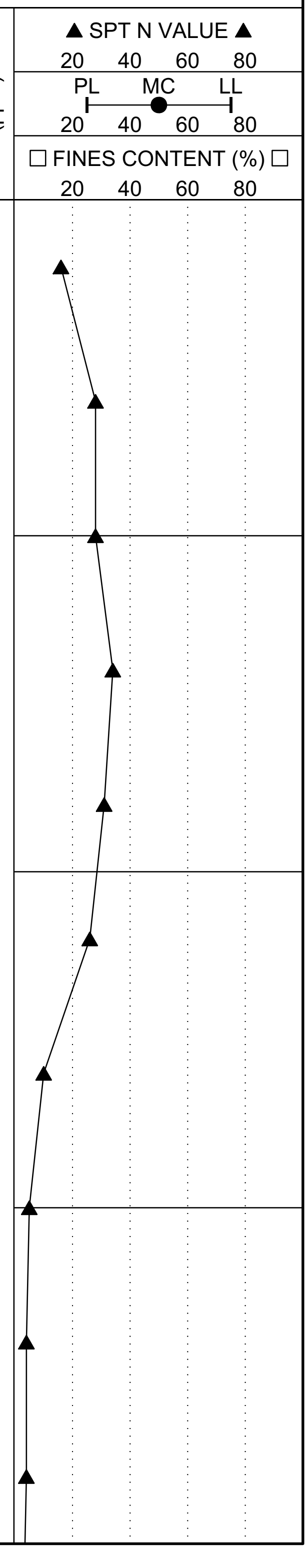
BORING NUMBER B-19

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/5/09 **COMPLETED** 3/5/09
GROUND ELEVATION 494.2 ft **BACKFILL** Cement Grout
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING 44.8 ft / Elev 449.4 ft
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
	Brown and gray SAND AND GRAVEL, trace clay, moist, medium dense, poorly graded, **(BERM FILL)**	0	SS 1	75	2 4 12 15	NP	
			SS 2	90	10 12 16 20	NP	
490		5	SS 3	95	14 16 12 10	NP	
	Grades to gravelly SAND		SS 4	90	5 9 25 18	NP	
485			SS 5	100	6 11 20 11	NP 3.5	
	Black silty CLAY, trace sand, roots, moist, very stiff, **(BERM FILL)**	10					
	Dark gray coarse SAND, dry to moist, medium dense, poorly graded, **(BERM FILL)**		SS 6	90	10 11 15 14	NP	
480			SS 7	75	4 4 6 5	NP	
	Gray SILT, with fine sand laminantions, dry to moist, very loose to loose, **(ASH/ML)**	15	SS 8	100	3 2 3 2	NP	
			SS 9	90	3 2 2 2	NP	
475		20	SS 10	90	3 2 2 2	NP	



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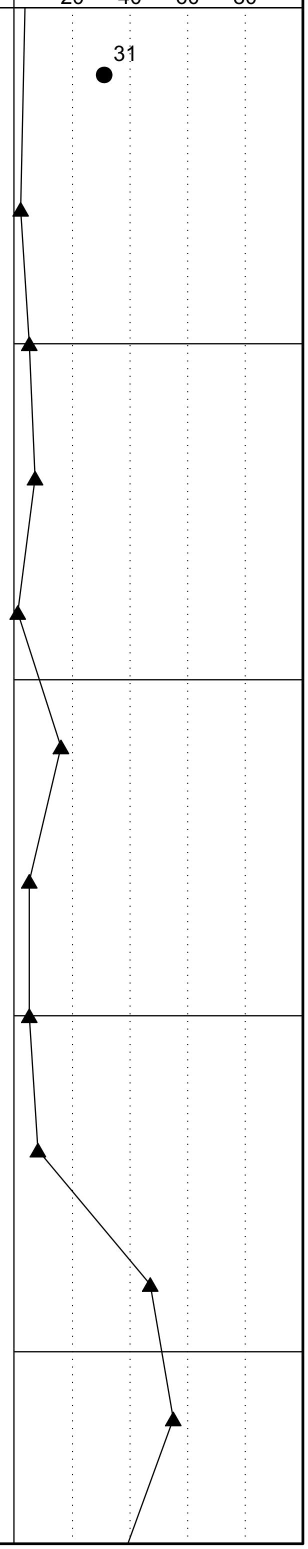
CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
	Gray SILT, with fine sand laminantions, dry to moist, very loose to loose, **(ASH/ML)** *(continued)* Gravel ~ 0.6%; Sand ~ 22.8% Silt ~ 62.6%; Clay ~ 14.0%	20	ST 11	100			
	Dark gray SILT, some black sand laminations, dry to moist, very loose, **(ASH)**		SS 12	100	2 1 1 1	NP	
470	Grades to moist.	25	SS 13	85	2 3 2 6	NP	
	Grades moist to wet.		SS 14	95	1 3 4 3	NP	
465	Grades to wet.	30	SS 15	100	0 0 1 1	NP	
			SS 16	90	3 4 12 8	NP	
460			SS 17	100	2 3 2 2	NP	
		35	SS 18	100	2 3 2 2	NP	
			SS 19	95	2 2 6 13	NP	
	Brown medium SAND, trace gravel, moist, medium dense, poorly graded, **(STREAM TERRACE DEPOSIT)**						
455	Brown gravelly SAND, moist, dense, poorly graded, **(GLACIAL OUTWASH)**	40	SS 20	65	8 12 35 25	NP	
			SS 21	75	18 20 35 15	NP	
					8		

▲ SPT N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
□ FINES CONTENT (%) □ 20 40 60 80



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BORING NUMBER B-19

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
450		Brown gravelly SAND, moist, dense, poorly graded, **(GLACIAL OUTWASH)** *(continued)*		SS 22	65	18 20 26	NP		
		Grades to wet.	45	SS 23	90	25 15 13 12	NP		
		End of Borehole at 46.0 feet.							

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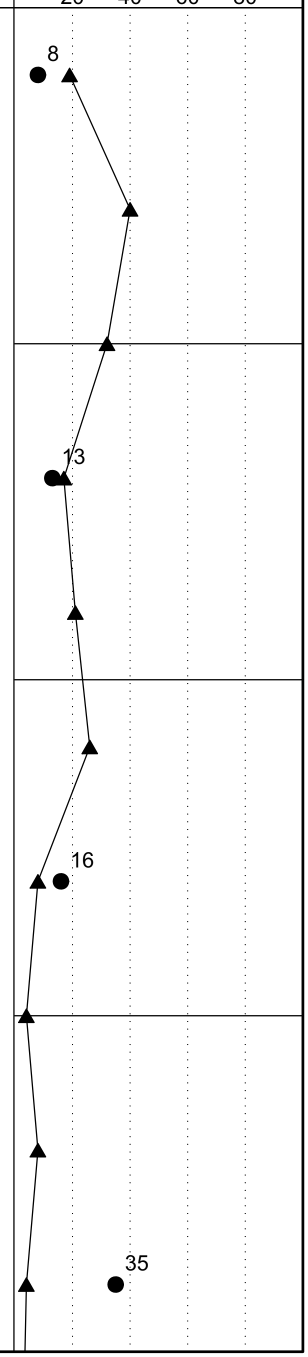
BORING NUMBER B-20

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/5/09 **COMPLETED** 3/5/09
GROUND ELEVATION 494.3 ft **BACKFILL** Cement Grout
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ **WHILE DRILLING** 46.0 ft / Elev 448.3 ft
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
	Brown and gray SAND AND GRAVEL, moist, medium dense to dense, **(BERM FILL)**	0	SS 1	75	5 8 11 17	NP	
			SS 2	100	12 20 20 17	NP	
490		5	SS 3	90	12 20 12 12	NP	
	Brown medium SAND, trace gravel, moist, medium dense, poorly graded, **(BERM FILL)**						
	Dark brown to black clayey SAND AND GRAVEL, with cobbles, moist, medium dense, **(BERM FILL)**		SS 4	85	6 8 9 12	NP	
485		10	SS 5	65	7 10 11 11	NP	
	Dark gray coarse SAND, trace coal pieces, dry to moist, medium dense, poorly graded, **(BERM FILL)**		SS 6	100	15 15 11 11	NP	
			SS 7	80	9 5 3 3	NP	
480	Gray SILT, with fine sand laminantions, dry to moist, very loose, **(ASH)**	15	SS 8	100	2 2 2 2	NP	
			SS 9	100	2 2 6 2	NP	
475		20	SS 10	100	2 2 2 2	NP	

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80



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BORING NUMBER B-20

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	MC (%)
	Gray SILT, with fine sand laminantions, dry to moist, very loose, **(ASH)** *(continued)*	20						
	Grades to wet.		SS 11	100	1 1 2 2	NP		
	Grades to moist.		SS 12	100	2 2 1 2	NP		
470		25						
	Dark brown to gray SILT, with fine sand laminantions, trace coal pieces, moist, very loose, **(ASH)**		SS 13	95	2 3 2 2	NP		31
			SS 14	100	3 4 2 1	NP		
465			SS 15	100	2 2 1 1	NP		
		30						
	Grades to wet.		SS 16	100	2 0 1 1	NP		43
			SS 17	100	0 1 1 1	NP		
460		35	SS 18	100	3 3 3 4	NP		
			SS 19	100	3 4 5 9	NP		
455	Brown and gray SAND AND GRAVEL, dry to moist, very dense, poorly graded, **(GLACIAL OUTWASH)**		SS 20	55	20 44 40	NP		
		40						
			SS 21	100	25 75	NP		6

▲ SPT N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
☐ FINES CONTENT (%) ☐ 20 40 60 80

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BORING NUMBER B-20

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
450		Brown and gray SAND AND GRAVEL, dry to moist, very dense, poorly graded, **(GLACIAL OUTWASH)** *(continued)*		SS 22	100	10 20 65	NP		▲
			45	SS 23	100	40 60	NP		
		Grades to wet.		SS 24	58	70 30	NP		
		End of Borehole at 46.8 feet.							

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BORING NUMBER B-21

CLIENT	Dynegy - Hennepin Power Station	**PROJECT NAME**	Dry Ash Landfill Feasability Study
PROJECT NUMBER	082-255	**PROJECT LOCATION**	Hennepin, Illinois
DATE STARTED	2/25/09	**COMPLETED**	2/25/09
GROUND ELEVATION	494.3 ft	**BACKFILL**	Cement Grout
DRILLING CONTRACTOR	Groff Testing	**GROUND WATER LEVELS:**	
DRILLING METHOD	Hollow Stem Auger	**WHILE DRILLING**	Dry
CEC REP	CAC	**AT END OF DRILLING**	---
CHECKED BY	MDJ	**AFTER DRILLING**	---
NOTES			

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	FINES CONTENT (%)
	Brown gravelly SAND, moist, medium dense, poorly graded, **(BERM FILL)**	0	SS 1	0	7 10 12 14	NP		
			SS 2	90	10 16 22 20	NP		
490		5	SS 3	85	12 10 9 8	NP		6
	Gray SAND, some gravel, moist, medium dense, poorly graded, **(BERM FILL)** Grades to brown		SS 4	100	9 10 10 14	NP		
485	Brown gravelly SAND, moist, medium dense, **(BERM FILL)**		SS 5	85	14 14 14 10	NP		
	Dark gray medium SAND, trace coal pieces, dry to moist, medium dense, non plastics; poorly graded, **(BERM FILL)**	10	SS 6	95	7 10 14 12	NP		9
			SS 7	50	13 8 7 5	NP		
480	Gray SILT, with fine sand laminantions, moist, loose, poorly graded, **(ASH)**	15	SS 8	80	6 5 3 3	NP		
			SS 9	100	4 3 3 2	NP		28
475		20	SS 10	34	3 4 5 5	NP		

▲ SPT N VALUE ▲ (20 40 60 80)
PL — MC — LL (20 40 60 80)
☐ FINES CONTENT (%) ☐ (20 40 60 80)

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Downers Grove, IL 60510

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
		Gray SILT, with fine sand laminantions, moist, loose, poorly graded, **(ASH)** *(continued)*	20	SS 11	100	2 2 2 3	NP		
		Grades to dark gray		SS 12	100	3 2 2 4	NP		36
470			25	SS 13	100	2 2 1 6	NP		
				SS 14	100	2 2 1 1	NP		
465		Moist		SS 15	100	1 1 2 4	NP		50
		Grades to wet.	30	SS 16	100	2 1 1 1	NP		
				SS 17	100	1 1 1 0	NP		
460			35	SS 18	100	1 2 1 1	NP		48
				SS 19	100	0 0 0 1	NP		48
455				SS 20		0 1 3 6	NP NP 2.75		
		Dark brown silty SAND, trace fine gravel, moist, very stiff, **(STREAM TERRACE DEPOSIT)**	40						
		Reddish brown clayey SAND WITH GRAVEL, trace silt, moist, medium dense, **(STREAM TERRACE DEPOSIT/SC)** Gr ~ 2.1%; Sa ~ 46.2%; Si ~ 18.4%; Cl ~ 15.4%.		SS 21	80	3 8 12 45	NP		19 / 20 35
		Brown gravelly SAND, dry to moist, dense, **(GLACIAL OUTWASH)**				10			

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Downers Grove, IL 60510

BORING NUMBER B-21

CLIENT Dynegy - Hennepin Power Station

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

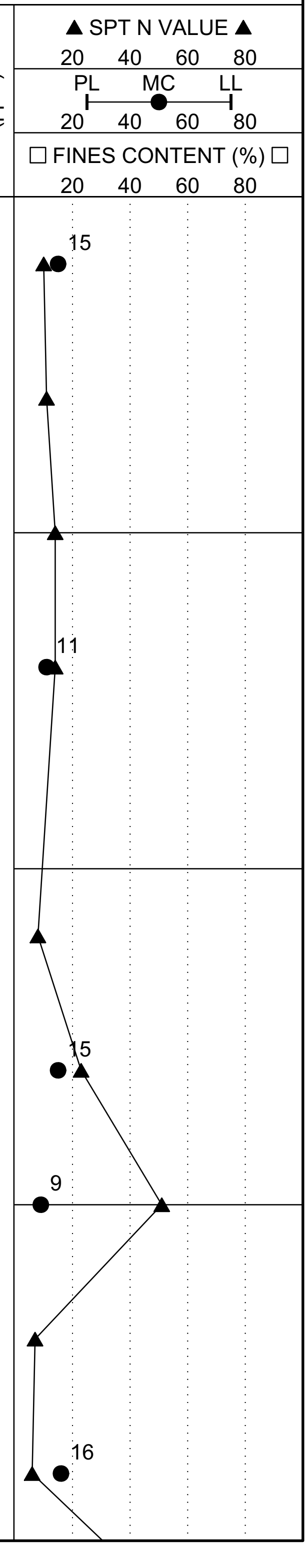
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
450		Brown gravelly SAND, dry to moist, dense, **(GLACIAL OUTWASH)** *(continued)*		SS 22	90	18 18 22	NP		
		Brown SAND AND GRAVEL, with cobbles, dry to moist, dense, **(GLACIAL OUTWASH)**	45	SS 23	100	8 20 15 15	NP		
		End of Borehole at 46.0 feet.							

BORING NUMBER B-24

Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/20/09 **COMPLETED** 3/20/09
GROUND ELEVATION 494.9 ft **BACKFILL** Cement Grout
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING Dry
CEC REP D. KORTH **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
	Dark brown LEAN CLAY WITH SAND, trace fine to coarse gravel, moist, hard, **(BERM FILL)**	0	SS 1	70	3 4 6 12	>4.5	
	Dark yellowish brown SAND AND GRAVEL, moist, medium dense, **(BERM FILL)**		SS 2	55	7 6 5 4	NP	
490		5	SS 3	70	7 8 6 5	NP	
			SS 4	80	8 8 6 12	NP	
			SS 5	100	65	NP	
485	Black LEAN CLAY, trace medium to coarse sand, moist, stiff, **(BERM FILL)**	10	SS 6	55	6 4 4 3	1.5	
			SS 7	100	6 12 11 25	4.0	
480	Dark yellowish brown with very dark brown SILTY SAND WITH GRAVEL, moist, very dense, **(ASH/SM)** Gravel ~ 22.3% Sand ~ 59.4% Silt ~ 16.0% Clay ~ 2.2%	15	SS 8	80	20 25 26 20	NP	
	Yellowish brown SILTY SAND, trace fine gravel, moist, loose, **(STREAM TERRACE DEPOSIT)**		SS 9	80	3 4 3 3	NP	
475	Dark yellowish brown SILTY GRAVEL WITH SAND, with cobbles, moist, dense, **(GLACIAL OUTWASH/GM)**	20	SS 10	40	2 5 1 30	NP	



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Downers Grove, IL 60510

BORING NUMBER B-24

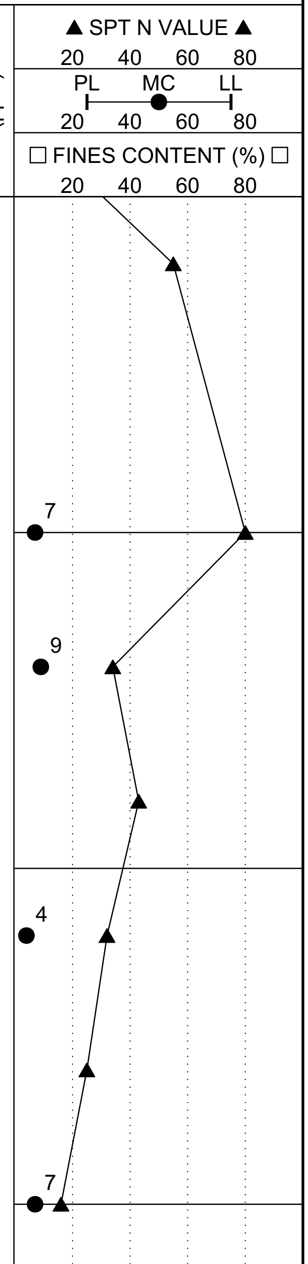
CLIENT Dynegy - Hennepin Power Station

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
		Dark yellowish brown SILTY GRAVEL WITH SAND, with cobbles, moist, dense, **(GLACIAL OUTWASH/GM)** *(continued)*	20	SS 11	50	20 25 30 28	NP	
				SS 12	100	50 50	NP	
470			25	SS 13	33	20 50 30	NP	
				SS 14	25	25 18 16 21	NP	
		Grades medium dense to dense Gravel ~ 45.5% Sand ~ 37.6% Silt ~ 11.8% Clay ~ 5.1%		SS 15	50	12 13 30 35	NP	
465			30	SS 16	30	25 16 16 10	NP	
				SS 17	30	15 13 12 12	NP	
460			35	SS 18	35	10 8 8 11	NP	
		End of Borehole at 36.0 feet.						



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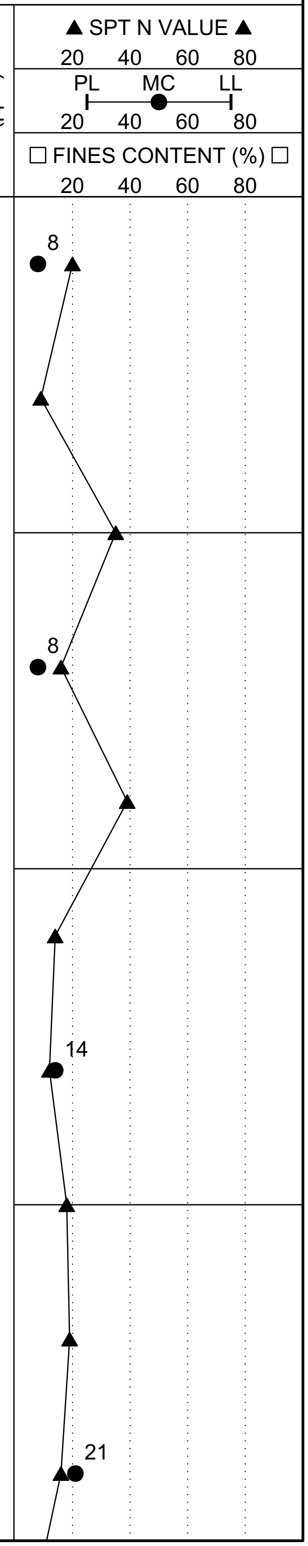
BORING NUMBER B-25

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/19/09 **COMPLETED** 3/20/09
GROUND ELEVATION **BACKFILL** Cement Grout
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING ---
CEC REP D. KORTH **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
		Brown and gray SAND AND GRAVEL, moist, medium dense, poorly graded, **(BERM FILL)**	0	SS 1	34	11 10 10 14	NP	
		Brown medium SAND, trace gravel, moist, medium dense, poorly graded, **(BERM FILL)**		SS 2	85	5 5 4 9	1.0	
			5	SS 3	80	15 15 20 35	NP	
				SS 4	25	4 7 9 12	NP	
			10	SS 5	75	15 17 22 32	NP	
		Dark yellowish brown LEAN CLAY WITH GRAVEL, trace fine to coarse sand, moist, stiff to very stiff, **(BERM FILL)**		SS 6	75	8 6 8 6	2.25	
				SS 7	50	4 6 6 6	1.0	
		Dark grayish brown to brown sandy CLAY, trace gravel, moist, soft to very stiff, **(BERM FILL)**	15	SS 8	80	6 8 10 8	3.0 4.25	
		Very dark grayish brown SILT, with fine sand laminantions, moist, medium dense, **(ASH)**		SS 9	85	7 7 12 11	NP	
			20	SS 10	75	5 7 9 9	2.25	



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Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

BORING NUMBER B-25

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ / PL MC LL / ☐ FINES CONTENT (%) ☐
		Very dark grayish brown SILT, with fine sand laminantions, moist, medium dense, **(ASH)** *(continued)*	20	SS 11	100	5 3 3 3	NP		
		Grades loose to medium dense		SS 12	100	2 4 4 3	NP		
			25	SS 13	100	3 4 4 7	NP		35
				SS 14	100	12 5 7 7	NP		
		Grades moist to wet.	30	SS 15	95	6 5 4 6	NP		
				SS 16	100	4 6 4 4	NP		56
		Very dark grayish brown to very dark brown SILTY SAND, trace fine gravel, moist, dense, **(ASH/SM)** Gravel ~ 14.2% Sand ~ 64.9% Silt ~ 18.9% Clay ~ 2.0%		SS 17	90	16 25 25 18	NP		29
			35	SS 18	85	16 10 5 3	1.5		
		Black LEAN CLAY, with fine sand, moist, medium stiff to stiff, **(LOESS DEPOSIT)**		SS 19	90	2 3 3 2	0.5		27
		Very dark brown to olive brown fine SAND, moist to wet, loose, poorly graded, **(STREAM TERRACE DEPOSIT)**	40	SS 20	95	0 2 2 5	NP		
		Dark yellowish brown fine SAND, moist to wet, very loose, **(STREAM TERRACE DEPOSIT)**		SS 21	85	3 3 3 4	NP		23
						1			

(Continued Next Page)

Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

BORING NUMBER B-25

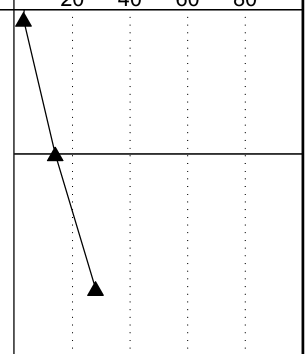
CLIENT Dynegy - Hennepin Power Station

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / □ FINES CONTENT (%) □ 20 40 60 80
		Dark yellowish brown fine SAND, moist to wet, very loose, **(STREAM TERRACE DEPOSIT)** *(continued)*		SS 22	100	1 2 4	NP		
			45	SS 23	80	2 5 9 18	NP		
		Dark yellowish brown GRAVEL AND SAND, wet, medium dense, **(GLACIAL OUTWASH)**		SS 24	55	25 16 12 17	NP		
		End of Borehole at 48.0 feet.							



BORING NUMBER B-26

Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/13/09 **COMPLETED** 3/13/09
GROUND ELEVATION 494.0 ft **BACKFILL** Well sand & Bentonite Chips
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING ---
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES Far West, Well (MW-26) installed.
AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	MC
	Brown-black coarse SAND, trace silt, roots, coal pieces, trace gravel, dry to moist, non-plastic; poorly graded, **(SP)**	0	SS 1	85	2 2 4 4	NP		
			SS 2	80	3 8 15 14	NP		33
490	Gray sandy SILT, moist, medium dense, non-plastic, **(ML)** Black-gray coarse SAND, some silt, moist, non-plastic; poorly graded, **(SP)**	5	SS 3	95	23 16 9 4	NP		
	Gray sandy SILT, some black and brown sand lenses, wet to moist, medium dense, adhesive, **(SM)**		SS 4	80	3 4 2 6	<0.25		
485		10	SS 5	100	3 8 12 8	NP		24
			SS 6	95	4 7 10 10	0.5 1.0		
	Gray SILT, some sand lenses, dry to moist, dense, non-plastic, **(ML)**		SS 7	90	10 11 26 6	NP		
480		15	SS 8	100	2 0 0 1	<0.25		41
	Grades to wet.		SS 9	100	0 0 0 1	<0.25		46
475		20	SS 10	100	2 1 1 1	<0.25		

▲ SPT N VALUE ▲ (20 40 60 80); PL — MC — LL (20 40 60 80); ☐ FINES CONTENT (%) ☐ (20 40 60 80)

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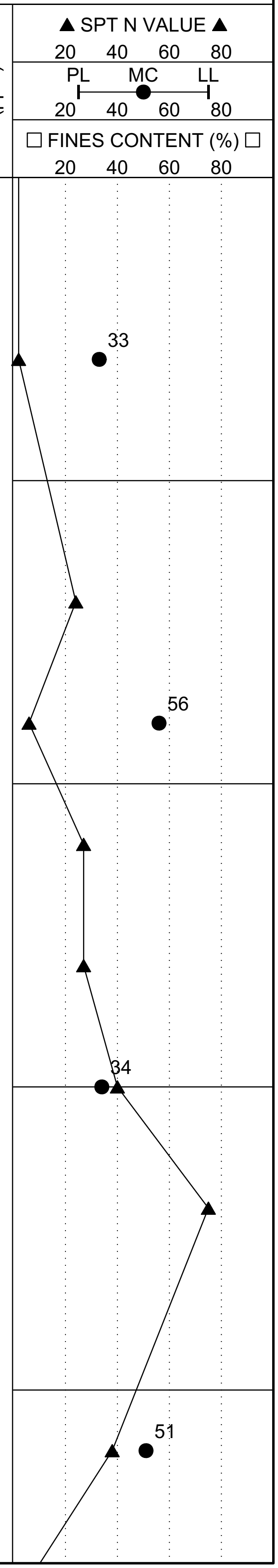
CLIENT Dynegy - Hennepin Power Station

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
	Gray SILT, some sand lenses, dry to moist, dense, non-plastic, **(ML)** *(continued)*	20	ST 11	100			
470	Grades moist to wet.		SS 12	100	1 1 1 3		
		25	ST 13	100			
			SS 14	100	11 6 18 6	1.5	
465			SS 15	100	6 3 3 8	<0.5	
		30	SS 16	100	2 11 16 40	NP	
	Gray silty coarse SAND, moist, dense, non-plastic; poorly graded, **(SP)**		SS 17	90	15 15 12 30	NP	
460	Grades to silty sand.	35	SS 18	100	15 30 10 10	NP	
			SS 19	100	20 40 35 25	<4.0	
455	Dark gray - dark brown silty coarse SAND, moist, very dense, non-plastic; poorly graded, **(SM)**	40	SS 20	100	35 65	NP	
			SS 21	100	6 30 8 10	<1.0	
	Grades moist to wet.				4		



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Civil & Environmental Consultants, Inc.
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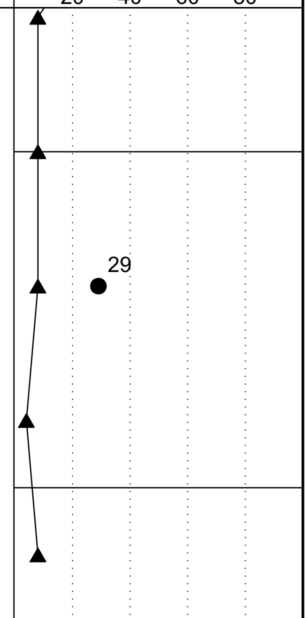
Downers Grove, IL 60510

BORING NUMBER B-26

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
450		Dark gray - dark brown silty coarse SAND, moist, very dense, non-plastic; poorly graded, **(SM)** *(continued)*		SS 22	100	2 6 13	NP		
		Dark brown gray clayey SAND, trace silt, moist, medium stiff, low plasticity, **(SC)**	45	SS 23	100	5 3 5 6	0.5 1.25		
				SS 24	95	2 2 6 7	1.75 1.25		29
445		Grades moist to wet.	50	SS 25	100	2 2 2 3	1.25		
				SS 26	100	1 3 5 5	1.0		



End of Borehole at 52.0 feet.

BORING NUMBER B-27

Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

CLIENT Dynegy - Hennepin Power Station

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

DATE STARTED 3/16/09 **COMPLETED** 3/16/09

GROUND ELEVATION 493.8 ft **BACKFILL** Bentonite Chips

DRILLING CONTRACTOR Groff Testing

GROUND WATER LEVELS:

DRILLING METHOD Hollow Stem Auger

WHILE DRILLING 46.2 ft / Elev 447.6 ft

CEC REP D. KORTH **CHECKED BY** MDJ

AT END OF DRILLING ---

NOTES

AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	MC (%)
	Gray SILT, with fine sand laminantions, trace of small coal fragments, moist to wet, very loose to loose, **(ASH)**	0	SS 1	85	1 2 2 3	NP		
490			SS 2	80	1 1 1 3	NP		46
		5	SS 3	65	4 4 3 2	NP		
			SS 4	75	5 5 2 2	NP		16
485		10	SS 5	95	2 2 2 1	NP		56
	Very dark grayish brown SILTY SAND, moist, loose, **(ASH)**		SS 6	85	1 2 3 3	NP		
480	Gray SANDY SILT, moist, loose to medium dense, **(ASH)**		SS 7	95	12 12 8 5	3.5		41
		15	SS 8	90	4 4 3 4	2.0		
	Very dark grayish brown SILTY SAND, moist, **(ASH)**							
	Dark olive gray to gray SANDY SILT, moist to wet, loose, **(ASH)**		SS 9	85	2 3 3 2	NP		
475	Dark olive gray to very dark gray SILTY SAND, moist to wet, medium dense, **(ASH)**	20	SS 10		8 12 15 10	2.5		

▲ SPT N VALUE ▲ 20 40 60 80

PL MC LL 20 40 60 80

☐ FINES CONTENT (%) ☐ 20 40 60 80

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Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

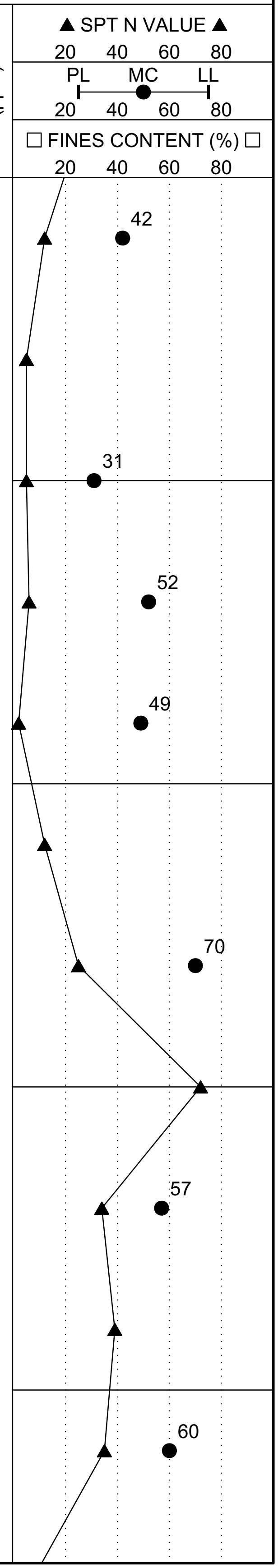
CLIENT Dynegy - Hennepin Power Station

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
		Dark olive gray to very dark gray SILTY SAND, moist to wet, medium dense, **(ASH)** *(continued)*	20	SS 11	100	4 7 5 2	NP	
		Dark olive gray to very dark gray SILT WITH SAND, laminated, moist to wet, loose, **(ASH/ML)**		SS 12	90	3 2 3 2	NP	
470		Gravel ~ 0.8% Sand ~ 27.0% Silt ~ 65.3% Clay ~ 6.9%	25	SS 13	90	5 3 2 3	NP	
				SS 14	85	2 2 4 5	NP	
465			30	SS 15	100	4 1 1 4	NP	
		Coarse granular Bottom Ash Layer from 30.8 to 31.2 feet.		SS 16	100	4 6 6 9	NP	
		Very dark gray SILTY SAND, laminated, moist to wet, medium dense, **(ASH FILL)**		SS 17	90	4 11 14 7	NP	
460		Grades to very dense.	35	SS 18	85	30 22 50	NP	
		Gravel ~ 0% Sand ~ 28.9% Silt ~ 66.2% Clay ~ 4.9%		SS 19	90	7 14 20 30	NP	
455			40	SS 20	95	10 17 22 35	NP	
				SS 21	100	15 20 15 32	NP	
						6		



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CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
450		Dark olive brown CLAYEY SAND, moist to wet, loose, **(STREAM TERRACE DEPOSIT)**		SS 22	90	5 4 4	NP		
			45	SS 23	100	3 3 6 5	4.0		
		Dark yellowish brown GRAVEL WITH SAND, wet, medium dense, **(GLACIAL OUTWASH)**		SS 24	70	3 6 8 12	NP		15

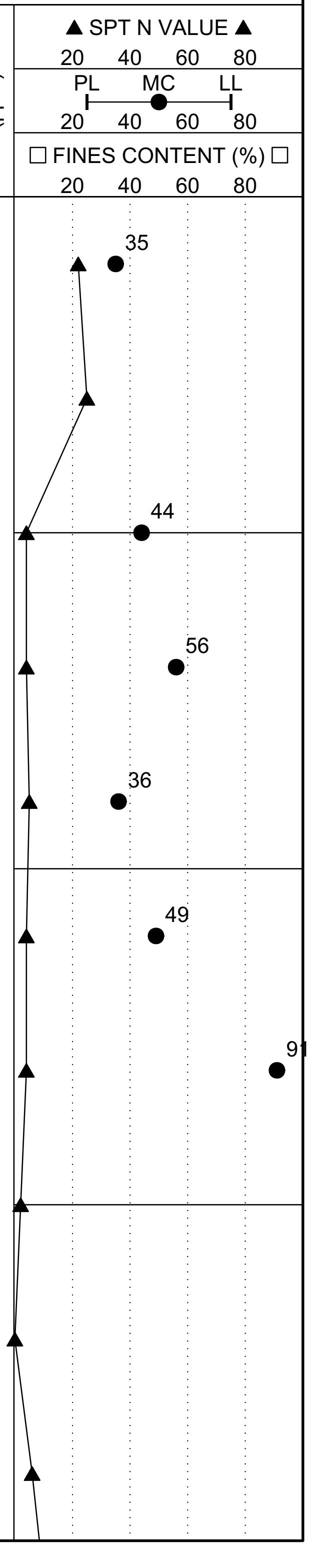
End of Borehole at 48.0 feet.

Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

BORING NUMBER B-28

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/11/09 **COMPLETED** 3/11/09
GROUND ELEVATION 496.6 ft **BACKFILL** Bentonite Chips
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ **WHILE DRILLING** 47.8 ft / Elev 448.9 ft
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES 15 feet North o/s from stake
AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
495	Brown and black to brown and gray medium SAND, some coal pieces, trace gravel, dry to moist, medium dense, **(ASH)**	0	SS 1	90	2 10 12 14	NP	
			SS 2	100	10 12 13 9	NP	
	Gray SILT, with fine sand laminantions, trace coal pieces, dry to moist, loose to very loose, **(ASH)**	5	SS 3	100	6 2 2 5	NP	
490	Black-dark gray SAND, dry to moist, very loose, poorly graded, **(ASH)**		SS 4	90	2 2 2 1	NP	
	Gray SILT, with fine sand laminantions, dry to moist, loose, **(ASH/ML)**	10	SS 5	100	2 3 2 4	NP	
485			SS 6	100	2 2 2 2	NP	
	Grades moist to wet.		SS 7	100	3 2 2 2	NP	
		15	SS 8	100	1 1 1 2	NP	
480	Grades to wet.		SS 9	100	1 0 0 1	<0.25	
	Grades to moist.	20	SS 10	80	1 3 3 5		



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Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

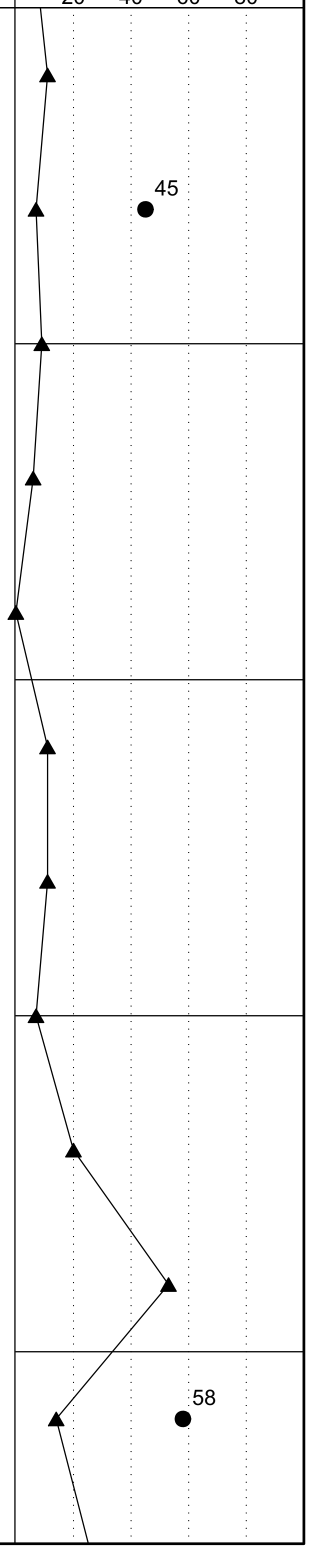
CLIENT Dynegy - Hennepin Power Station

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
		Gray SILT, with fine sand laminantions, dry to moist, loose, **(ASH/ML)** *(continued)*	20						
475		Grades to dark gray; trace coal pieces.		SS 11	100	6 6 5 3	NP		
		Grades moist to wet with a three inch sand seam at 22.5 feet.		SS 12	85	3 4 3 6	NP		45
		Gravel ~ 0.0% Sand ~ 10.4% Grades dark brown to dark gray; moist to wet. Silt ~ 76.3% Clay ~ 13.2%	25	SS 13	100	3 4 5 4	NP		
470				SS 14	90	1 1 5 4	NP		
		Black-dark gray SAND, trace silt, moist, loose, poorly graded, **(ASH)**							
		Dark gray SILT, trace sand, wet, very loose		SS 15	100	1 0 0 1	NP		
465		Grades moist to wet with sand	30	SS 16	80	1 4 7 8	NP		
				SS 17	100	7 6 5 4	NP		
460			35	SS 18	95	3 3 4 6	NP		
				SS 19	90	2 8 12 16	NP		
				SS 20	100	2 18 35 15	NP		
455			40	SS 21	100	5 7 7 12	NP		58
						8			



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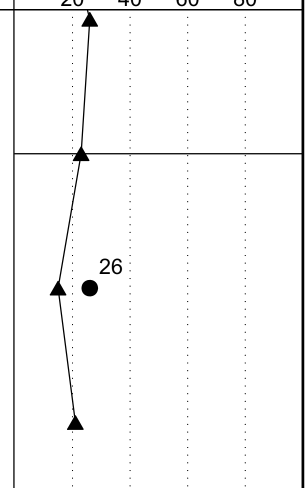
Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

BORING NUMBER B-28

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
		Dark gray SILT, trace sand, wet, very loose *(continued)*		SS 22	85	14 12 35	NP	
			45	SS 23	100	10 12 11 9	NP	
450		Dark brown medium SAND, trace silty gravel, moist to wet, medium dense, poorly graded, **(STREAM TERRACE DEPOSIT)**		SS 24	100	6 6 9 10	NP	
		Brown and gray SAND AND GRAVEL, wet, medium dense, poorly graded, **(GLACIAL OUTWASH)**	50	SS 25	70	7 9 12 25	NP	
		End of Borehole at 50.0 feet.						

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80



Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

BORING NUMBER B-29

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/12/09 **COMPLETED** 3/12/09
GROUND ELEVATION 494.4 ft **BACKFILL** Monitoring Well
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ **WHILE DRILLING** 46.0 ft / Elev 448.4 ft
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	SPT N VALUE / PL MC LL / FINES CONTENT (%)
	Dark brown silty SAND, trace gravel , roots, and coal, moist, poorly graded, **(ASH)**	0	SS 1	80	2-2-4-2	NP		
	Gray SILT, with fine sand laminantions, wet to moist, very loose, low to no plasticity, **(ASH)**		SS 2	75	1-1-2-2	NP		
490		5	SS 3	90	1-2-2-1	NP		41
			SS 4	85	2-1-1-1	NP		
485		10	SS 5	90	2-3-4-4	NP		
			SS 6	100	2-4-2-2	NP		36
			SS 7	85	2-1-2-5	NP		
480		15	SS 8	100	1-5-6-9	NP		
			SS 9	95	2-2-10-13	NP		25
	Grades to silty SAND, **(ASH)**							
475		20	SS 10	95	2-4-2-2	NP		

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Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

BORING NUMBER B-29

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	MC (%)
	20	Grades to silty SAND, **(ASH)** *(continued)*	SS 11	85	2-2-2-2	NP		
			SS 12	95	2-2-1-4	NP		38
470	25	Dark gray to black coarse SAND, some silt, trace fine gravel and coal, dry to moist, medium dense, non plastic, **(ASH)**	SS 13	90	6-10-10-7	NP		
		Gray SILT, some sand lenses, moist to wet, loose to medium dense, **(ASH)**	SS 14	100	2-3-6-14	NP		
465	30	Dark brown-dark gray silty SANDY SILT, trace coal pieces, dry to moist, medium dense, poorly graded, **(ASH/ML)** Gravel ~ 2.9% Sand ~ 39.7% Silt ~ 61.9% Clay ~ 5.5%	SS 15	100	5-8-14-10	NP		47
		Grades moist to wet.	SS 16	100	8-8-7-3	NP		
		Gray SILT, with fine sand laminantions, moist to wet, loose, **(ASH)**	SS 17	95	4-2-5-4	NP		
460	35		SS 18	75	3-3-2-5	NP		57
		Grades to very dense	SS 19	100	12-13-10-22	NP		
455	40		SS 20	100	18-13-10-8	NP		
		Wet between 40.0 to 40.25 feet.	SS 21	100	13-13-25-30	NP		52
		Dark brown to black silty CLAY, trace sand, trace roots, moist, stiff, **(LOESS DEPOSIT)**			1			

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Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

BORING NUMBER B-29

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
		Dark brown to black silty CLAY, trace sand, trace roots, moist, stiff, **(LOESS DEPOSIT)** *(continued)*		SS 22	90	1 3 6	2.5		
450		Dark brown to black sandy CLAY, trace silt, moist, stiff, **(STREAM TERRACE DEPOSIT)**	45	SS 23	85	3 3 3 4	2.5		
		Dark brown coarse SAND, trace gravel, wet, loose to medium stiff, poorly graded, **(STREAM TERRACE DEPOSIT)**		SS 24	90	2 2 2 4	1.0		20
445		Gray-black-brown clayey GRAVEL, some sand, wet, loose, poorly graded, **(GLACIAL OUTWASH)**	50	SS 25	75	3 4 5 5	NP		

End of Borehole at 50.0 feet.

BORING NUMBER B-30

Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/2/09 **COMPLETED** 3/2/09
GROUND ELEVATION 490.8 ft **BACKFILL** Bentonite Chips
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
∇ **WHILE DRILLING** 42.0 ft / Elev 448.8 ft
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ (20 40 60 80) / PL MC LL (20 40 60 80) / ☐ FINES CONTENT (%) ☐ (20 40 60 80)
490		Gray SILT WITH SAND, moist to wet, very loose to loose, **(ASH/ML)**	0	SS 1	80	2 2 1 1	NP		44
				SS 2	70	2 2 1 1	NP		
485			5	SS 3	90	2 3 2 1	NP		
				SS 4	90	3 1 1 1	NP		36
				SS 5	60	1 1 0 1	NP		
480			10	SS 6	100	5 5 4 5	NP		
				SS 7	100	2 2 3 4	NP		33
475			15	SS 8	90	3 4 3 2	NP		
		With black and brown sand lenses		SS 9	95	1 1 4 2	NP		
			20	SS 10	100	3 2 2 2	NP		40

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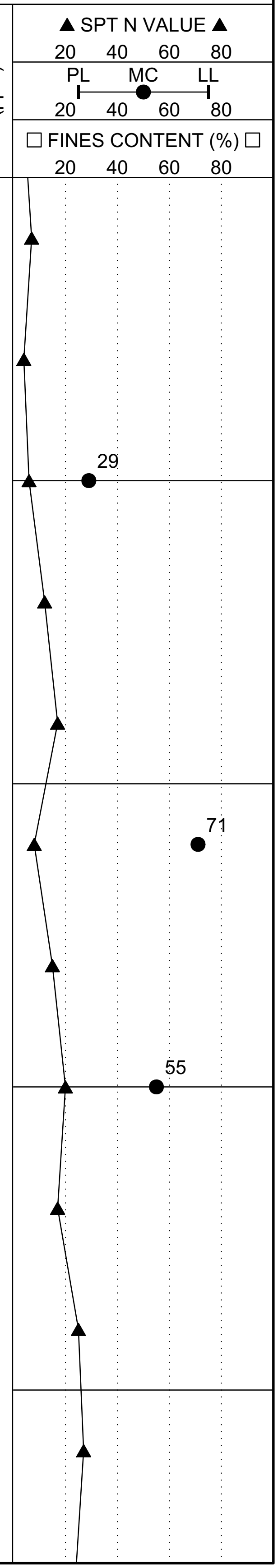
CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
470	Gray SILT WITH SAND, moist to wet, very loose to loose, **(ASH/ML)** *(continued)* Grades to dark gray at 21 feet.	20	SS 11	100	2-4-3-5	NP	
	Grades moist to wet.		SS 12	90	3-2-2-2	NP	
465		25	SS 13	75	5-3-3-4	NP	
	Gravel ~ 0.0% Sand ~ 24.6% Silt ~ 66.9% Clay ~ 8.5%		SS 14	90	5-8-4-3	NP	
		30	SS 15	100	6-8-9-6	NP	
460	Grades to wet.		SS 16	100	4-4-4-5	NP	
	Wet to moist, Grades to light gray at 33 feet.		SS 17	100	3-6-9-14	NP	
455		35	SS 18	100	10-10-10-10	NP	
	Dark brown to brown fine to medium SILTY SAND, dry to moist, medium dense, non-plastic; poorly graded, **(STREAM TERRACE DEPOSIT)**		SS 19	90	6-6-11-12	NP	
	Brown and gray SAND AND GRAVEL, coarse to cobble gravel, dry to moist, medium dense, non-plastic; poorly graded, **(GLACIAL OUTWASH)** Grades to wet.		SS 20	80	5-14-11-14	NP	
450		40	SS 21	50	15-15-12-10	NP	
					9		



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Downers Grove, IL 60510

BORING NUMBER B-30

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / □ FINES CONTENT (%) □ 20 40 60 80
		Brown and gray SAND AND GRAVEL, coarse to cobble gravel, dry to moist, medium dense, non-plastic; poorly graded, **(GLACIAL OUTWASH)** *(continued)*		SS 22	50	12 12 11	NP		7
		End of Borehole at 44.0 feet.							
445									

BORING NUMBER B-31

Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/3/09 **COMPLETED** 3/3/09
GROUND ELEVATION 488.4 ft **BACKFILL** Bentonite Chips
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING ---
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES Surveyed location; truck mounted rig
AFTER DRILLING ---

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80; PL MC LL 20 40 60 80; ☐ FINES CONTENT (%) ☐ 20 40 60 80
		Gray SILT, with fine sand laminations, trace gravel and organics, moist to wet, very loose, **(ASH/ML)**	0						
				SS 1	65	3 2 2 1	NP		52
485									
		Grades to moist with frequent sand lenses		SS 2	85	3 1 1 1	NP		
			5						
				SS 3	95	3 1 1 2	NP		52
480									
				SS 4	95	4 3 3 3	NP		
			10						
475									
				SS 5	100	2 2 2 2	NP		43
			15						
470									
		Grades moist to wet		SS 6	95	2 1 1	NP		
			20						

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Civil & Environmental Consultants, Inc.
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Downers Grove, IL 60510

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
		Gray SILT, with fine sand laminations, trace gravel and organics, moist to wet, very loose, **(ASH/ML)** *(continued)*	20			4			
465		Grades moist to wet Gravel ~ 0.0% Sand ~ 13.3% Silt ~ 79.0% Clay ~ 7.6%	25	SS 7	100	1 3 4 5	NP		44
460			30	SS 8	100	4 5 5 5			
455			35	SS 9	90	7 7 6 5	1.5		31
		Brown to black clayey SILT, trace sand, moist, stiff, low plasticity, **(ML)**							
450		Brown silty SAND, trace fine to coarse gravel, trace clay, moist to wet, medium dense, poorly graded, **(STREAM TERRACE DEPOSIT)**	40	SS 10	80	3 5 7 4	NP		

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BORING NUMBER B-31

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
445									
		Brown and gray SAND AND GRAVEL, wet, poorly graded, **(GLACIAL OUTWASH)**	45	SS 11	81	50 50			10
		End of Borehole at 45.5 feet.							

BORING NUMBER B-32

Civil & Environmental Consultants, Inc.
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Downers Grove, IL 60510

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/3/09 **COMPLETED** 3/3/09
GROUND ELEVATION 494.7 ft **BACKFILL** Bentonite Chips
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING 48.5 ft / Elev 446.2 ft
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES Staked boring location
AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	SPT N VALUE / PL MC LL / FINES CONTENT (%)
	Dark brown coarse SAND, trace coal pieces, dry to moist, medium dense, poorly graded, **(ASH)**	0	SS 1	100		NP		17
			SS 2	90	6-9-9-6	NP		
	Gray SILT, with fine sand laminantions, dry to moist, loose, **(ASH/SM)**							
490		5	SS 3	100	5-2-3-6	NP		30
			SS 4	100	3-2-2-2	NP		
485		10	SS 5	100	3-2-2-3	NP		40
480		15	SS 6	100	2-2-1-1	NP		
	Moist to wet, fine black sand seams							
	Gravel ~ 0.0% Sand ~ 40.0% Silt ~ 53.5% Clay ~ 6.5% Bulk Unit Weight = 104.1 pcf		ST 7	100		NP		40
475		20	SS 8	100	3-2-2	NP		42

SPT N VALUE scale: 20 40 60 80; PL MC LL scale: 20 40 60 80; FINES CONTENT (%) scale: 20 40 60 80

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BORING NUMBER B-32

Civil & Environmental Consultants, Inc.
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CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ / PL MC LL / ☐ FINES CONTENT (%) ☐
	Gray SILT, with fine sand laminantions, dry to moist, loose, **(ASH/SM)** *(continued)*	20			2			
	Grades moist to wet		SS 9	100	3 5 6 6	NP		
470	Grades to Gray SILT WITH SAND, **(ASH/ML)**	25	ST 10	100		NP		38
	Gravel ~ 0.0% Sand ~ 17.0% Silt ~ 69.0% Clay ~ 13.9% Bulk Unit Weight = 95.4 pcf							39
465	Medium dense	30	SS 11	95	5 7 12 18	NP		
	Gravel ~ 0.0% Sand ~ 31.5% Silt ~ 59.8% Clay ~ 8.6% Bulk Unit Weight = 106.4 pcf		ST 12	100		NP		53 58
460	Moist to wet, with sand lenses	35	SS 13		12 10 10 12	NP		69
455		40	SS 14		7 12 18 28	NP		

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BORING NUMBER B-32

Civil & Environmental Consultants, Inc.
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CLIENT Dynegy - Hennepin Power Station

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
		Gray SILT, with fine sand laminantions, dry to moist, loose, **(ASH/SM)** *(continued)*							
450		Dark brown fine SAND, moist, medium dense, poorly graded, **(SP)**	45	SS 15	100	4 6 7 7	NP		14
445		Brown and gray SAND AND GRAVEL, moist to wet, medium dense to dense, poorly graded, **(GLACIAL OUTWASH)**	50	SS 16	65	7 12 12 20	NP		

End of Borehole at 50.5 feet.

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BORING NUMBER B-33

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/2/09 COMPLETED 3/2/09
GROUND ELEVATION 493.1 ft BACKFILL Bentonite Chips
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING ---
CEC REP CAC CHECKED BY MDJ
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	SPT N VALUE / PL MC LL / FINES CONTENT (%)
		Gray SILT WITH SAND, moist to wet, loose, non plastic, **(ASH/ML)**	0	SS 1	100	4 3 3 3	NP		
490				SS 2	100	2 3 3 4	NP		
		With fine sand laminantions	5	SS 3	85	2 2 3 2	NP		31
				SS 4	90	2 2 1 2	NP		
485		Gravel ~ 0.0% Sand ~ 18.7% Silt ~ 65.8% Clay ~ 15.5%	10	SS 5	90	3 2 2 2	NP		33
				SS 6	95	2 2 2 1	NP		43
480				SS 7	100	4 2 3 5	NP		
			15	SS 8	100	2 3 2 2	NP		
		Grades dry to moist		SS 9	100	2 2 2 4	NP		48
475			20	SS 10	100	2 2 2 2	NP		

SPT N VALUE scale: 20 40 60 80; PL MC LL scale: 20 40 60 80; FINES CONTENT (%): 20 40 60 80

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CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	MC
	Gray SILT WITH SAND, moist to wet, loose, non plastic, **(ASH/ML)** *(continued)*	20	SS 11	100	2 1 3 6	NP		
470	Dark gray SILT, trace sand, dry to moist, loose, **(ASH)**		SS 12	95	5 2 2 3	NP		33
		25	SS 13	100	3 2 2 2	NP		
465	Grades moist to wet		SS 14	100	5 4 2 2	NP		
	Gray SILT, trace sand, wet, loose, poorly graded, **(ASH)**	30	SS 15	100	3 2 2 2	NP		50
			SS 16	100	3 11 15 15	NP		
460			SS 17	100	4 5 6 10	NP		42
		35	SS 18	80	7 11 10 28	NP		38
455	Dark brown fine to medium SAND, trace fine gravel, organics, moist, dense to very dense, poorly graded, **(STREAM TERRACE DEPOSIT)**		SS 19	100	12 25 25 30	NP		
	Brown and gray SAND AND GRAVEL, dry to moist, non plastic; poorly graded, **(GLACIAL OUTWASH)**	40	SS 20	100	35 60	NP		
			SS 21	100	20 20 30	NP		7

▲ SPT N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
☐ FINES CONTENT (%) ☐ 20 40 60 80

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BORING NUMBER B-33

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
450		Brown and gray SAND AND GRAVEL, dry to moist, non plastic; poorly graded, **(GLACIAL OUTWASH)** *(continued)*		SS 22	100	25 75	NP		
		End of Borehole at 44.0 feet.							

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CLIENT	Dynegy - Hennepin Power Station	**PROJECT NAME**	Dry Ash Landfill Feasability Study
PROJECT NUMBER	082-255	**PROJECT LOCATION**	Hennepin, Illinois
DATE STARTED	3/3/09 **COMPLETED** 3/3/09	**GROUND ELEVATION**	491.0 ft **BACKFILL** Bentonite Chips
DRILLING CONTRACTOR	Groff Testing	**GROUND WATER LEVELS:**	
DRILLING METHOD	Hollow Stem Auger	**WHILE DRILLING**	---
CEC REP	CAC **CHECKED BY** MDJ	**AT END OF DRILLING**	---
NOTES	Surveyed location	**AFTER DRILLING**	---

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	SPT N VALUE / PL MC LL / FINES CONTENT (%)
490		Gray to dark gray SILT, with fine sand laminantions, dry to moist, loose to very loose, poorly graded, **(ASH)**	0						
				SS 1	85	3-2-3-3	2.5		MC 29
485			5	SS 2	100	3-4-2-1	2.6		
				SS 3	100	2-2-2-3	2.5		MC 32
480		Grades moist to wet	10	SS 4	85	2-2-1-5	NP		
			15	SS 5		2-4-4-2	NP		MC 39
475		Grades to moist							
			20	SS 6		2-1-1	NP		

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CLIENT Dynegy - Hennepin Power Station

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	DEPTH (ft)	MATERIAL DESCRIPTION
470–458.5	20	Gray to dark gray SILT, with fine sand laminantions, dry to moist, loose to very loose, poorly graded, **(ASH)** *(continued)*
	~30.5	Grades moist to wet
458.5–457.5	33.5	Brown silty SAND, trace gravel, moist, loose, poorly graded, **(STREAM TERRACE DEPOSIT)**
457.5–	34.5	Brown and gray SAND AND GRAVEL, dry to moist, medium dense, pooly graded, **(GLACIAL OUTWASH)**

SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	MC (%)
		3			
SS 7	100	4 3 2 2	NP		40
SS 8	100	5 2 2 4	NP		47
SS 9	85	2 2 7 15	2.5		
SS 10	0	20 25 30 25	NP		

▲ SPT N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
☐ FINES CONTENT (%) ☐ 20 40 60 80

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BORING NUMBER B-34

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
		Brown and gray SAND AND GRAVEL, dry to moist, medium dense, pooly graded, **(GLACIAL OUTWASH)** *(continued)*							
		Brown gravelly SAND, some cobbles, wet, medium dense, poorly graded, **(SP)**	45	SS 11		7 6 4 4	NP		13
445		End of Borehole at 45.5 feet.							

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Downers Grove, IL 60510

BORING NUMBER B-35

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/3/09 **COMPLETED** 3/3/09
GROUND ELEVATION 487.8 ft **BACKFILL** Bentonite Chips
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING ---
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES Surveyed location
AFTER DRILLING ---

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	SPT N VALUE / PL MC LL / FINES CONTENT (%)
		Dark gray to gray SILT, with fine sand laminantions, moist to wet, loose to very loose, poorly graded, **(ASH/ML)**	0						
485				SS 1	85	0 3 2 2	NP		MC 35
			5	SS 2	90	4 3 1 1	NP		MC 37
480				SS 3	85	2 2 1 1	NP		MC 36
		Gravel ~ 0.0% Sand ~ 12.2% Silt ~ 70.3% Clay ~ 17.6%	10	SS 4	100	3 4 5 6	NP		MC 31
475									
			15	SS 5	100	3 1 2 2	NP		
470									
			20	SS 6	100	3 4 1	NP		

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Civil & Environmental Consultants, Inc.
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BORING NUMBER B-35

CLIENT Dynegy - Hennepin Power Station

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ / PL MC LL / ☐ FINES CONTENT (%) ☐
		Dark gray to gray SILT, with fine sand laminantions, moist to wet, loose to very loose, poorly graded, **(ASH/ML)** *(continued)*	20			1			
465									
			25	SS 7	100	3 4 2 2	NP		45
460									
		Grades to medium dense	30	SS 8	100	3 4 7 9	NP		53
455		Dark brown silty SAND, trace fine gravel, moist, medium dense, poorly graded, **(STREAM TERRACE DEPOSIT)**							
			35	SS 9	100	2 2 3 5	NP		
450		SAND AND GRAVEL, with cobbles, dry, dense to very dense, poorly graded, **(GLACIAL OUTWASH)**							
			40	SS 10	100	100	NP		13
445									

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Civil & Environmental Consultants, Inc.
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Downers Grove, IL 60510

BORING NUMBER B-35

CLIENT Dynegy - Hennepin Power Station **PROJECT NAME** Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255 **PROJECT LOCATION** Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80; PL MC LL 20 40 60 80; ☐ FINES CONTENT (%) ☐ 20 40 60 80
		SAND AND GRAVEL, with cobbles, dry, dense to very dense, poorly graded, **(GLACIAL OUTWASH)** *(continued)*	45	SS 11	90	25 40 32	NP		
440		End of Borehole at 45.0 feet.							

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BORING NUMBER B-36

CLIENT	Dynegy - Hennepin Power Station	**PROJECT NAME**	Dry Ash Landfill Feasability Study
PROJECT NUMBER	082-255	**PROJECT LOCATION**	Hennepin, Illinois
DATE STARTED	3/16/09	**COMPLETED**	3/16/09
GROUND ELEVATION	480.9 ft	**BACKFILL**	Cement Grout
DRILLING CONTRACTOR	Groff Testing	**GROUND WATER LEVELS:**	
DRILLING METHOD	Hollow Stem Auger	**WHILE DRILLING**	24.0 ft / Elev 456.9 ft
CEC REP	D. KORTH	**CHECKED BY**	MDJ
		AT END OF DRILLING	---
NOTES		**AFTER DRILLING**	---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	SPT N VALUE / PL MC LL / FINES CONTENT (%)
480	Dark yellowish brown GRAVEL WITH SAND, moist, medium dense to dense, **(BERM FILL)**	0	SS 1	50	12 15 20 25	NP		
			SS 2	60	12 15 15 17	NP		9
475		5	SS 3	35	20 11 7 6	NP		
	Very dark gray SILTY SAND, dark organic material, trace gravel, moist, very loose, **(STREAM TERRACE DEPOSIT)**		SS 4	65	4 1 1 1	NP		28
			SS 5	50	1 1 1 1	NP		
470		10	SS 6	45	2 1 1 1	NP		
	Very dark grayish brown SANDY SILT, trace fine to coarse gravel, moist, **(STREAM TERRACE DEPOSIT)**		SS 7	90	1 2 1 1	NP		39
465		15	SS 8	85	2 4 4 2	NP		
			SS 9	90	2 1 1 1	NP		
	Very dark grayish brown SILTY SAND WITH GRAVEL, moist, **(STREAM TERRACE DEPOSIT)**	20	SS 10	75	2 5 5 10	NP		25

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CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
460		Very dark grayish brown SILTY SAND WITH GRAVEL, moist, **(STREAM TERRACE DEPOSIT)** *(continued)*	20	SS 11	75	5 8 20 10	4.0		16
		Dark yellowish brown GRAVEL WITH SAND, moist to wet, dense, **(GLACIAL OUTWASH)** ∇		SS 12	90	12 15 16 12	NP		
455			25	SS 13	50	8 15 18 18	NP		10

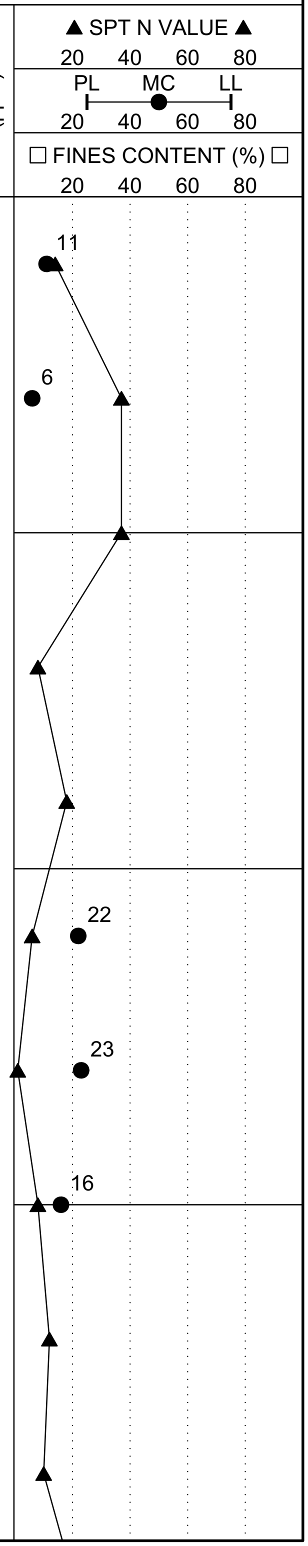
End of Borehole at 26.0 feet.

BORING NUMBER B-37

Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

CLIENT Dynegy - Hennepin Power Station	**PROJECT NAME** Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255	**PROJECT LOCATION** Hennepin, Illinois
DATE STARTED 3/17/09 **COMPLETED** 3/17/09	**GROUND ELEVATION** 480.6 ft **BACKFILL** Cement Grout
DRILLING CONTRACTOR Groff Testing	**GROUND WATER LEVELS:**
DRILLING METHOD Hollow Stem Auger	▽ **WHILE DRILLING** 26.0 ft / Elev 454.6 ft
CEC REP D. KORTH **CHECKED BY** MDJ	**AT END OF DRILLING** ---
NOTES	**AFTER DRILLING** ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	MC
480	Dark yellowish brown GRAVEL WITH SAND, moist, medium dense to dense, **(BERM FILL)**	0	SS 1	45	5 7 7 9	NP		11
			SS 2	60	12 17 20 20	NP		6
475		5	SS 3	55	15 16 21 20	NP		
	Very Dark gray to black SILTY SAND, with black silt laminations, moist, medium dense, **(STREAM TERRACE DEPOSIT/SM)** Gravel ~ 2.1% Sand ~ 52.7% Silt ~ 35.8% Clay ~ 9.4%		SS 4	5	11 6 2 4	NP		
			SS 5	90	7 11 7 7	NP		
470		10	SS 6	95	4 4 2 2	NP		22
			SS 7	75	0 1 0 1	NP		23
	Yellowish brown fine SAND, moist to wet, very loose, poorly graded, **(STREAM TERRACE DEPOSIT)**							
465	Very Dark gray SILTY SAND, moist, medium dense, **(STREAM TERRACE DEPOSIT)**	15	SS 8	95	2 2 6 9	NP		16
			SS 9	100	4 5 7 9	NP		
		20	SS 10	90	2 4 6 4	NP		



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Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

BORING NUMBER B-37

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
460		Very Dark gray SILTY SAND, moist, medium dense, **(STREAM TERRACE DEPOSIT)** *(continued)* Grades moist to wet	20	SS 11	90	3 13 10 7	NP		25
				SS 12	75	3 5 10 11	NP		
455		Dark yellowish brown GRAVEL WITH SAND, moist, medium dense, poorly graded, **(GLACIAL OUTWASH)**	25	SS 13	50	12 13 20 18	NP		
		∇ Grades to wet.		SS 14	75	5 20 15 20	NP		11

End of Borehole at 28.0 feet.

Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

BORING NUMBER B-38

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/4/09 **COMPLETED** 3/4/09
GROUND ELEVATION 484.7 ft **BACKFILL** Bentonite Chips
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING 38.0 ft / Elev 446.7 ft
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES Lower Dike North of B-19
AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	SPT N VALUE / PL MC LL / FINES CONTENT (%)
	Dark brown silty CLAY, some coarse gravel, trace sand, moist, hard, **(BERM FILL)**	0	SS 1	70	10 15 10 10	>4.5		
			SS 2	100	6 7 10 13	>4.5		
480	Dark brown clayey SAND, some coarse gravel, moist, medium dense, **(BERM FILL)**	5	SS 3	90	5 6 7 8	NP		MC 12
	Gray and brown SAND AND GRAVEL, with cobbles, dry to moist, medium dense, poorly graded, **(BERM FILL)**		SS 4	65	8 8 9 20	NP		
475		10	SS 5	80	9 11 13 13	NP		
			SS 6	75	9 10 15 25	NP		MC 13
	Dark brown to black coarse SAND, trace coal pieces, dry to moist, medium dense, poorly graded, **(BERM FILL)**		SS 7	75	14 13 8 5	NP		
470	Dark gray SILTY SAND, moist, medium dense, **(ASH/SM)** Gravel ~ 12.5% Sand ~ 46.7% Silt ~ 27.7% Sand ~ 13.1% Bulk Unit Weight = 99.8 pcf	15	SS 8	100	2 2 2 2			MC 58
	Dark brown sandy CLAY, trace gravel, moist, medium dense, poorly graded, **(ASH)**		ST 9	75				MC 27
465		20	SS 10	100	6 7 9 10	3.5		MC 11

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BORING NUMBER B-38

Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

CLIENT Dynegy - Hennepin Power Station

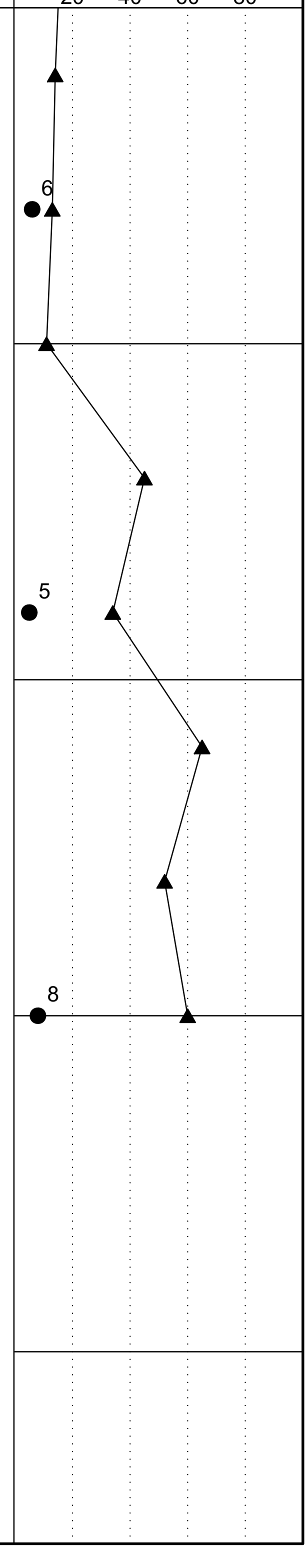
PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255

PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
		Dark brown sandy CLAY, trace gravel, moist, medium dense, poorly graded, **(ASH)** *(continued)*	20	SS 11	100	6 7 7 8	2.5	
		Brown gravelly SAND, dry to moist, medium dense, poorl;y graded, **(STREAM TERRACE DEPOSIT)**		SS 12	65	7 7 6 5	NP	
460			25	SS 13	100	8 6 5 5	NP	
		Brown and gray SAND AND GRAVEL, with cobbles, dry to moist, dense to very dense, poorly graded, **(GLACIAL OUTWASH)**		SS 14	90	14 20 25 15	NP	
455			30	SS 15	85	15 19 15 12	NP	
				SS 16	100	22 25 40	NP	
				SS 17	85	20 27 25 25	NP	
450		Grade to wet.	35	SS 18	100	40 30 30	NP	
				SS 19	75	40 60	NP	
445			40	SS 20	100	100	NP	
		End of Borehole at 40.0 feet.						

▲ SPT N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
☐ FINES CONTENT (%) ☐ 20 40 60 80

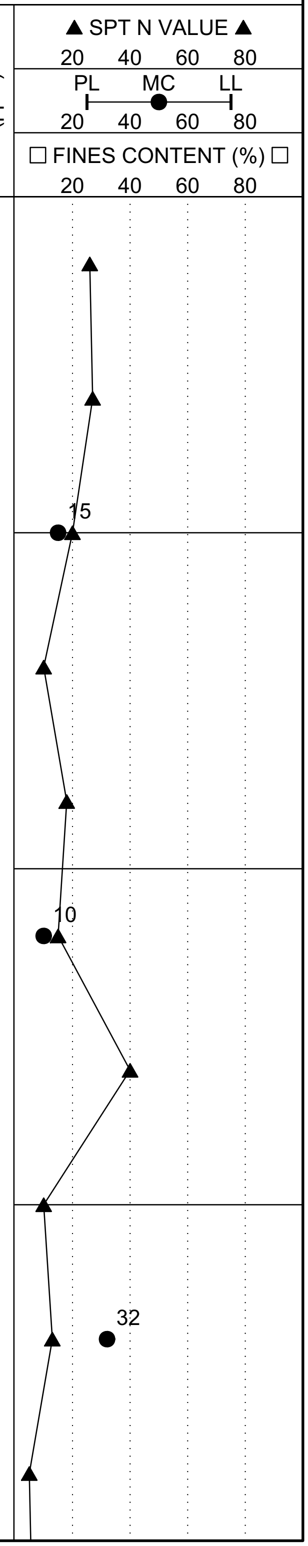


BORING NUMBER B-39

Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/4/09 **COMPLETED** 3/4/09
GROUND ELEVATION 484.7 ft **BACKFILL** Cement Grout
DRILLING CONTRACTOR Groff Testing
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
WHILE DRILLING 36.0 ft / Elev 448.7 ft
CEC REP CAC **CHECKED BY** MDJ
AT END OF DRILLING ---
NOTES Lower Dike by River
AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)
	Brown SAND, trace gravel, moist to wet, medium dense, poorly graded, **(BERM FILL)**	0					
	Gray crushed limestone GRAVEL, trace sand, coarse to cobbles, dry to moist, medium dense, poorly graded, **(BERM FILL)**		SS 1	55	14 14 12 14	np	
	Black to dark brown silty CLAY, trace sand and gravel, trace coal fragments, moist, hard, **(BERM FILL)**		SS 2	90	5 11 16 18	>4.5	
	Black to gray GRAVEL, trace sand, dry to moist, dense, poorly graded, **(BERM FILL)**						
480	Black to dark brown silty CLAY, trace sand and gravel, moist, very stiff, **(BERM FILL)**	5	SS 3	80	5 10 10 11	3.5	
	Brown sandy CLAY, with gravel, moist, medium dense, **(BERM FILL)**		SS 4	70	5 5 5 6	2.0	
475		10	SS 5	50	6 9 9 8	3.0	
	Reddish brown to black coarse SAND, trace gravel, coal pieces, dry to moist, medium dense to dense, **(BERM FILL)**		SS 6	75	4 6 9 9	NP	
			SS 7	100	14 20 20 12	NP	
470		15	SS 8	90	6 4 6 6	NP	
	Dark brown fine SAND, trace coal pieces and gravel, dry to moist, medium dense, poorly graded, **(BERM FILL)**		SS 9	100	6 5 8 5	NP	
	Dark gray to brown SILT, with fine sand laminantions, trace coal fragments, moist to wet, loose, **(ASH)**		SS 10	100	2 2 3 4	NP	
465	Gray SILT, with black sand laminations, moist, loose, **(ASH)**	20					



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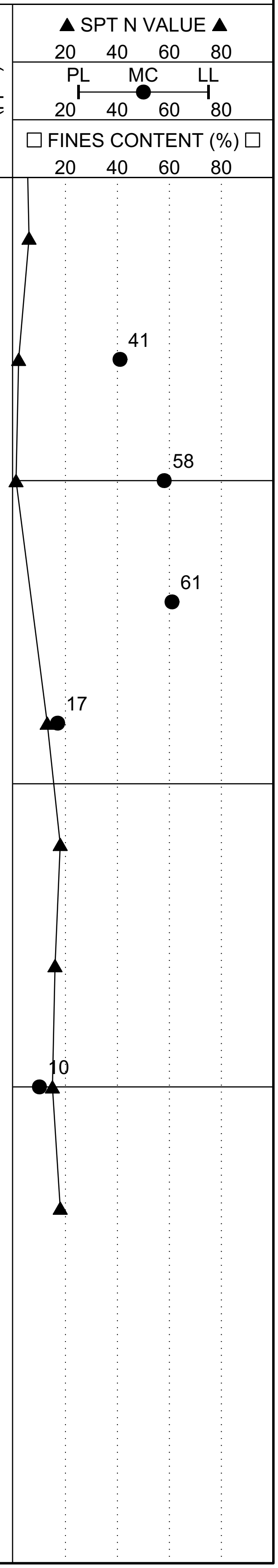
BORING NUMBER B-39

Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

CLIENT Dynegy - Hennepin Power Station **PROJECT NAME** Dry Ash Landfill Feasability Study

PROJECT NUMBER 082-255 **PROJECT LOCATION** Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	Pocket Pen. (tsf)	PID (ppm)	MC (%) / Fines
	Gray SILT, with black sand laminations, moist, loose, **(ASH)** *(continued)*	20	SS 11	100	2 2 4 5	NP		
	6-inch fine sand seam at 21.5 feet.		SS 12	25	1 1 1 1	NP		41
460		25	SS 13	100	0 0 1 1	NP		58
	Dark brown SILT WITH SAND, trace gravel, moist, medium dense, poorly graded, **(STREAM TERRACE DEPOSIT/ML)** Gravel ~ 1.3% Sand ~ 16.4% Silt ~ 64.7% Clay ~ 17.5% Bulk Unit Weight = 99.6 pcf		ST 14	75		NP		61
455		30	SS 15	90	3 6 7 7	NP		17
			SS 16	100	5 9 9 12	NP		
	Dark brown to black SAND, trace gravel and coal pieces, moist, medium dense, poorly graded, **(STREAM TERRACE DEPOSIT)**							
	Reddish brown sandy CLAY, trace gravel, moist, stiff, **(STREAM TERRACE DEPOSIT)**		SS 17	100	4 8 8 9	2.5 3.25		
450	Reddish tan gravelly CLAY, with cobbles, some sand, moist, medium dense, poorly graded, **(STREAM TERRACE DEPOSIT)**	35	SS 18	55	4 7 8 13	--		10
	Brown and gray SAND AND GRAVEL, wet, medium dense, poorly graded, **(GLACIAL OUTWASH)**		SS 19	65	11 9 9 7	NP		
	End of Borehole at 38.0 feet.							

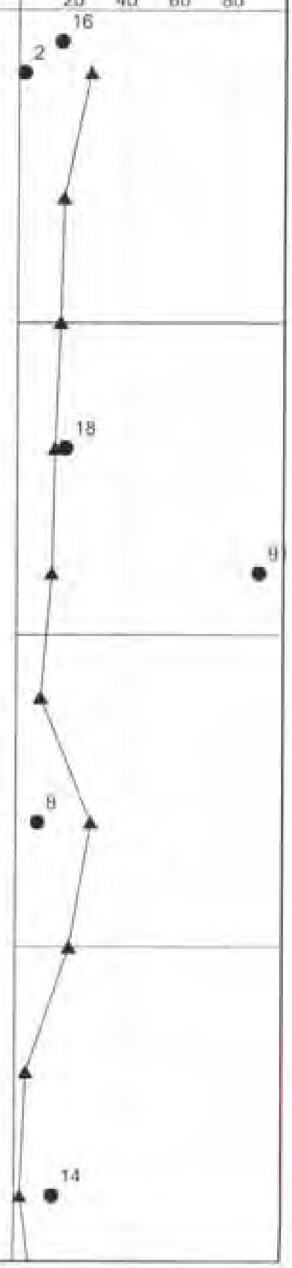


Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

BORING NUMBER B-40

CLIENT Dynegy - Hennepin Power Station	PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255	PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/9/09 COMPLETED 3/9/09	GROUND ELEVATION 483.2 ft BACKFILL Cement Grout
DRILLING CONTRACTOR Groff Testing	GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger	WHILE DRILLING 31.3 ft / Elev 452.0 ft
CEC REP CAC CHECKED BY MDJ	AT END OF DRILLING ---
NOTES	AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen (tsf)	PID (ppm)
	Dark brown SAND, trace silt, trace gravel, moist to wet, loose to medium dense, poorly graded. **(BERM FILL)**	0	SS 1	65	5 16 11	NP	
	Brown coarse GRAVEL, trace sand, dry to moist, medium dense, poorly graded. **(BERM FILL)**						
480	Brown sandy CLAY, trace gravel, moist, stiff to very stiff. **(BERM FILL)**		SS 2	90	5 6 11 15	1.9	
		5	SS 3	75	6 8 8 20	2.5	
			SS 4	50	5 7 7 6	--	
475			SS 5	50	5 7 6 9	--	
	Brown and gray SAND AND GRAVEL, moist, poorly graded. **(BERM FILL)**	10	SS 6	55	3 3 6 10	NP	
	Reddish brown clayey SAND, some gravel, moist. **(BERM FILL)**						
470	Black and dark brown coarse SAND, trace silt, coal pieces, dry to moist, dense, poorly graded. **(BERM FILL)**		SS 7	100	5 6 22 18	2.0	
		15	SS 8	0	17 14 6 9	--	
	Brown to gray SILT, trace sand lenses, trace fine gravel, moist to wet, very loose. **(STREAM TERRACE DEPOSIT)**		SS 9	90	2 2 2 1	NP	
465	Reddish brown sandy SILT, trace fine gravel, dry to moist, very loose. **(STREAM TERRACE DEPOSIT)**	20	SS 10	90	0 1 1 2	NP	



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Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

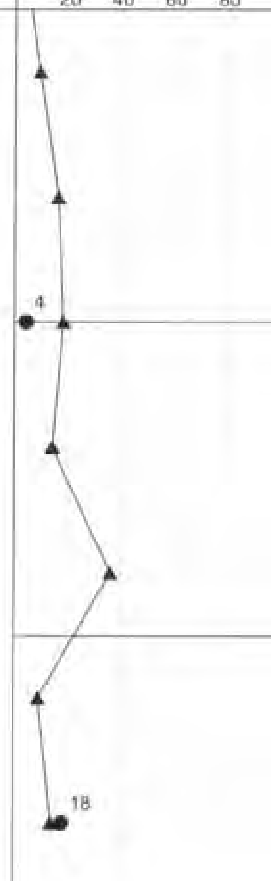
BORING NUMBER B-40

CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)
	Reddish brown sandy SILT, trace fine gravel, dry to moist, very loose, **(STREAM TERRACE DEPOSIT)** *(continued)*	20	SS 11	25	2 2 7 9	NP	
460	Grades to dark brown		SS 12	85	2 10 6 15	NP	
	Brown and gray SAND AND GRAVEL, dry to moist, medium dense, poorly graded, **(GLACIAL OUTWASH)**	25	SS 13	50	8 8 10 15	NP	
455	Brown medium SAND, trace gravel, moist, medium dense, poorly graded, **(GLACIAL OUTWASH)**		ST 14	85	5 8 6 3	NP	
	Brown and gray SAND AND GRAVEL, dry to moist, medium dense to dense, **(GLACIAL OUTWASH)**		SS 15	85	8 22 14 6	NP	
	Brown coarse SAND, trace pebbles, moist, loose, poorly graded, **(GLACIAL OUTWASH)**	30	SS 16	100	3 4 5 5	NP	
450	Wet		SS 17	95	3 6 8 15	NP	

End of Borehole at 34.0 feet.

▲ SPT N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
☐ UCS (tsf) ☐ 20 40 60 80



Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

BORING NUMBER B-41

CLIENT Dynegy - Hennepin Power Station	PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255	PROJECT LOCATION Hennepin, Illinois
DATE STARTED 3/9/09 COMPLETED 3/9/09	GROUND ELEVATION 493.3 ft BACKFILL Cement Grout
DRILLING CONTRACTOR Groff Testing	GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger	WHILE DRILLING 32.0 ft / Elev 461.3 ft
CEC REP CAC CHECKED BY MDJ	AT END OF DRILLING ---
NOTES	AFTER DRILLING ---

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)	SPT N VALUE / PL MC LL / UCS (tsf)
	Brown to black CLAY, some sand, coarse gravel, moist, very stiff, **(BERM FILL)**	0	SS 1	75	6 6 10 10	2.5		
490	Brown clayey GRAVEL, some sand, moist, medium dense, poorly graded, **(BERM FILL)**		SS 2	85	3 8 16 13	3.3		MC 17
		5	SS 3	75	8 45 18 18	NP		
			SS 4	65	10 16 32 20	NP		
485			SS 5	65	25 15 15 20	NP		MC 5
	Dark brown to black silty CLAY, trace sand, gravel, moist, hard, **(BERM FILL)**	10	SS 6	95	8 10 20 42	4.1		
	Black silty SAND, trace clay, moist to wet, medium dense, poorly graded, **(BERM FILL)**							
480	Dark brown to black silty CLAY, trace sand, gravel, trace roots, moist, stiff, **(BERM FILL)**		SS 7	90	7 10 10 11	2.1		
		15	SS 8	80	7 5 6 7	1.6		MC 21
			SS 9	70	4 3 4 5	NP		
475	Dark brown to brown fine SAND, some gravel, trace silt, moist, loose, poorly graded, **(BERM FILL)**		SS 10	75	5 4 5 2	NP		
		20						

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Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

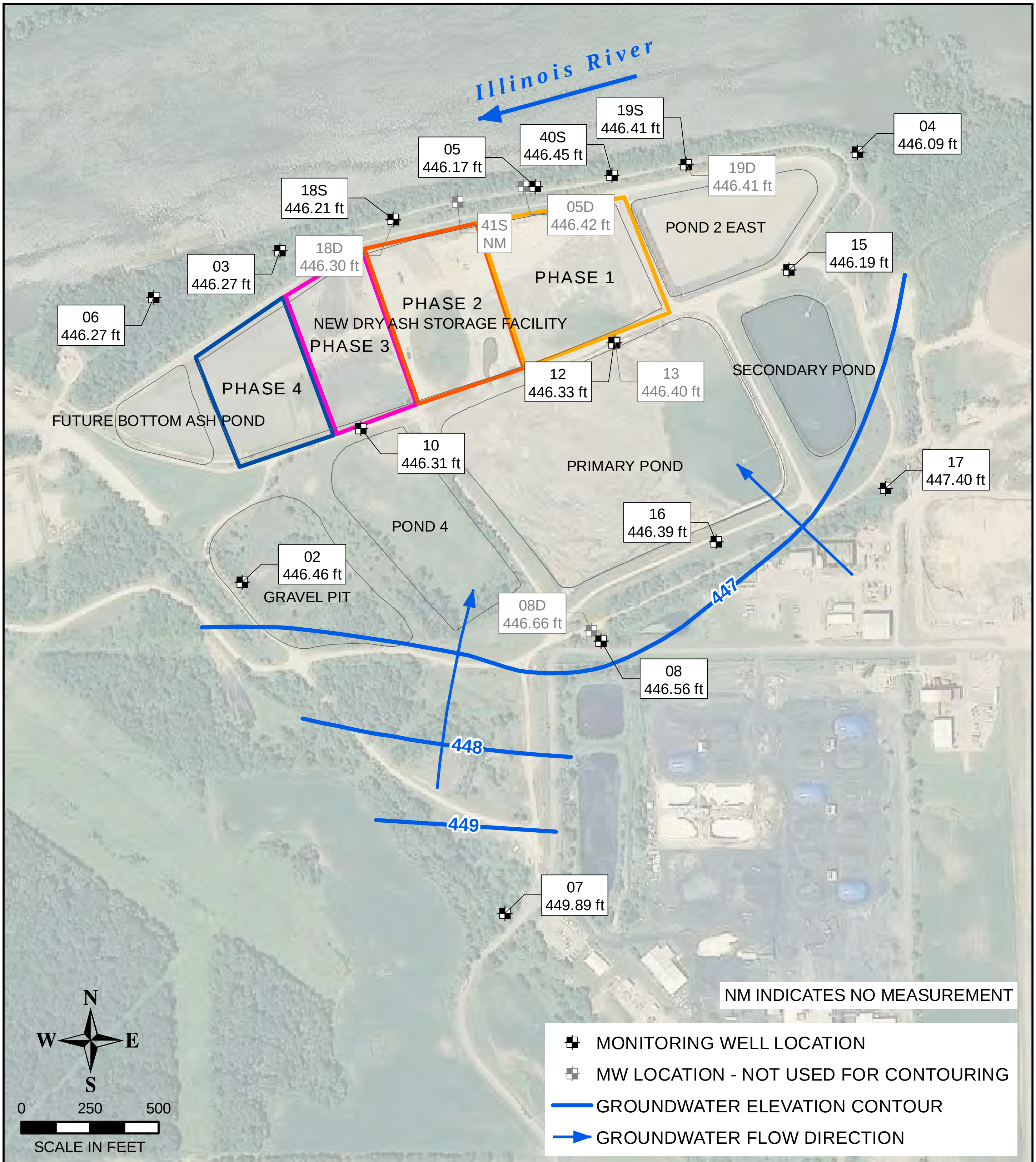
BORING NUMBER B-41

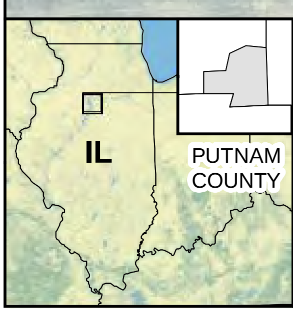
CLIENT Dynegy - Hennepin Power Station
PROJECT NAME Dry Ash Landfill Feasability Study
PROJECT NUMBER 082-255
PROJECT LOCATION Hennepin, Illinois

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS	Pocket Pen. (tsf)	PID (ppm)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ UCS (tsf) ☐ 20 40 60 80
	Gray SILT, trace sand, wet, very soft to very loose, **(ASH)** *(continued)*	20	SS 11	0	0 0 1 1	NP		42
470			ST 12	100		NP		
	Dark brown-gray silty CLAY, moist to wet, very soft, **(TERRACE DEPOSIT)**	25	SS 13	85	0 0 0 1	<0.25		
	Dark brown fine SAND, some silt, trace wood, roots, dry to moist, dense, poorly graded, **(GLACIAL OUTWASH)**		SS 14	100	8 15 15 0	NP		
465	Brown fine SAND, trace silt, dry to moist, dense, poorly graded, **(GLACIAL OUTWASH)**	30	SS 15	100	5 10 20 13	NP		19
	Brown and gray SAND AND GRAVEL, trace clay, dry to moist, very dense, poorly graded, **(GLACIAL OUTWASH)**		SS 16	100	5 20 35 26	NP		
460			SS 17	58	22 80	NP		14
	End of Borehole at 34.0 feet							

Appendix B

Groundwater Contour Maps 2012 through 2016





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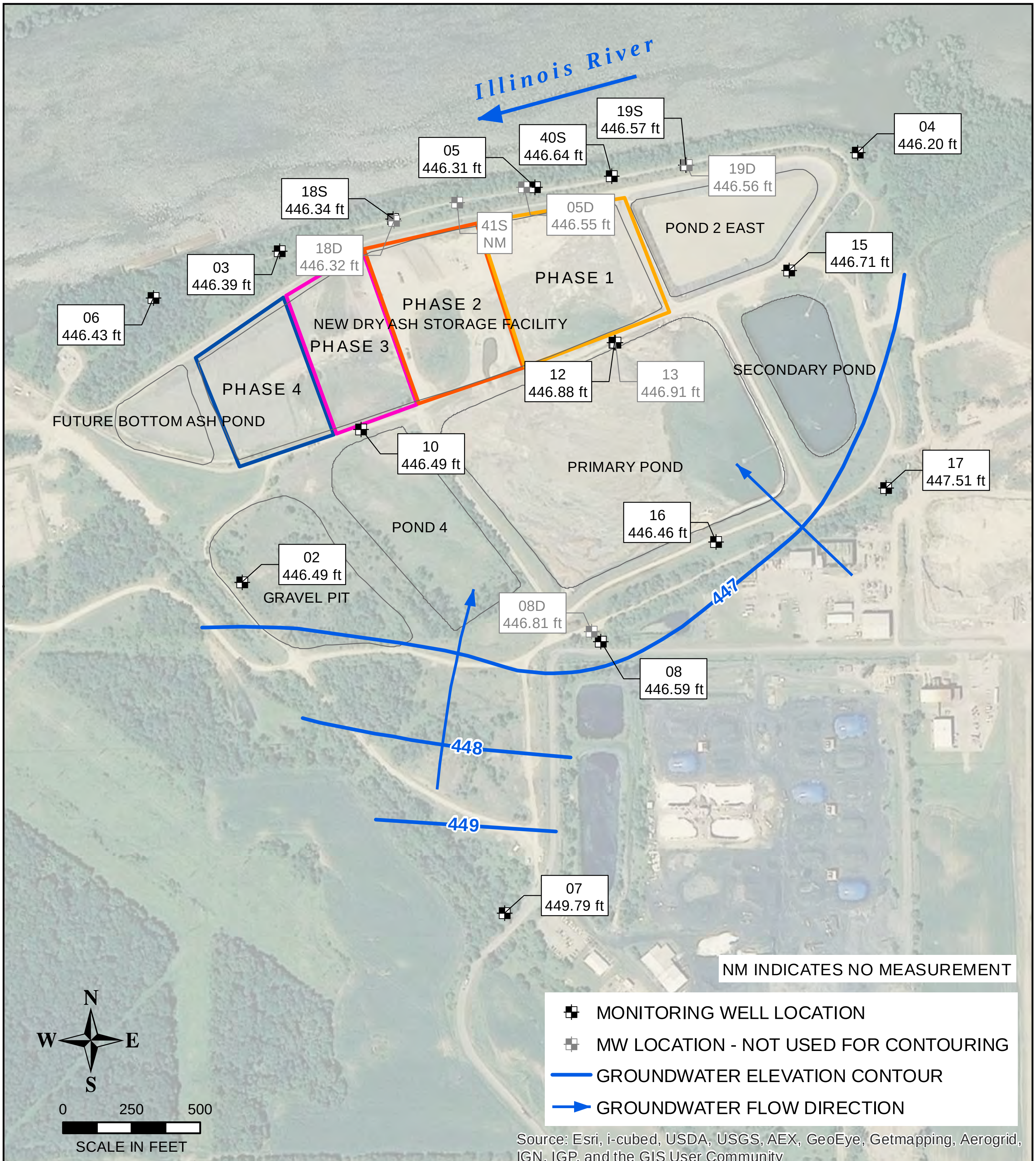
GROUNDWATER ELEVATION CONTOURS
MARCH 1, 2012

NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

NATURAL RESOURCE TECHNOLOGY

PROJECT NO: 1645
FIGURE NO: 1

DRAWN BY/DATE:	TDC	5/8/12
CHECKED BY/DATE:	JJW	5/8/12
APPROVED BY/DATE:	BRH	5/11/12



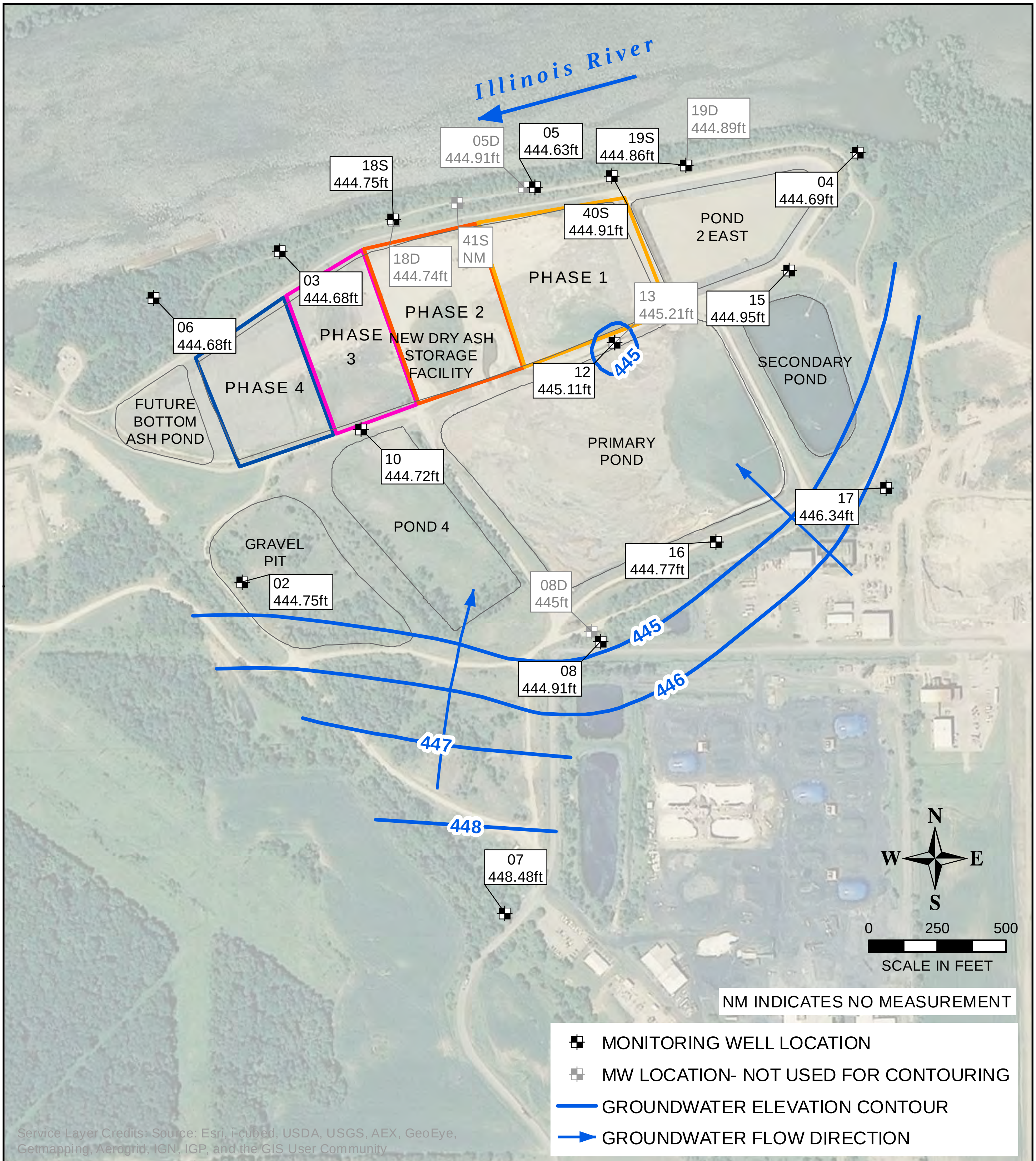
GROUNDWATER ELEVATION CONTOURS
MAY 30, 2012

NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

NATURAL RESOURCE TECHNOLOGY

PROJECT NO: 1645
FIGURE NO: 1

DRAWN BY/DATE:	NDK	7/25/12
CHECKED BY/DATE:	BRH	7/30/12
APPROVED BY/DATE:	BRH	7/30/12



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NDK 10/19/12
REVIEWED BY/DATE:
TDC 10/19/12
APPROVED BY/DATE:
BRH 10/23/12

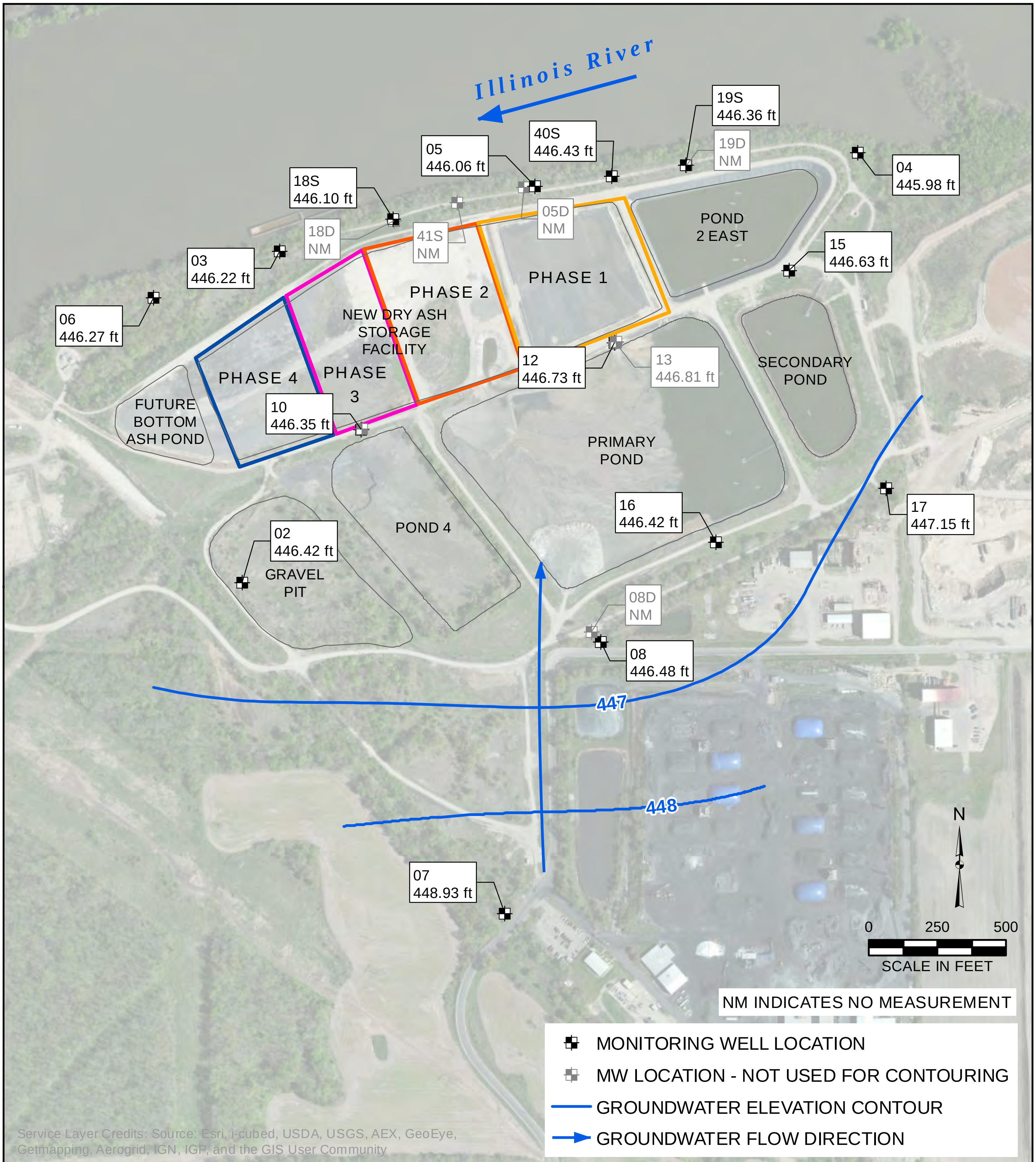
GROUNDWATER ELEVATION CONTOURS
AUGUST 28, 2012

NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

PROJECT NO: 1645

FIGURE NO: 1

NATURAL RESOURCE TECHNOLOGY



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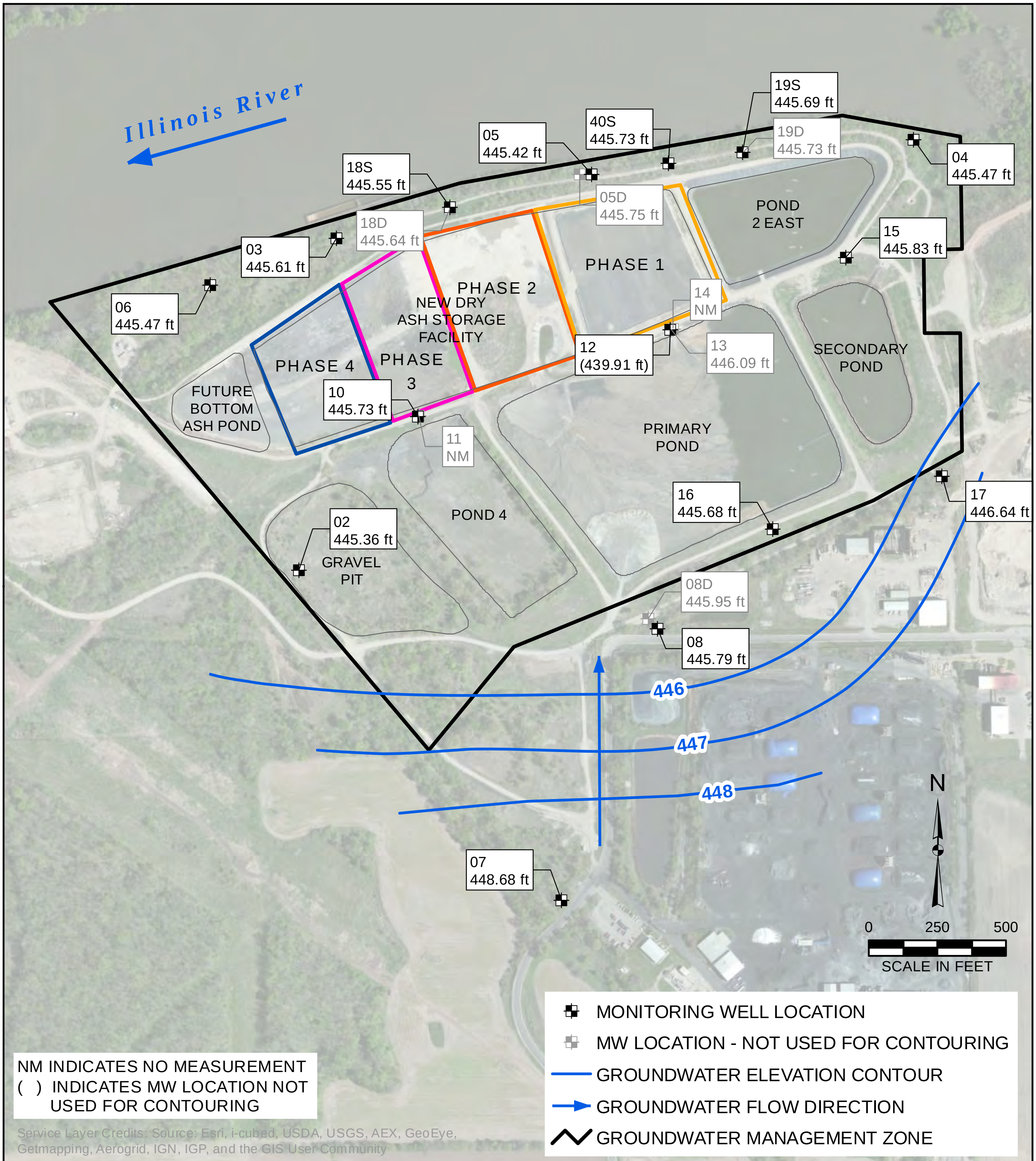
DRAWN BY/DATE: TDC 1/21/13 REVIEWED BY/DATE: BRH 1/21/13 APPROVED BY/DATE: BRH 1/22/13	**GROUNDWATER ELEVATION CONTOURS NOVEMBER 27, 2012** NEW CCW LANDFILL - HENNEPIN POWER STATION DYNEGY MIDWEST GENERATION, LLC PUTNAM COUNTY, ILLINOIS	PROJECT NO: 1645 FIGURE NO: 1 Natural Resource Technology



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DRAWN BY/DATE:
NDK 5/7/13
REVIEWED BY/DATE:
TDC 5/7/13
APPROVED BY/DATE:
BRH 5/7/13

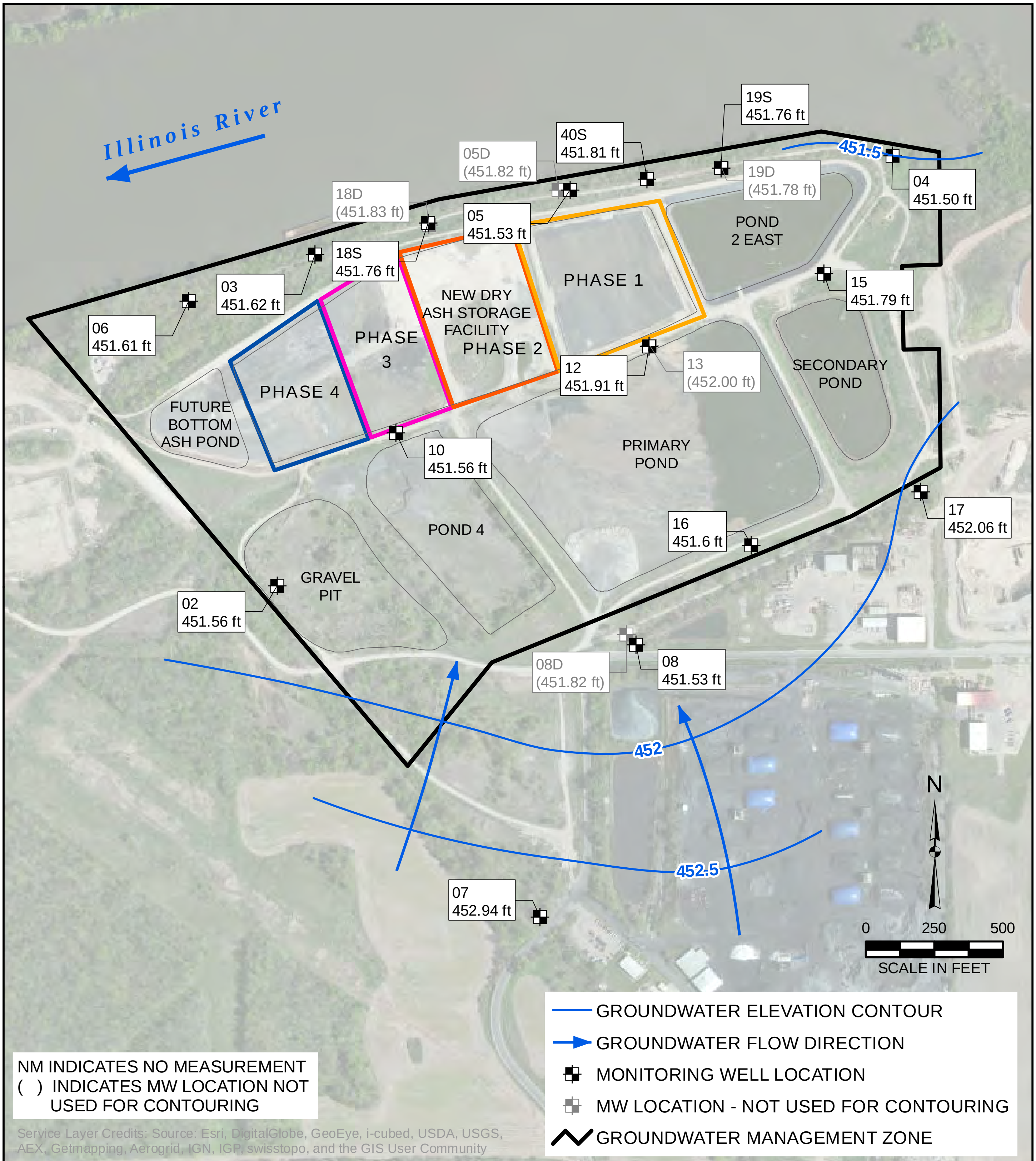
GROUNDWATER ELEVATION CONTOURS
MARCH 7, 2013

NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

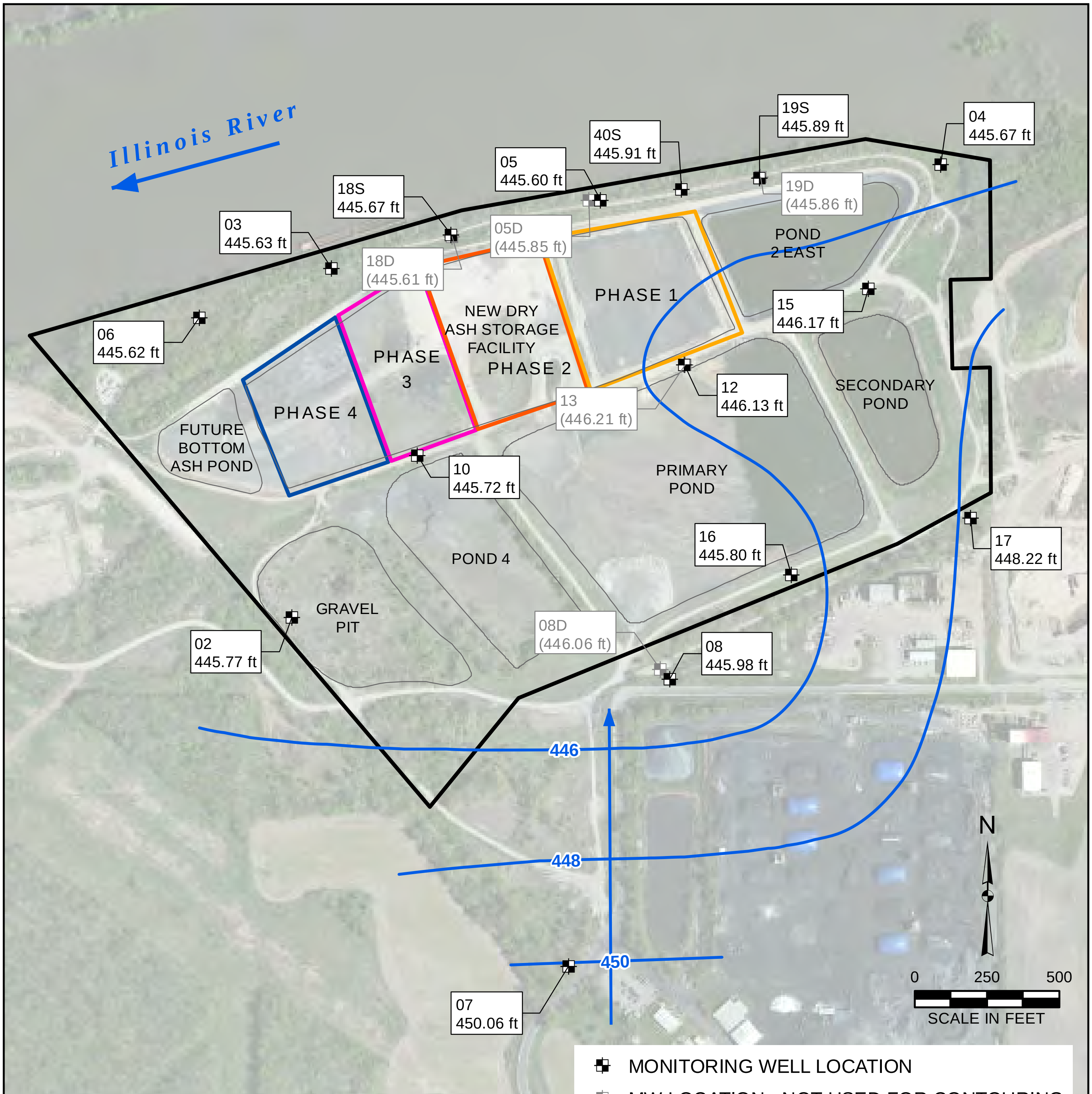
PROJECT NO: 1645

FIGURE NO: 1

Natural Resource Technology



DRAWN BY/DATE: TDC 8/5/13 REVIEWED BY/DATE: BRH 8/7/13 APPROVED BY/DATE: BRH 8/7/13	**GROUNDWATER ELEVATION CONTOURS** **JUNE 6, 2013** NEW CCW LANDFILL - HENNEPIN POWER STATION DYNEGY MIDWEST GENERATION, LLC PUTNAM COUNTY, ILLINOIS	PROJECT NO: 1645 FIGURE NO: 1 NATURAL RESOURCE TECHNOLOGY



NM INDICATES NO MEASUREMENT
( ) INDICATES MW LOCATION NOT USED FOR CONTOURING
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

DRAWN BY/DATE:
TDC 10/29/13
REVIEWED BY/DATE:
BRH 10/30/13
APPROVED BY/DATE:
BRH 10/30/13

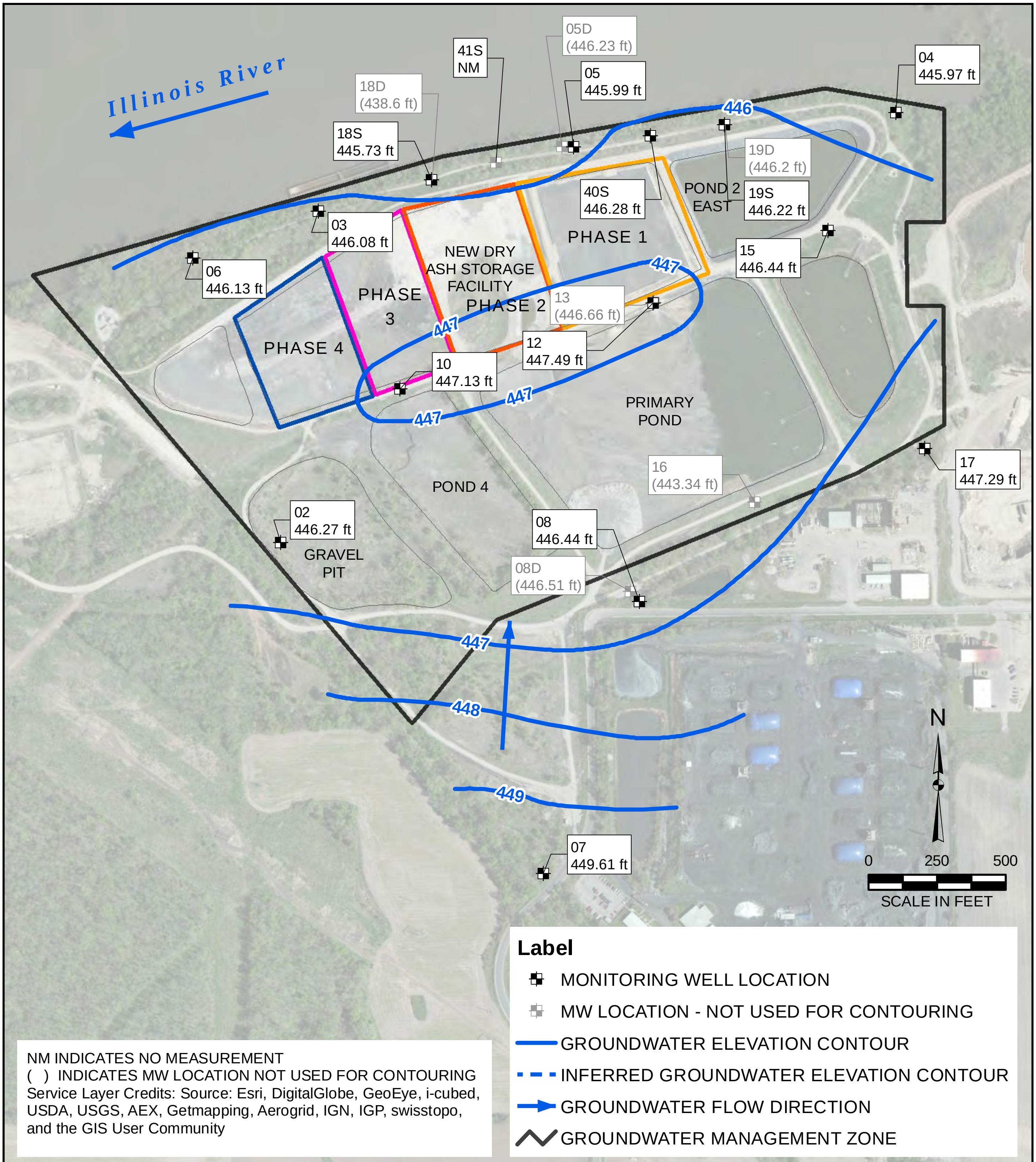
GROUNDWATER ELEVATION CONTOURS
SEPTEMBER 3, 2013

NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

PROJECT NO: 1645

FIGURE NO: 1

NATURAL RESOURCE TECHNOLOGY



DRAWN BY/DATE:
MDM 1/28/14
REVIEWED BY/DATE:
NDK 1/28/14
APPROVED BY/DATE:
BRH 1/28/14

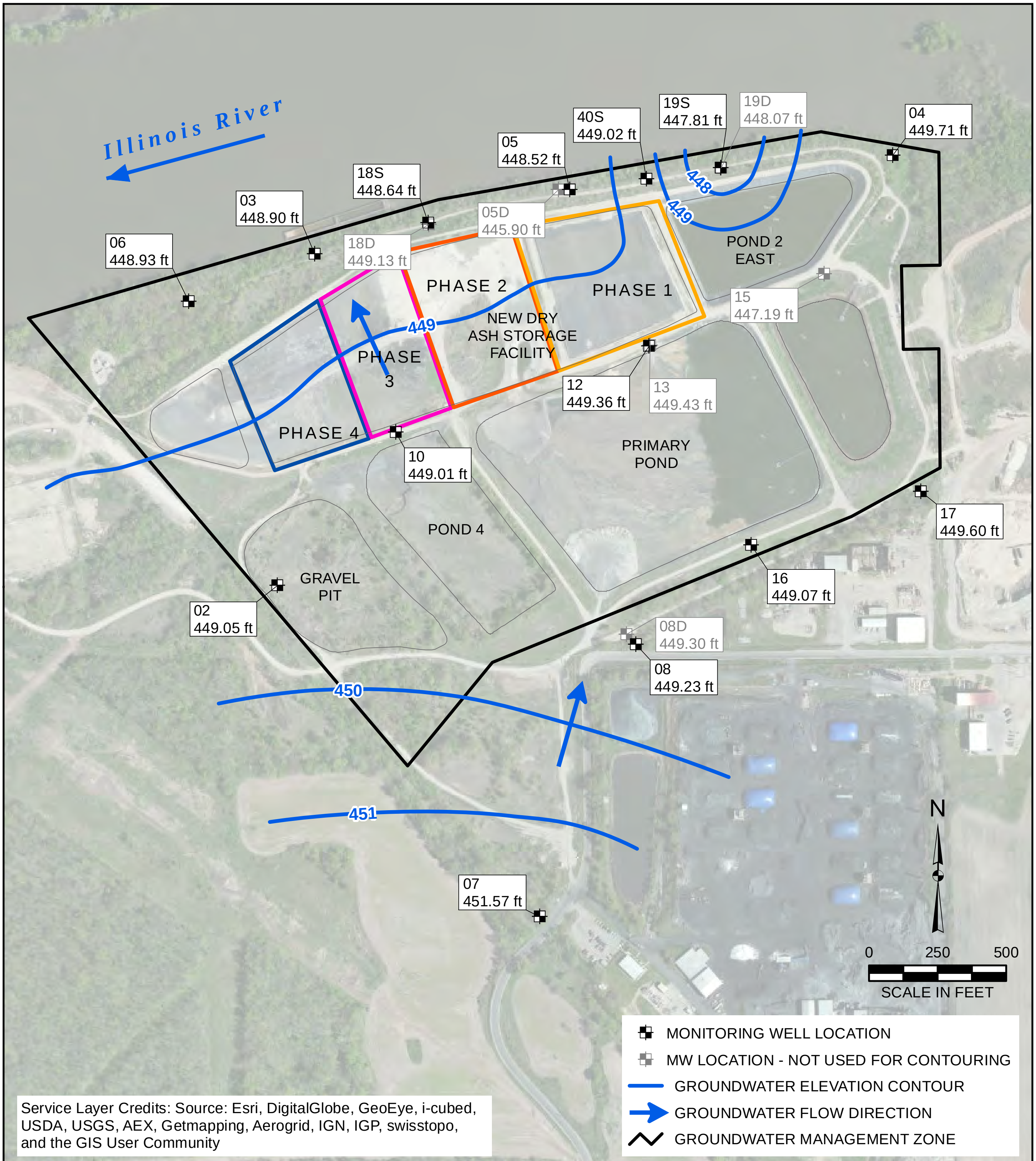
GROUNDWATER ELEVATION CONTOURS
DECEMBER 11, 2013

NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

PROJECT NO: 1645

FIGURE NO: 1

NATURAL RESOURCE TECHNOLOGY



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DRAWN BY/DATE:
TDC 4/28/14
REVIEWED BY/DATE:
NDK 4/28/14
APPROVED BY/DATE:
BRH 4/30/14

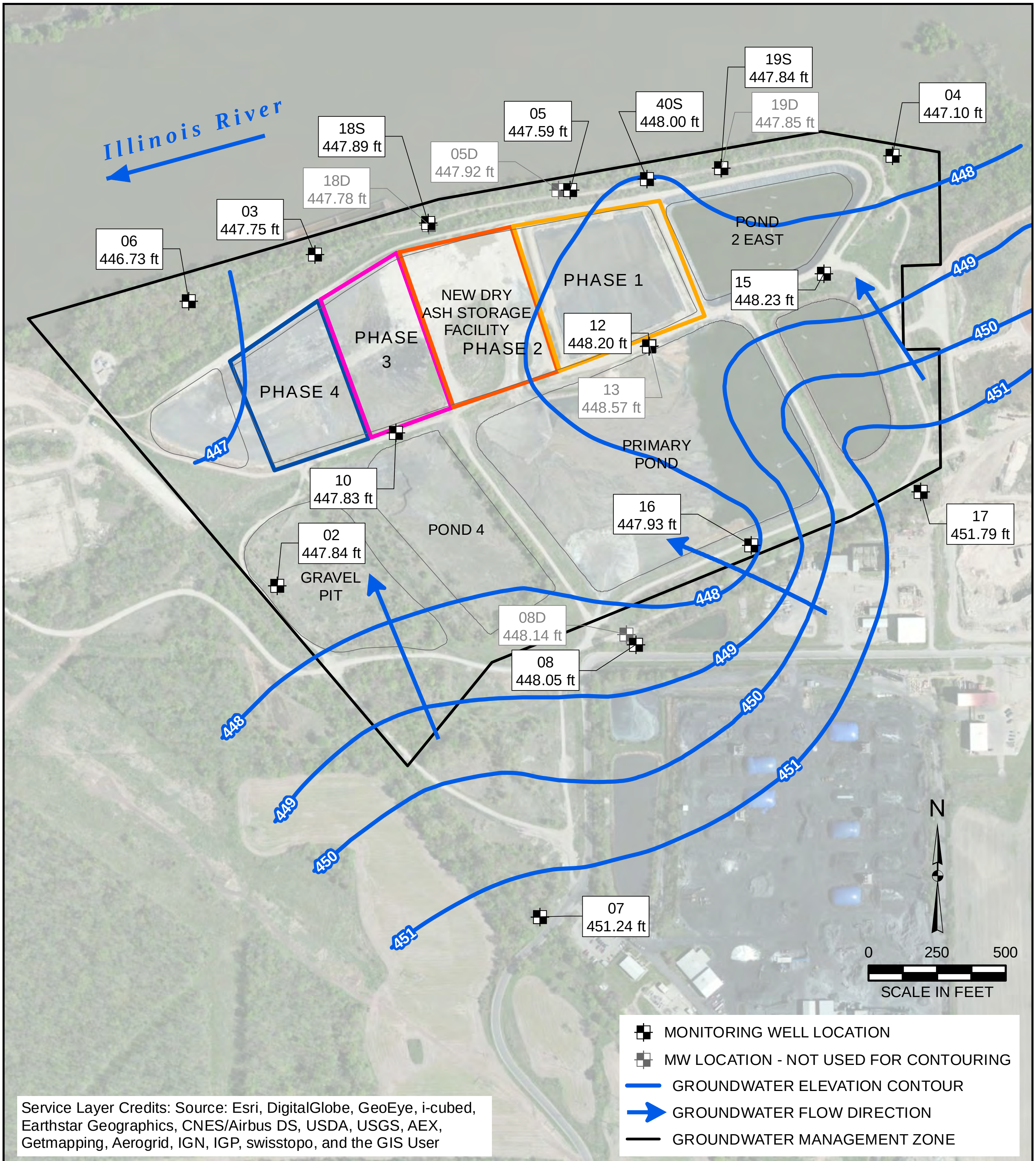
GROUNDWATER ELEVATION CONTOURS
MARCH 26, 2014

NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

PROJECT NO: 1645

FIGURE NO: 1

NATURAL RESOURCE TECHNOLOGY



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DRAWN BY/DATE:
MDM 7/31/14
REVIEWED BY/DATE:
NDK 7/31/14
APPROVED BY/DATE:
SJC 8/1/14

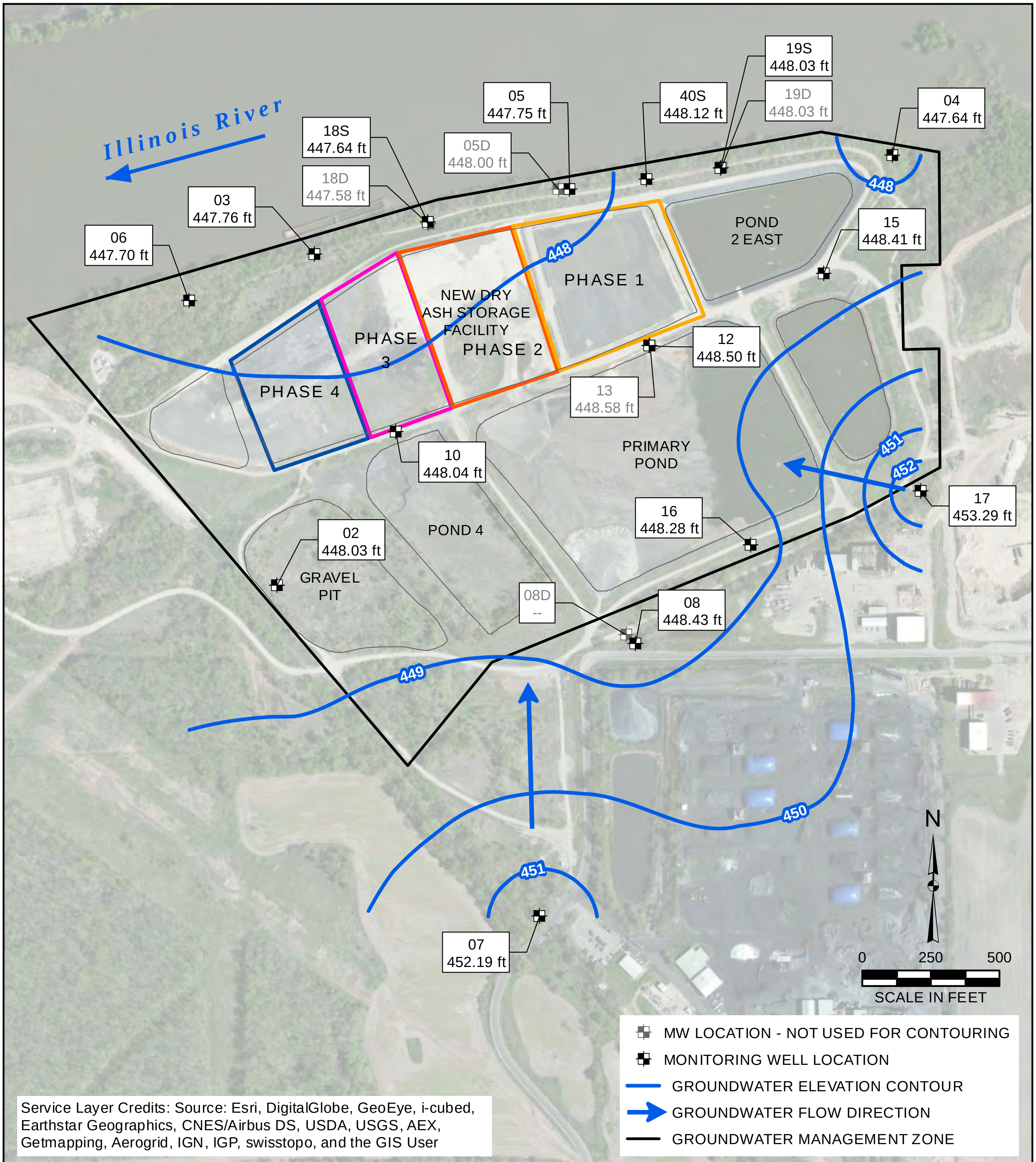
GROUNDWATER ELEVATION CONTOURS
JUNE 18, 2014

NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

PROJECT NO: 2205

FIGURE NO: 1

NATURAL RESOURCE TECHNOLOGY



DRAWN BY/DATE:
MDM 10/1/14
REVIEWED BY/DATE:
SJC 10/14/14
APPROVED BY/DATE:
SJC 11/6/14

GROUNDWATER ELEVATION CONTOURS
AUGUST 20, 2014

NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

PROJECT NO: 2205

FIGURE NO: 1

NATURAL RESOURCE TECHNOLOGY

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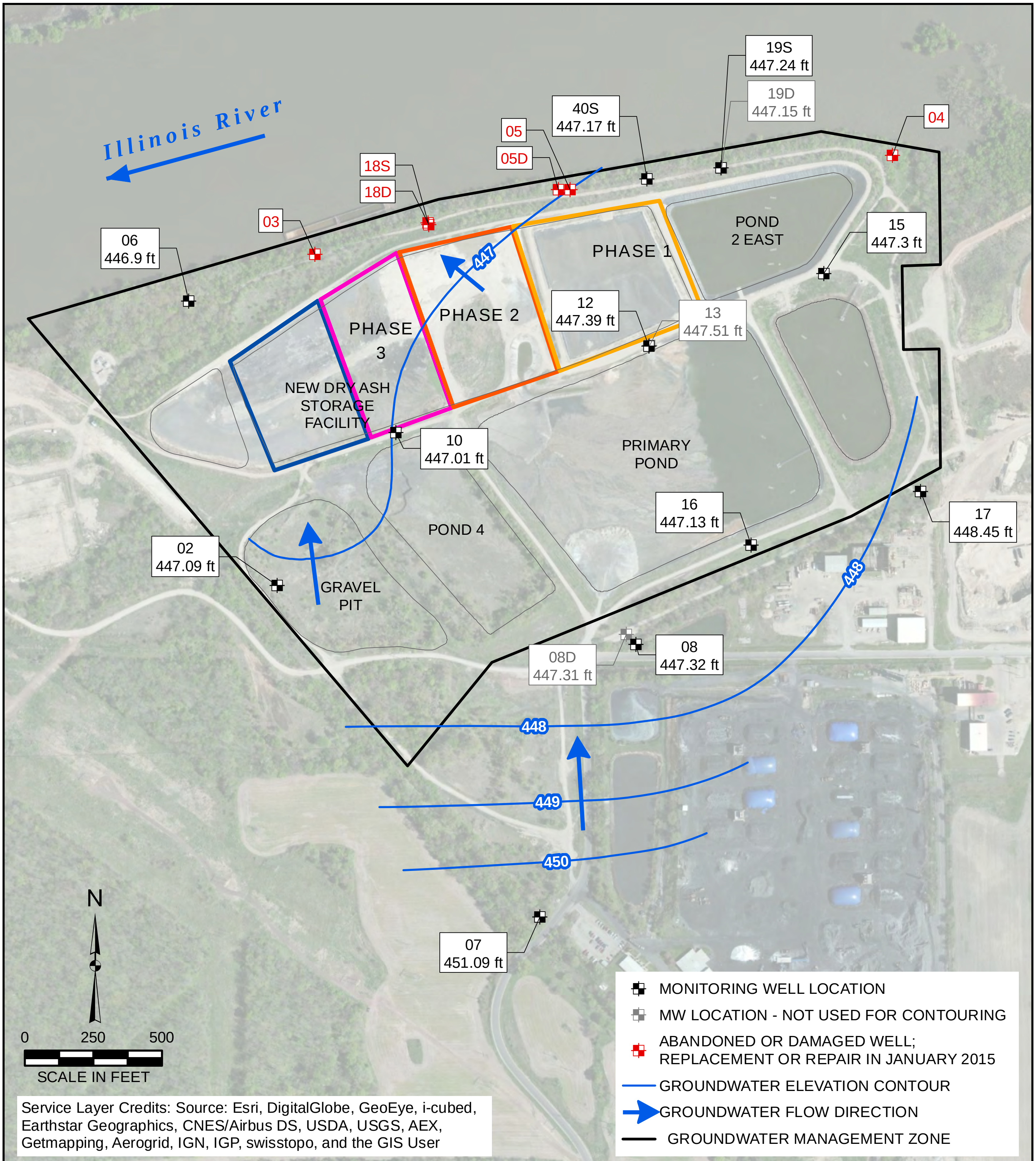
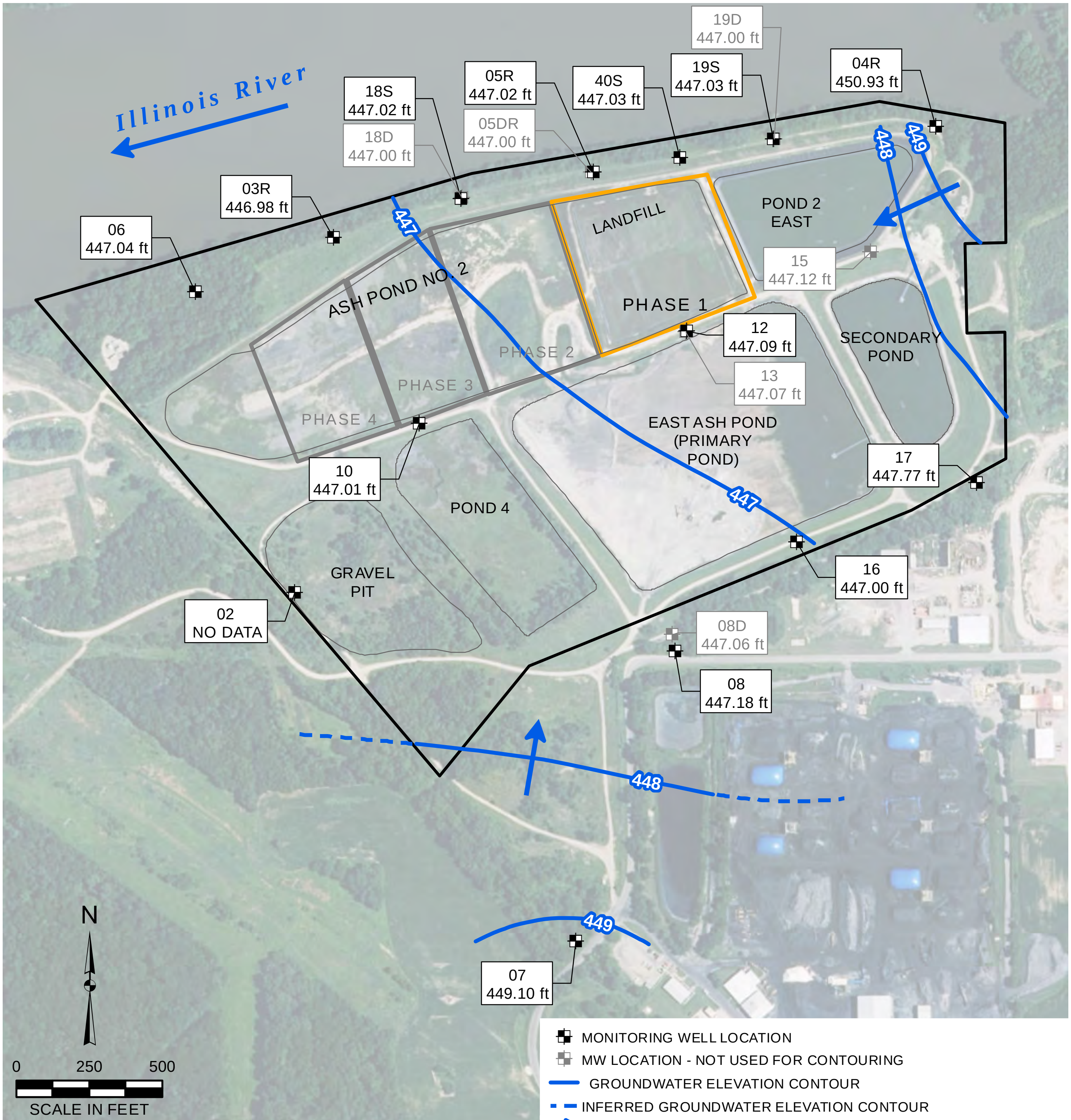


Y:\Mapping\Projects\22\2205\MXD\GW_Elevation_Contour_Map_1412.mxd Author: mmejac; Date/Time: 1/13/2015, 10:26:13 AM

DRAWN BY/DATE: MDM 1/12/15 REVIEWED BY/DATE: SJC 1/13/15 APPROVED BY/DATE: SJC 1/13/15	**GROUNDWATER ELEVATION CONTOURS** **DECEMBER 9, 2014** NEW CCW LANDFILL - HENNEPIN POWER STATION DYNEGY MIDWEST GENERATION, LLC PUTNAM COUNTY, ILLINOIS	PROJECT NO: 2205 FIGURE NO: 1 NATURAL RESOURCE TECHNOLOGY



NOTE: GROUNDWATER ELEVATION AT MONITORING WELL 02 RECORDED MARCH 19, 2015.

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

DRAWN BY/DATE:
MDM 9/25/15
REVIEWED BY/DATE:
YAD 10/6/15
APPROVED BY/DATE:
SJC 10/6/15

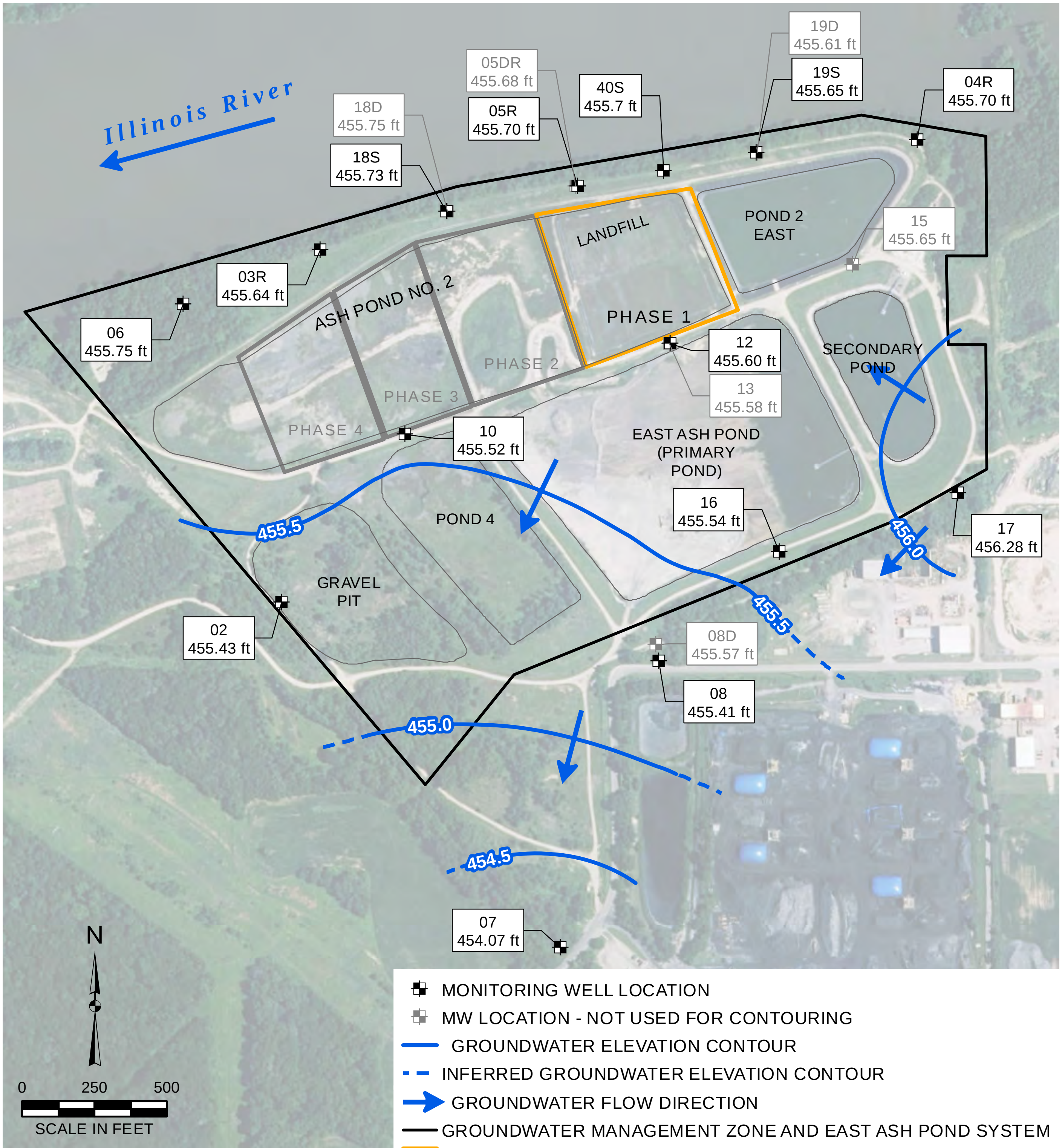
GROUNDWATER ELEVATION CONTOURS
MARCH 18, 2015

NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

PROJECT NO: 2205

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\22\2205\MXD\Hen_East_Q3-4_2015\GW_Elevation_Contour_Map_1503.mxd Author: tcushman; Date/Time: 3/10/2016, 3:03:34 PM



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

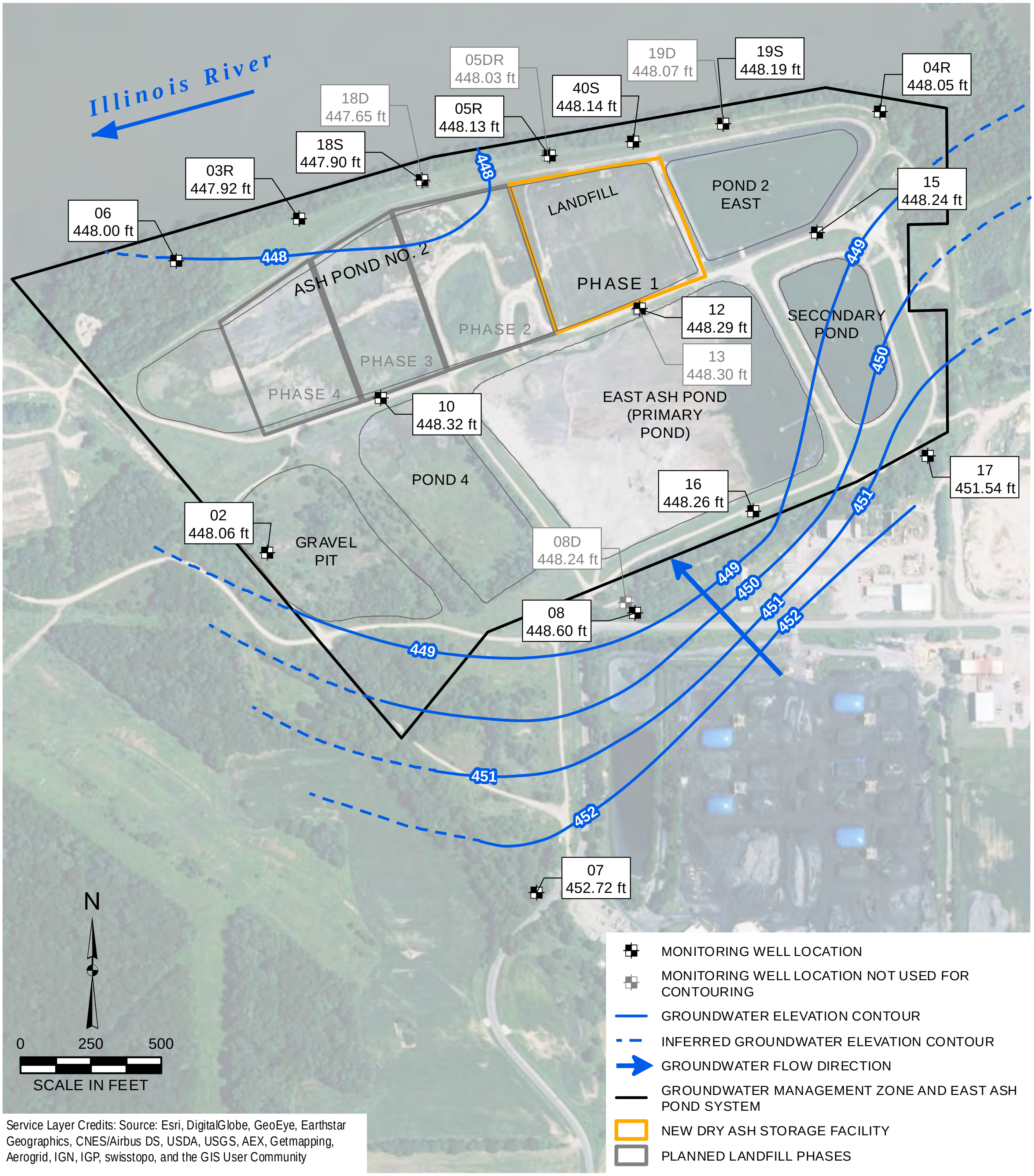
DRAWN BY/DATE: MDM 9/25/15
REVIEWED BY/DATE: YAD 10/6/15
APPROVED BY/DATE: SJC 10/6/15

GROUNDWATER ELEVATION CONTOURS
JUNE 22-23, 2015

NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

PROJECT NO: 2205

NATURAL RESOURCE TECHNOLOGY



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

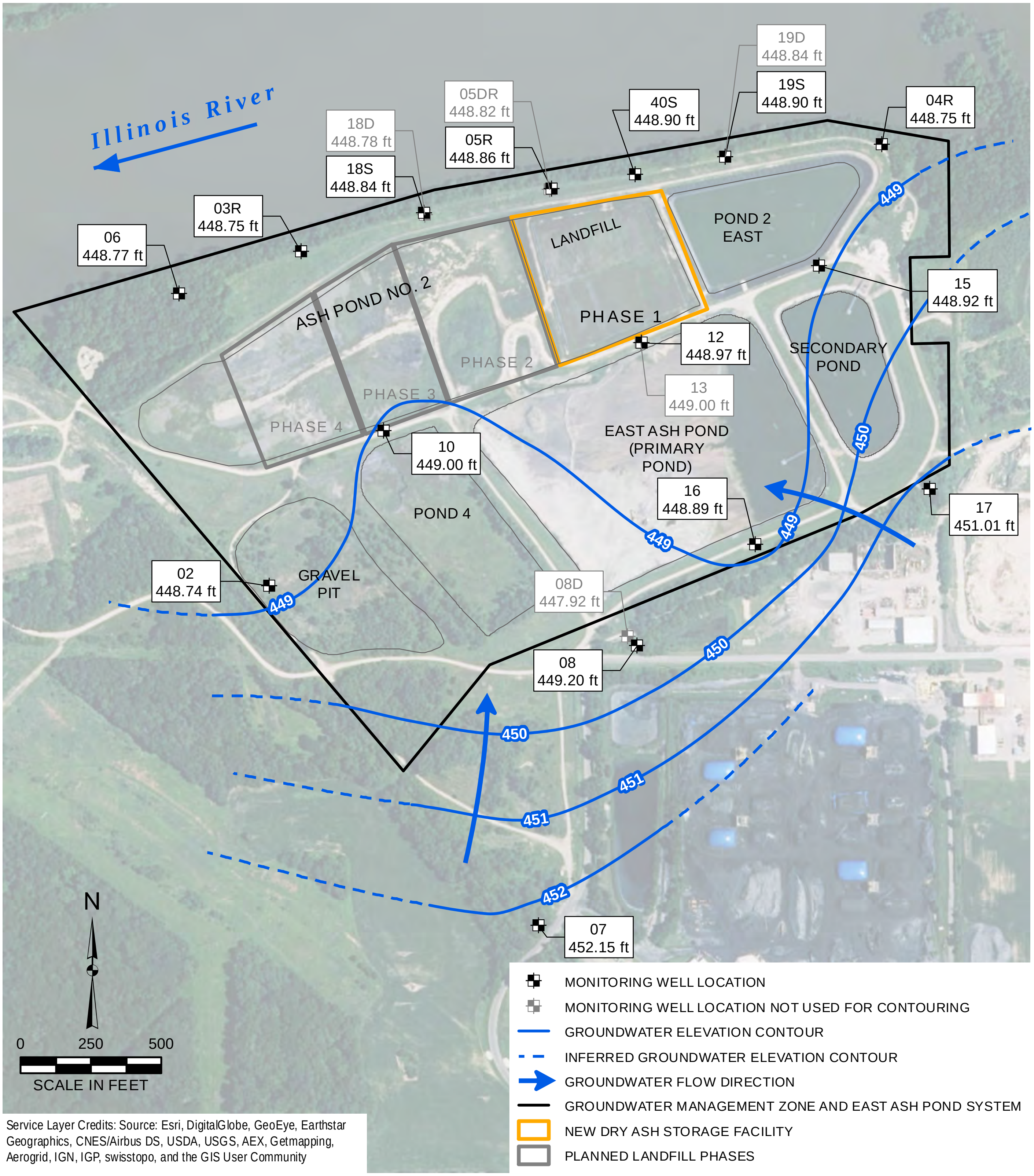
DRAWN BY/DATE:
TDC 3/8/16
REVIEWED BY/DATE:
KLT 3/9/16
APPROVED BY/DATE:
JJW 3/10/16

GROUNDWATER ELEVATION CONTOURS
SEPTEMBER 16, 2015

NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

PROJECT NO: 2205

NATURAL RESOURCE TECHNOLOGY



DRAWN BY/DATE:
TDC 3/8/16
REVIEWED BY/DATE:
KLT 3/8/16
APPROVED BY/DATE:
JJW 3/10/16

GROUNDWATER ELEVATION CONTOURS
DECEMBER 8, 2015

NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

PROJECT NO: 2205

NATURAL RESOURCE TECHNOLOGY

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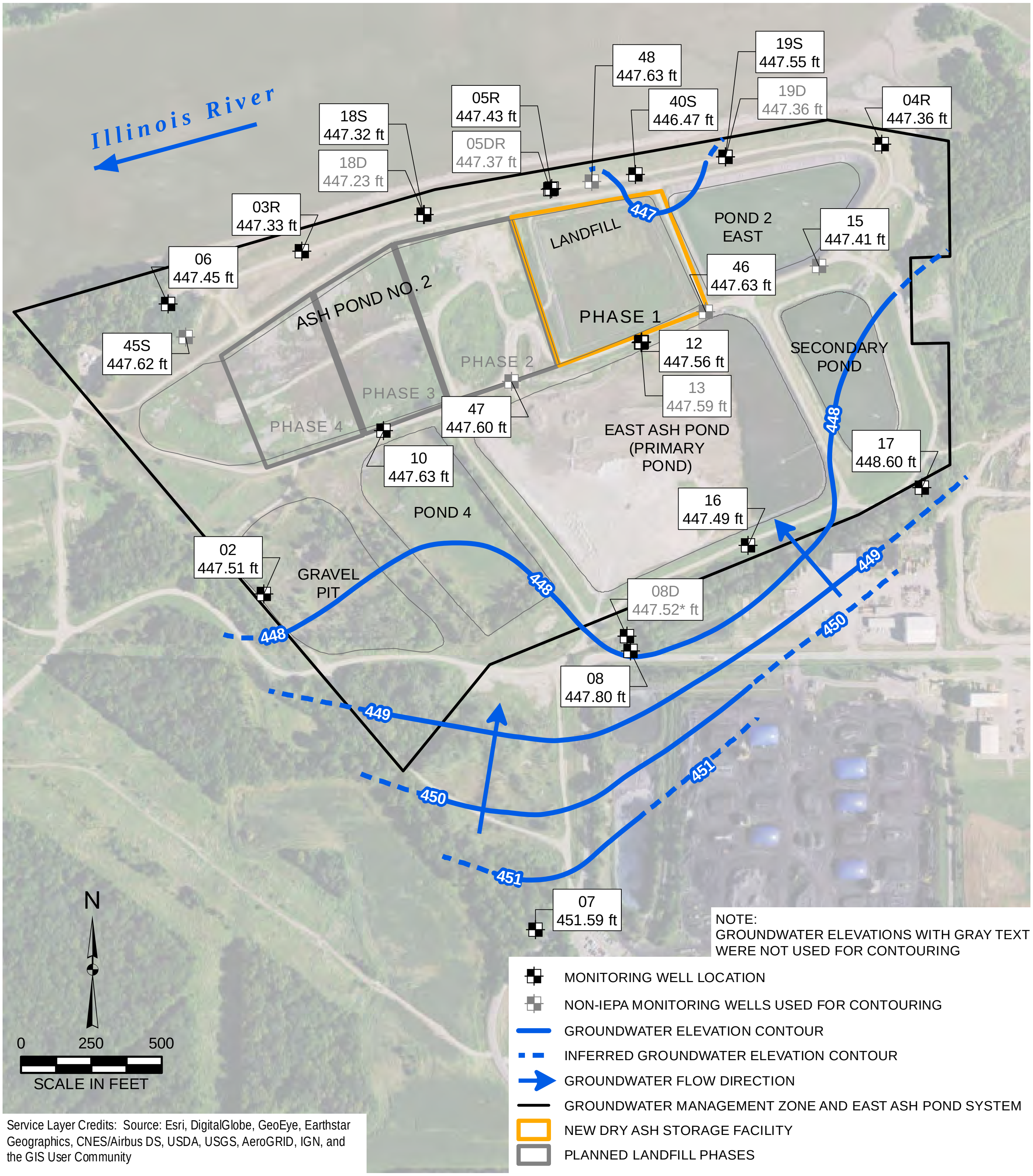


Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Y:\Mapping\Projects\23\2362\mxd\IEPA_GW_Contours\GW_Elevation_Contour_Map_1603.mxd Author: CushmaTD; Date/Time: 3/10/2017, 10:15:20 AM

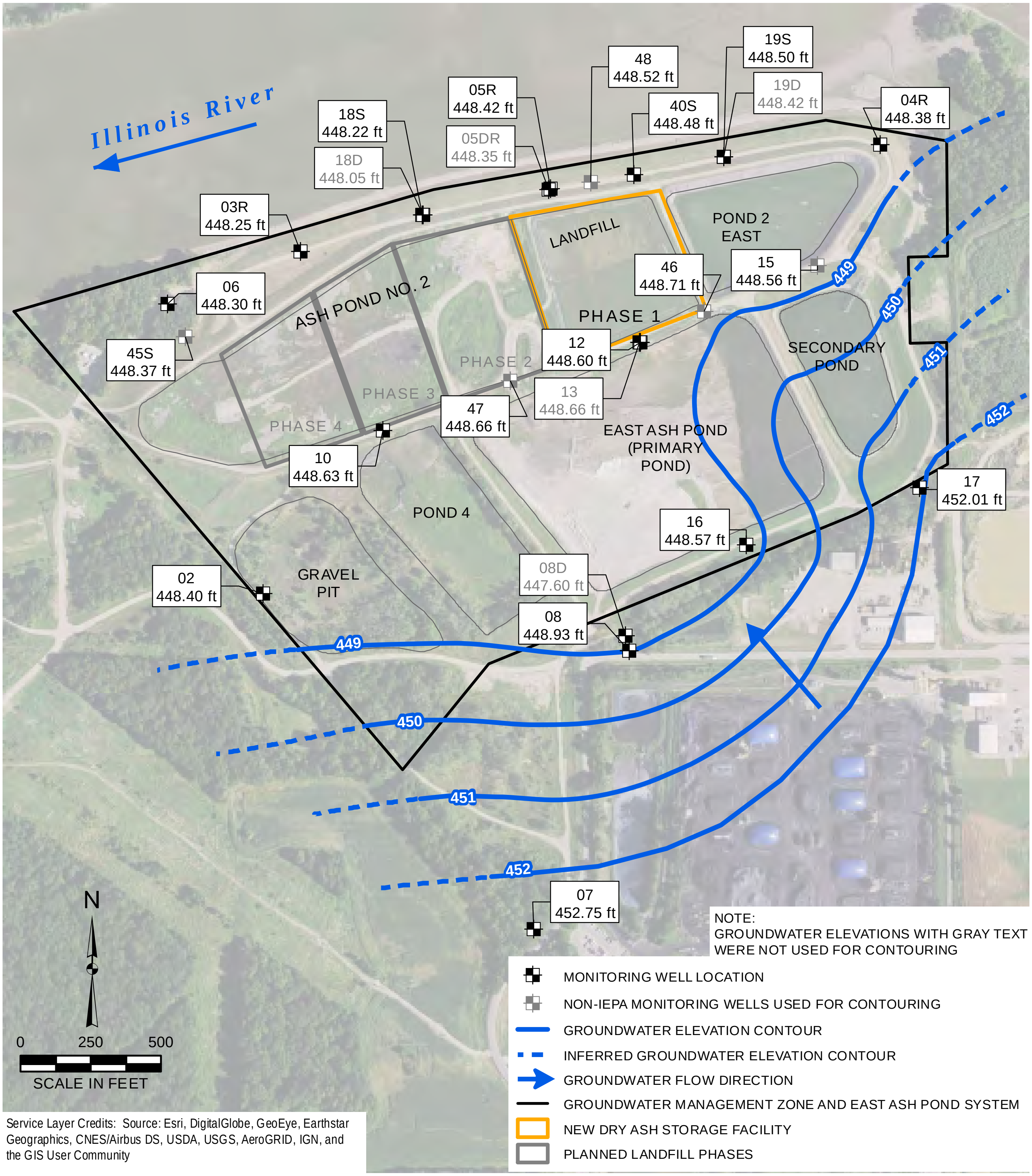
DRAWN BY/DATE:
TDC 3/10/17
REVIEWED BY/DATE:
TBN 3/10/17
APPROVED BY/DATE:
SJC 3/10/17

GROUNDWATER ELEVATION CONTOURS
MARCH 8, 2016

NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

PROJECT NO: 2362

Natural Resource Technology
AN OBG COMPANY



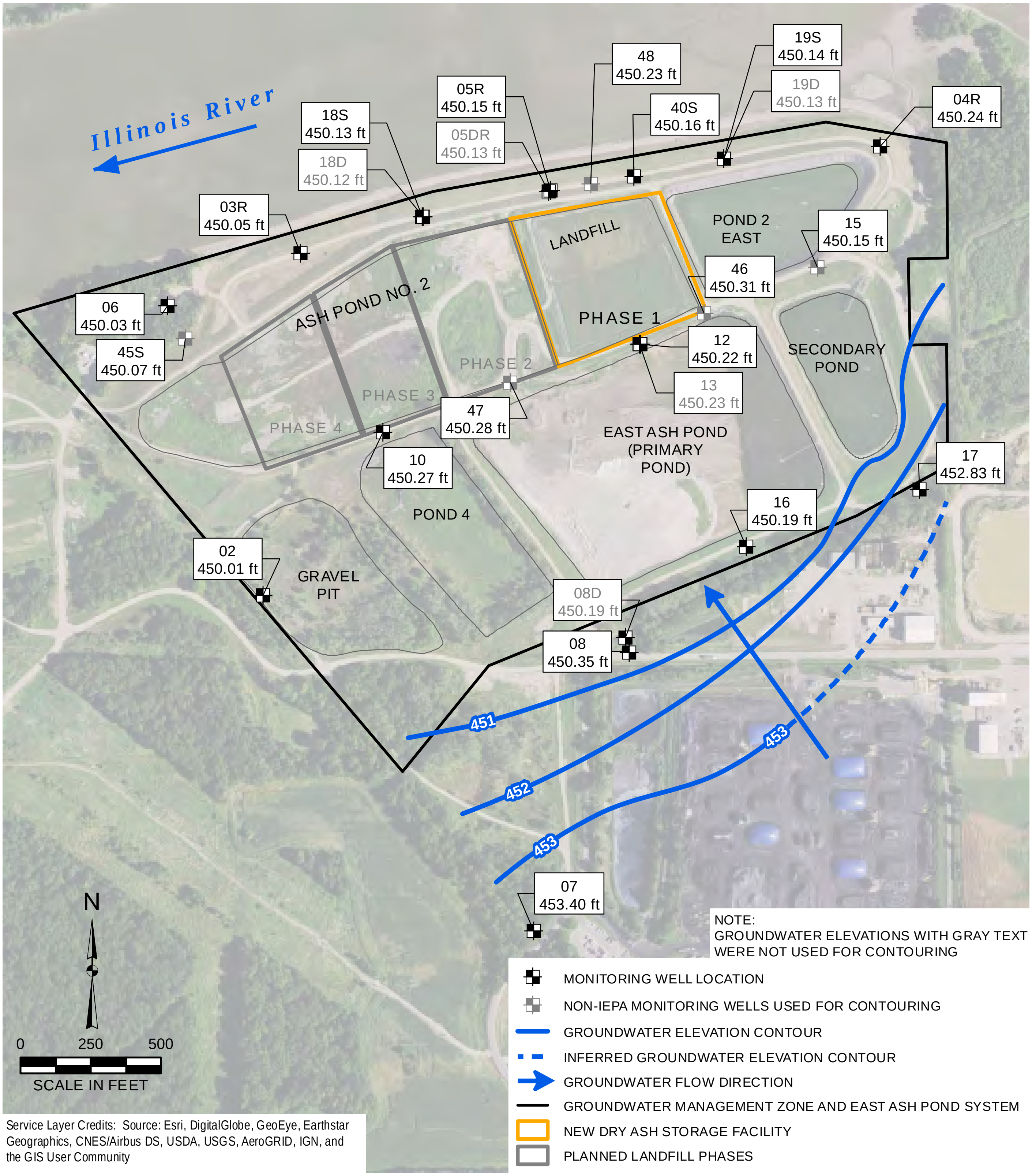
DRAWN BY/DATE:
SDS 3/7/17
REVIEWED BY/DATE:
TBN 3/7/17
APPROVED BY/DATE:
SJC 3/10/17

GROUNDWATER ELEVATION CONTOURS
JUNE 7, 2016

NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

PROJECT NO: 2362

Natural Resource Technology
AN OBG COMPANY



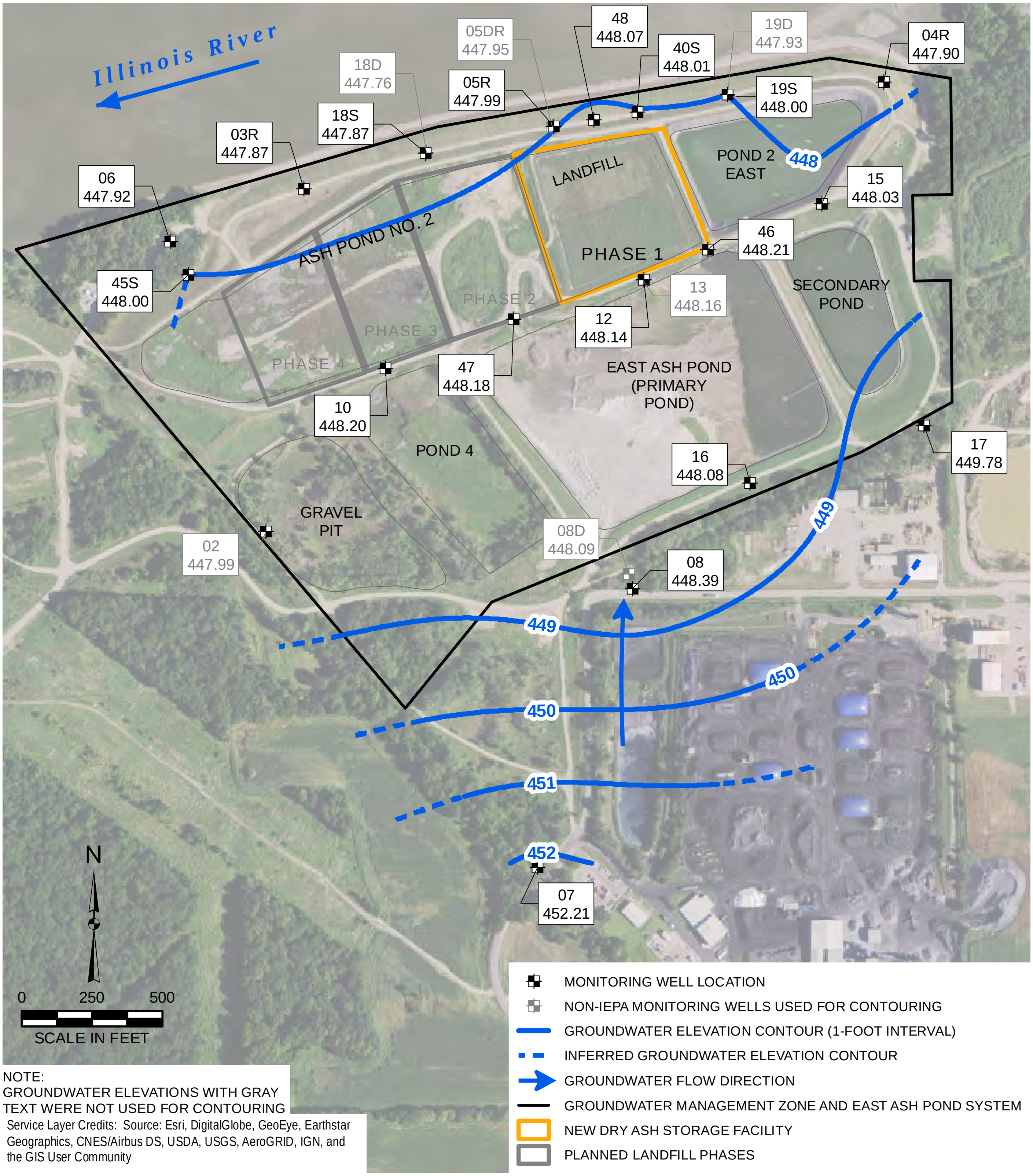
DRAWN BY/DATE:
SDS 3/7/17
REVIEWED BY/DATE:
TBN 3/7/17
APPROVED BY/DATE:
SJC 3/10/17

GROUNDWATER ELEVATION CONTOURS
SEPTEMBER 15, 2016

NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

PROJECT NO: 2362

Natural Resource Technology
AN OBG COMPANY



DRAWN BY/DATE:
TDC 3/10/17
REVIEWED BY/DATE:
TBN 3/10/17
APPROVED BY/DATE:
SJC 3/10/17

GROUNDWATER ELEVATION CONTOURS
DECEMBER 9, 2016

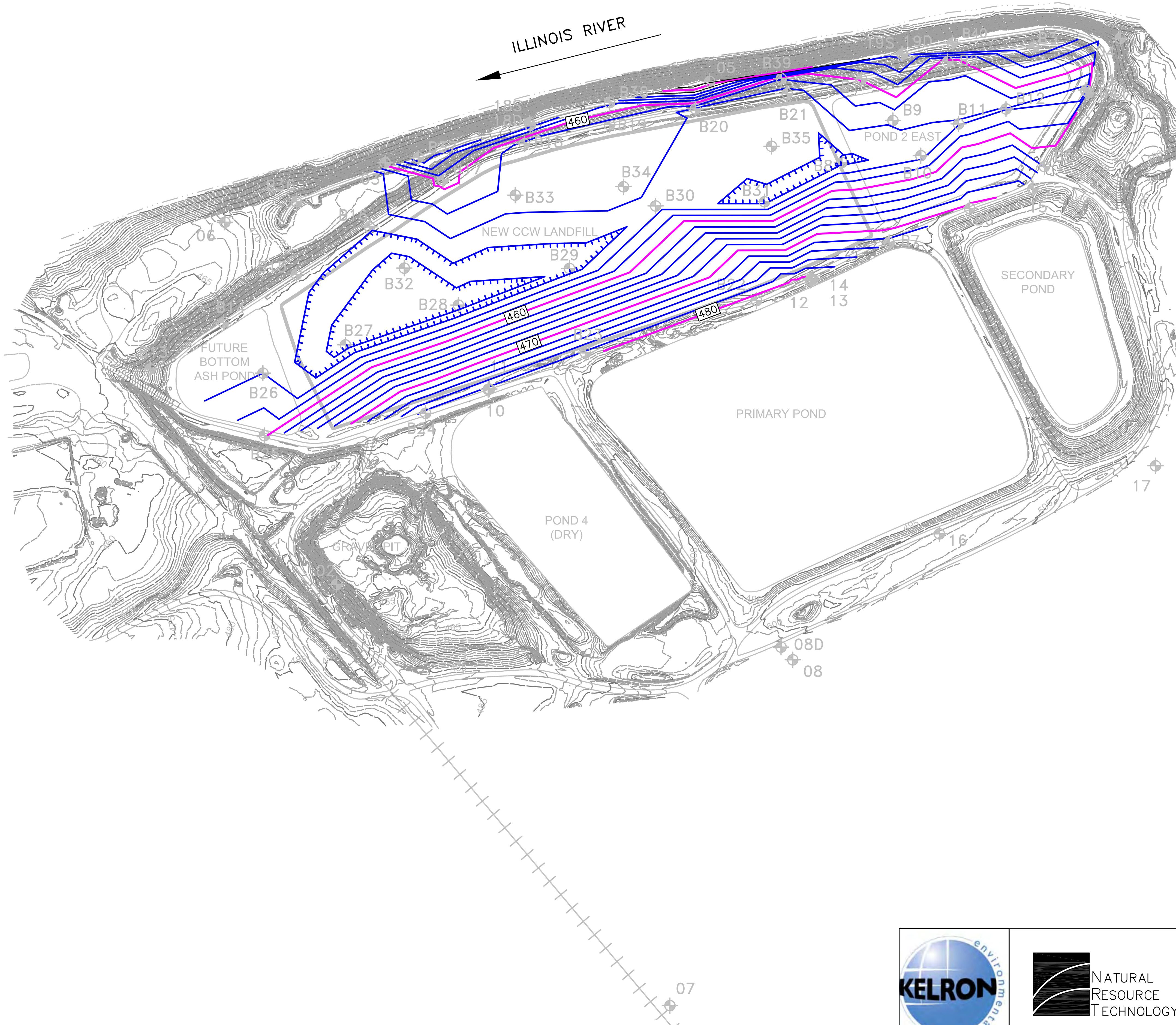
NEW CCW LANDFILL - HENNEPIN POWER STATION
DYNEGY MIDWEST GENERATION, LLC
PUTNAM COUNTY, ILLINOIS

PROJECT NO: 2362

Natural Resource Technology
AN OBG COMPANY

Appendix C

Ash Pond No 2 Base Grades



LEGEND

- BASE OF ASH CONTOUR, 2 FT. INTERVALS (470)
- SOIL BORING LOCATION AND IDENTIFICATION (B24)
- EXISTING GROUND SURFACE CONTOURS (1 FOOT) (500)
- SHORELINE
- RAILROAD

SOURCE NOTES:
CIVIL AND ENVIRONMENTAL CONSULTANTS, INC., DRAWING 3H DRAFT 30% SUBMITTAL TOP OF CAP–FINAL GRADING PLAN, DATED APRIL, 2010.
STMI, STMI/135/96–02, DRAWING DATED JUNE 1996.

N

0 75 150 300
SCALE IN FEET

KELRON environmental

NATURAL RESOURCE TECHNOLOGY

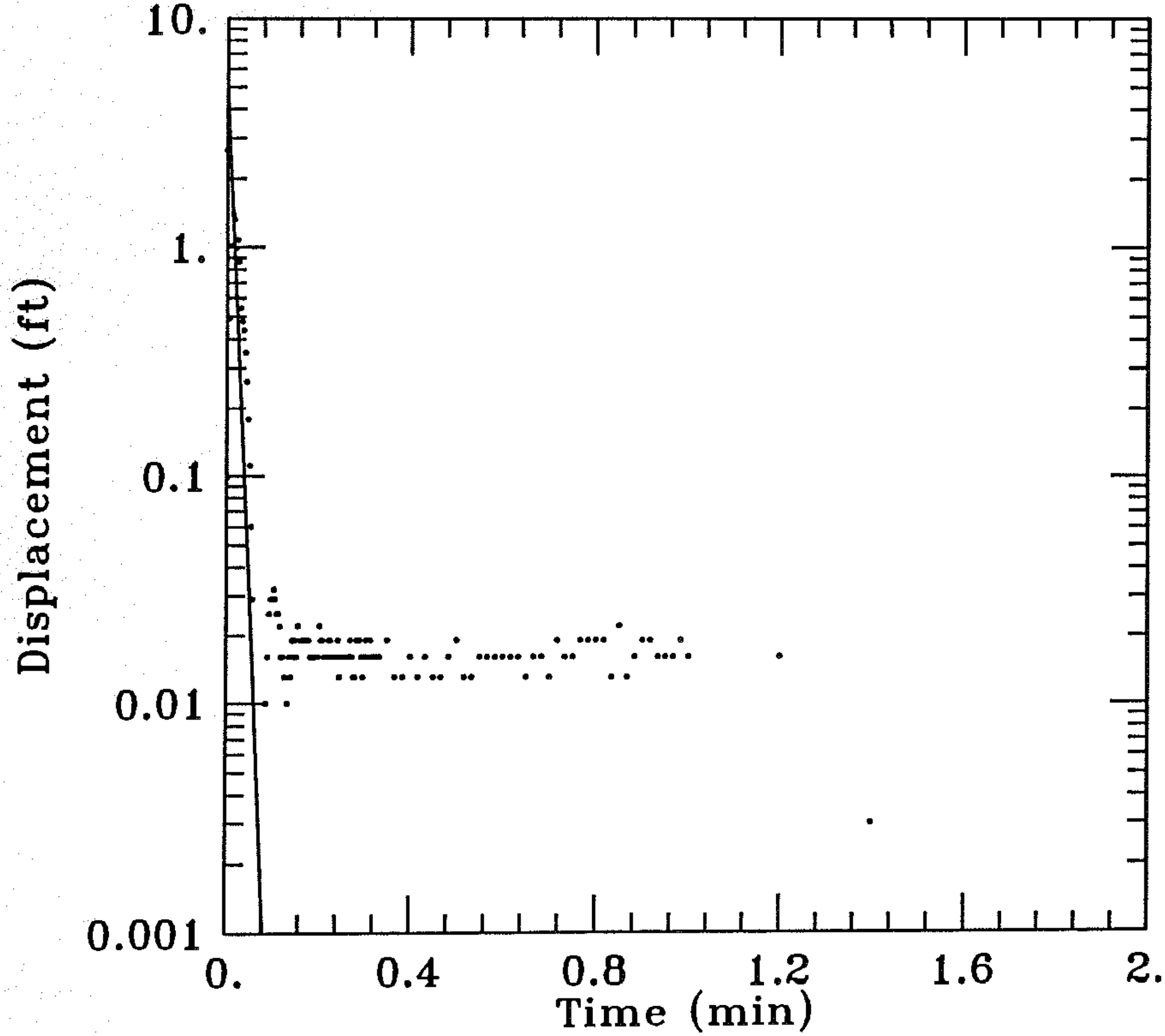
PROJECT NO. 1940/3.0	BASE OF ASH ELEVATIONS
DRAWN BY: KNW 09/22/10	INITIAL FACILITY REPORT, NEW CCW LANDFILL HENNEPIN POWER STATION DYNEGY MIDWEST GENERATION, INC. HENNEPIN, ILLINOIS
CHECKED BY: BGH 12/08/10	
APPROVED BY: BRH 12/08/10	DRAWING NO: 1940–3–B19C REFERENCE: .
	FIGURE 25–5

Appendix D

Hydraulic Conductivity Test Data

Appendix D1

STMI Field Hydraulic Conductivity Tests



DATA SET:
T4W3.DAT
10/09/95

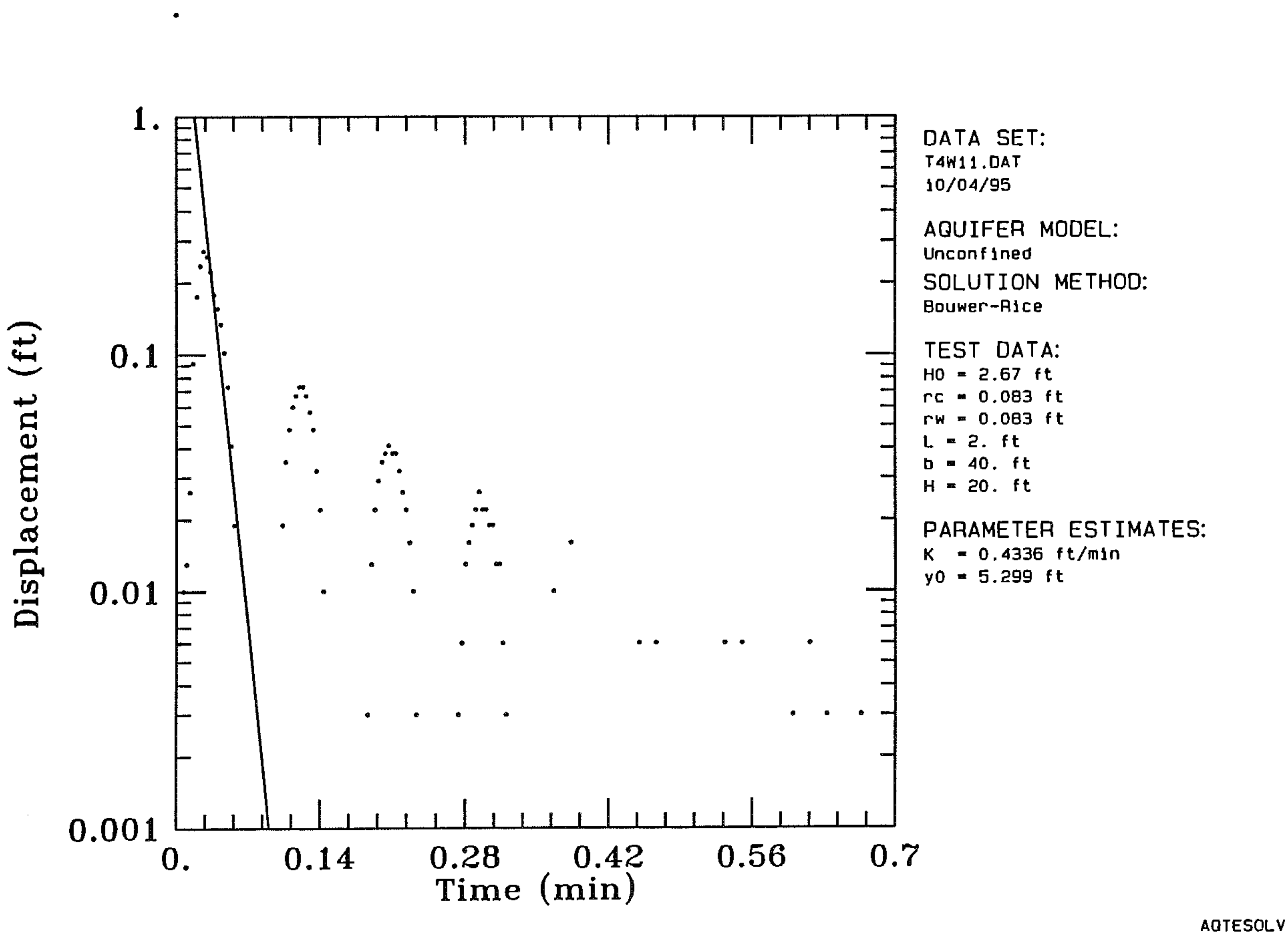
AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

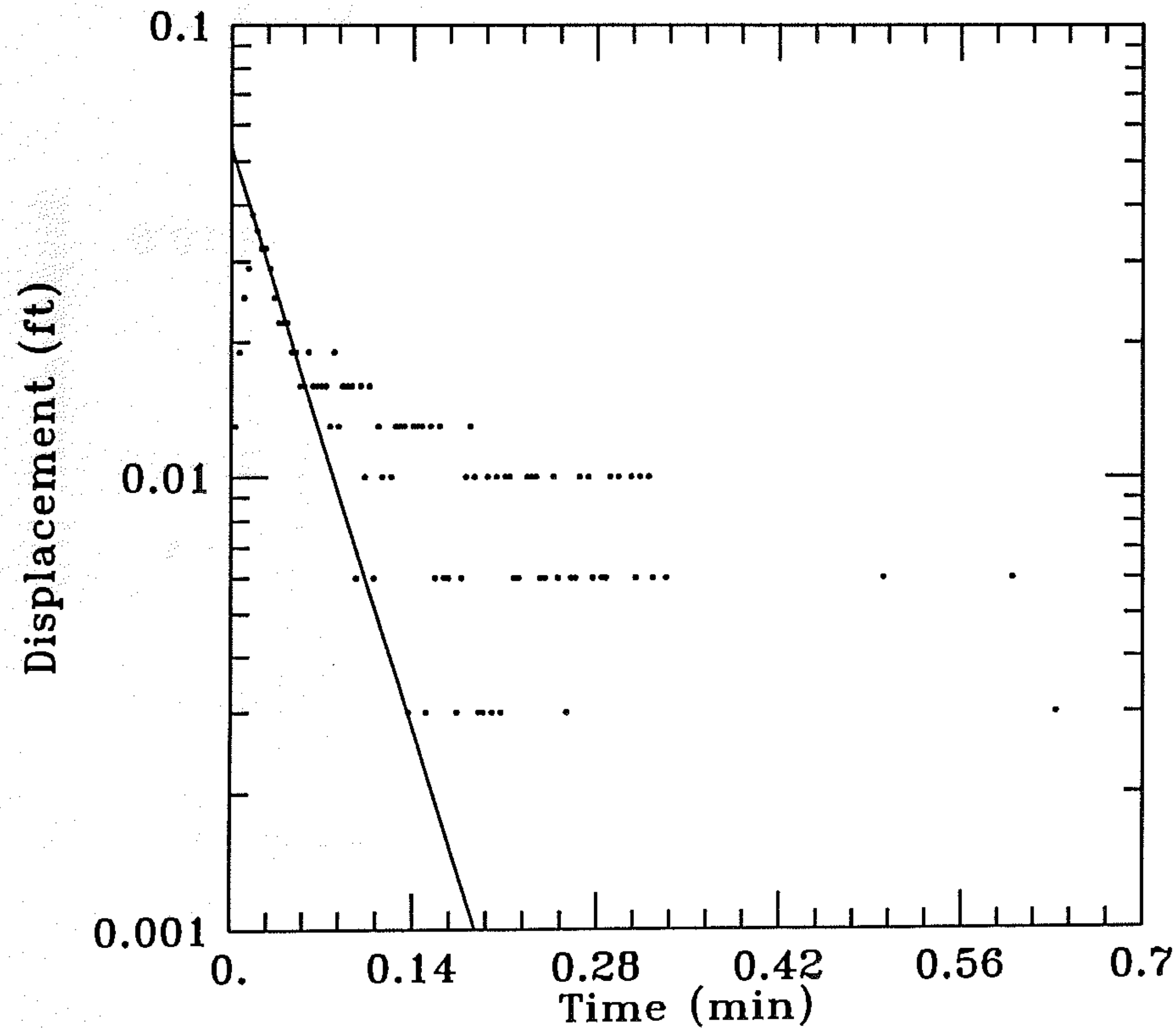
TEST DATA:
H0 = 2.67 ft
rc = 0.083 ft
rw = 0.083 ft
L = 15. ft
b = 40. ft
H = 18. ft

PARAMETER ESTIMATES:
K = 0.08738 ft/min
y0 = 4.852 ft

AQTESOLV



1.
0.1
0.01
0.001
Displacement (ft)
0.
0.14
0.28
0.42
0.56
0.7
Time (min)
DATA SET:
T4W11.DAT
10/04/95
AQUIFER MODEL:
Unconfined
SOLUTION METHOD:
Bouwer-Rice
TEST DATA:
H0 = 2.67 ft
rc = 0.083 ft
rw = 0.083 ft
L = 2. ft
b = 40. ft
H = 20. ft
PARAMETER ESTIMATES:
K = 0.4336 ft/min
y0 = 5.299 ft
AQTESOLV



DATA SET:
T1W12.DAT
10/03/95

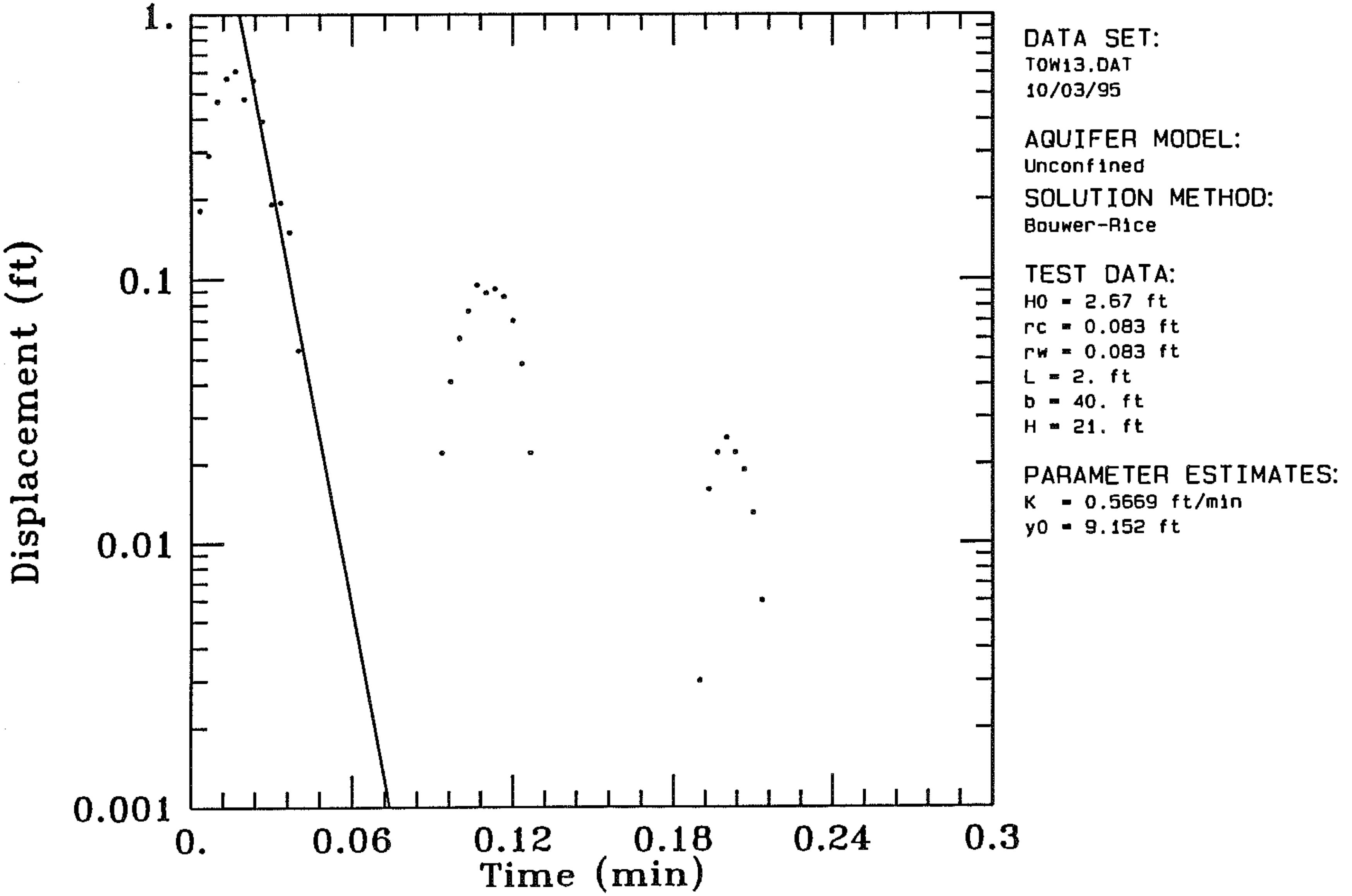
AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATA:
H0 = 2.67 ft
rc = 0.083 ft
rw = 0.083 ft
L = 10. ft
b = 40. ft
H = 11. ft

PARAMETER ESTIMATES:
K = 0.02397 ft/min
y0 = 0.05333 ft

AQTESOLV


1.
0.1
0.01
0.001
Displacement (ft)
0.
0.06
0.12
0.18
0.24
0.3
Time (min)
DATA SET:
TOW13.DAT
10/03/95
AQUIFER MODEL:
Unconfined
SOLUTION METHOD:
Bouwer-Rice
TEST DATA:
H0 = 2.67 ft
rc = 0.083 ft
rw = 0.083 ft
L = 2. ft
b = 40. ft
H = 21. ft
PARAMETER ESTIMATES:
K = 0.5669 ft/min
y0 = 9.152 ft

AQTESOLV

Appendix D2

AECOM Laboratory Hydraulic Conductivity Tests

Hydraulic Conductivity Tests
ASTM D 5084

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

Terracon
Consulting Engineers & Scientists

Laboratory Services Group 750 Corporate Woods Parkway Vernon Hills, Illinois 60061 Phone:(847) 793-0306 Fax:(847) 793-0309

TERRACON PROJECT NO.:	**MR155233**	**12/21/2015**
PROJECT NAME:	**DYNERGY - HENNEPIN SITE**	
CLIENT:	**AECOM**	
LOCATION :	**HENNEPIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	HEN-B010
SAMPLE NO.	S-5
DEPTH:	10.0'-11.5'
CLASSIFICATION	VERY DARK GRAY FLY ASH WITH SAND AND GRAVEL

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	86.6	93.3
WATER CONTENT (%)	26.5	23.2
DIAMETER (cm)	7.215	6.956
LENGTH (cm)	4.527	4.521

SAMPLE PHOTO

HYDRAULIC GRADIENT (MAXIMUM)	20.83
PERCENT SATURATION	99.5
HYDRAULIC CONDUCTIVITY k (cm/sec)	1.16E-05

(Percent saturation calculation is based on final measurements and an estimated specific gravity.)

Deaired water was used as the liquid permeant.

Terracon
Consulting Engineers & Scientists

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

Laboratory Services Group 750 Corporate Woods Parkway Vernon Hills, Illinois 60061 Phone:(847) 793-0306 Fax:(847) 793-0309

TERRACON PROJECT NO.:	**MR155233**	**12/21/2015**
PROJECT NAME:	**DYNERGY - HENNEPIN SITE**	
CLIENT:	**AECOM**	
LOCATION :	**HENNEPIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	HEN-B017
SAMPLE NO.	S-3
DEPTH:	5.0'-7.0'
CLASSIFICATION	VERY DARK GRAY LEAN CLAY WITH SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	76.0	82.8
WATER CONTENT (%)	36.7	38.2
DIAMETER (cm)	6.929	6.692
LENGTH (cm)	7.541	7.425

SAMPLE PHOTO

HYDRAULIC GRADIENT (MAXIMUM)	26.49
PERCENT SATURATION	99.3
HYDRAULIC CONDUCTIVITY k (cm/sec)	6.79E-07

(Percent saturation calculation is based on final measurements and an estimated specific gravity.)

Deaired water was used as the liquid permeant.

Terracon
Consulting Engineers & Scientists

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

Laboratory Services Group 750 Corporate Woods Parkway Vernon Hills, Illinois 60061 Phone:(847) 793-0306 Fax:(847) 793-0309

TERRACON PROJECT NO.:	**MR155233**	**12/21/2015**
PROJECT NAME:	**DYNERGY - HENNEPIN SITE**	
CLIENT:	**AECOM**	
LOCATION :	**HENNEPIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	HEN-B023
SAMPLE NO.	S-9
DEPTH:	27.0'-29.0'
CLASSIFICATION	VERY DARK GRAY FLY ASH WITH SAND AND GRAVEL

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	81.8	83.2
WATER CONTENT (%)	28.3	31.5
DIAMETER (cm)	7.154	7.063
LENGTH (cm)	5.432	5.479
HYDRAULIC GRADIENT (MAXIMUM)	17.36	
PERCENT SATURATION	100.4	
HYDRAULIC CONDUCTIVITY k (cm/sec)	1.00E-05	

SAMPLE PHOTO

(Percent saturation calculation is based on final measurements and an estimated specific gravity.)

Deaired water was used as the liquid permeant.

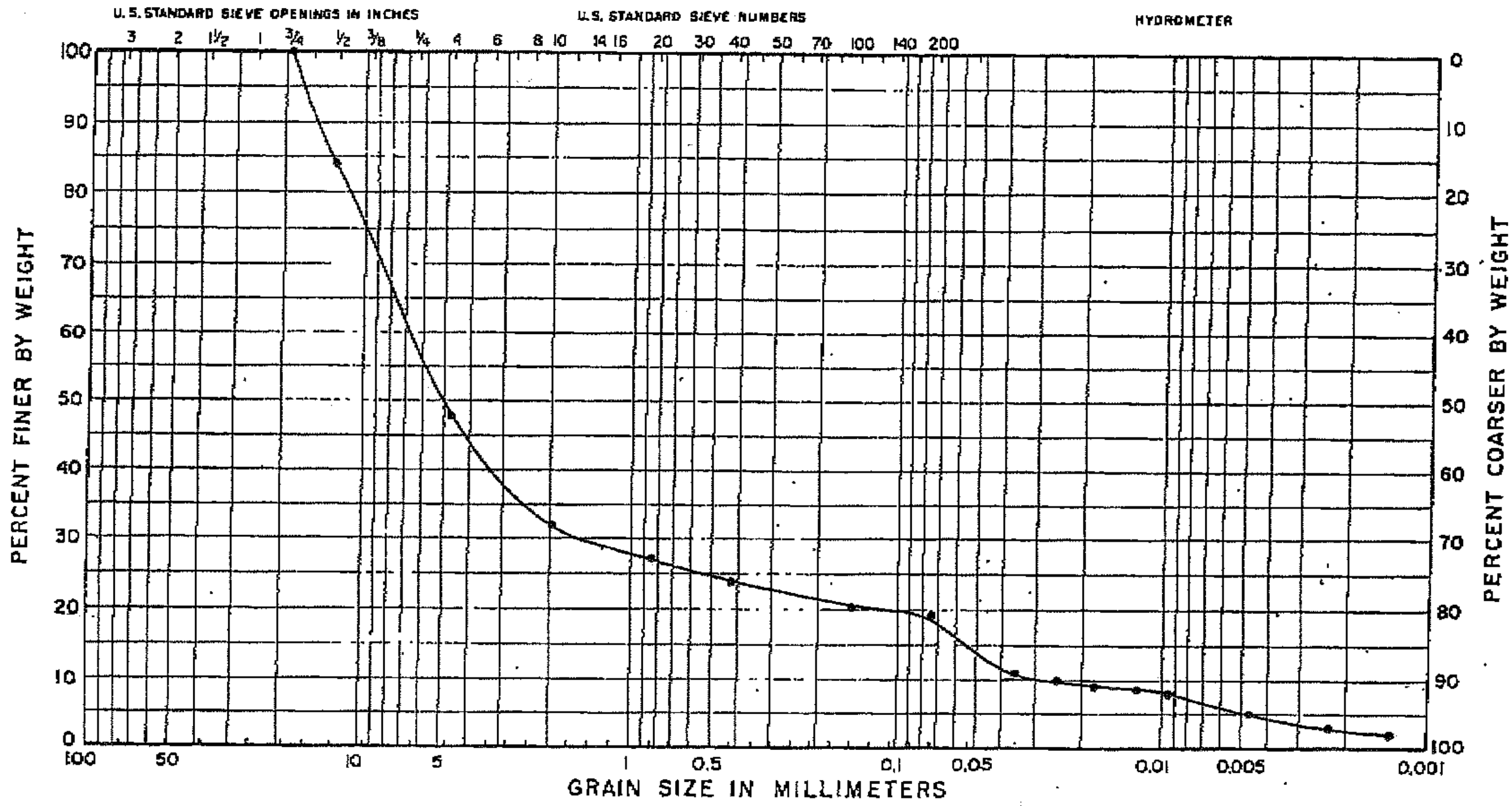
Appendix E

Geotechnical Test Data

Appendix E1

MATHES Grain Size Analysis

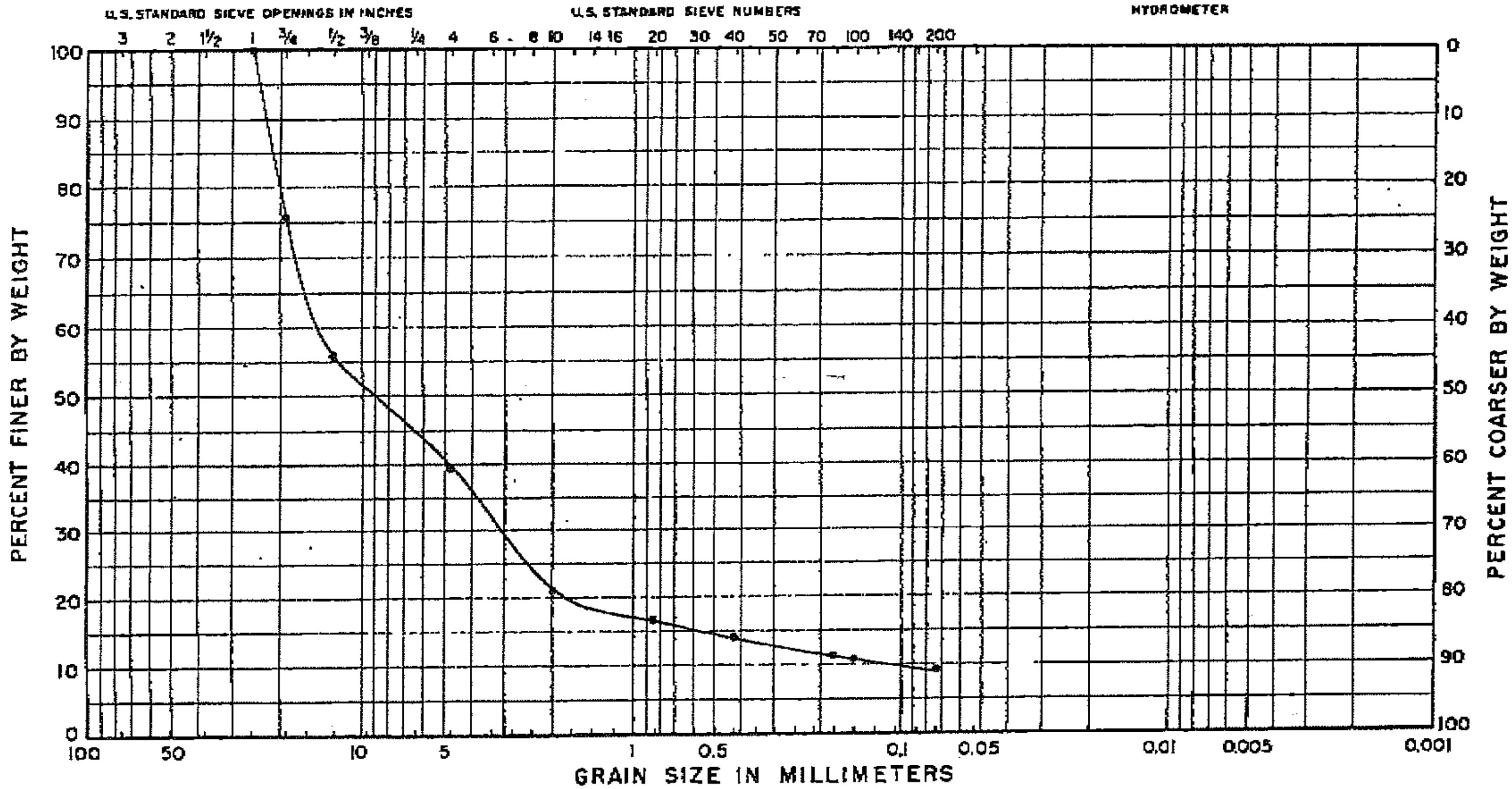
GRAIN SIZE CURVES



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Boring	Sample	Depth	D_{10}	Description
E4	9	39.0-40.5'	.03	Gray-Brown GRAVEL w/Sand, Silt, GM

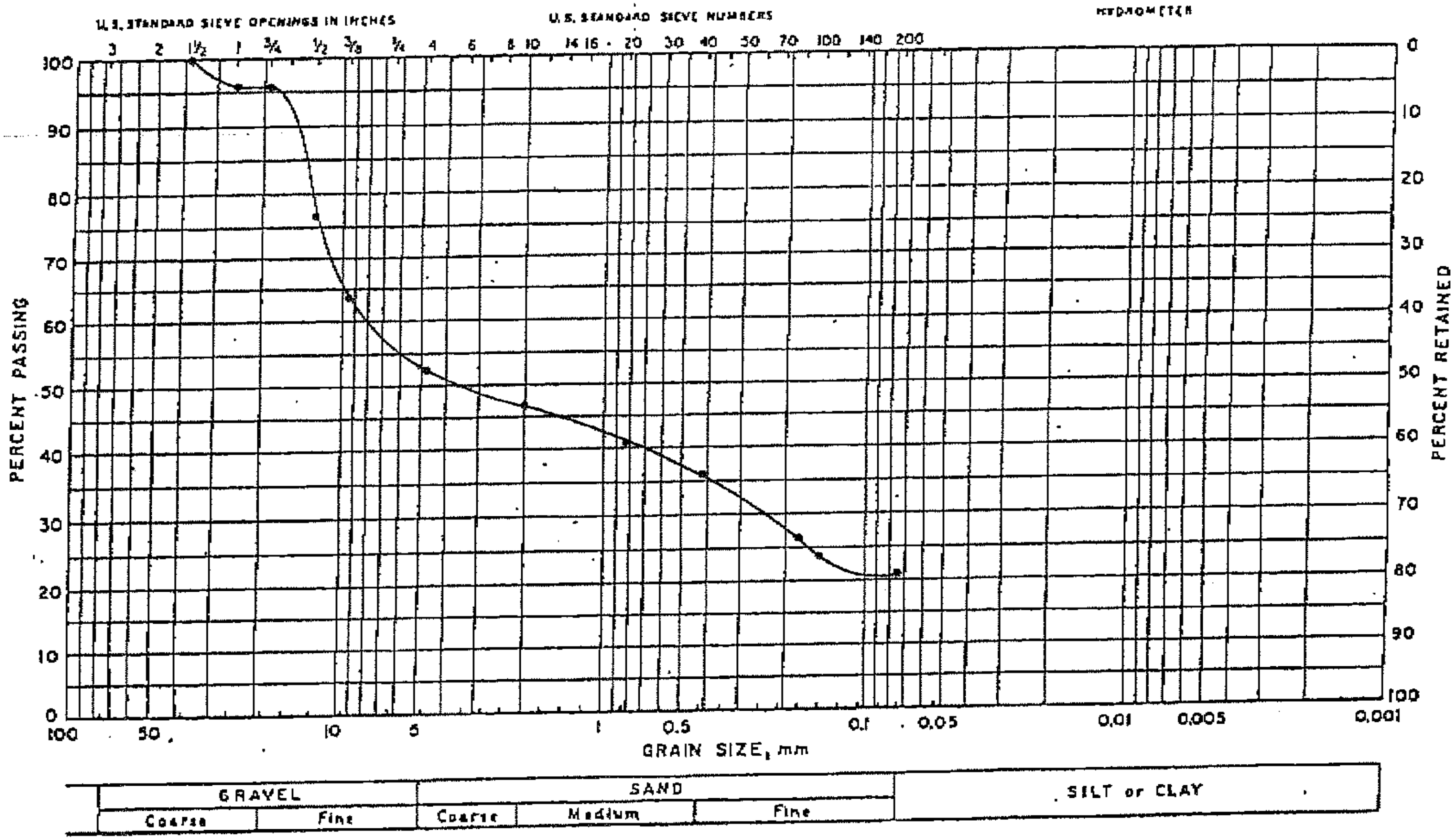
GRAIN SIZE CURVES



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Boring	Sample	Depth	D_{10}	Description
E5	9	44.0-45.5'	.11	Brown GRAVEL w/Sand Trace Silt, GP-GM

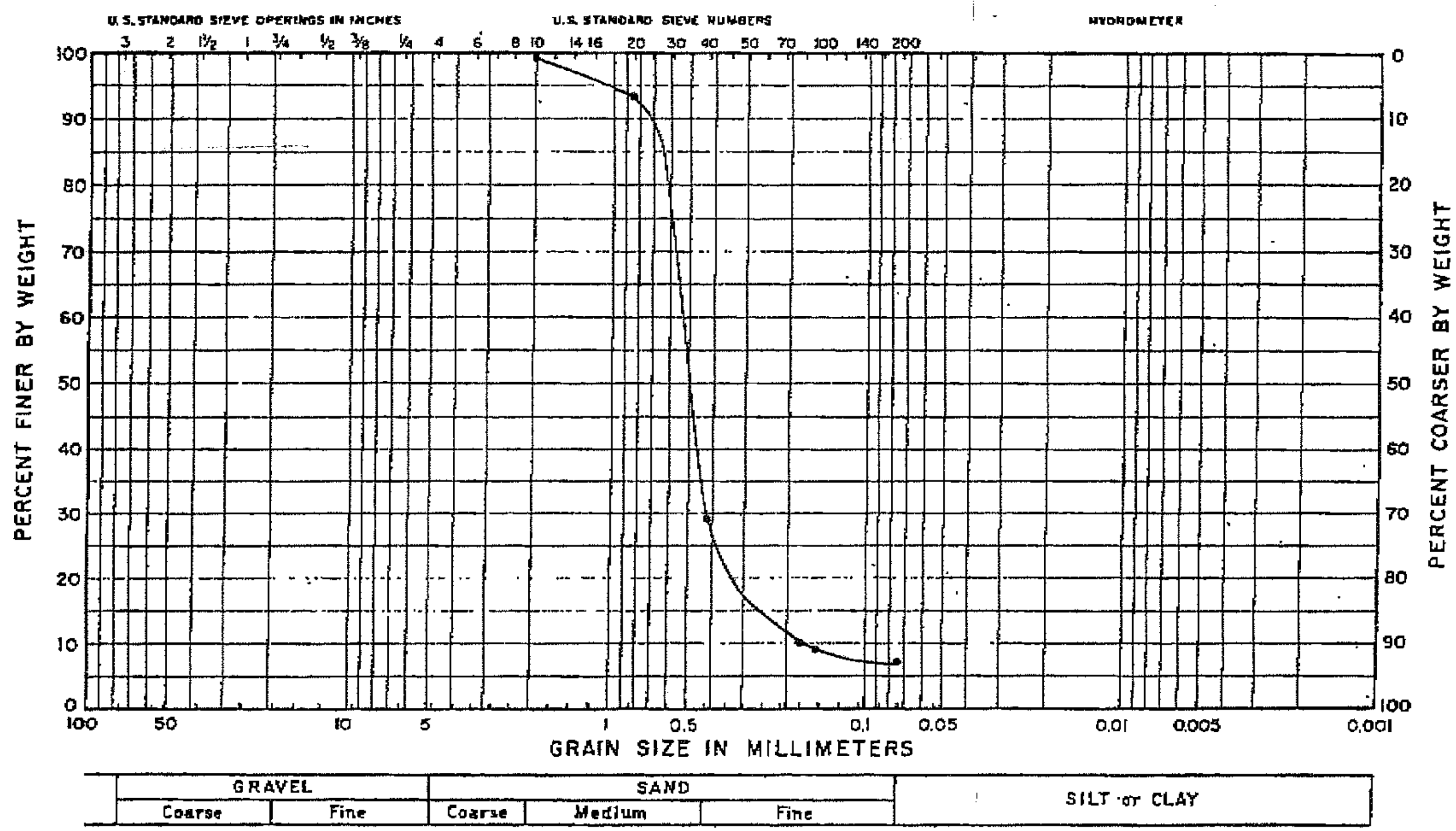
PARTICLE SIZE ANALYSIS



JOB NO. 04-1934 PROJECT I.P. Hennepin, Hydrogeologic Investigation

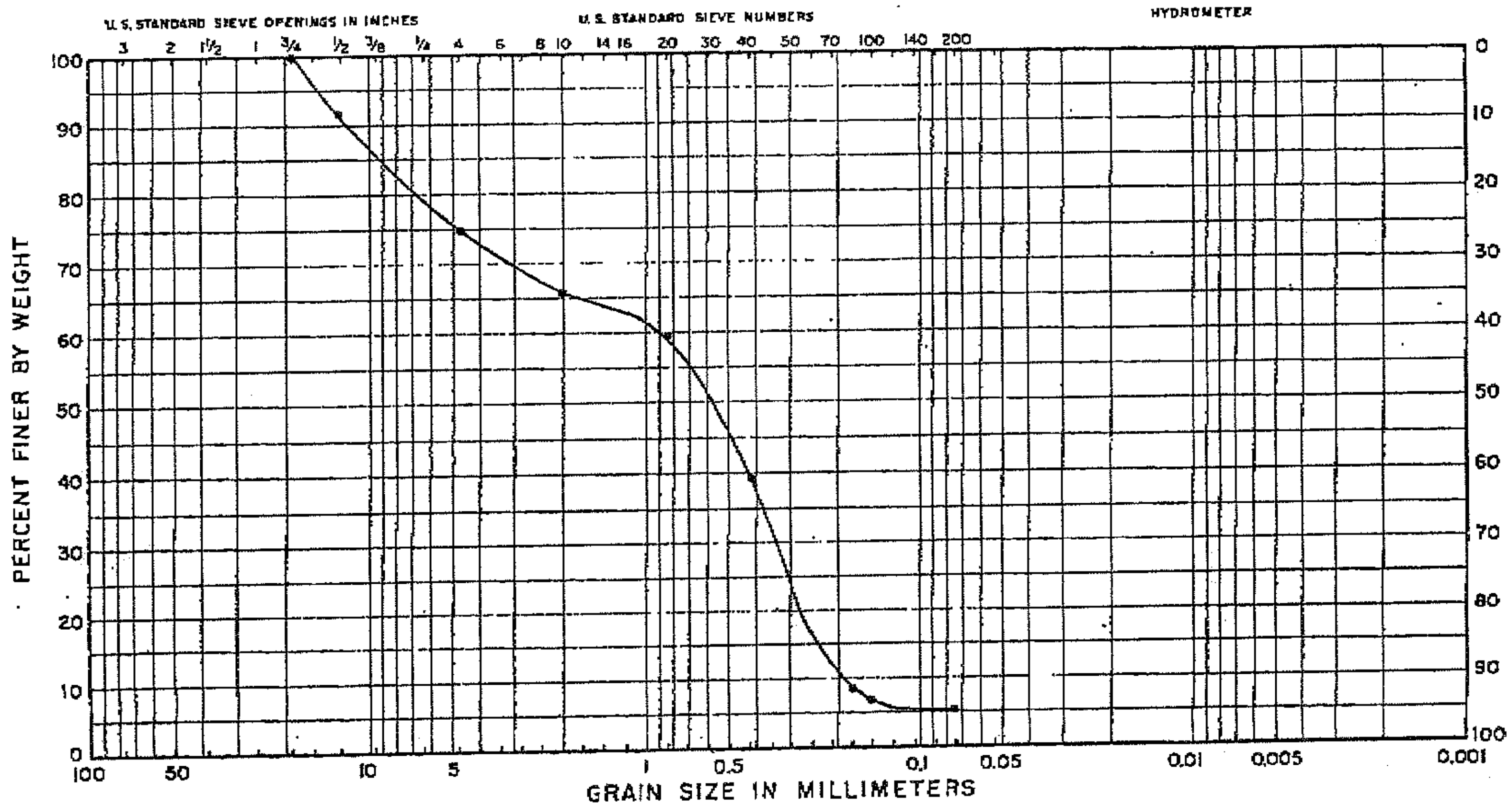
CURVE	BORING	SAMPLE	DEPTH, ft	DESCRIPTION
3	E-8B	12	58.0-59.5'	Brown Sandy GRAVEL w/Silt, Clay, GC-GM

GRAIN SIZE CURVES



Boring	Sample	Depth	D_{10}	Description
W1	11	54.0-55.5'	.2	Gray Fine-Medium SAND w/Shells Trace Silt, SP-SM

GRAIN SIZE CURVES



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Boring	Sample	Depth	D_{10}	Description
W4	13	59.0-60.5'	.19	Dark Gray Gravelly Fine-Medium SAND Trace Silt, SP-SM

Appendix E2

AECOM Geotechnical Test Results

XXX–X### — EXPLORATION METHOD (B=BORING, C=CPT, P=PIEZOMETER); ID NUMBER; STATION ABBREVIATION

LEGEND

- PROPOSED BORING LOCATION
- PROPOSED CPT LOCATION
- PROPOSED PIEZOMETER LOCATION
- PROPOSED CROSS SECTION LOCATION
- CCR UNIT BERM ALIGNMENT

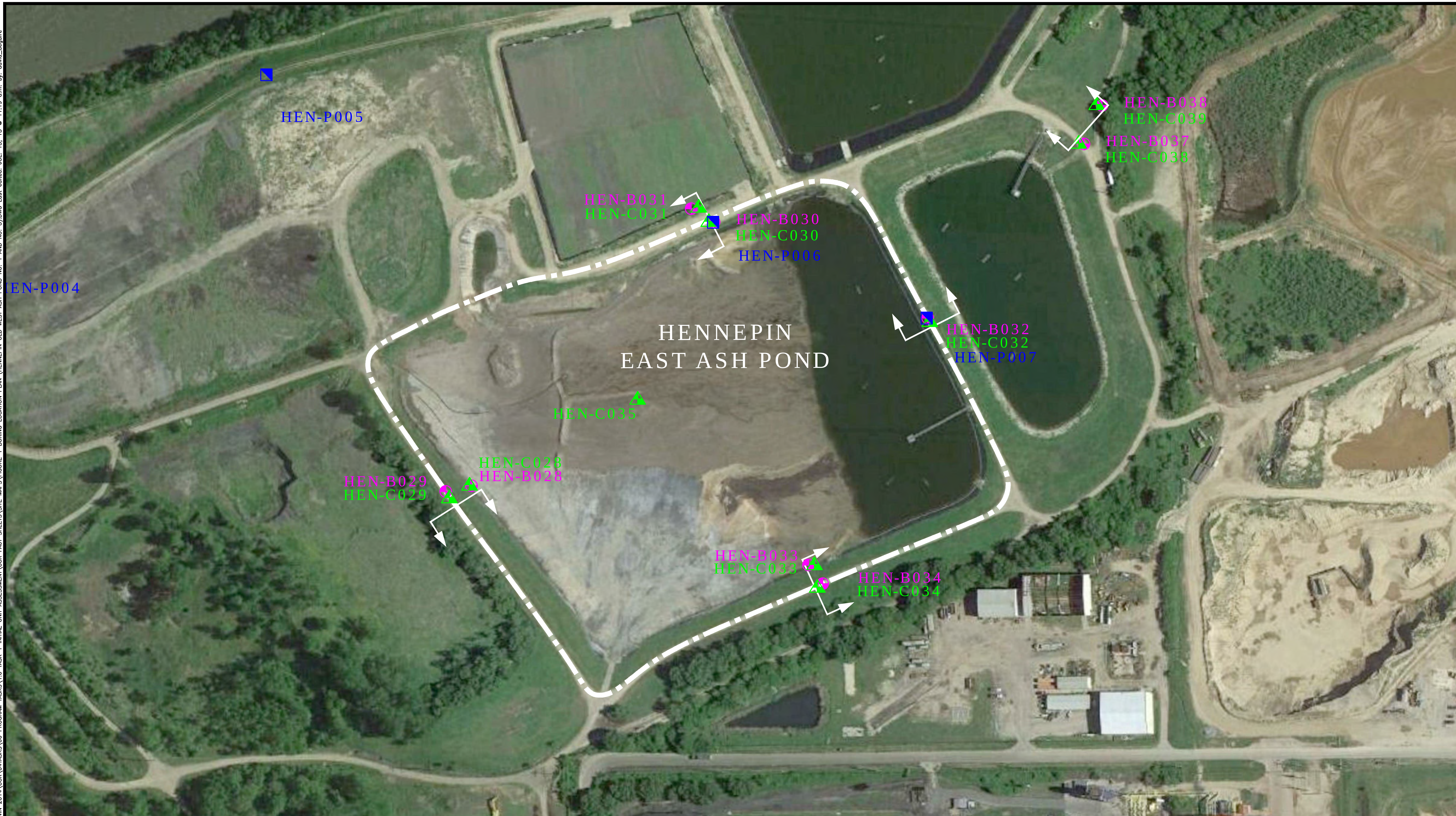
SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

DRAFT

0 200
APPROXIMATE SCALE FEET

N

DYNEGY, INC	PROJECT NO. 60428794
AECOM	
DRN. BY: djd July 2015 DSGN. BY: eg CHKD. BY: eg	Hennepin Ash Pond No. 2 Field Investigation Plan — FIG. NO. D-01



XXX–X### — EXPLORATION METHOD (B=BORING, C=CPT, P=PIEZOMETER); ID NUMBER; STATION ABBREVIATION

LEGEND

PROPOSED BORING LOCATION

PROPOSED CPT LOCATION

PROPOSED PIEZOMETER LOCATION

PROPOSED CROSS SECTION LOCATION

CCR UNIT BERM ALIGNMENT

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

DRAFT

N

0 200

APPROXIMATE SCALE FEET

7

DYNEGY, INC		PROJECT NO. 60428794
AECOM		
DRN. BY: djd July 2015 DSGN. BY: eg CHKD. BY: eg	Hennepin East Ash Pond Field Investigation Plan	FIG. NO. D-02

Terracon

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Hennepin Site PROJECT NUMBER: MR155233 CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	% Fines	LL	PL	PI	Specific Gravity
HEN-B001	S-1	0.0'-1.5'	POSSIBLE FILL: REDDISH BROWN SANDY LEAN CLAY - ROOTS AND BRICK NOTED	CL	7.6										
HEN-B001	S-2	2.5'-4.0'	DARK BROWN SANDY LEAN CLAY	CL	13.1										
HEN-B001	S-3	5.0'-7.5'	DARK BROWN LEAN CLAY WITH SAND	CL	19.0										
HEN-B001	S-4	7.5'-9.5'	BROWN AND GRAY LEAN CLAY WITH SAND - SAND SEAMS NOTED	CL	17.4							21	14	7	
HEN-B001	S-5	10.0'-11.5'	BROWN AND DARK BROWN SANDY LEAN CLAY	CL	16.8										
HEN-B001	S-6	15.0'-16.5'	GRAY LEAN CLAY	CL	44.8										
HEN-B001	S-7	20.0'-22.0'	GRAY ORGANIC LEAN CLAY - SHELL NOTED	CL	37.0							38	22	16	
HEN-B001	S-8	25.0'-26.5'	GRAYISH BROWN LEAN CLAY	CL	30.6										
HEN-B001	S-9	30.0'-31.5'	BROWN LEAN CLAY	CL	36.6										
HEN-B001	S-10	35.0'-36.5'	DARK GRAY LEAN CLAY - ORGANICS NOTED	CL	39.8										
HEN-B001	S-11	40.0'-41.5'	DARK GRAY FAT CLAY	CH	43.3							59	30	29	
HEN-B001	S-12	45.0'-46.5'	GRAY SANDY LEAN CLAY	CL	31.5										
HEN-B001	S-13	50.0'-51.5'	GRAY SAND WITH GRAVEL	SP	18.6										
HEN-B001	S-14	55.0'-56.5'	BROWN AND GRAY SILTY SAND WITH GRAVEL	SM	7.4										
HEN-B002	S-1	0.0-1.5'	FILL: BROWN SANDY LEAN CLAY	CL	5.7										
HEN-B002	S-2	2.5'-4.0'	BROWN POORLY GRADED SAND WITH CLAY	SP-SC	6.8										2.68
HEN-B002	S-3	5.5'-6.5'	GRAY SANDY LEAN CLAY	CL	15.0										
HEN-B002	S-4	7.5'-9.0'	BROWN SILT WITH CLAY	ML	9.3							20	14	6	
HEN-B002	S-6	15.0'-16.5'	BROWN POORLY GRADED SAND WITH SILT AND GRAVEL	SP-SM	15.7		22.7	65.7	7.2	4.4	11.6				
HEN-B002	S-7A	20.0'-20.8'	BROWN CLAYEY SAND	SC	7.4										
HEN-B002	S-7B	20.8'-21.5'	GRAY SILTY LEAN CLAY	CL-ML	47.1										
HEN-B002	S-8	25.0'-27.0'	DARK GRAY LEAN CLAY WITH SAND AND GRAVEL - FLY ASH NOTED	OL	24.6							41	23	18	
HEN-B002	S-9	30.0'-31.5'	GRAYISH BROWN LEAN CLAY	CL	32.0										
HEN-B002	S-10	35.0'-37.0'	GRAY LEAN CLAY	CL	31.7							46	21	25	
HEN-B002	S-11	40.0'-41.5'	BROWN AND GRAY LEAN CLAY	CL	57.9										
HEN-B002	S-12A	45.0'-46.0'	DARK GRAY LEAN CLAY - ORGANICS NOTED	CL	57.9										
HEN-B002	S-12B	46.0'-46.5'	GRAY CLAYEY SILT	CL-ML	43.1										
HEN-B002	S-13	50.0'-51.5'	BROWN AND GRAY SILTY SAND	SM	21.2										
HEN-B002	S-14	55.0'-56.5'	BROWN POORLY GRADED SAND WITH SILT AND GRAVEL	SP-SM	15.3		16.8	71.3			11.9				
HEN-B002	S-15	60.0'-61.5'	GRAY GRAVEL	GP	4.0										

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Hennepin Site   PROJECT NUMBER: MR155233   CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	% Fines	LL	PL	PI	Specific Gravity
HEN-B003	S-1	0.0'-1.5'	GRAY SILTY LEAN CLAY	CL	70.4										
HEN-B003	S-2	2.5'-4.0'	GRAY CLAYEY SILT	CL-ML	42.9										
HEN-B003	S-3	5.0'-6.5'	GRAY CLAYEY SILT	CL-ML	49.5										
HEN-B003	S-4	7.5'-9.0'	GRAY SILTY LEAN CLAY	CL	48.5										
HEN-B003	S-5	10.0'-12.0'	BLACK ORGANIC CLAY WITH SAND - WOOD NOTED	OL	38.5										
HEN-B003	S-6	15.0'-16.5'	BROWN TO GRAY LEAN CLAY	CL	36.8										
HEN-B003	S-7	20.0'-21.5'	GRAYISH BROWN LEAN CLAY	CL	32.2										
HEN-B003	S-8	25.0'-27.5'	DARK GRAY LEAN CLAY	CL	32.1							45	21	24	
HEN-B003	S-9	30.0'-31.5'	DARK GRAY LEAN CLAY	CL	66.3										
HEN-B003	S-10	35.0'-36.5'	GRAY LEAN CLAY	CL	44.4										
HEN-B003	S-11	40.0'-41.5'	BROWN AND GRAY SANDY SILT	ML	30.3										
HEN-B003	S-12	45.0'-46.5'	CLAYEY SAND WITH SILT	SC	15.6										
HEN-B003	S-13	50.0'-51.5'	BROWN CLAYEY SAND WITH GRAVEL	SC	7.7										
HEN-B004	S-1	0.0'-0.5'	FILL: SILTY SAND - CLAY LENSES NOTED	SM	8.9										
HEN-B004	S-1A	0.5'-1.5'	BROWN SILTY SAND WITH GRAVEL - CLAY LENSES NOTED	SM	6.8										
HEN-B004	S-2	2.5'-4.0'	BROWN, TAN AND GRAY POORLY GRADED GRAVEL WITH SAND	GP	2.9										2.746
HEN-B004	S-3	5.0'-6.5'	BROWN SANDY LEAN CLAY WITH GRAVEL	CL	6.3										
HEN-B004	S-4	7.5'-9.0'	GRAY SILTY SAND	SM	22.2										
HEN-B004	S-5	10.0'-12.0'	BROWN BLACK AND GRAY SANDY SILT WITH GRAVEL	ML	36.8							32	35	NP	
HEN-B004	S-6	15.0'-16.5'	DARK BROWN SANDY LEAN CLAY	CL	14.9										
HEN-B004	S-7	20.0'-22.0'	VERY DARK GRAY LEAN CLAY - ORGANICS NOTED	CL	29.7							45	23	22	
HEN-B004	S-8	25.0'-26.5'	GRAY LEAN CLAY	CL	32.0										
HEN-B004	S-9	30.0'-32.0'	BROWN AND GRAY LEAN CLAY	CL	33.5							43	22	21	
HEN-B004	S-10	35.0'-36.5'	GRAYISH BROWN LEAN CLAY WITH SAND	CL	19.5										
HEN-B004	S-11	40.0'-41.5'	DARK BROWN LEAN CLAY	CL	10.9										
HEN-B004	S-12	45.0'-46.5'	BROWN CLAYEY SAND WITH SILT AND GRAVEL	SC	7.2										
HEN-B005	S-1	4.0'-6.0'	DARK GRAY TO BROWN CLAYEY SILT WITH SAND	CL-ML	28.5										
HEN-B005	S-2	7.5'-9.5'	BLACK TO VERY DARK GRAY ORGANIC CLAY	OL	59.5										
HEN-B005	S-4	12.5'-14.5'	DARK GRAY LEAN CLAY WITH SAND AND FLY ASH	CL	53.0		0.0	16.2	51.2	32.6	83.8	43	24	19	
HEN-B005	S-5	14.5'-16.0'	DARK GRAY LEAN CLAY WITH GRAVEL	CL	16.3										
HEN-B005	S-3	10.0'-12.5'	GRAY ORGANIC CLAY WITH SAND	OL	41.4										
HEN-B005	S-6	20.0'-21.5'	BROWN AND GRAY CLAYEY GRAVEL WITH SAND	GC	7.8										
HEN-B005	S-7	25.0'-27.0'	BROWN CLAYEY GRAVEL	GC	7.2										

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Hennepin Site | PROJECT NUMBER: MR155233 | CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	% Fines	LL	PL	PI	Specific Gravity
HEN-B006	S-1	0.0'-1.5'	FILL: BROWN SILTY SAND WITH GRAVEL	SM	4.4										
HEN-B006	S-2	2.5'-4.0'	BROWN AND LIGHT BROWN POORLY GRADED SAND WITH GRAVEL	SP	6.8										2.665
HEN-B006	S-3	5.0'-6.5'	BROWN SILTY SAND - CLAY LENSES NOTED	SM	5.9										
HEN-B006	S-4	7.5'-9.0'	POSSIBLE FILL: DARK BROWN SANDY LEAN CLAY	CL	7.1										
HEN-B006	S-5	10.0'-11.5'	BROWN SILTY SAND	SM	14.6										
HEN-B006	S-6	15.0'-16.5'	BROWN SILTY SAND	SM	13.8		0.8	62.3	23.1	13.8	36.9				
HEN-B006	S-7	20.0'-21.5'	BROWN GRAVELLY SAND	SP-SM	7.9										
HEN-B006	S-8	25.0'-26.5'	BROWN GRAVELLY SAND	SP-SC	8.2										
HEN-B006	S-9	30.0'-31.5'	LIGHT BROWN SILTY GRAVEL WITH SAND	GM	15.2		42.4	38.3	12.1	7.2	19.3				
HEN-B006	S-10	35.0'-36.5'	BROWN GRAVELLY LEAN CLAY WITH SAND	CL	10.7										
HEN-B006	S-11	40.0'-41.5'	BROWN GRAVELLY SAND	SP	9.1										
HEN-B007	S-1	3.5'-5.0'	FILL: GRAY SILTY SAND - ASPHALT NOTED	SM	31.2										
HEN-B007	S-2	5.0'-5.5'	GRAYISH BROWN TO DARK GRAY SILTY SAND WITH CLAY	SM	36.2										
HEN-B007	S-2A	5.5'-6.5'	GRAY GRAVELLY LEAN CLAY WITH SAND	CL	7.1										
HEN-B007	S-3	7.5'-9.0'	GRAYISH BROWN CLAYEY GRAVEL WITH SAND	GC	6.0										
HEN-B007	S-4	10.0'-11.0'	BROWN POORLY GRADED GRAVEL WITH CLAY	GP-GC	17.6										
HEN-B007	S-4A	11.0'-11.5'	BROWN CLAYEY GRAVEL WITH SAND	GC	9.5										
HEN-B007	S-5	12.5'-14.5'	BROWN CLAYEY SAND WITH SILT	SC	10.2										
HEN-B007	S-6	15.0'-16.5'	BROWN GRAVEL WITH POORLY GRADED SAND AND SILT	GP	11.1		59.2	28.9	7.2	4.7	11.9				
HEN-B007	S-7	20.0'-21.5'	BROWN CLAYEY SAND WITH GRAVEL	SC	11.3										
HEN-B008	S-1	0.0'-1.5'	POSSIBLE FILL: GRAY FLY ASH - WOODCHIPS NOTED		34.5										
HEN-B008	S-2	2.5'-4.0'	GRAY FLY ASH		44.7										
HEN-B008	S-3	5.0'-6.5'	DARK GRAY TO BLACK SANDY SILT	ML	49.0		1.5	41.0	47.9	9.6	57.5				
HEN-B008	S-4	7.5'-9.5'	MULTI STRATA SAMPLE: TOP, FLY ASH - MIDDLE, FLY ASH LEAN CLAY WITH SAND MIX - BOTTOM, BROWN SANDY CLAY		43.4										
HEN-B008	S-5	10.0'-11.5'	BROWN AND DARK BROWN LEAN CLAY	CL	16.2										
HEN-B008	S-6	15.0'-16.5'	BROWN POORLY GRADED SAND WITH GRAVEL	SP	9.8										
HEN-B008	S-7	20.0'-21.5'	BROWN POORLY GRADED GRAVEL WITH SILT AND SAND	GP-GM	7.4		54.4	33.9			11.7				

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Hennepin Site PROJECT NUMBER: MR155233 CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	% Fines	LL	PL	PI	Specific Gravity
HEN-B009	S-1	0.0'-1.5'	FILL: DARK BROWN SILTY SAND	SM	10.6										
HEN-B009	S-2	2.5'-4.0'	DARK GRAY AND BLACK SILT WITH SAND AND GRAVEL	ML	11.3										
HEN-B009	S-3	5.0'-6.5'	GRAY SILTY SAND	SM	15.5										
HEN-B009	S-4	8.0'-9.0'	DARK BROWN SILT WITH SAND	ML	10.0										2.672
HEN-B009	S-5	10.0'-11.5'	DARK BROWN AND BROWN LEAN CLAY WITH SILT AND SAND	CL	17.7										
HEN-B009	S-6	15.0'-16.5'	BROWN SILTY SAND WITH GRAVEL	SM	7.3										
HEN-B009	S-7	20.0'-21.5'	BROWN CLAYEY SAND WITH GRAVEL	SC	7.7										
HEN-B009	S-8	25.0'-26.5'	BROWN SILTY SAND	SM	20.1		0.4	76.9			22.7				
HEN-B009	S-9	30.0'-31.5'	BROWN POORLY GRADED SAND	SP	20.9										
HEN-B009	S-10A	35.0'-35.5'	BROWN SILTY LEAN CLAY	CL	27.7										
HEN-B009	S-10B	35.5'-36.0'	BROWN SILTY LEAN CLAY	CL	26.4										
HEN-B009	S-10C	36.0'-36.5'	BROWN SILTY LEAN CLAY	CL	25.9										
HEN-B009	S-11	40.0'-41.5'	BROWN SILTY SAND	SM	27.2		0.0	70.3			29.7				
HEN-B009	S-12A	45.0'-45.5'	BROWN SILTY LEAN CLAY	CL	24.4										
HEN-B009	S-12B	45.5'-46.5'	BROWN SILTY SAND	SM	26.4										
HEN-B009	S-13	50.0'-51.5'	BROWN AND DARK BROWN CLAYEY SAND WITH GRAVEL	SC	10.3										
HEN-B010	S-1	0.0'-1.5'	POSSIBLE FILL: BROWN, GRAYISH BROWN AND GRAY SAND WITH GRAVEL	SP-SM	3.6										
HEN-B010	S-2A	2.5'-3.5'	BROWN SANDY CLAY	CL	11.2										
HEN-B010	S-2B	3.5'-4.0'	BROWN, GRAY AND DARK GRAY POORLY GRADED SAND WITH GRAVEL	SP	7.6										
HEN-B010	S-3	5.0'-6.5'	DARK GRAY FLY ASH		26.6										
HEN-B010	S-4	7.5'-9.0'	BROWN AND DARK BROWN SILTY SAND	SM	28.3		1.3	77.9			20.8				2.723
HEN-B010	S-5	10.0'-11.5'	VERY DARK GRAY FLY ASH WITH SAND AND GRAVEL		29.8							29	33	NP	
HEN-B010	S-6	15.0'-16.5'	DARK BROWN LEAN CLAY	CL	19.7										
HEN-B010	S-7	20.0'-21.5'	BROWN TO DARK BROWN POORLY GRADED SAND WITH SILT AND GRAVEL	SP-SM	14.2		24.8	61.0	9.3	4.9	14.2				
HEN-B010	S-8	25.0'-26.5'	BROWN POORLY GRADED SAND	SP	10.4										
HEN-B010	S-9	30.0'-31.5'	BROWN GRAVELLY SAND	SP	9.1										
HEN-B010	S-10	35.0'-36.5'	BROWN POORLY GRADED SAND	SP	20.3										
HEN-B010	S-11	40.0'-41.5'	BROWN SILTY SAND WITH GRAVEL	SM	16.2		8.2	67.9			23.9				
HEN-B011	S-1	0.0'-1.5	POSSIBLE FILL: DARK BROWN POORLY GRADED SAND - ROOTS NOTED	SP	10.5										
HEN-B011	S-2	2.5'-4.0'	RUST BROWN SANDY LEAN CLAY	CL	12.7							22	15	7	2.693
HEN-B011	S-3	5.0'-6.5'	BROWN POORLY GRADED SAND	SP	15.2										
HEN-B011	S-4	7.5'-9.0'	BROWN AND DARK BROWN POORLY GRADED SAND	SP	19.8										
HEN-B011	S-5	10.0'-11.5'	BROWN POORLY GRADED SAND	SP	13.2										
HEN-B011	S-6	15.0'-16.5'	BROWN SILTY GRAVEL WITH SAND	GM	7.3		47.4	36.6			16.0				
HEN-B011	S-7	20.0'-21.5'	BROWN AND GRAYISH BROWN POORLY GRADED GRAVEL	GP	6.3										

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Hennepin Site

PROJECT NUMBER: MR155233

CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	% Fines	LL	PL	PI	Specific Gravity
HEN-B012	S-1	0.0'-1.5'	DARK BROWN SILTY SAND WITH GRAVEL - CLAY LENSES NOTED	SM	4.5										
HEN-B012	S-2	2.5'-4.0'	LIGHT BROWN AND LIGHT GRAY SILTY GRAVEL WITH SAND	GM	4.9		47.5	33.4	11.1	8.0	19.1				
HEN-B012	S-3	5.0'-6.5'	BROWN SANDY LEAN CLAY WITH GRAVEL	CL	7.7										
HEN-B012	S-4	8.0'-9.0'	BROWN SILTY LEAN CLAY WITH SAND	CL	9.0										
HEN-B012	S-5	10.0'-11.5'	DARK BROWN LEAN CLAY WITH SILT AND SAND - SILT AND SAND SEAM NOTED	CL	14.3							23	14	9	
HEN-B012	S-6	15.0'-16.5'	DARK GRAY SILTY SAND	SM	45.4										
HEN-B012	S-7	20.0'-22.0'	VERY DARK GRAY LEAN CLAY - ORGANICS NOTED	CL	38.1		0.0	2.7	38.5	58.8	97.3				
HEN-B012	S-8	25.0'-26.5'	DARK GRAY LEAN CLAY	CL	22.5										
HEN-B012	S-9	30.0'-32.0'	BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND	CL	26.0							30	15	15	
HEN-B012	S-10	35.0'-36.5'	GRAYISH BROWN LEAN CLAY	CL	26.2										
HEN-B012	S-11	40.0'-41.5'	BROWN SILTY SAND WITH GRAVEL	SM	4.4										
HEN-B012	S-12	45.0'-46.5'	BROWN SILTY SAND WITH GRAVEL	SM	11.3										
HEN-B014	S-1	0.0'-1.5'	FILL: DARK BROWN AND GRAYISH BROWN SILTY SAND WITH GRAVEL	SM	7.0										
HEN-B014	S-2	2.5'-4.0'	FILL: DARK BROWN SILTY SAND WITH GRAVEL - ORGANIC CLAY AND BRICK NOTED	SM	7.0										
HEN-B014	S-3	5.5'-6.5'	GREENISH GRAY CLAYEY SILT WITH SAND	CL-ML	39.2										
HEN-B014	S-4	7.5'-9.0'	DARK GRAY FLY ASH		36.8		1.1	32.1	58.1	8.7	66.8				
HEN-B014	S-5A	10.0'-11.0'	DARK GRAY FLY ASH WITH SAND		34.2										
HEN-B014	S-5B	11.0'-11.5'	DARK GRAY FLY ASH		43.4										
HEN-B014	S-6A	15.0'-16.0'	DARK GRAY FLY ASH		61.1										
HEN-B014	S-6B	16.0'-16.5'	DARK GRAY LEAN CLAY - ORGANICS NOTED	CL	29.8										
HEN-B014	S-7	20.0'-21.5'	GRAYISH BROWN AND DARK GRAY LEAN CLAY - ORGANICS NOTED	CL	33.7										
HEN-B014	S-8	25.0'-27.0'	BROWN AND GRAY LEAN CLAY	CL	32.4							43	20	23	
HEN-B014	S-9	30.0'-31.5'	GRAYISH BROWN AND DARK GRAY LEAN CLAY - ORGANICS NOTED	CL	38.1										
HEN-B014	S-10	35.0'-37.0'	VERY DARK BROWNISH GRAY ORGANIC SILT	OH	63.4							70	38	32	
HEN-B014	S-11	40.0'-41.5'	DARK GRAY PEAT	PT	77.8										
HEN-B014	S-12	45.0'-46.5'	GRAY POORLY GRADED SAND WITH SILT	SP-SM	22.6		4.3	86.4	5.1	4.2	9.3				
HEN-B014	S-13	50.0'-51.5'	GRAY SILTY SAND	SM	13.2										
HEN-B014	S-14	55.0'-56.5'	GRAYISH BROWN SILTY SAND WITH GRAVEL	SM	8.1										
HEN-B014	S-15	60.0'-61.5'	BROWN AND GRAYISH BROWN SILTY SAND WITH CLAY AND GRAVEL	SM	14.4										

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LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Hennepin Site　　PROJECT NUMBER: MR155233　　CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	% Fines	LL	PL	PI	Specific Gravity
HEN-B015	S-1	0.5'-1.5'	BROWN AND GRAY SANDY LEAN CLAY	CL	18.4										
HEN-B015	S-2	2.5'-4.0'	DARK GRAY LEAN CLAY	CL	2.9										
HEN-B015	S-3	5.0'-6.5'	BROWN TO GRAY LEAN CLAY	CL	35.7										
HEN-B015	S-4	7.5'-9.5'	BLACK AND DARK GRAY ORGANIC LEAN CLAY WITH SAND AND GRAVEL	OL	131.9							48	25	23	
HEN-B015	S-5	10.0'-11.5'	DARK BROWN TO GRAY LEAN CLAY	CL	32.3										
HEN-B015	S-6	15.0'-16.5'	BROWN AND GRAY LEAN CLAY	CL	32.1										
HEN-B015	S-7	20.0'-21.5'	GRAY LEAN CLAY	CL	41.6										
HEN-B015	S-8	25.0'-27.0'	BLACK ORGANIC SILT WITH SAND	OH	67.8							74	37	37	
HEN-B015	S-9	30.0'-31.5'	GRAY AND DARK GRAY CLAYEY SAND WITH SILT	SC	40.1										
HEN-B015	S-10	35.0'-36.5'	GRAY POORLY GRADED SAND WITH SILT	SP-SM	24.5										
HEN-B015	S-11	40.0'-41.5'	BROWN CLAYEY SAND WITH GRAVEL	SC	8.7										
HEN-B015	S-12	45.0'-46.5'	GRAY AND BROWN POORLY GRADED GRAVEL WITH SILT AND SAND	GP-GM	10.9		49.3	40.5	7.1	3.1	10.2				
HEN-B016	S-1	0.0'-1.5'	POSSIBLE FILL: DARK BROWN SANDY LEAN CLAY - GRAVEL AND BRICK NOTED	CL	7.1										
HEN-B016	S-2	2.5'-4.5'	BROWN SANDY LEAN CLAY	CL	6.3										
HEN-B016	S-3	5.0'-6.5'	DARK BROWN AND BROWN SILTY SAND WITH GRAVEL		10.1		31.5	45.2	13.0	10.3	23.3				
HEN-B016	S-4	7.5'-9.0'	BROWN SANDY LEAN CLAY WITH GRAVEL	CL	7.3										
HEN-B016	S-5	10.0'-11.5'	DARK GRAY FLY ASH WITH SAND		29.8										
HEN-B016	S-6	15.0'-16.5'	DARK GRAY LEAN CLAY - ORGANICS NOTED	CL	31.8										
HEN-B016	S-7	20.0'-22.0'	VERY DARK GRAY CLAY WITH SAND AND GRAVEL - ORGANICS AND ASH NOTED	CL	35.2							38	21	17	
HEN-B016	S-8	25.0'-26.5'	GRAY LEAN CLAY	CL	32.7										
HEN-B016	S-9	30.0'-31.5'	GRAYISH BROWN LEAN CLAY	CL	32.9										
HEN-B016	S-10	35.0'-37.0'	DARK GRAY LEAN CLAY WITH SAND - FLY ASH AND ORGANICS NOTED	CL	22.3							41	23	18	
HEN-B016	S-11	40.0'-41.5'	DARK GRAY ORGANIC CLAY	OL	48.8										
HEN-B016	S-12	45.0'-46.5'	GRAY LEAN CLAY	CL	42.3										
HEN-B016	S-13	51.0'-51.5'	GRAY POORLY GRADED SAND	SP	26.4										
HEN-B016	S-14	55.0'-56.5'	GRAY TO BROWN POORLY GRADED SAND	SP	18.7										
HEN-B016	S-15	60.0'-61.5'	DARK GRAY LEAN CLAY WITH SILT	CL	51.9							55	34	21	
HEN-B016	S-16	65.0'-66.5'	BROWN LEAN CLAY	CL	38.9										
HEN-B016	S-17	70.0'-71.5'	BROWNISH GRAY GRAVEL WITH SILT AND SAND	GP-GM	10.4		52.4	35.5	9.0	3.1	12.1				
HEN-B016	S-18	75.0'-76.5'	GRAYISH BROWN GRAVELLY SAND	SP	6.5										

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Hennepin Site   PROJECT NUMBER: MR155233   CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	% Fines	LL	PL	PI	Specific Gravity
HEN-B017	S-1	0.0'-1.5'	FILL: SILTY LEAN CLAY WITH SAND	CL	20.6										
HEN-B017	S-2	2.5'-4.0'	DARK BROWN SILTY SAND WITH CLAY	SM	24.1										
HEN-B017	S-3	5.0'-7.0'	VERY DARK GRAY LEAN CLAY WITH SAND	CL	36.7							39	21	18	
HEN-B017	S-4	7.5'-9.0'	GRAY TO BROWN ORGANIC CLAY	OL	35.4										
HEN-B017	S-5	10.0'-11.5'	GRAYISH BROWN LEAN CLAY - ORGANICS NOTED	CL	31.4										
HEN-B017	S-6	15.0'-17.0'	BROWN AND GRAY LEAN CLAY	CL	34.1							45	24	21	
HEN-B017	S-7	20.0'-21.5'	BROWN LEAN CLAY - ORGANICS NOTED	CL	34.8										
HEN-B017	S-8	25.0'-26.5'	BROWN AND GRAY LEAN CLAY	CL	31.7										
HEN-B017	S-9	30.0'-32.0'	DARK BROWNISH GRAY ORGANIC CLAY WITH SAND - SAND SEAMS AND SHELL NOTED	OL	50.0							60	35	25	
HEN-B017	S-10	35.0'-36.5'	GRAY LEAN CLAY	CL	41.8										
HEN-B017	S-11	40.5'-41.5'	GRAY CLAYEY SAND WITH SILT	SC	24.0										
HEN-B017	S-12	45.0'-46.5'	DARK GRAY SAND WITH SILT	SM	19.2		0.0	91.9	4.1	4.0	8.1				
HEN-B017	S-13	50.0'-51.5'	GRAY LEAN CLAY - ORGANICS NOTED	CL	46.8										
HEN-B017	S-14	55.0'-56.5'	GRAYISH BROWN LEAN CLAY - ORGANICS NOTED	CL	40.9										
HEN-B017	S-15	60.0'-61.5'	GRAY SILTY SAND WITH GRAVEL	SM	9.7										
HEN-B017	S-16	65.0'-66.5'	BROWN SILTY SAND WITH GRAVEL	SM	7.2										
HEN-B018	S-1	0.0'-1.5'	FILL: BROWN SILTY SAND WITH GRAVEL	SM	6.7										
HEN-B018	S-2A	2.5'-3.5'	BROWN SANDY LEAN CLAY	CL	10.2										
HEN-B018	S-2B	3.5'-4.0'	BROWN SILTY LEAN CLAY WITH GRAVEL	CL	9.7										
HEN-B018	S-3	5.0'-6.5'	BROWN, TAN AND GRAY SILT WITH CLAY AND GRAVEL	ML	9.3										2.7
HEN-B018	S-4	7.5'-9.0'	DARK GRAY FLY ASH WITH SAND		62.5										
HEN-B018	S-5	10.0'-12.0'	GRAY TO VERY DARK GRAY FLY ASH WITH SAND AND GRAVEL		44.3										
HEN-B018	S-6	15.0'-16.5'	DARK GRAY ORGANIC CLAY	CL	41.1										
HEN-B018	S-7	20.0'-21.5'	GRAYISH BROWN LEAN CLAY	CL	30.0										
HEN-B018	S-8	25.0'-27.0'	DARK BROWNISH GRAY LEAN CLAY	CL	31.8							43	22	21	
HEN-B018	S-9	30.0'-31.5'	GRAYISH BROWN LEAN CLAY	CL	33.0										
HEN-B018	S-10	35.0'-36.5'	DARK BROWN ORGANIC CLAY	OL	58.1										
HEN-B018	S-11	40.0'-42.0'	DARK BROWN AND GRAY ORGANIC CLAY WITH SAND - SAND SEAMS AND SHELL NOTED	OL	40.5							27	20	7	
HEN-B018	S-12	45.0'-46.5'	DARK GRAY LEAN CLAY	CL	37.6										
HEN-B018	S-13	50.0'-51.5'	GRAY POORLY GRADED SAND	SP	21.5										
HEN-B018	S-14	55.0'-56.5'	GRAY AND BROWN SILTY SAND	SM	16.8		0.0	79.1			20.9				
HEN-B018	S-15	60.0'-61.5'	GRAYISH BROWN AND DARK GRAY LEAN CLAY - ORGANICS NOTED	CL	49.2										
HEN-B018	S-16	65.0'-66.5'	BROWN AND GRAY SILTY SAND WITH GRAVEL	SM	10.5										
HEN-B018	S-17	70.0'-71.5'	GRAY SILTY SAND WITH GRAVEL	SM	10.6										

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Hennepin Site | PROJECT NUMBER: MR155233 | CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	% Fines	LL	PL	PI	Specific Gravity
HEN-B019	S-1	4.0'-4.3'	GRAYISH BROWN GRAVELLY SAND	SP	9.9										
HEN-B019	S-1A	4.3'-5.8'	BROWN AND GRAY LEAN CLAY	CL	34.8										
HEN-B019	S-2	7.5'-9.5'	DARK BROWN LEAN CLAY WITH SAND	CL	33.0							41	22	19	
HEN-B019	S-3	10.0'-11.5'	BROWN LEAN CLAY	CL	35.5										
HEN-B019	S-4	12.5'-14.5'	GRAY AND BROWN LEAN CLAY	CL	34.5							45	24	21	
HEN-B019	S-5	14.5'-16.0'	BROWN TO GRAY LEAN CLAY	CL	31.1										
HEN-B019	S-6	20.0'-22.0'	BROWN AND GRAY LEAN CLAY	CL	33.9							38	22	16	
HEN-B019	S-7	25.0'-27.0'	VERY DARK GRAY ORGANIC SILT WITH SAND - SHELL NOTED	ML	44.5							34	26	8	
HEN-B019	S-8	30.0'-31.5'	DARK GRAY SANDY LEAN CLAY	CL	30.9										
HEN-B019	S-9	35.0'-36.0'	GRAY SANDY LEAN CLAY	CL	39.1										
HEN-B019	S-9A	36.0'-36.5	GRAY CLAYEY SAND	SC	22.5										
HEN-B019	S-10	40.0'-41.5'	BROWN AND GRAY SILTY SAND	SM	20.2		0.5	76.1			23.4				
HEN-B019	S-11	45.0'-46.5'	BROWN TO GRAY LEAN CLAY	CL	42.6										
HEN-B019	S-12	50.0'-51.5'	GRAY LEAN CLAY WITH SILT	CL	43.7							46	29	17	
HEN-B019	S-13	54.0'-55.5'	GRAYISH BROWN GRAVELLY SAND	SP	12.6										
HEN-B020	S-1	0.0'-1.5'	BROWN AND DARK BROWN LEAN CLAY WITH SILT AND GRAVEL	CL	4.9							25	17	8	
HEN-B020	S-2	2.5'-4.0'	BROWN GRAVELLY SAND - CLAY LENSES NOTED	SP	5.5										
HEN-B020	S-3	5.0'-6.5'	BROWN SILT WITH CLAY, SAND AND GRAVEL	ML	12.6										2.672
HEN-B020	S-4	7.5'-9.0'	BROWN SANDY LEAN CLAY	CL	11.4										
HEN-B020	S-5	9.5'-11.5	BROWN SANDY LEAN CLAY WITH GRAVEL	CL	14.2							30	17	13	
HEN-B020	S-6	15.0'-16.5'	BROWN GRAVEL	GP											
HEN-B020	S-7	20.0'-21.4'	BROWN AND REDDISH BROWN SILTY SAND WITH GRAVEL	SM	8.5		33.5	48.9	10.6	7.0	17.6				
HEN-B020	S-8	25.0'-26.5'	BROWN CLAYEY SAND WITH GRAVEL	SC	9.1										
HEN-B020	S-9	30.0'-31.5'	BROWN AND LIGHT BROWN GRAVELLY SAND	SP	9.3										
HEN-B020	S-10	35.0'-36.5'	BROWN CLAYEY SAND WITH GRAVEL	SC	10.8										
HEN-B020	S-11	40.0'-41.5'	BROWN CLAYEY SAND WITH GRAVEL	SC	8.3										

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Hennepin Site   PROJECT NUMBER: MR155233   CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	% Fines	LL	PL	PI	Specific Gravity
HEN-B021	S-1	0.0'-0.5'	FILL: BROWN AND DARK BROWN SANDY LEAN CLAY WITH ROOT HAIRS	CL	7.3										
HEN-B021	S-2	2.5'-4.0'	BROWN SANDY LEAN CLAY	CL	16.5										
HEN-B021	S-3	5.0'-6.0'	BROWN LEAN CLAY WITH SAND AND GRAVEL	CL	15.7										
HEN-B021	S-4A	7.5'-8.3'	BROWN LEAN CLAY	CL	13.1										
HEN-B021	S-4B	8.3'-8.5'	BROWN SILTY SAND WITH GRAVEL	SM	2.9										
HEN-B021	S-5	10.0'-11.5'	BROWN CLAYEY SAND WITH GRAVEL	SC	9.0										
HEN-B021	S-6	15.0'-16.5'	BROWN LEAN CLAY WITH SAND - ROOTS NOTED	CL	16.7							22	14	8	
HEN-B021	S-7	20.0'-21.5'	DARK GRAY FLY ASH		34.9										
HEN-B021	S-8	22.0'-24.0'	DARK GRAY VARVED FLY ASH		31.9		1.7	20.0	60.8	17.5	78.3				
HEN-B021	S-9	25.0'-26.5'	GRAY AND DARK GRAY FLY ASH		41.6										
HEN-B021	S-10	30.0'-31.5'	GRAY FLY ASH		48.8										
HEN-B021	S-11	35.0'-36.5'	DARK GRAY AND BLACK SILTY SAND WITH CLAY	SM	20.3		0.9	44.3	31.6	23.2	54.8				
HEN-B021	S-12	40.0'-41.5'	BROWN CLAYEY SAND	SC	17.1										
HEN-B022	S-1	0.0'-1.5'	GRAY FLY ASH		37.4										
HEN-B022	S-2	2.5'-4.5'	VERY DARK GRAY VARVED FLY ASH		26.8							36	42	NP	
HEN-B022	S-3A	5.0'-6.3'	GRAY FLY ASH		37.0										
HEN-B022	S-3B	6.3'-6.5'	GRAY FLY ASH		21.8										
HEN-B022	S-4	7.5'-9.0'	VERY DARK GRAY VARVED FLY ASH WITH SAND - SAND SEAMS NOTED		34.2		1.4	26.4	57.3	14.9	72.2				
HEN-B022	S-5	10.0'-11.5'	GRAY SILTY SAND	SM	31.5										
HEN-B022	S-6	15.0'-16.5'	FILL: BLACK POORLY GRADED SAND - CINDERS NOTED	SP-SM	7.2										
HEN-B022	S-7	20.0'-21.5'	REDDISH BROWN SANDY LEAN CLAY	CL	18.3							26	16	10	

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Hennepin Site

PROJECT NUMBER: MR155233

CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	% Fines	LL	PL	PI	Specific Gravity
HEN-B023	S-1	0.0'-1.5'	FILL: BROWN AND DARK BROWN SILTY SAND WITH GRAVEL	SM	5.3										
HEN-B023	S-2	2.5'-4.0'	BROWN AND TAN SILTY SAND WITH GRAVEL	SM	6.5		31.7	44.3	12.2	11.8	24.0				
HEN-B023	S-3	5.0'-6.5'	FILL: BROWN AND DARK BROWN SILT WITH CLAY, SAND AND GRAVEL	ML	8.3										2.701
HEN-B023	S-5A	10.0'-11.0'	BROWN AND GRAY SILTY LEAN CLAY WITH SAND	CL	15.9										
HEN-B023	S-5B	11.0'-11.5'	POSSIBLE FILL: BROWN TO DARK BROWN LEAN CLAY	CL	21.6										
HEN-B023	S-6	15.0'-16.5'	BROWN SILTY SAND WITH GRAVEL - SILT POCKETS NOTED	SM	3.3										
HEN-B023	S-7	20.0'-21.5'	DARK GRAY AND BLACK SILTY SAND AND FLY ASH - CINDERS NOTED	SM	25.5		7.2	44.9	39.9	8.0	47.9				
HEN-B023	S-8	25.0'-26.5'	GRAY FLY ASH		38.9										
HEN-B023	S-9	27.0'-29.0'	VERY DARK GRAY FLY ASH WITH SAND AND GRAVEL		27.1										
HEN-B023	S-10	30.0'-31.5'	DARK GRAY FLY ASH		35.6										
HEN-B023	S-11	35.0'-36.5'	DARK GRAY FLY ASH WITH SAND AND CINDERS		18.6		23.3	51.4	20.6	4.7	25.3				
HEN-B023	S-12	40.0'-41.5'	DARK GRAY SILTY SAND	SM	14.4										
HEN-B023	S-13	45.0'-46.5'	BROWN AND GRAY LEAN CLAY	CL	19.8										
HEN-B023	S-14	50.0'-51.0'	LIGHT BROWN POORLY GRADED GRAVEL WITH SAND AND SILT	GP-GM	10.2		48.7	38.5	7.8	5.0	12.8				
HEN-B023	S-15	55.0'-56.5'	BROWN POORLY GRADED SAND WITH SILT AND GRAVEL	SP-SM	15.2										
HEN-B023	S-16	60.0'-61.5'	BROWN POORLY GRADED SAND WITH SILT AND GRAVEL	SP-SM	9.7										
HEN-B023	S-17	65.0'-66.5'	BROWN SILTY SAND	SM	15.1										
HEN-B023	S-18	70.0'-71.5'	BROWN SILTY SAND WITH CLAY	SM	19.3										
HEN-B023	S-19	75.0'-76.5'	BROWN SILTY SAND WITH GRAVEL	SM	9.6										
HEN-B023	S-4	7.5'-9.0'	BROWN POORLY GRADED GRAVEL WITH SAND AND CLAY	GP-GC	8.0										

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Hennepin Site PROJECT NUMBER: MR155233 CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	% Fines	LL	PL	PI	Specific Gravity
HEN-B024	S-1	0.0'-1.5'	FILL: GRAYISH BROWN SILTY SAND WITH GRAVEL - ASPHALT AND CONCRETE NOTED	SM	6.2										
HEN-B024	S-2	2.5'-4.0'	BROWN AND GRAY SAND WITH SILT, CLAY AND GRAVEL	SM	6.7										2.756
HEN-B024	S-3A	5.0'-5.8'	BROWN SILTY SAND WITH CLAY	SM	9.9										
HEN-B024	S-3B	5.8'-6.5'	BROWN LEAN CLAY WITH SAND AND GRAVEL	CL	8.5										
HEN-B024	S-4	7.0'-8.5'	DARK BROWN SANDY LEAN CLAY	CL	11.3										
HEN-B024	S-4	7.5'-9.0'	BROWN SILTY SAND WITH GRAVEL	SM	7.5										
HEN-B024	S-5	10.0'-11.5'	BROWN LEAN CLAY WITH GRAVEL	CL	10.0										
HEN-B024	S-6	15.0'-16.5'	BLACK FLY ASH WITH CINCERS AND SAND		16.4		14.8	62.8	19.4	3.0	22.4				
HEN-B024	S-7	20.0'-20.3'	DARK GRAY CLAYEY SAND	SC	16.3										
HEN-B024	S-8	25.0'-26.5'	BROWN CLAYEY SILT	CL-ML	47.3										
HEN-B024	S-9	26.5'-28.5'	DARK GRAY ORGANIC CLAY WITH SAND	0H	48.2							58	23	35	
HEN-B024	S-10	30.0'-31.5'	GRAY LEAN CLAY	CL	53.6										
HEN-B024	S-11	35.0'-36.5'	GRAY FLY ASH		47.4										
HEN-B024	S-12	40.0'-41.5'	BROWN AND GRAY CLAYEY SAND WITH GRAVEL	SC	13.0										
HEN-B024	S-13	45.0'-46.5'	BROWN AND DARK BROWN SILTY GRAVEL WITH SAND	GM	11.0		48.6	34.4	11.1	5.9	17.0				
HEN-B024	S-14	50.0-51.5	BROWN AND DARK BROWN LEAN CLAY WITH SAND AND GRAVEL	CL	11.2										
HEN-B024	S-16	60.0'-61.5'	BROWN POORLY GRADED SAND	SP	15.7										
HEN-B024	S-17	62.5'-62.7'	BROWN AND GRAY GRAVELLY SAND	SP	2.9										
HEN-B025	S-1	0.0'-1.5'	FILL: BROWN POORLY GRADED SAND WITH SILT AND GRAVEL	SP	6.2										
HEN-B025	S-2	2.5'-4.0'	BROWN LEAN CLAY WITH SILT AND SAND	CL	10.1										2.708
HEN-B025	S-3	5.0'-6.5'	BROWN AND GRAY SILTY GRAVEL WITH SAND	GM	4.3		37.3	35.4	18.6	8.7	27.3				
HEN-B025	S-4	7.5'-9.0'	GRAY FLY ASH		22.6										
HEN-B025	S-5	10.0'-11.5'	GRAY LEAN CLAYEY SILT WITH SAND AND GRAVEL	CL-ML	31.1										
HEN-B025	S-6	11.5'-14.0'	VERY DARK GRAY FLY ASH WITH SAND		31.9		16.8	10.7	52.3	20.2	72.5	38	38	NP	
HEN-B025	S-7	15.0'-16.5'	GRAY FLY ASH		31.1										
HEN-B025	S-8	20.0'-21.5'	GRAY SILTY LEAN CLAY WITH SAND	CL	46.7										
HEN-B025	S-9	25.0'-27.0'	VERY DARK GRAY TO GRAY FLY ASH WITH SAND		36.1							32	34	NP	
HEN-B025	S-10	27.0'-28.5'	GRAY CLAYEY SILT	CL-ML	38.9										
HEN-B025	S-11	30.0'-31.5'	GRAY CLAYEY SILT	CL-ML	44.8										
HEN-B025	S-12	35.0'-36.5'	GRAY FLY ASH - CLAY LENSES NOTED		38.3										
HEN-B025	S-13	40.0'-41.5'	GRAY FLY ASH WITH CLAY		42.9										
HEN-B025	S-14	45.0'-46.5'	GRAY FLY ASH		58.6										
HEN-B025	S-15	50.0'-51.5'	GRAY FLY ASH		66.7										
HEN-B025	S-16	55.0'-56.5'	GRAY SANDY LEAN CLAY	CL	19.1										

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Hennepin Site

PROJECT NUMBER: MR155233

CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	% Fines	LL	PL	PI	Specific Gravity
HEN-B026	S-1	4.0'-4.5'	GRAY POORLY GRADED SAND	SP	13.7										
HEN-B026	S-1A	4.5'-5.5'	GRAY AND GRAYISH BROWN SANDY LEAN CLAY	CL	15.5										
HEN-B026	S-2	7.5'-9.0'	GRAYISH BROWN LEAN CLAY WITH GRAVEL	CL	24.0										
HEN-B026A	S-1	10.0'-11.5'	BROWN TO GRAY SANDY LEAN CLAY WITH GRAVEL	CL	11.1										
HEN-B026A	S-2	13.5'-15.0'	BROWN SILTY SAND WITH GRAVEL	SM	19.2		32.6	33.8	18.4	15.2	33.6				
HEN-B026A	S-3	16.5'-18.5'	BROWN SANDY LEAN CLAY WITH GRAVEL	CL	11.9										
HEN-B026A	S-4	20.0'-21.5'	BROWN CLAYEY GRAVEL WITH SAND	GC	10.6										
HEN-B026A	S-5	25.0'-26.5'	BROWN SANDY GRAVEL WITH SILT	GP-GM	17.2										
HEN-B027	S-1	7.0'-7.5'	BROWN SANDY GRAVEL WITH SILT	GP-GM	15.7										
HEN-B027	S-1A	7.5'-9.0'	DARK GRAY LEAN CLAY - ORGANICS NOTED	CL	41.5										
HEN-B027	S-2	10.0'-12.0'	GRAY LEAN CLAY WITH SAND AND GRAVEL	CL	36.3										
HEN-B027	S-3	12.0'-13.5'	GRAYISH BROWN LEAN CLAY WITH SAND AND GRAVEL	CL	16.3										
HEN-B027	S-4	15.0'-16.5'	BROWN LEAN CLAY WITH GRAVEL	CL	26.4										
HEN-B027	S-5	20.0'-21.5'	BROWN LEAN CLAY WITH GRAVEL	CL	13.2										
HEN-B027	S-6	25.0'-26.5'	BROWN TO GREENISH GRAY SILTY LEAN CLAY WITH SAND	CL	9.7										
HEN-B027	S-7	30.0'-31.5'	BROWN SANDY GRAVEL WITH SILT	GP-GM	11.2										
HEN-B029	S-1	0.0'-1.5'	BROWN POORLY GRADED SAND	SP	4.7										
HEN-B029	S-2	2.5'-4.0'	DARK BROWN SANDY LEAN CLAY	CL	14.7										
HEN-B029	S-3	5.0'-7.0'	BROWN LEAN CLAY WITH SAND AND GRAVEL	CL	10.8							22	15	7	
HEN-B029	S-4	7.0'-8.5'	DARK BROWN LEAN CLAY	CL	14.8										
HEN-B029	S-5	10.0'-12.0'	VERY DARK BROWN AND GRAY SLIGHTLY ORGANIC LEAN CLAY WITH SAND AND GRAVEL	CL	16.7							31	17	14	
HEN-B029	S-6	15.0'-16.5'	POSSIBLE FILL: BROWN TO DARK BROWN LEAN CLAY	CL	21.7										
HEN-B029	S-7	20.0'-21.5'	BROWN TO GRAY SILTY LEAN CLAY	CL	11.5										
HEN-B029	S-8	25.0'-26.5'	BROWN SILTY LEAN CLAY WITH SAND	CL	8.8										
HEN-B029	S-9	30.0'-30.9'	BROWN SILTY LEAN CLAY WITH SAND	CL	12.7										
HEN-B029	S-10	35.0'-36.5'	LIGHT BROWN POORLY GRADED GRAVEL WITH SAND AND CLAY	GP-GC	13.8		61.0	26.0			13.0				
HEN-B029	S-11	40.0'-41.5'	BROWN SILTY SAND WITH CLAY	SM	4.6										

LABORATORY TESTING SUMMARY

Terracon

PROJECT NAME: Dynergy - Hennepin Site | PROJECT NUMBER: MR155233 | CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	% Fines	LL	PL	PI	Specific Gravity
HEN-B030	S-1A	0.0'-1.5'	FILL: DARK BROWN AND BROWN SANDY LEAN CLAY WITH GRAVEL	CL	7.0										
HEN-B030	S-2	2.5'-4.0'	BROWN AND LIGHT BROWN SILTY SAND WITH GRAVEL	SM	6.4		34.0	45.7	11.0	9.3	20.3				
HEN-B030	S-3	5.0'-6.5'	FILL: BROWN AND GRAY LEAN CLAY WITH SILT, SAND AND GRAVEL	CL	11.5										2.746
HEN-B030	S-4	7.5'-9.0'	BROWN LEAN CLAY	CL	17.1										
HEN-B030	S-5	10.0'-11.0'	DARK BROWNISH GRAY FLY ASH AND LEAN CLAY MIXTURE WITH SAND		18.1										
HEN-B030	S-6	15.0'-16.5'	LIGHT BROWN AND TAN WELL GRADED GRAVEL WITH SAND	GW	17.6		81.4	14.8			3.8				
HEN-B030	S-7	21.5'	DARK BROWN AND BLACK ORGANIC CLAY WITH GRAVEL - WOOD NOTED	OL	23.9										
HEN-B030	S-8	25.0'-26.5'	BROWN SILTY SAND WITH GRAVEL	SM	11.2										
HEN-B030	S-10	35.0'-36.5'	BROWN CLAYEY SAND WITH GRAVEL	SC	8.9										
HEN-B030	S-11	40.0'-41.5'	BROWN CLAYEY SAND	SC	9.0										
HEN-B032	S-1A	0.0'-1.0'	BROWN AND GRAYISH BROWN CLAYEY SAND	SC	2.7										
HEN-B032	S-1B	1.0'-1.5'	FILL: BROWN SANDY LEAN CLAY	CL	7.9										
HEN-B032	S-2	2.5'-4.0'	FILL: DARK BROWN SANDY LEAN CLAY	SC	9.7										
HEN-B032	S-3	5.0'-7.0'	DARK BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL	CL	14.0							35	18	17	
HEN-B032	S-4	7.5'-9.0'	DARK BROWN LEAN CLAY	CL	16.7										
HEN-B032	S-5	10.0'-11.5'	DARK BROWN AND DARK GRAY LEAN CLAY WITH GRAVEL	CL	16.2										
HEN-B032	S-6	15.0'-16.5'	BROWN AND GRAYISH BROWN SILTY SAND WITH GRAVEL	SM	8.2										
HEN-B032	S-7	20.0'-21.5'	BROWN SILTY SAND WITH GRAVEL	SM	11.1		30.5	43.6	13.4	12.5	25.9				
HEN-B032	S-8	25.0'-26.5'	BROWN SILTY SAND WITH GRAVEL AND CLAY	SM	9.1										
HEN-B032	S-9	30.0'-31.5'	BROWN LEAN CLAY WITH SAND AND GRAVEL	CL	10.6										
HEN-B032	S-10	35.0'-36.5'	BROWN SILTY SAND WITH GRAVEL	SM	5.5										
HEN-B032	S-11	40.0'-41.3'	BROWN AND GRAYISH BROWN SILTY LEAN CLAY WITH SAND AND GRAVEL	CL	10.9										
HEN-B034	S-1A	0.0'-0.5'	BROWN SILTY SAND WITH GRAVEL	SM	4.2										
HEN-B034	S-1B	0.5'-1.5	POSSIBLE FILL: DARK BROWN LEAN CLAY	CL	9.1										
HEN-B034	S-2	2.5'-4.0'	DARK BROWN LEAN CLAY WITH SILT AND SAND	CL	14.2										2.704
HEN-B034	S-3A	5.0'-5.5'	BROWN SILTY SAND	SM	15.9										
HEN-B034	S-3B	5.5'-6.5'	BROWN GRAVELLY SAND	SP	1.4										
HEN-B034	S-4	7.5'-9.0'	BROWN AND GRAYISH BROWN SILTY SAND WITH GRAVEL	SM	2.5										
HEN-B034	S-5	10.0'-11.5'	BROWN AND LIGHT BROWN POORLY GRADED GRAVEL WITH SILT AND	GP-GM	11.2		60.1	27.0	7.7	5.2	12.9				
HEN-B034	S-6	15.0'-16.5'	BROWN AND LIGHT BROWN POORLY GRADED GRAVEL WITH CLAY AND	GP-GC	9.1										2.808
HEN-B034	S-7	20.0'-21.5'	LIGHT BROWN SILTY SAND WITH GRAVEL	SM	12.5										
HEN-B034	S-9	30.0'-31.5'	BROWN, GRAY AND PINKISH BROWN POORLY GRADED GRAVEL	GP	13.6										
HEN-B034	S-10	35.0'-36.5'	LIGHT BROWN AND TAN POORLY GRADED GRAVEL WITH SAND AND SILT	GP-GM	10.9		82.8	11.3			5.9				
HEN-B034	S-11	40.0'-41.5'	BROWN POORLY GRADED GRAVEL WITH SILT AND SAND	GP-GM	1.5										

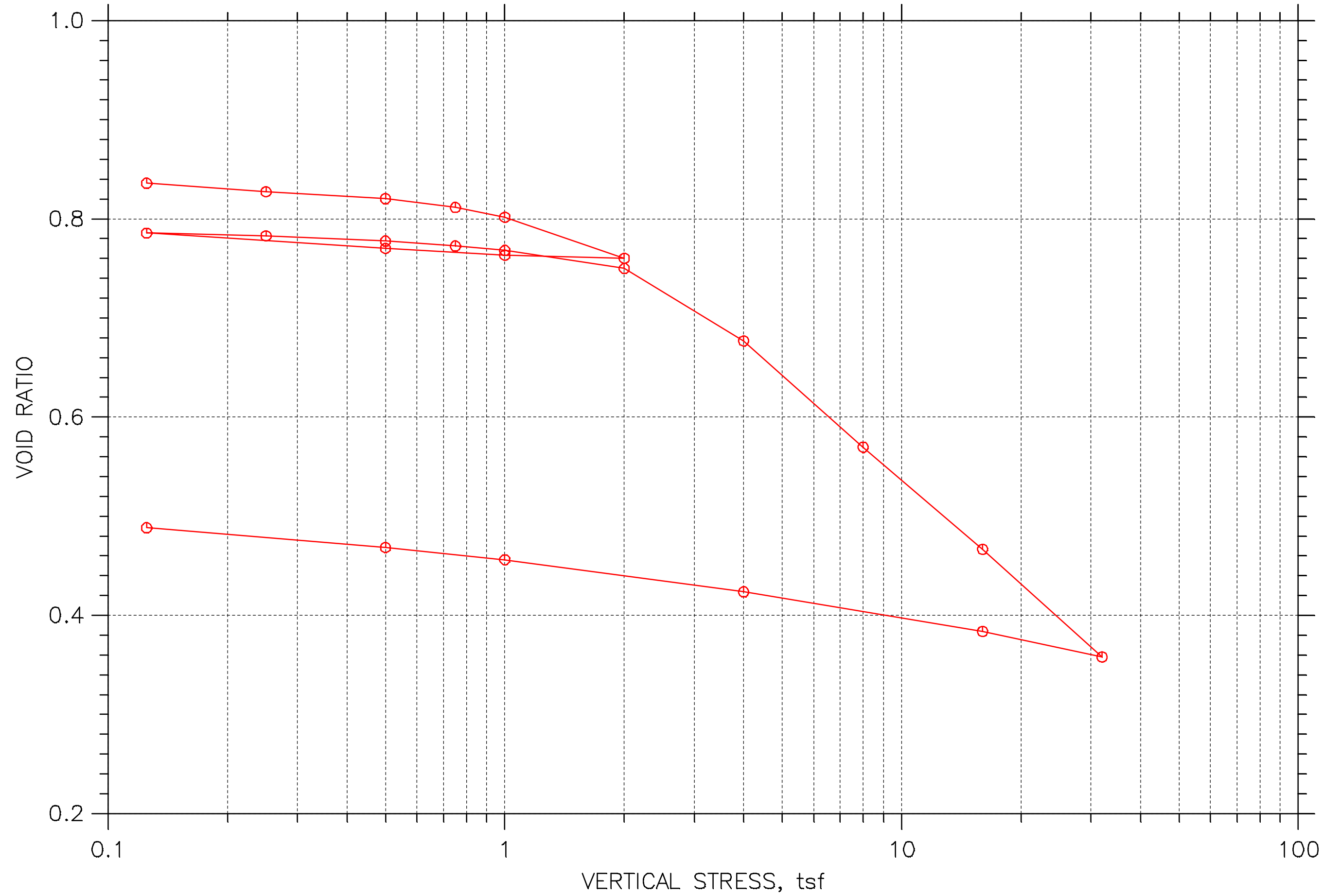
LABORATORY TESTING SUMMARY

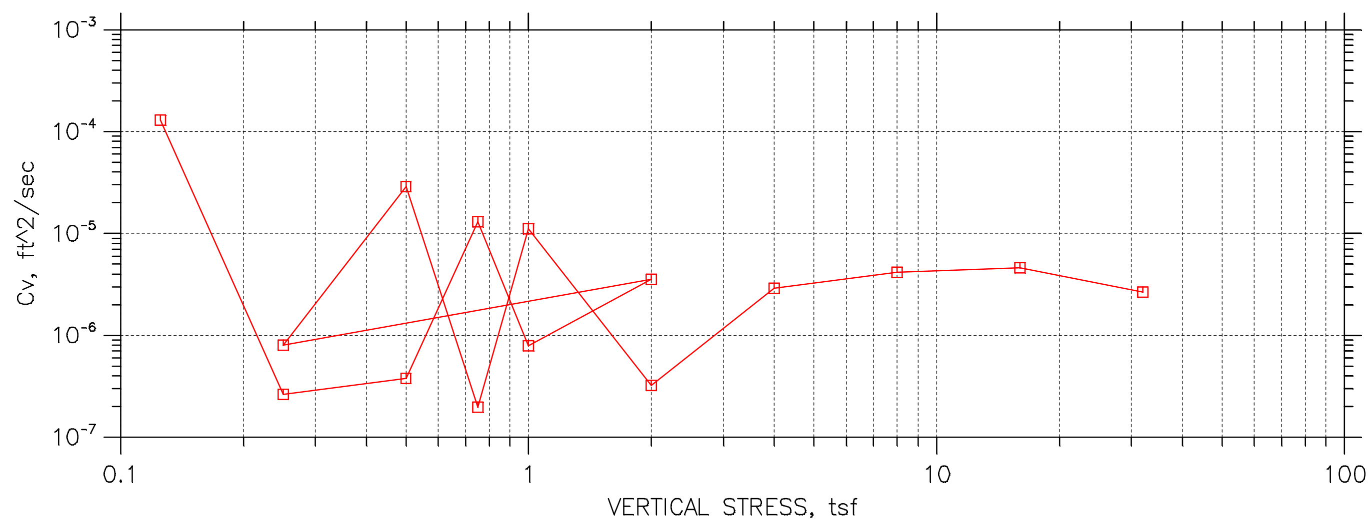
PROJECT NAME: Dynergy - Hennepin Site PROJECT NUMBER: MR155233 CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	% Fines	LL	PL	PI	Specific Gravity
HEN-B037	S-1	0.0'-1.5'	DARK BROWN POORLY GRADED SAND	SP	3.2										
HEN-B037	S-2	2.5'-4.0'	BROWN POORLY GRADED SAND WITH SILT AND GRAVEL	SP-SM	4.6										2.685
HEN-B037	S-3	5.0'-6.5'	BROWN AND DARK BROWN SILTY SAND WITH GRAVEL	SM	4.0		41.3	51.0			7.7				
HEN-B037	S-4A	7.5'-8.0'	DARK BROWN CLAYEY SAND	SC	4.8										
HEN-B037	S-4B	8.0'-9.0'	DARK BROWN LEAN CLAY	CL	15.4										
HEN-B037	S-5	10.0'-11.5'	BROWN SILTY SAND WITH GRAVEL - CLAY LENSES NOTED	SM	9.3										
HEN-B037	S-6	15.0'-16.5'	BROWN AND LIGHT BROWN CLAYEY GRAVEL WIRTH SAND	GC	9.6		34.1	26.5	16.2	23.2	39.4				
HEN-B037	S-7	20.0'-21.5'	BROWN AND GRAYISH BROWN SILTY LEAN CLAY WITH SAND	CL	9.5										
HEN-B037	S-8	25.0'-26.5'	BROWN SILTY SAND WITH GRAVEL	SM	12.1										
HEN-B037	S-9A	30.0'-30.5'	LIGHT BROWN SILTY SAND WITH GRAVEL	SM	14.1										
HEN-B037	S-9B	30.5'-31.5'	BROWN SILTY LEAN CLAY	CL	20.5										
HEN-B037	S-10	35.0'-36.5'	BROWN SILTY SAND WITH GRAVEL	SM	7.6										
HEN-B037	S-11	40.0'-41.5'	BROWN SILTY GRAVEL	GM	14.2										
HEN-B038	S-1	0.0'-1.5'	FILL: BROWN SILTY SAND	SM	7.0										
HEN-B038	S-2A	2.5'-3.0'	BROWN SANDY LEAN CLAY	CL	9.8										
HEN-B038	S-2B	3.0'-4.0'	LIGHT BROWN SILTY SAND WITH GRAVEL	SM	2.7										
HEN-B038	S-3	5.0'-6.5'	TAN POORLY GRADED SAND WITH GRAVEL AND SILT	SP-SM	2.3		30.1	61.6	4.4	3.9	8.3				
HEN-B038	S-4A	8.1'-8.6'	FILL: BROWN LEAN CLAY WITH SAND	CL	44.1										
HEN-B038	S-4B	8.6'-9.0'	BROWN SILTY SAND WITH GRAVEL	SM	6.0										
HEN-B038	S-5A	10.0'-10.5'	BROWN SANDY LEAN CLAY	CL	4.5										
HEN-B038	S-5B	10.5-11.5'	GREENISH GRAY FAT CLAY	CH	18.8							55	23	32	
HEN-B038	S-6	15.0'-16.5'	BROWN POORLY GRADED GRAVEL WITH CLAY AND SILT	GP-GC	6.5										2.763
HEN-B038	S-7	20.0'-21.5'	BROWN AND GRAY GRAVELLY SAND	SP	4.6										

One-Dimensional Consolidation Tests
ASTM D 2435

ONE DIMENSIONAL CONSOLIDATION TEST
ASTM D2435





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		

Mon, 21-DEC-2015 16:25:14

CONSOLIDATION TEST DATA

Project: DYNERGY HENNEPIN
Boring No.: HEN-016 S-7
Sample No.: S-7
Test No.: HENB016S7

Location: HENNEPIN, IL
Tested By: HP
Test Date: 12/13/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: BCM
Depth: 30.0'-22.0'
Elevation: ----

Soil Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL
Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435

Estimated Specific Gravity: 2.72
Initial Void Ratio: 0.84
Final Void Ratio: 0.49

Liquid Limit: 38
Plastic Limit: 21
Plasticity Index: 17

Initial Height: 0.74 in
Specimen Diameter: 2.50 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	X-11	RING	RING	X-19
Wt. Container + Wet Soil, gm	310.43	192.3	183.59	145.61
Wt. Container + Dry Soil, gm	249.7	167.91	167.91	130.41
Wt. Container, gm	44.46	79.89	79.89	45.08
Wt. Dry Soil, gm	205.24	88.021	88.021	85.33
Water Content, %	29.59	27.71	17.81	17.81
Void Ratio	---	0.84	0.49	---
Degree of Saturation, %	---	89.65	99.22	---
Dry Unit Weight, pcf	---	92.25	114.09	---

CONSOLIDATION TEST DATA

Project: DYNERGY HENNEPIN
Boring No.: HEN-016 S-7
Sample No.: S-7
Test No.: HENB016S7

Location: HENNEPIN, IL
Tested By: HP
Test Date: 12/13/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: BCM
Depth: 30.0'-22.0'
Elevation: ----

Soil Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL
Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435

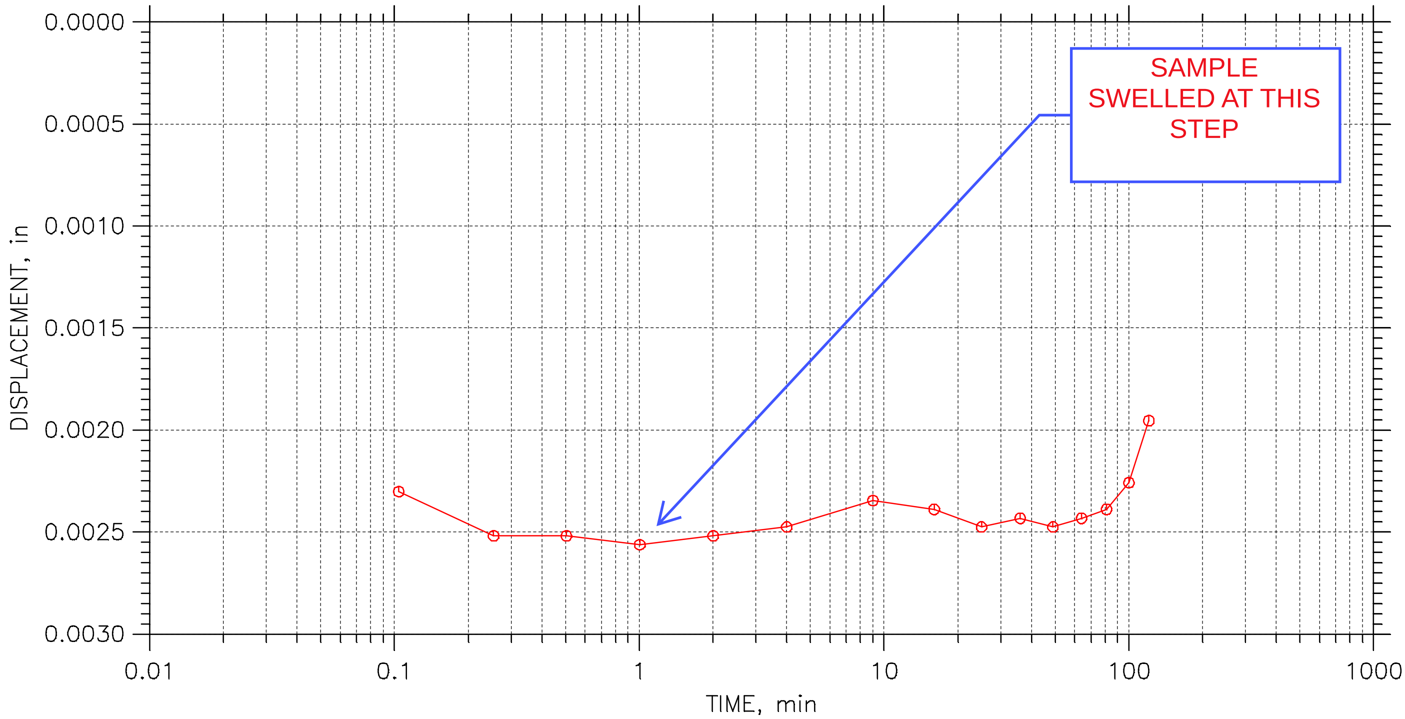
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. ft^2/sec	Coefficient of Consolidation Log ft^2/sec	Coefficient of Consolidation Ave. ft^2/sec
1	0.125	0.001955	0.836	0.26	0.0	0.0	1.29e-004	0.00e+000	1.29e-004
2	0.25	0.005429	0.827	0.73	11.9	0.0	2.63e-007	0.00e+000	2.63e-007
3	0.5	0.008253	0.820	1.11	8.2	0.0	3.77e-007	0.00e+000	3.77e-007
4	0.75	0.01181	0.811	1.59	0.2	0.0	1.30e-005	0.00e+000	1.30e-005
5	1	0.01581	0.802	2.13	3.8	0.0	7.94e-007	0.00e+000	7.94e-007
6	2	0.03249	0.760	4.37	1.5	0.2	2.00e-006	1.60e-005	3.56e-006
7	1	0.03123	0.763	4.20	0.1	0.0	2.83e-005	0.00e+000	2.83e-005
8	0.5	0.02849	0.770	3.83	0.1	0.0	3.01e-005	0.00e+000	3.01e-005
9	0.125	0.02224	0.786	2.99	3.6	0.0	8.17e-007	0.00e+000	8.17e-007
10	0.25	0.02341	0.783	3.15	3.7	0.0	8.03e-007	0.00e+000	8.03e-007
11	0.5	0.0255	0.778	3.43	0.1	0.0	2.87e-005	0.00e+000	2.87e-005
12	0.75	0.02754	0.772	3.70	14.9	0.0	1.96e-007	0.00e+000	1.96e-007
13	1	0.02932	0.768	3.94	0.3	0.0	1.11e-005	0.00e+000	1.11e-005
14	2	0.03666	0.750	4.93	8.9	0.0	3.24e-007	0.00e+000	3.24e-007
15	4	0.06615	0.677	8.90	0.9	0.0	2.90e-006	0.00e+000	2.90e-006
16	8	0.1094	0.570	14.72	1.0	0.2	2.54e-006	1.12e-005	4.14e-006
17	16	0.151	0.467	20.32	0.5	0.5	4.59e-006	4.58e-006	4.58e-006
18	32	0.1949	0.358	26.23	1.0	0.4	1.95e-006	4.19e-006	2.66e-006
19	16	0.1845	0.384	24.82	0.1	0.0	1.70e-005	0.00e+000	1.70e-005
20	4	0.1684	0.424	22.66	0.2	0.0	8.35e-006	0.00e+000	8.35e-006
21	1	0.1553	0.456	20.89	3.7	0.0	5.18e-007	0.00e+000	5.18e-007
22	0.5	0.1504	0.468	20.23	19.6	12.7	1.01e-007	1.57e-007	1.23e-007
23	0.125	0.1423	0.488	19.14	14.5	0.0	1.40e-007	0.00e+000	1.40e-007

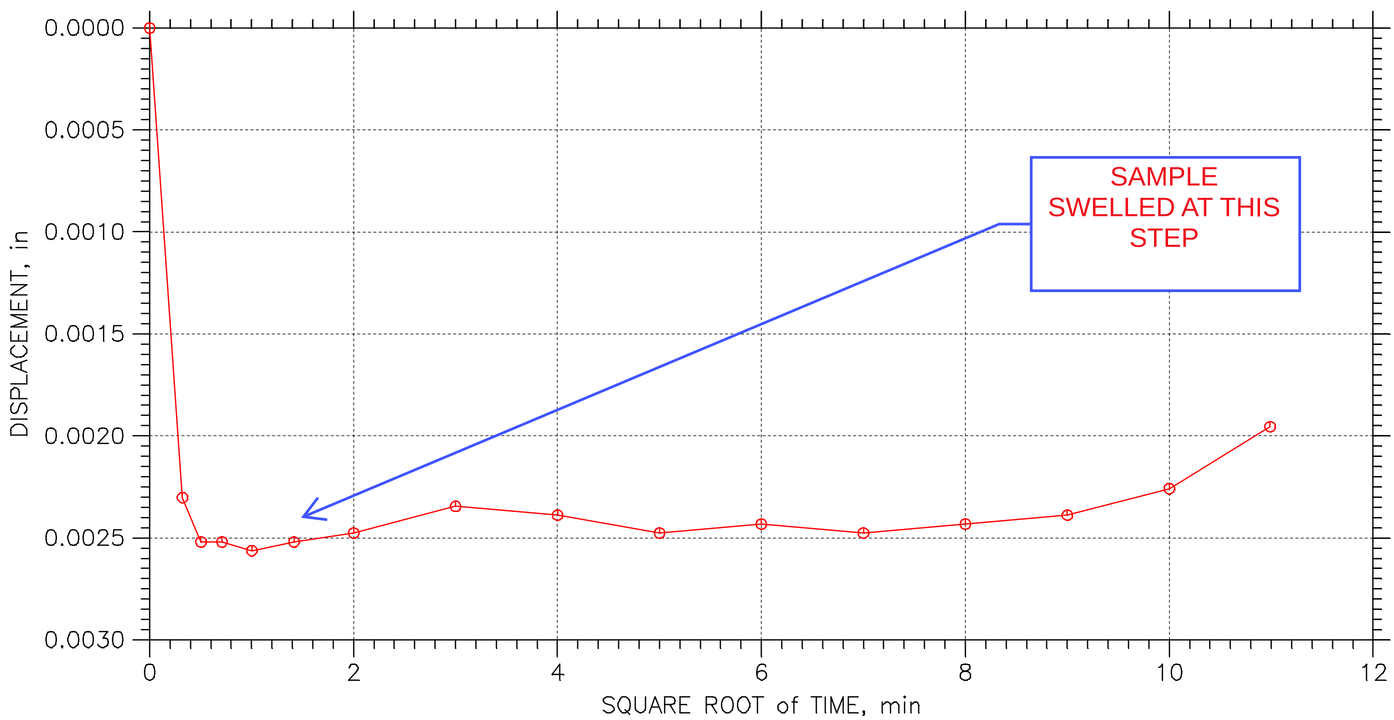
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 1 of 23

Stress: 0.125 tsf





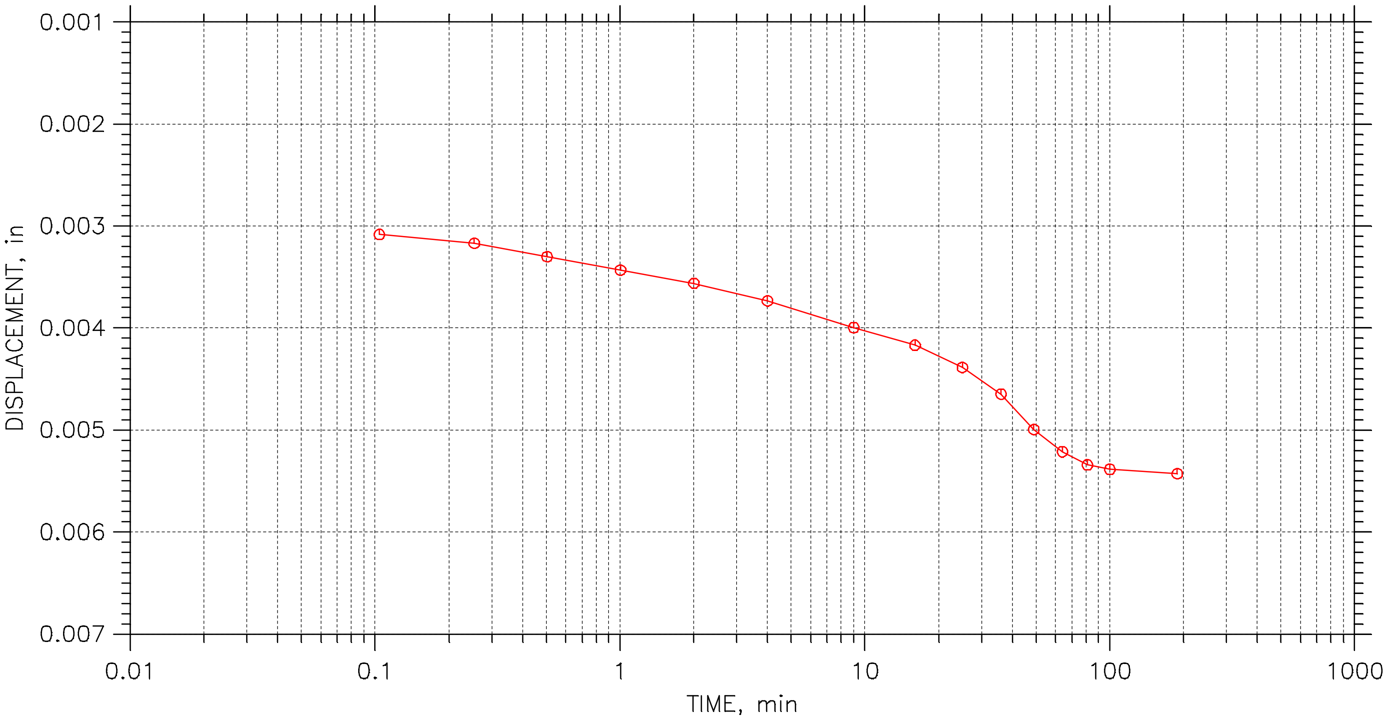
Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0" ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		
	222		

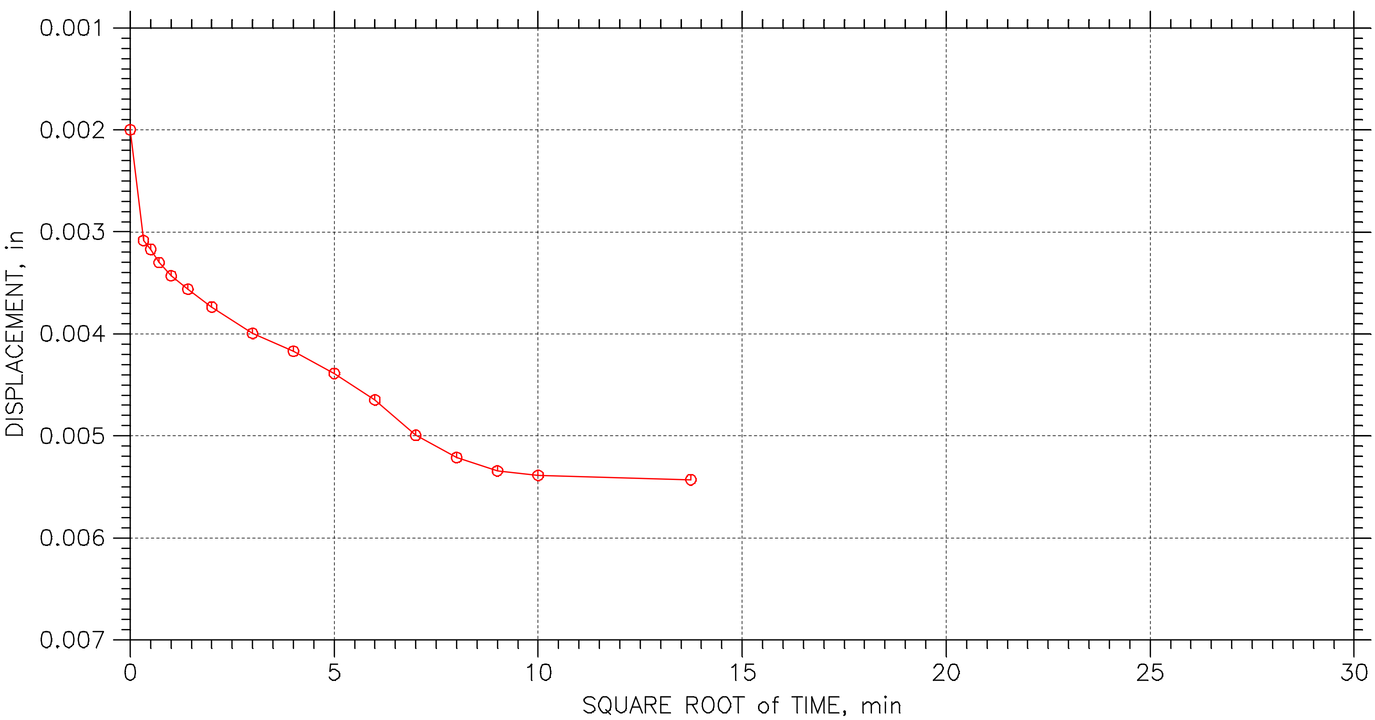
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 2 of 23

Stress: 0.25 tsf





Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0" ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		

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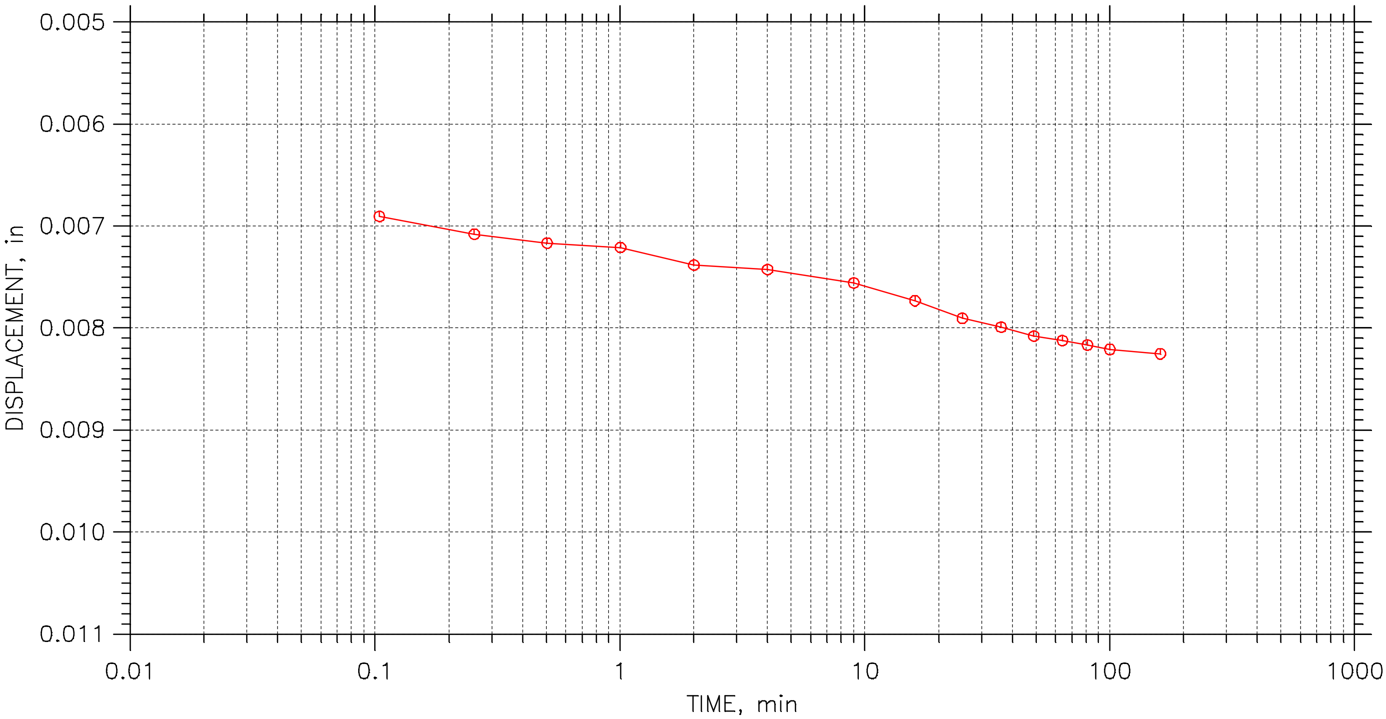
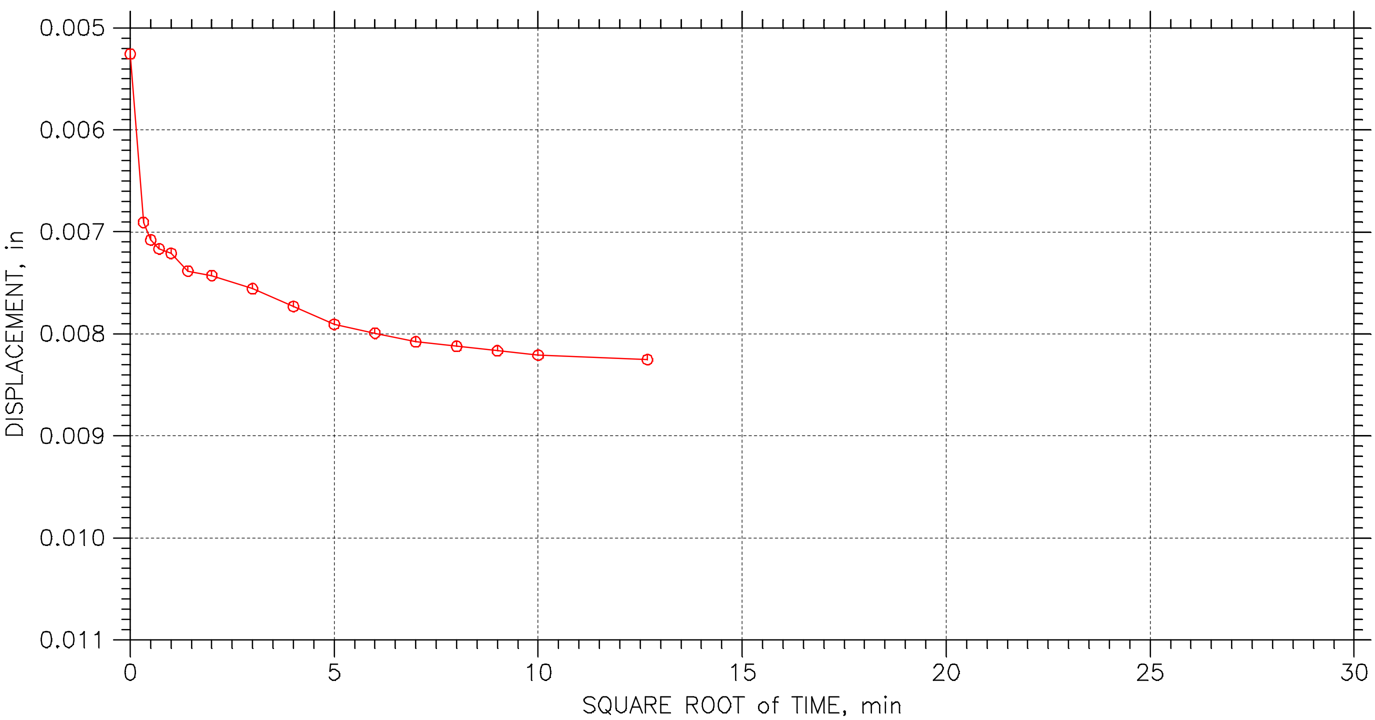
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 3 of 23

Stress: 0.5 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		
	224		

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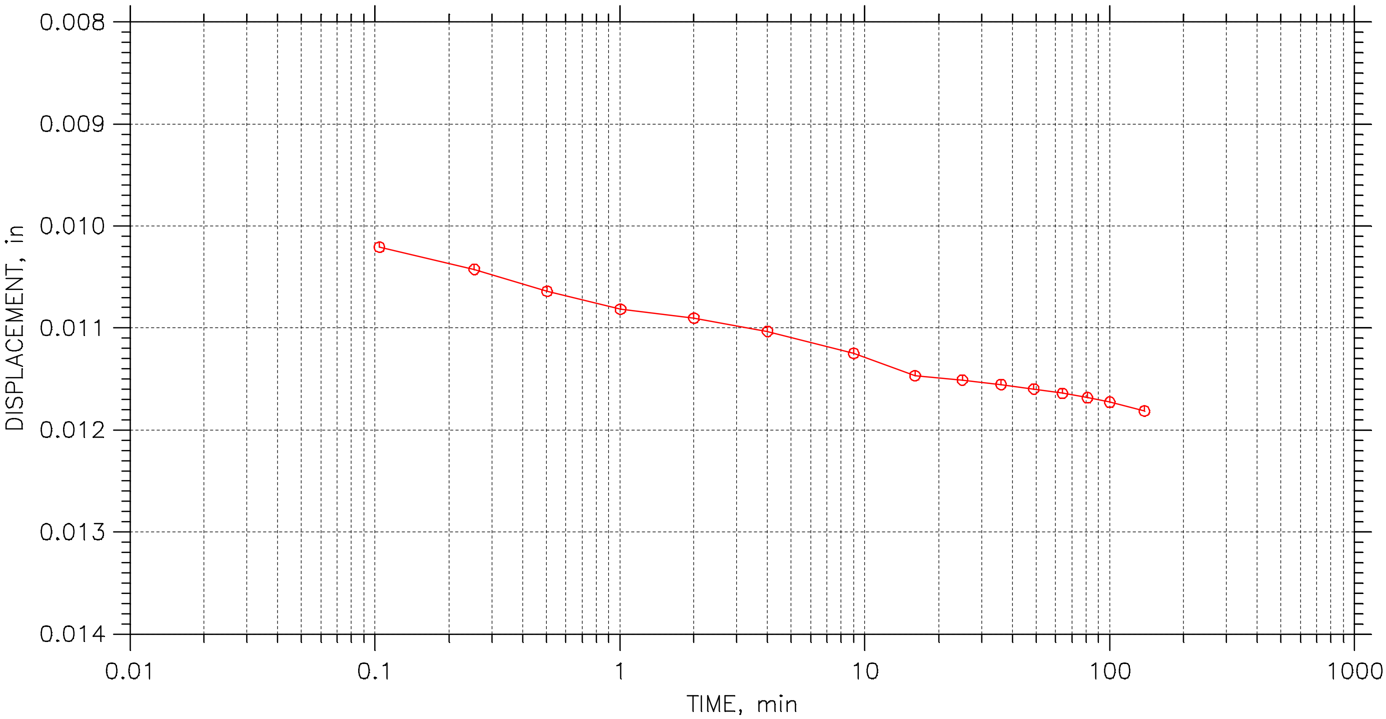
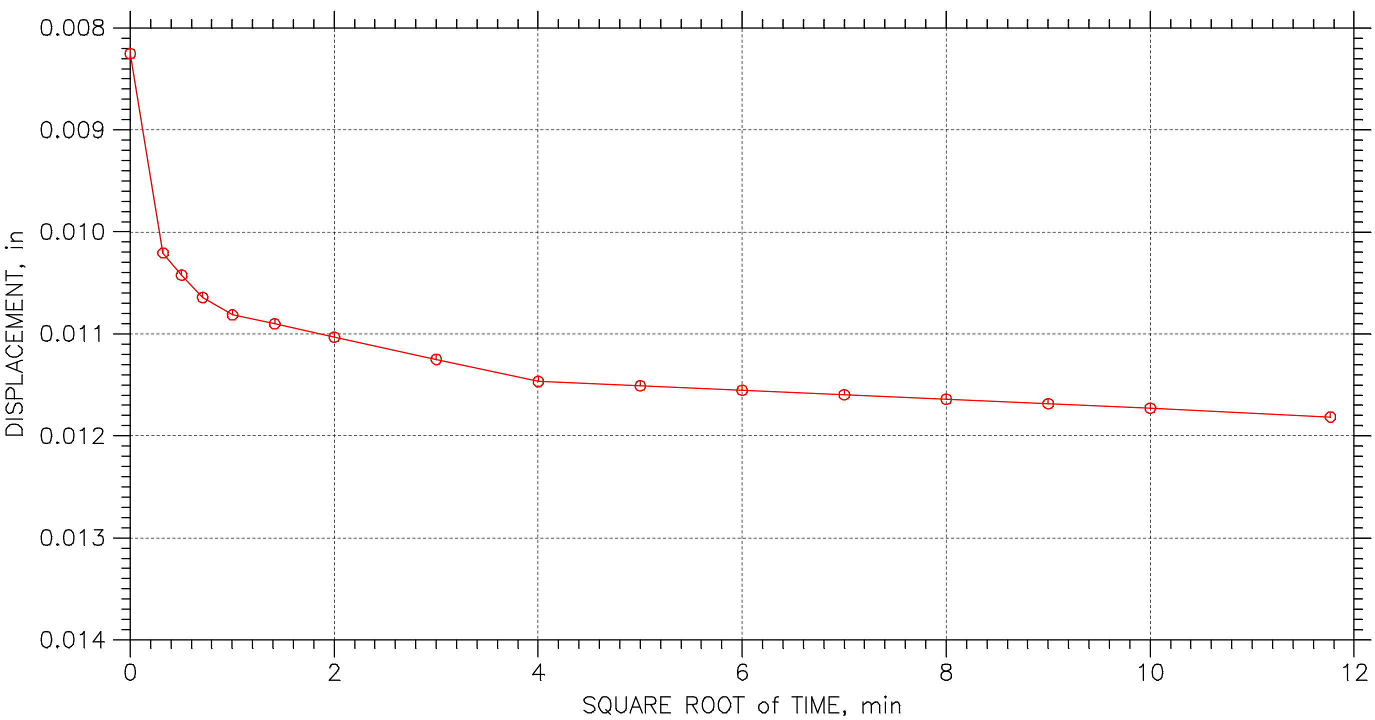
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 4 of 23

Stress: 0.75 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		

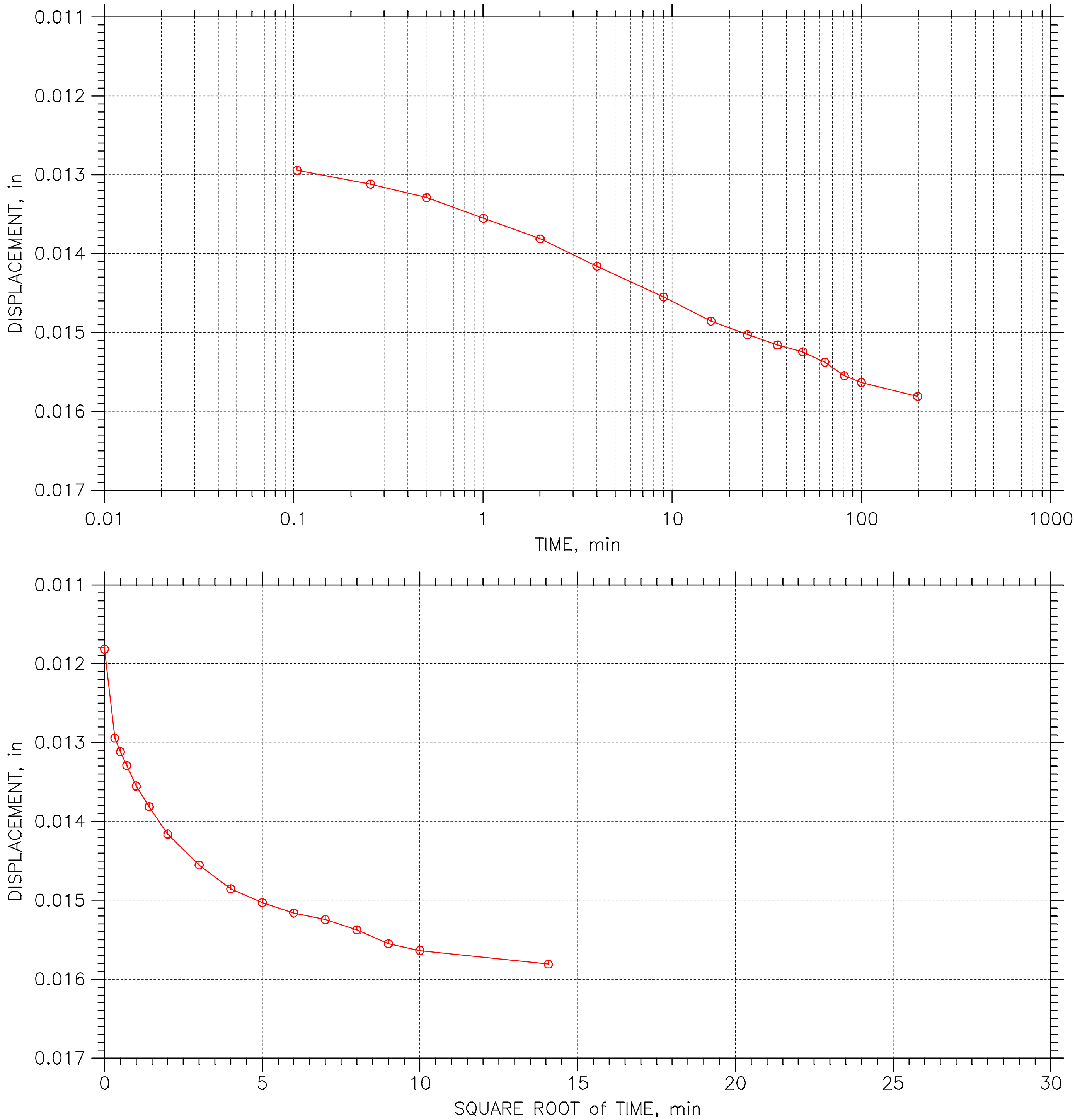
Mon, 21-DEC-2015 16:25:45

CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 5 of 23

Stress: 1. tsf



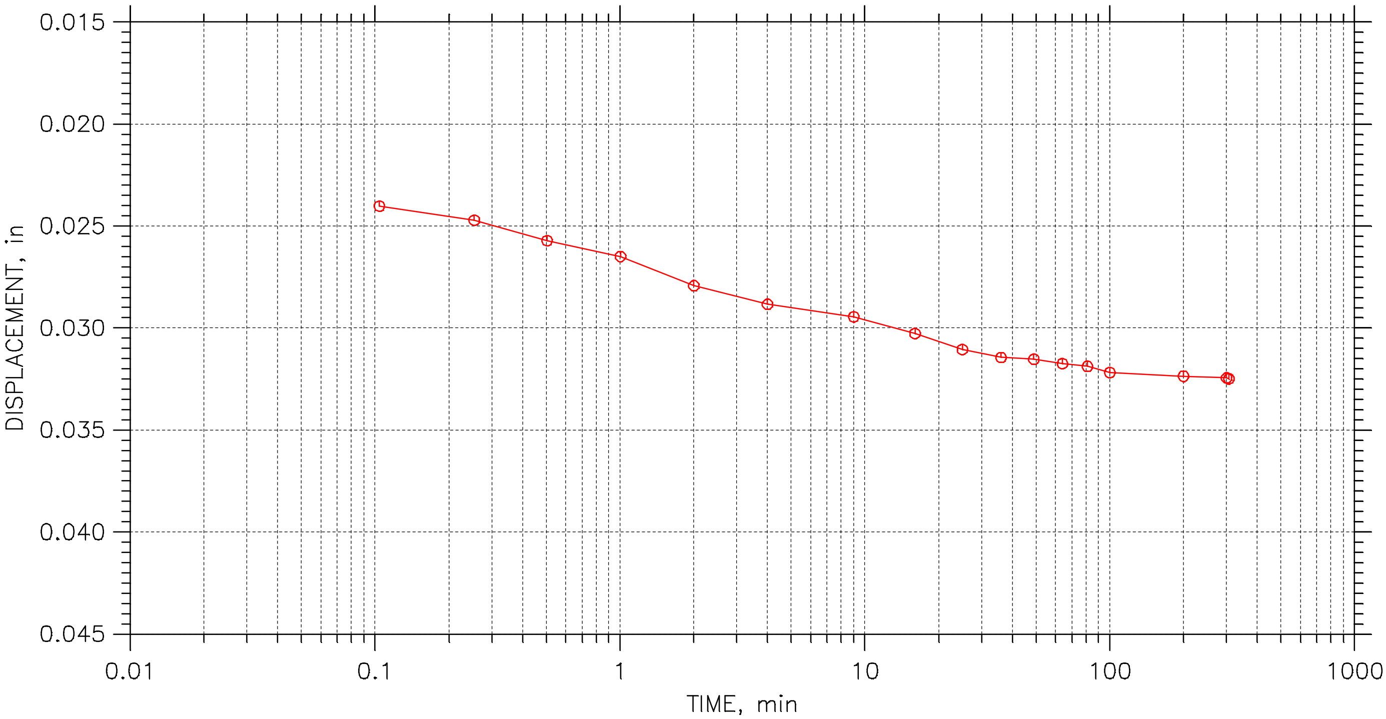
Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		
	226		

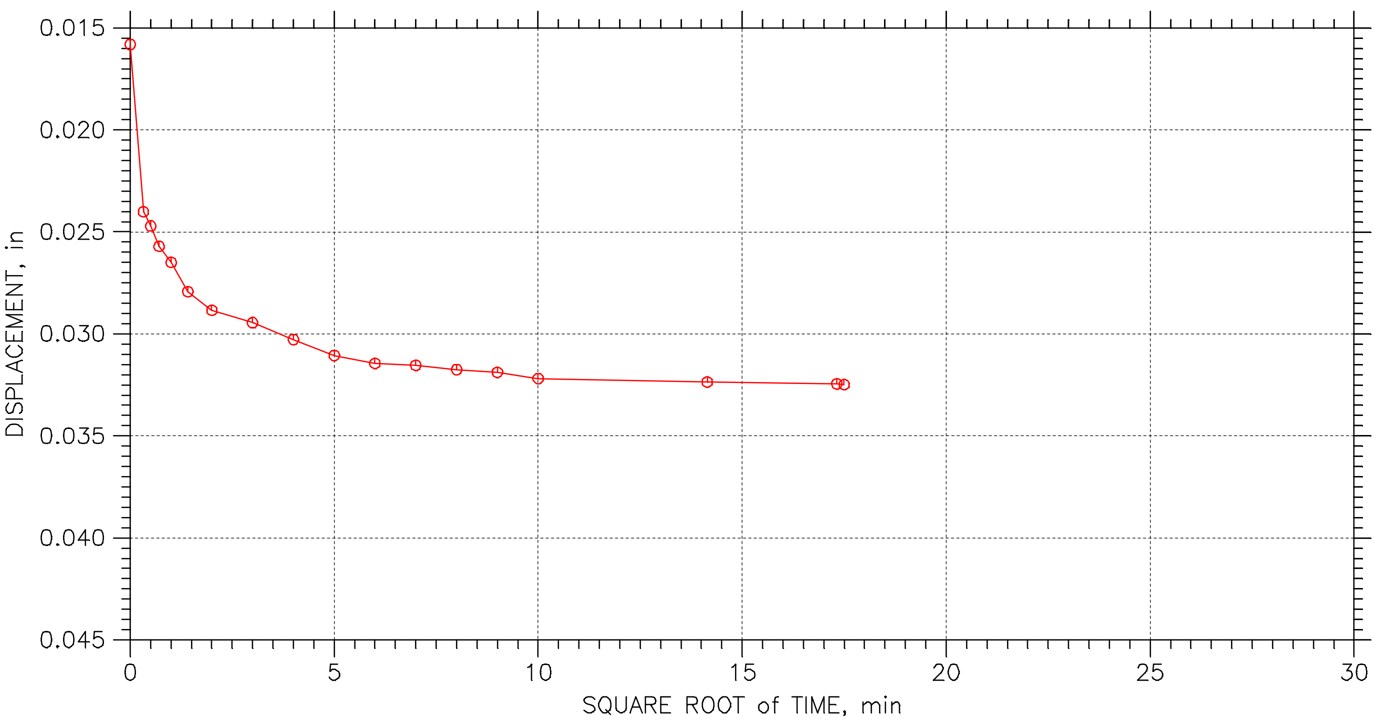
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 6 of 23

Stress: 2. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		

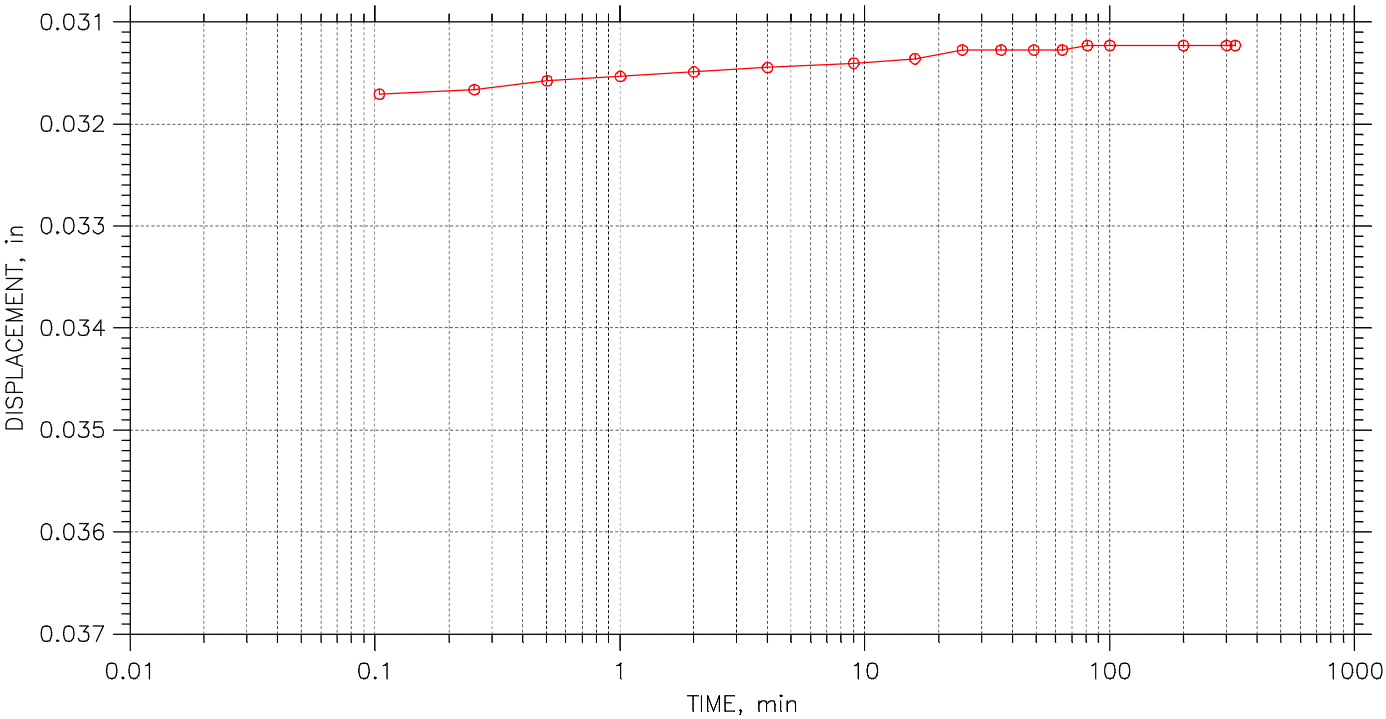
Mon, 21-DEC-2015 16:25:47

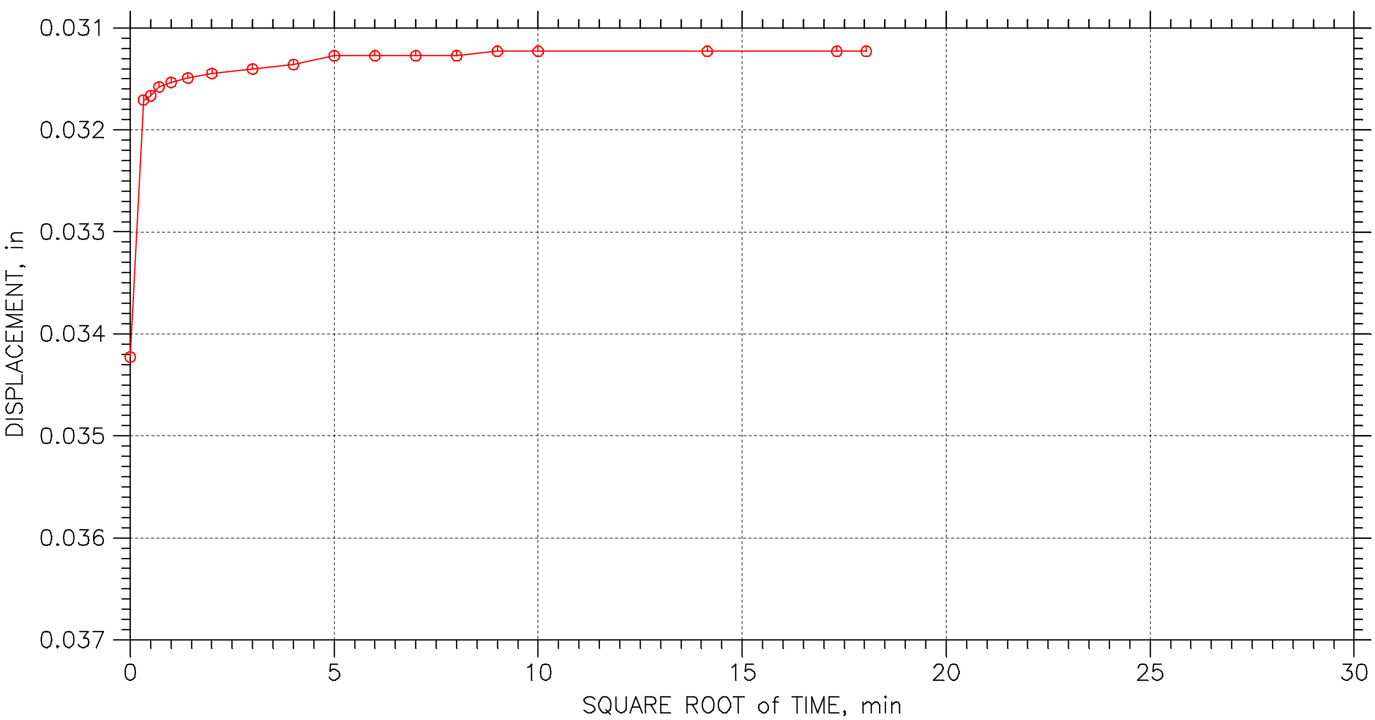
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 7 of 23

Stress: 1. tsf





Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		

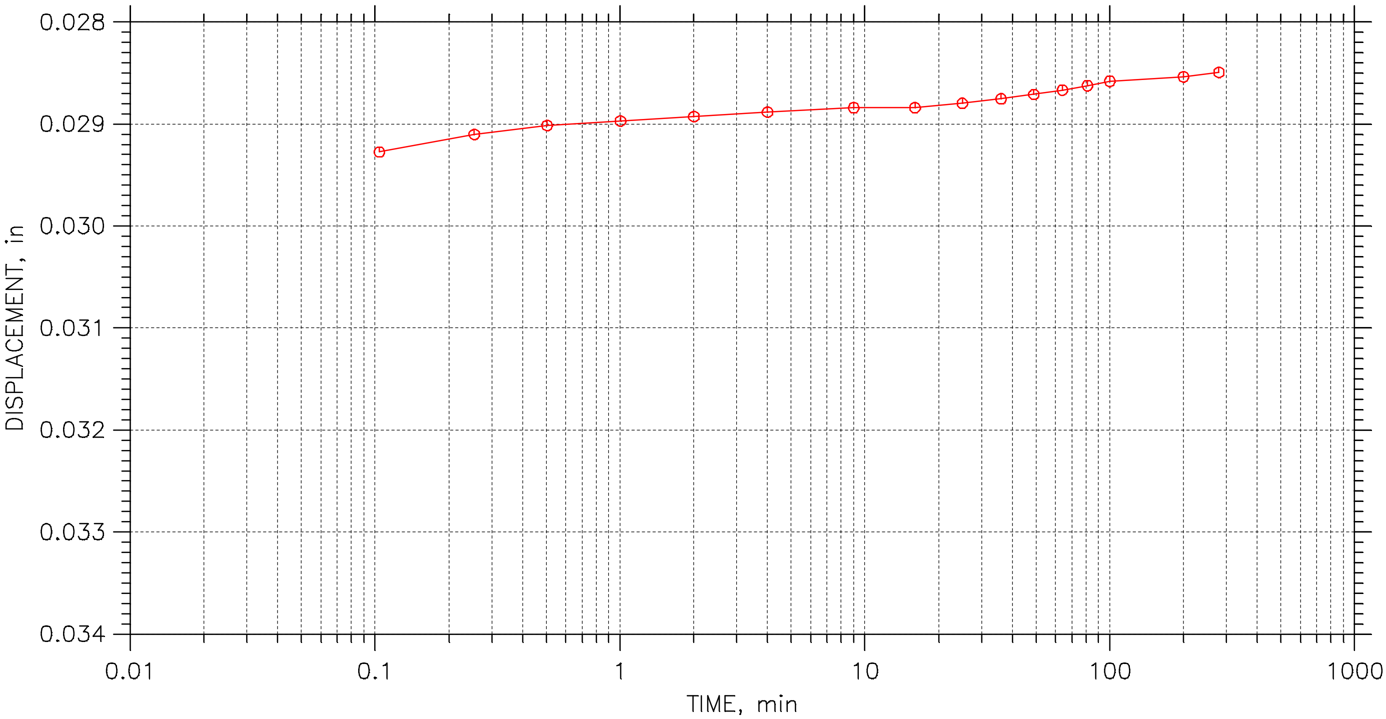
Mon, 21-DEC-2015 16:25:49

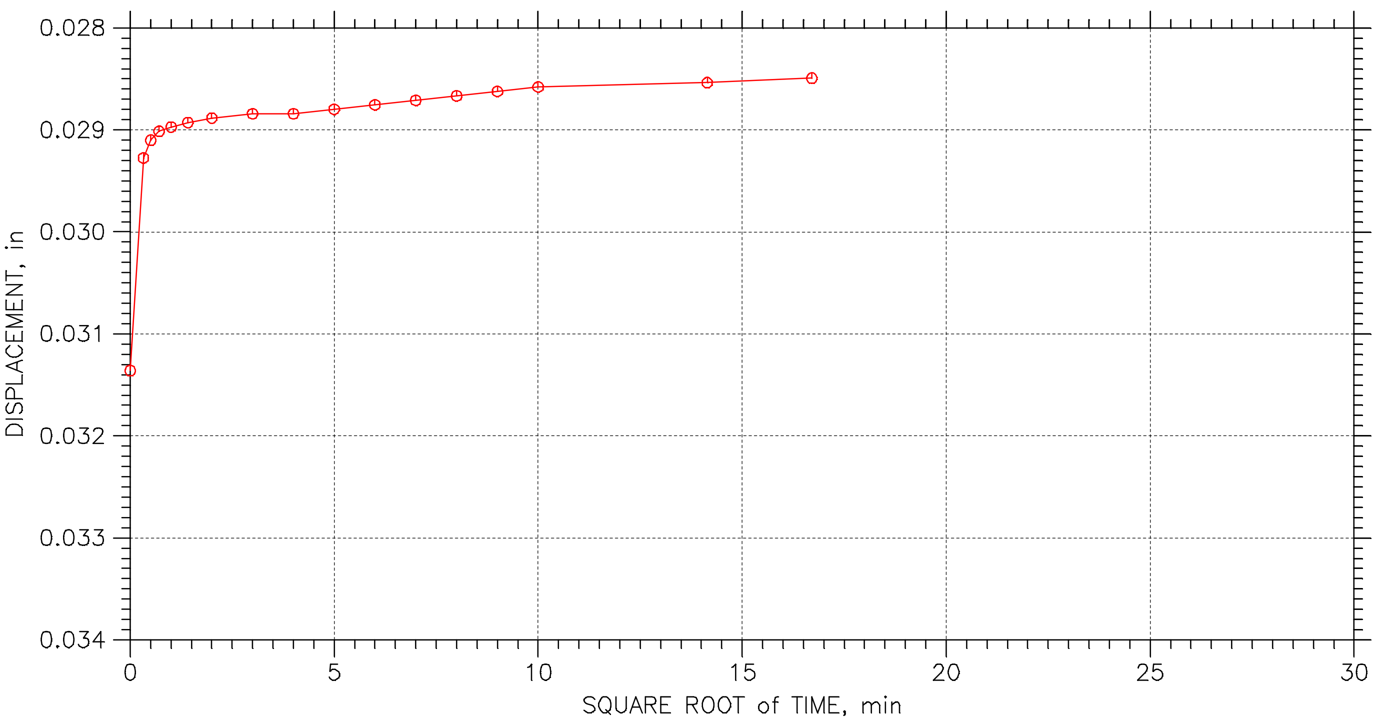
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 8 of 23

Stress: 0.5 tsf





Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		

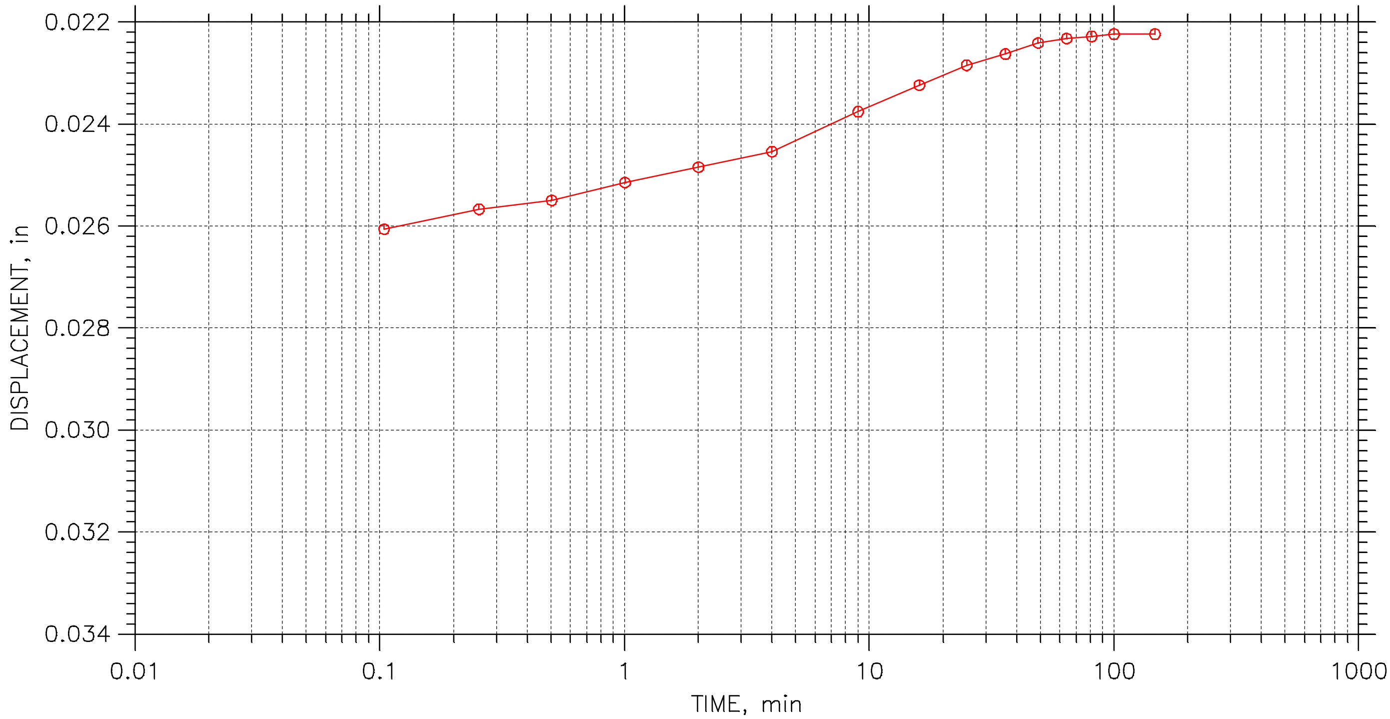
Mon, 21-DEC-2015 16:25:50

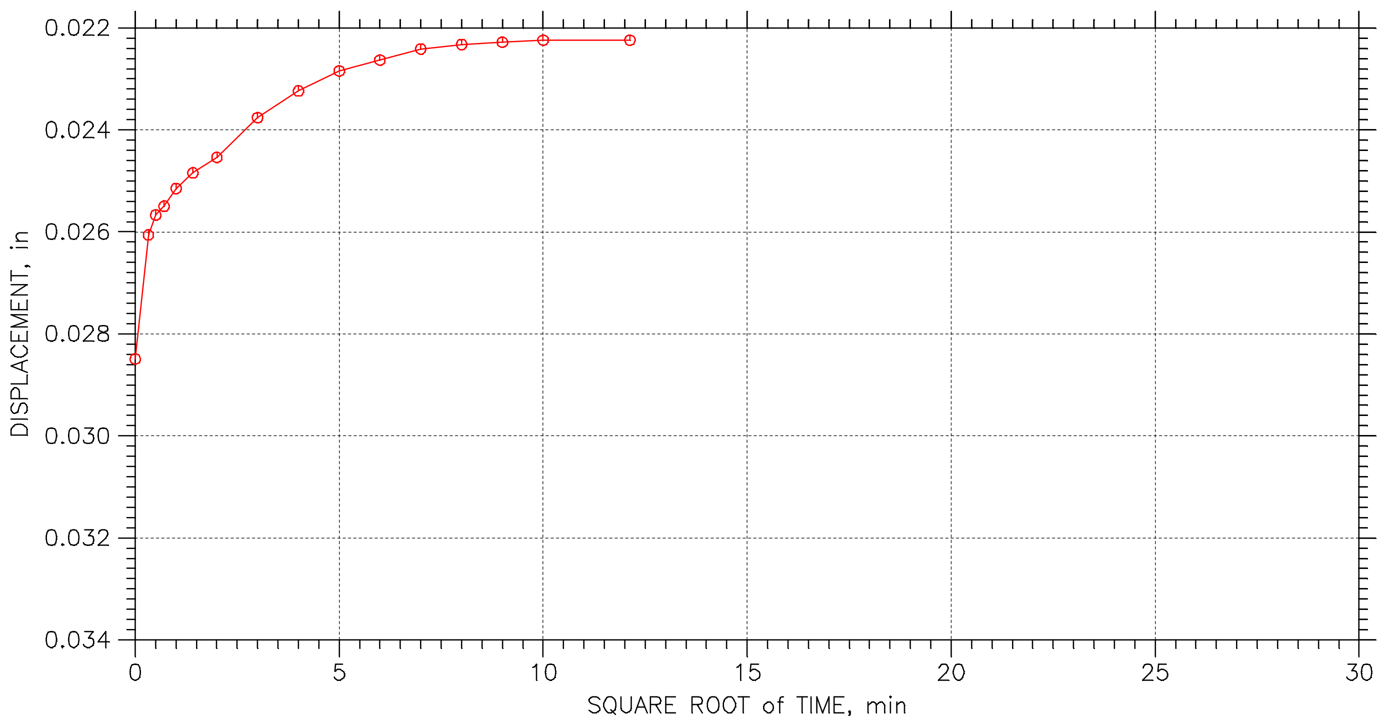
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 9 of 23

Stress: 0.125 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		

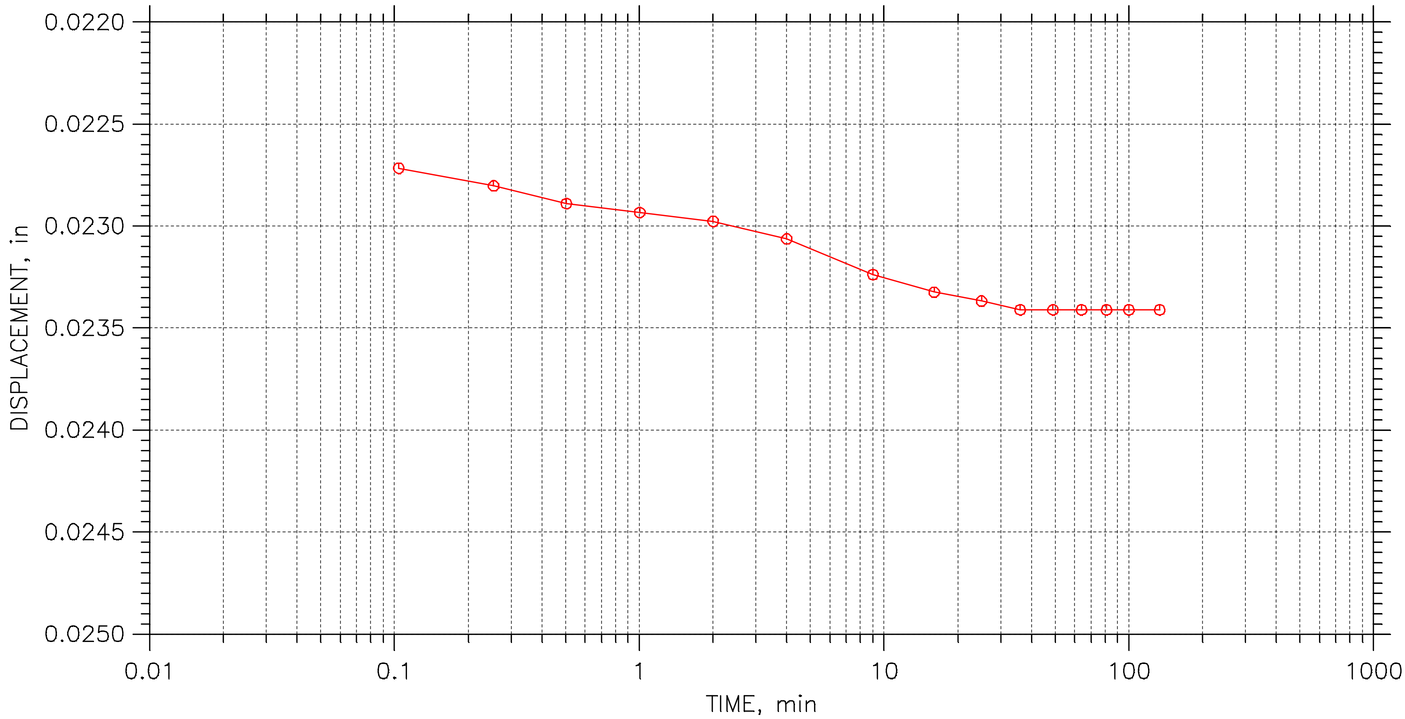
Mon, 21-DEC-2015 16:25:52

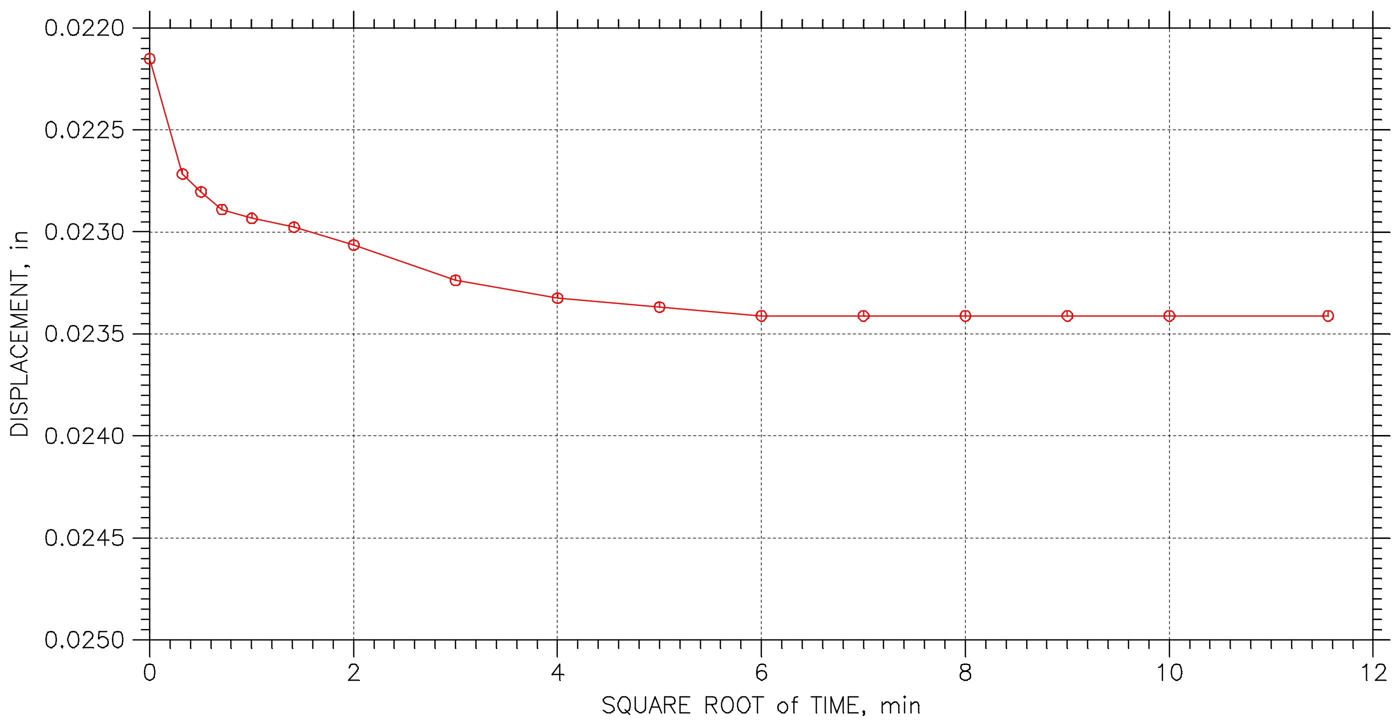
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 10 of 23

Stress: 0.25 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0" ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		

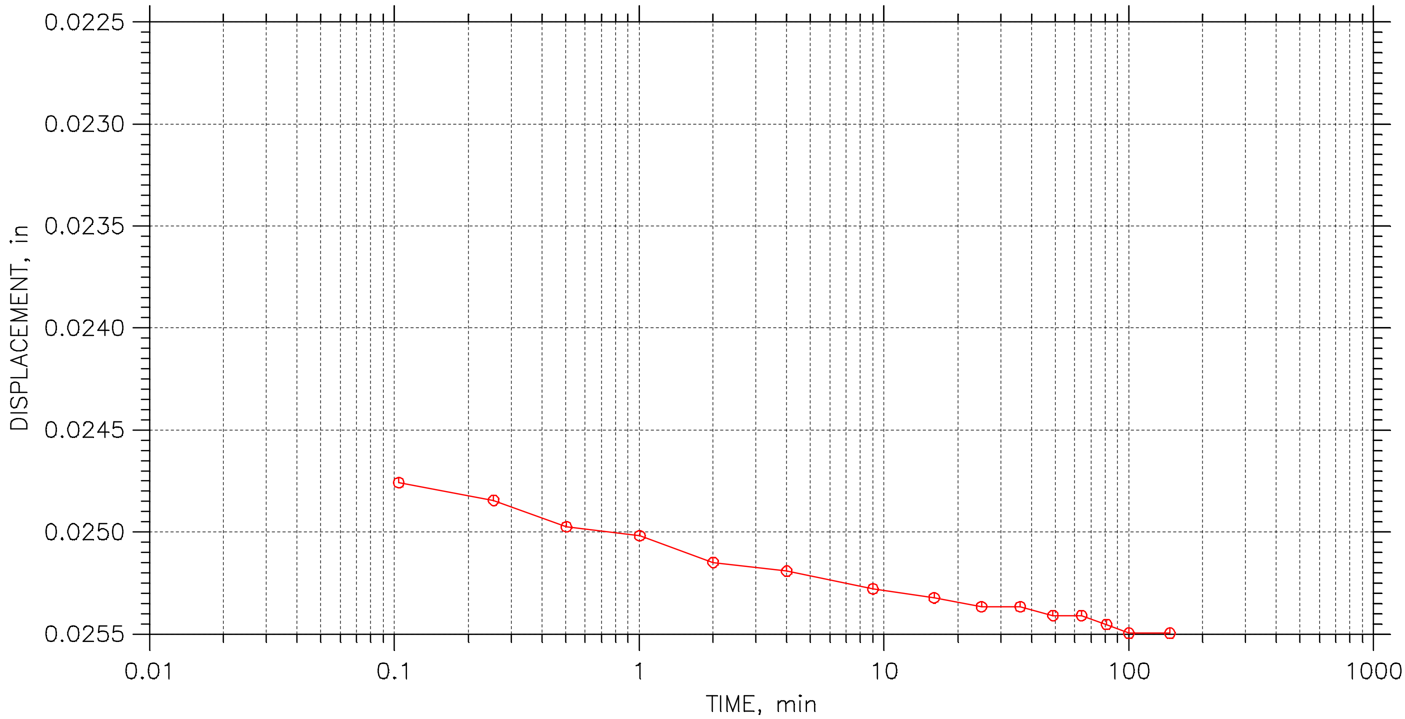
Mon, 21-DEC-2015 16:25:53

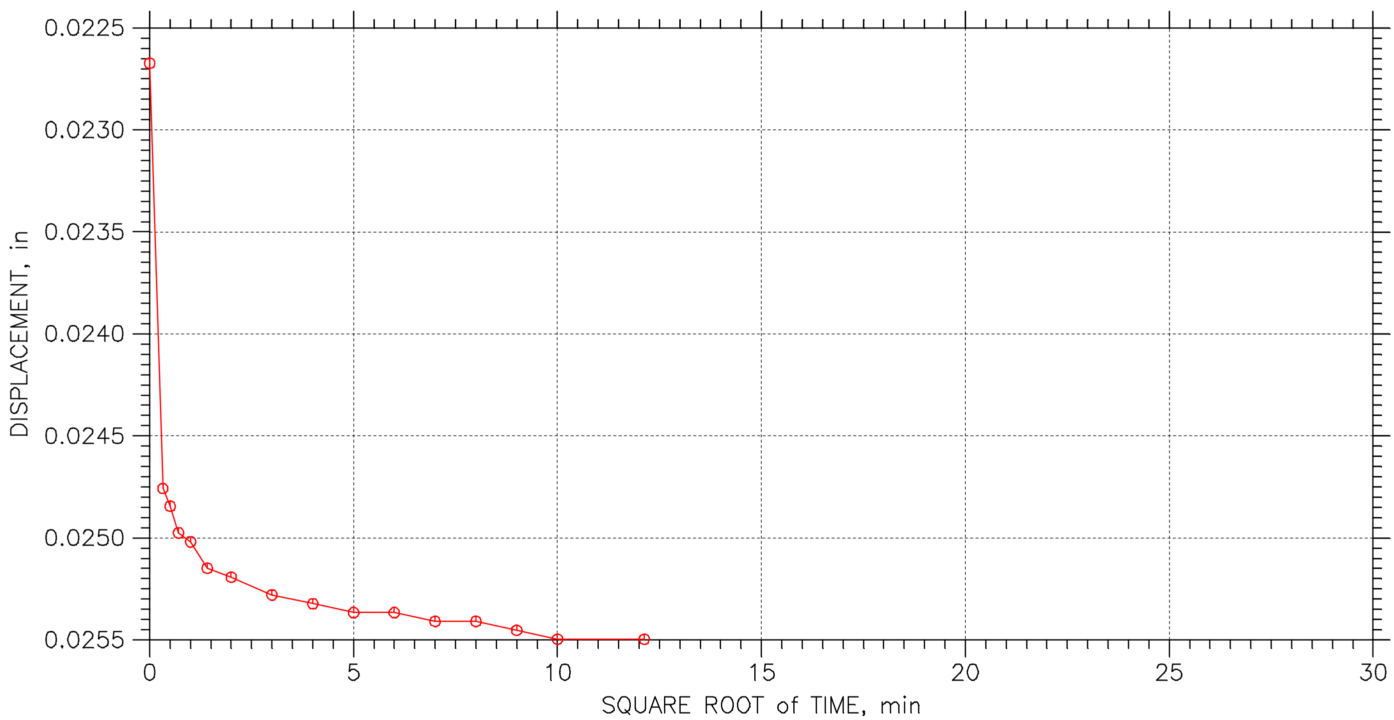
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 11 of 23

Stress: 0.5 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		
	232		

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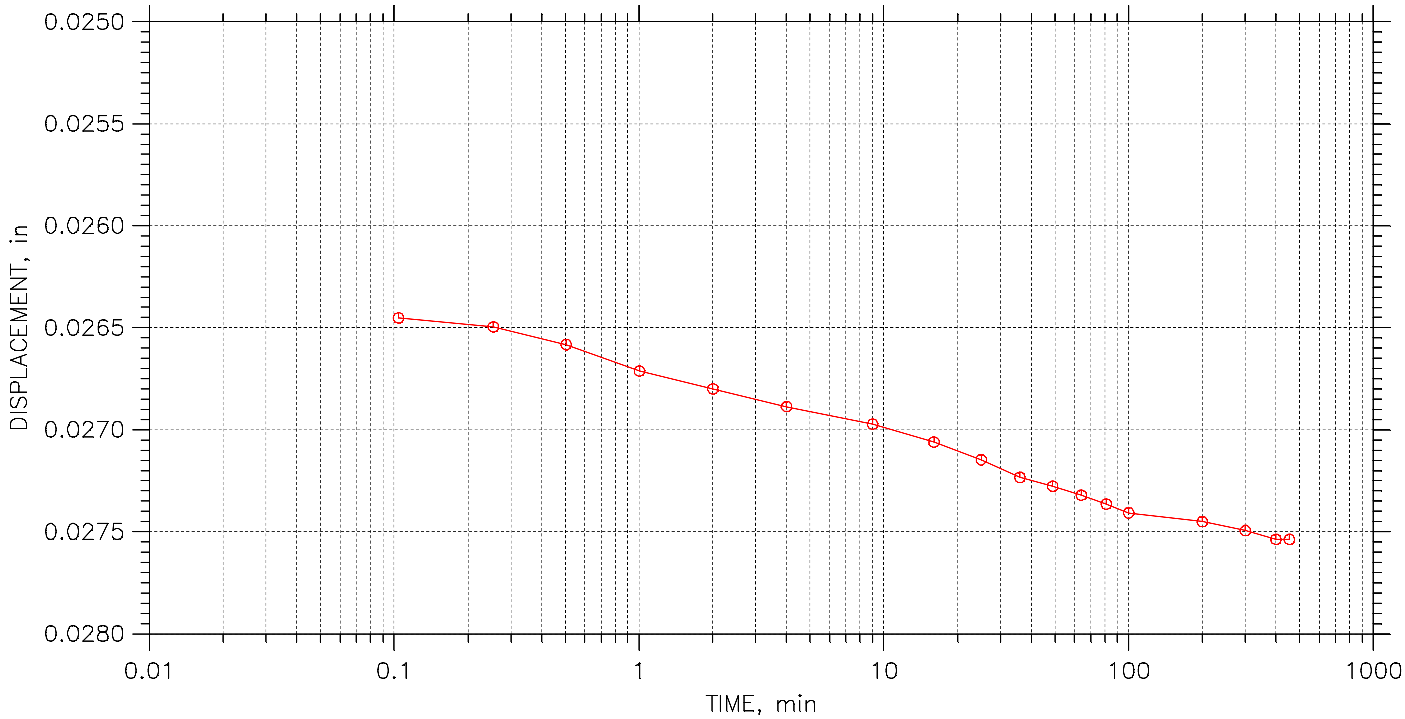
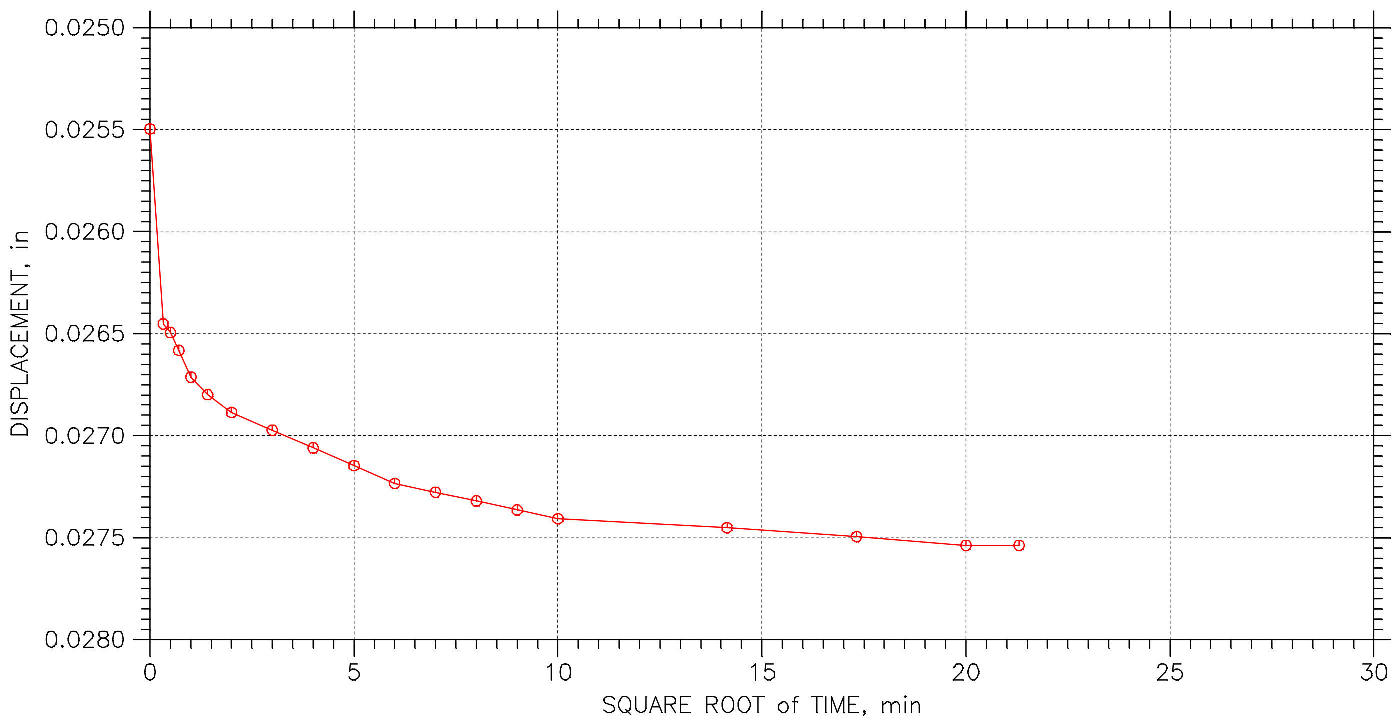
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 12 of 23

Stress: 0.75 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		
	233		

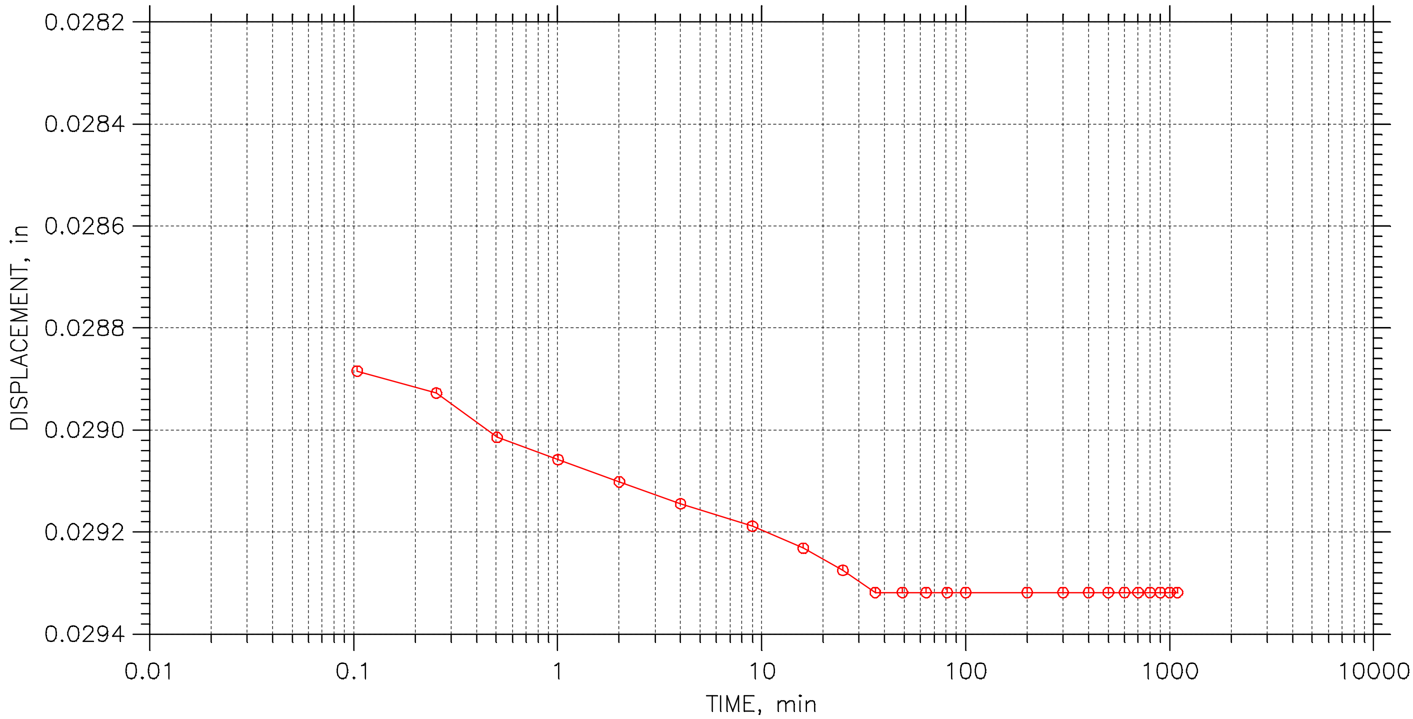
Mon, 21-DEC-2015 16:25:56

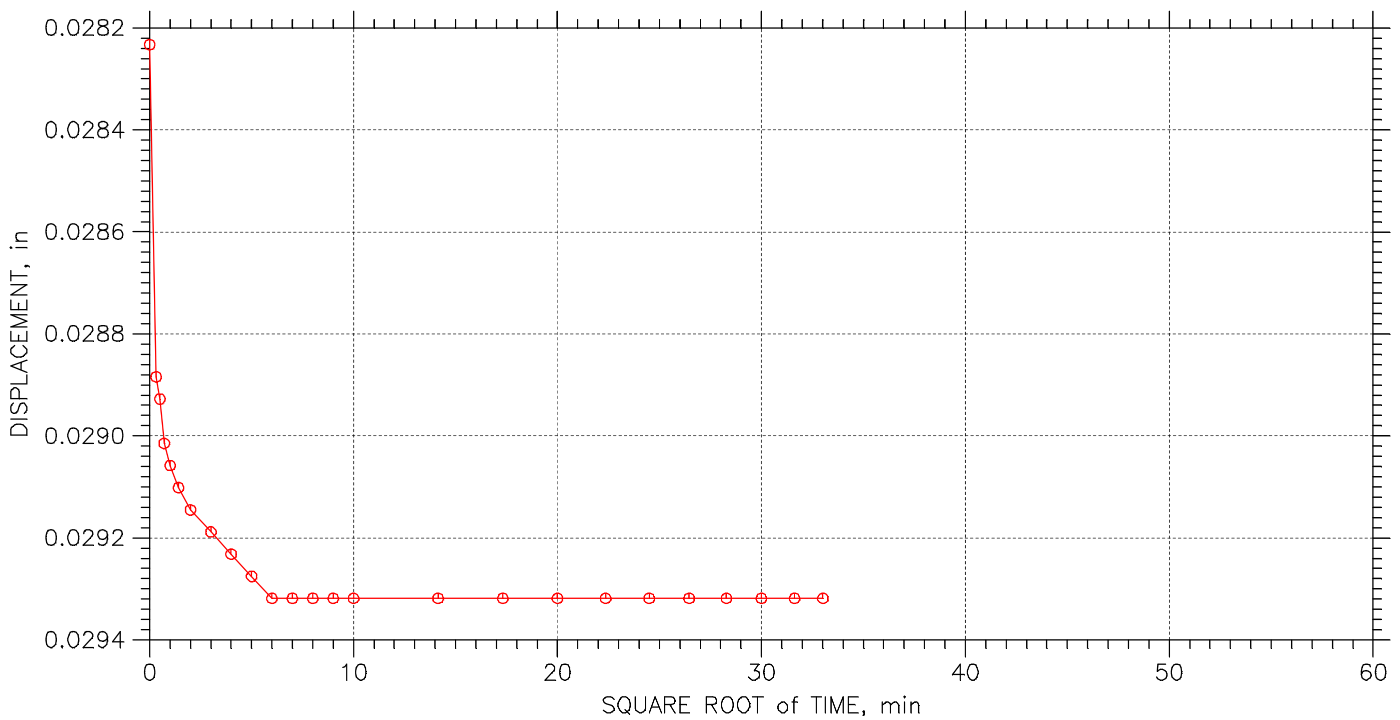
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 13 of 23

Stress: 1. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		

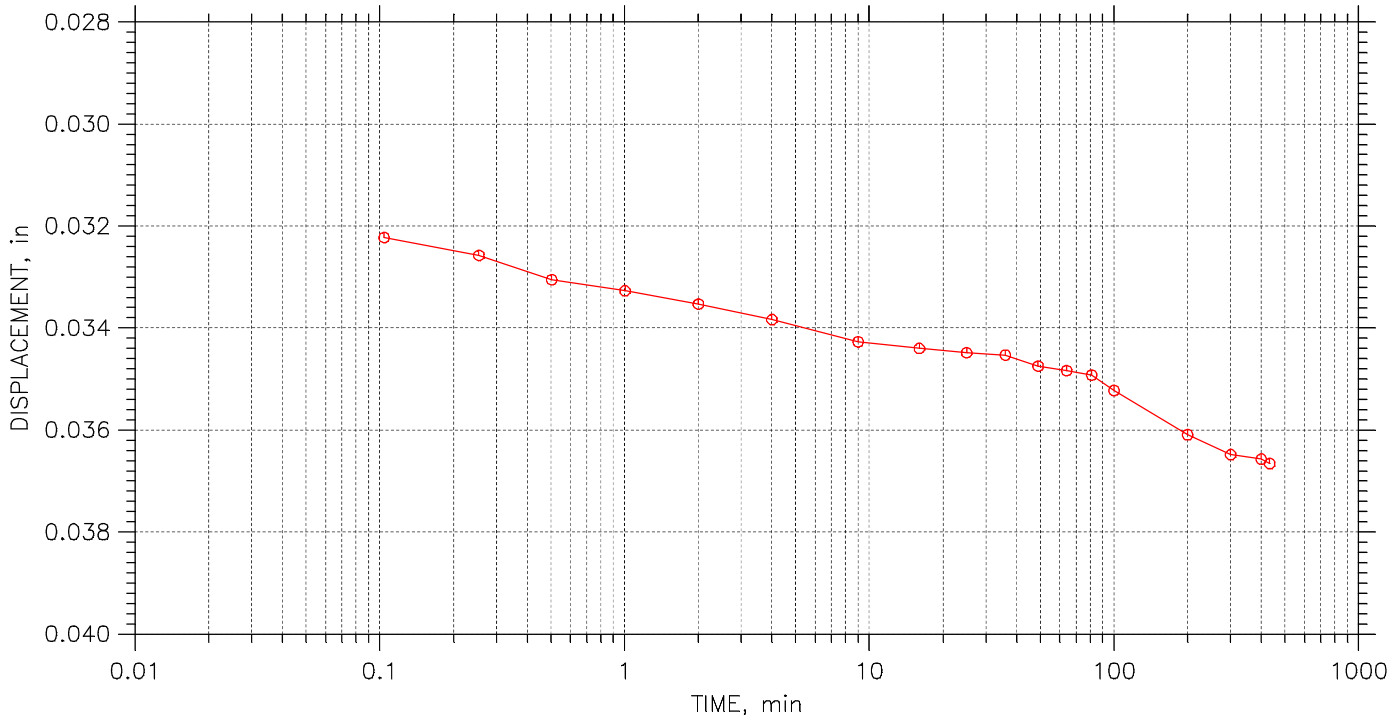
Mon, 21-DEC-2015 16:25:58

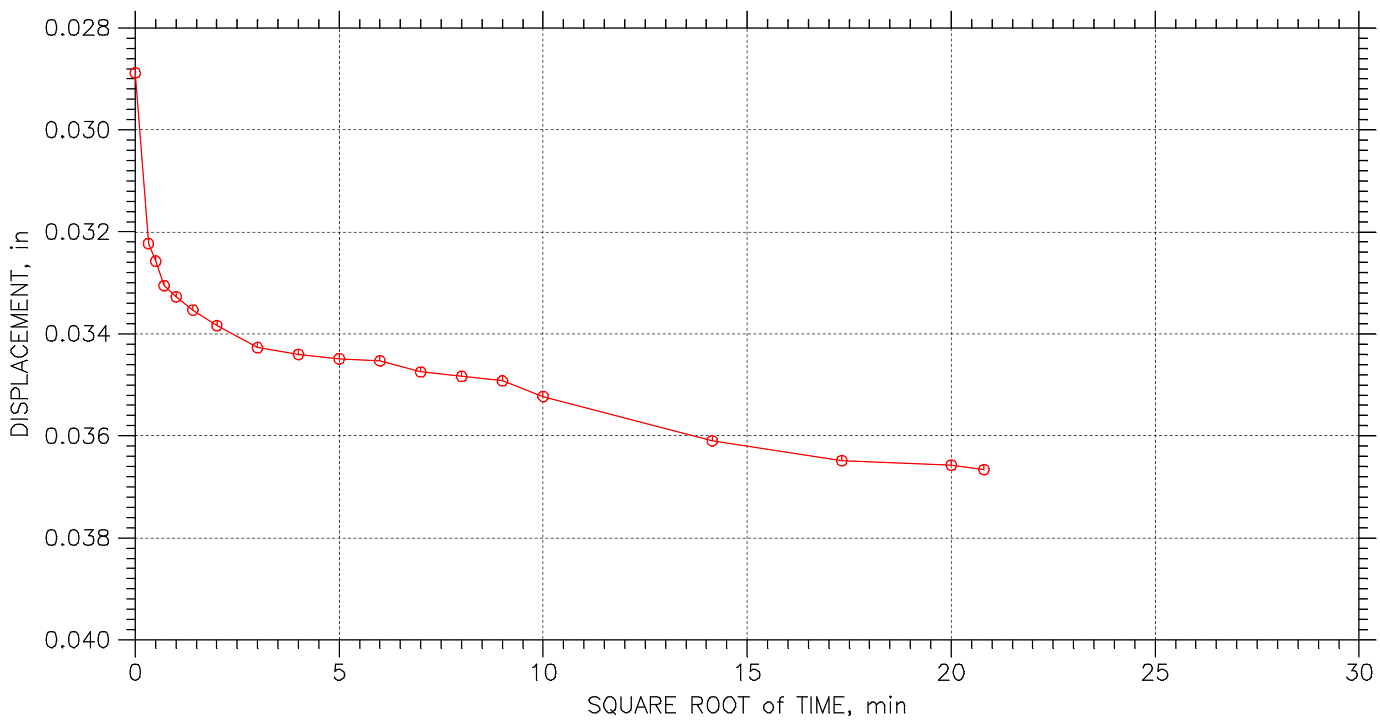
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 14 of 23

Stress: 2. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		

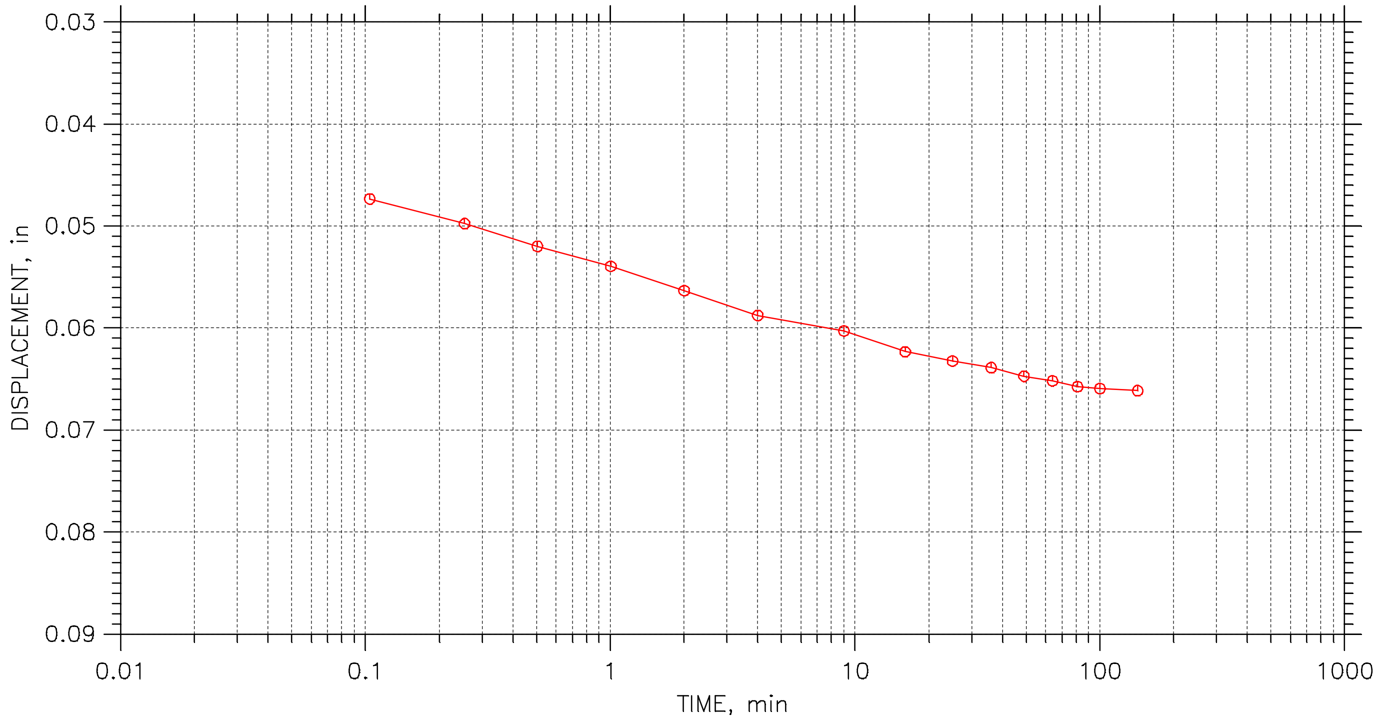
Mon, 21-DEC-2015 16:25:59

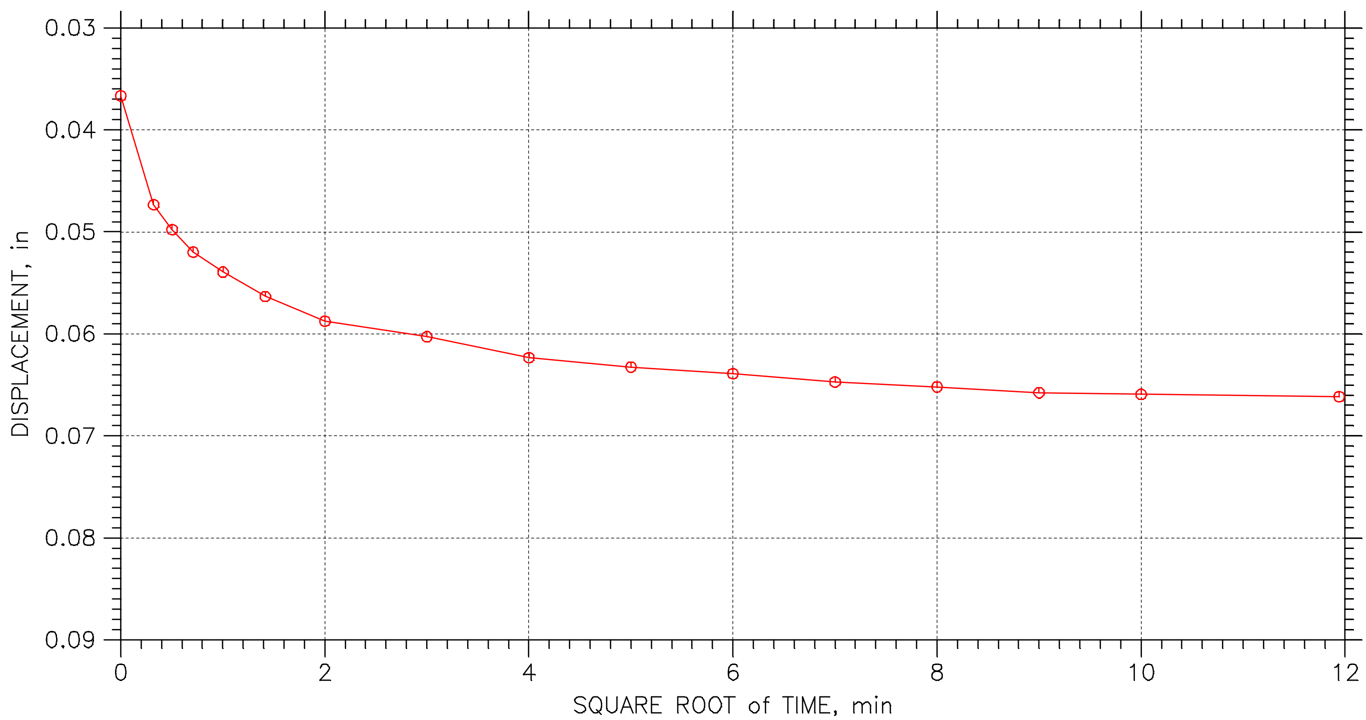
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 15 of 23

Stress: 4. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0" ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		
	236		

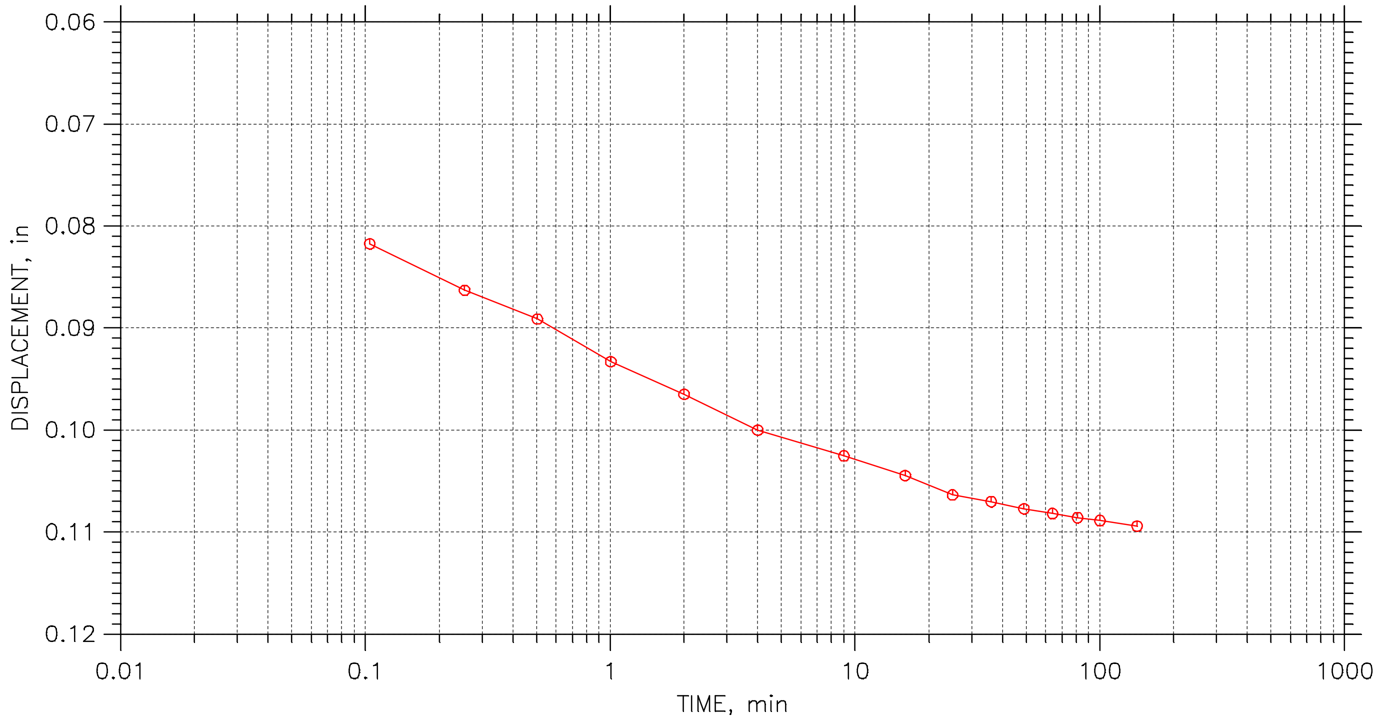
Mon, 21-DEC-2015 16:26:01

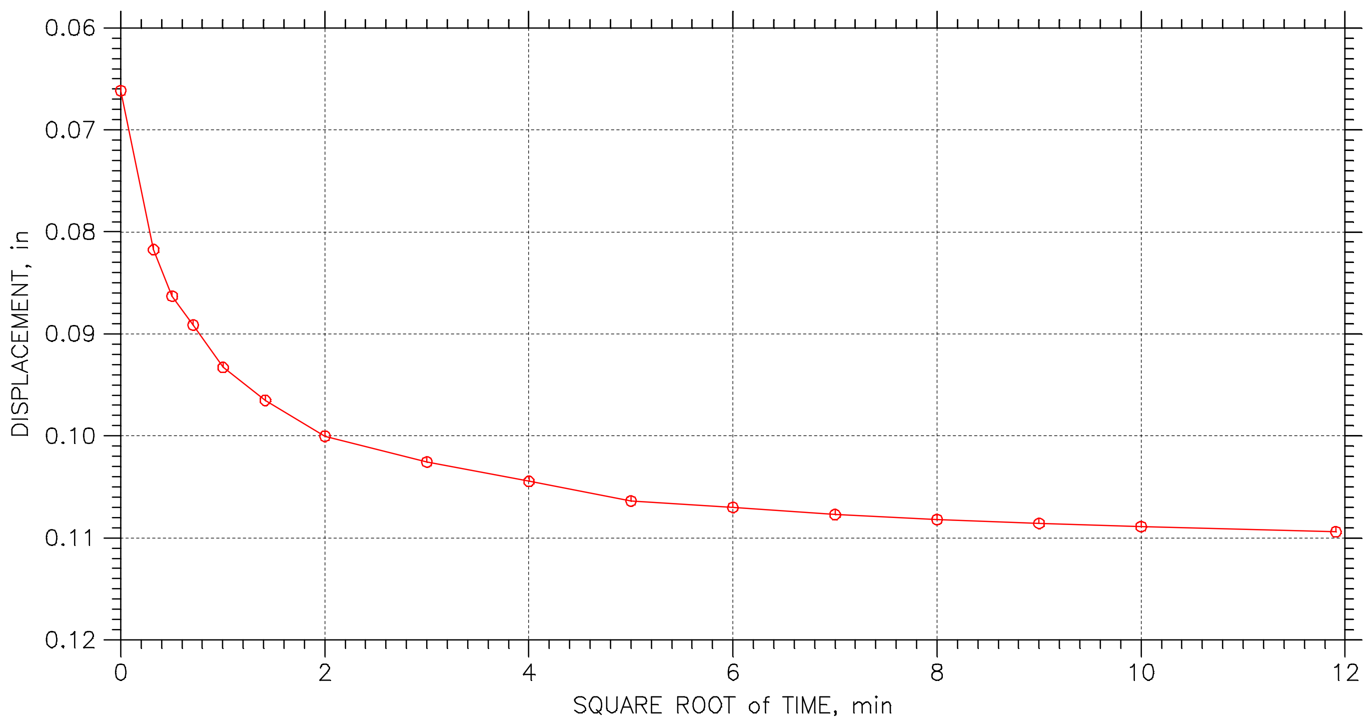
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 16 of 23

Stress: 8. tsf





Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		
	237		

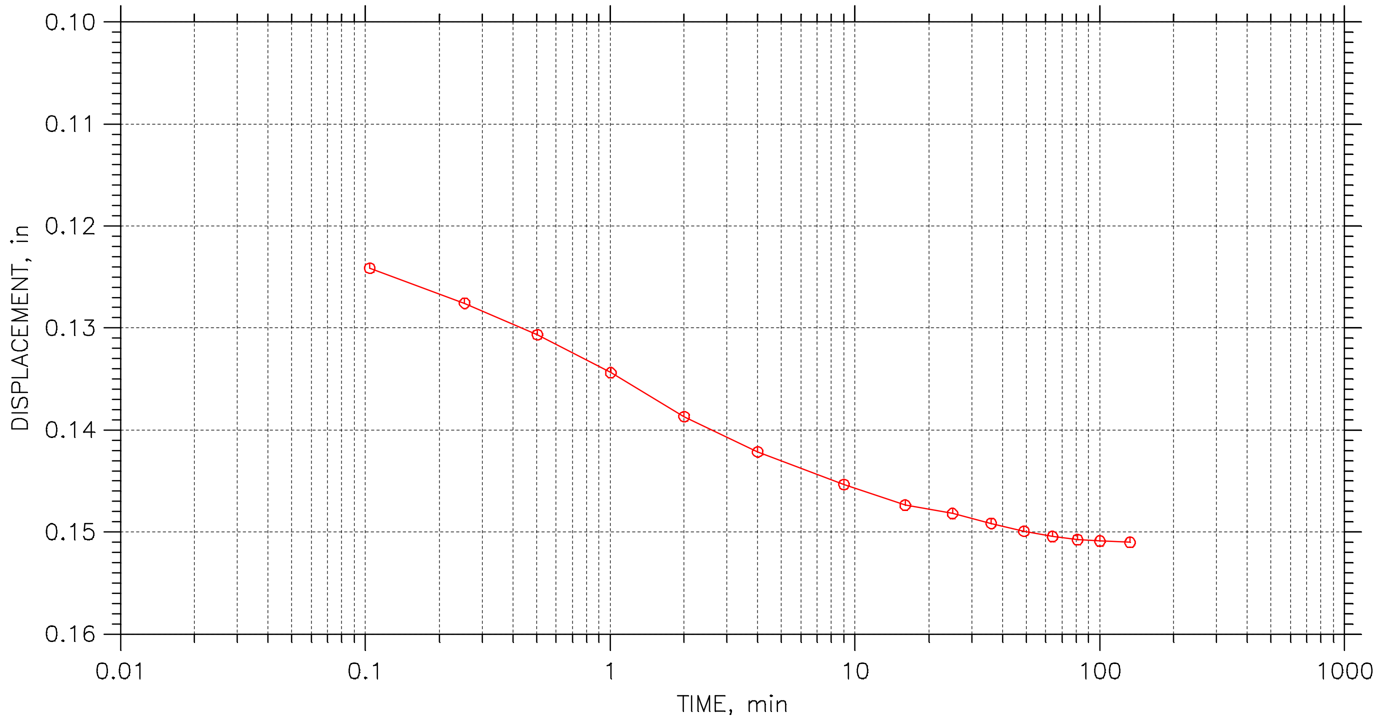
Mon, 21-DEC-2015 16:26:02

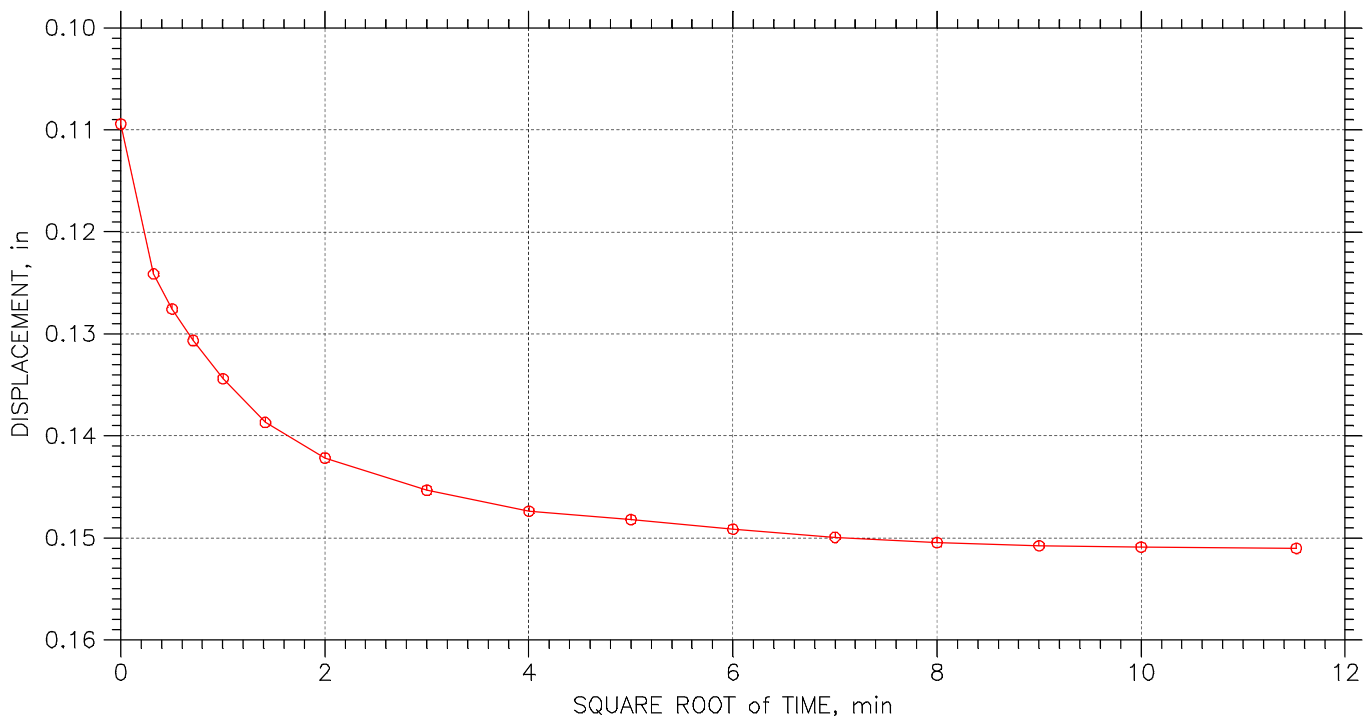
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 17 of 23

Stress: 16. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		
	238		

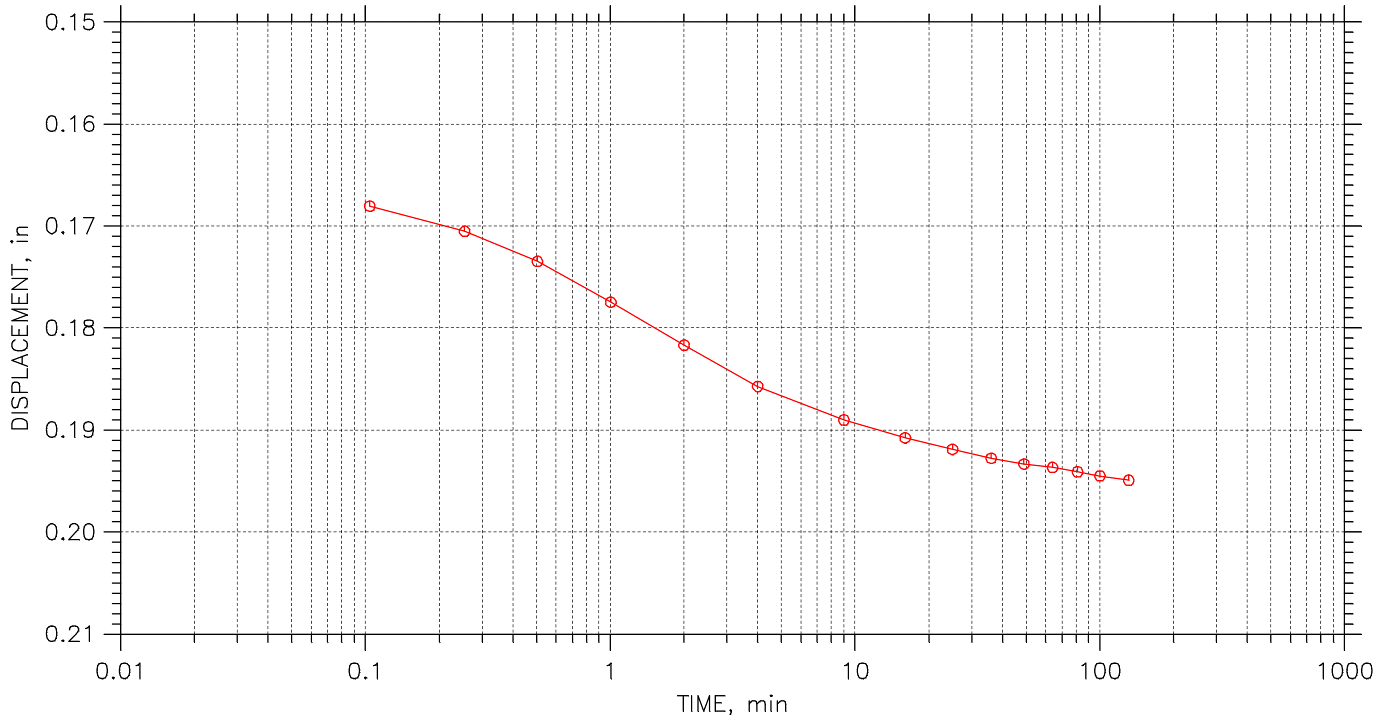
Mon, 21-DEC-2015 16:26:03

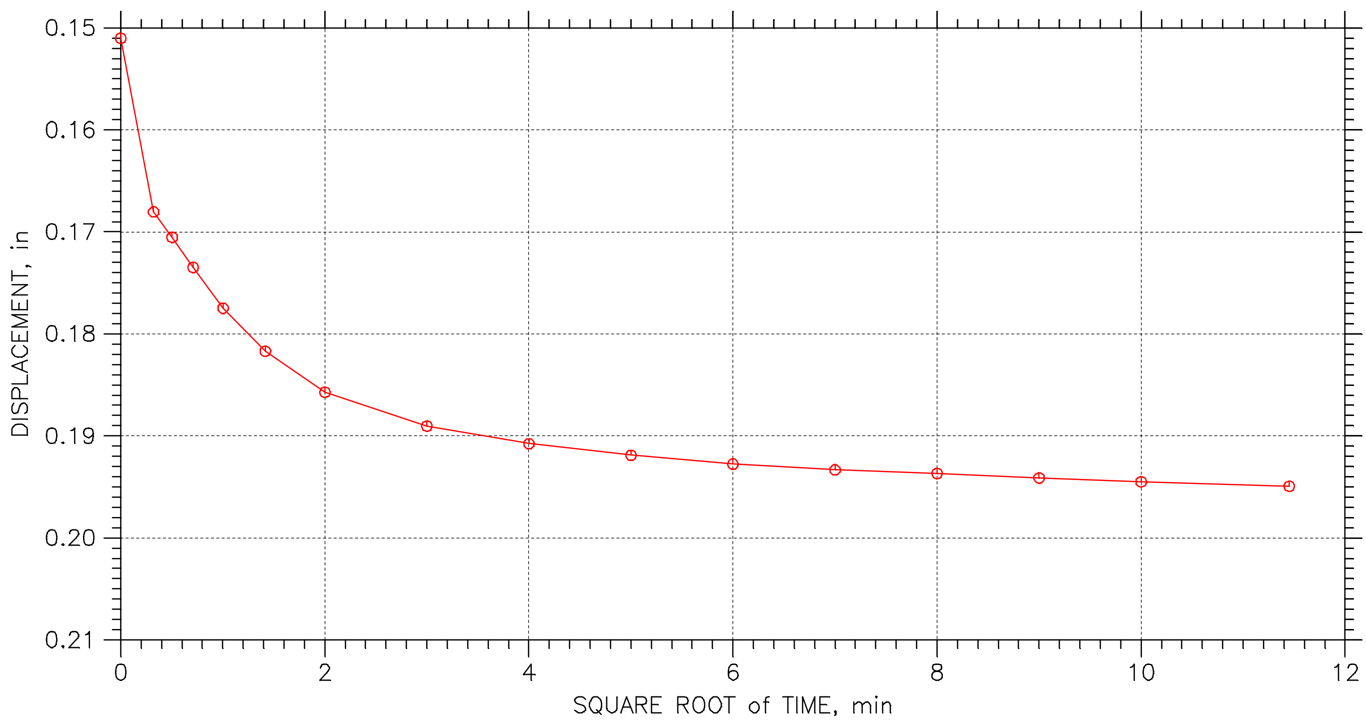
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 18 of 23

Stress: 32. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		

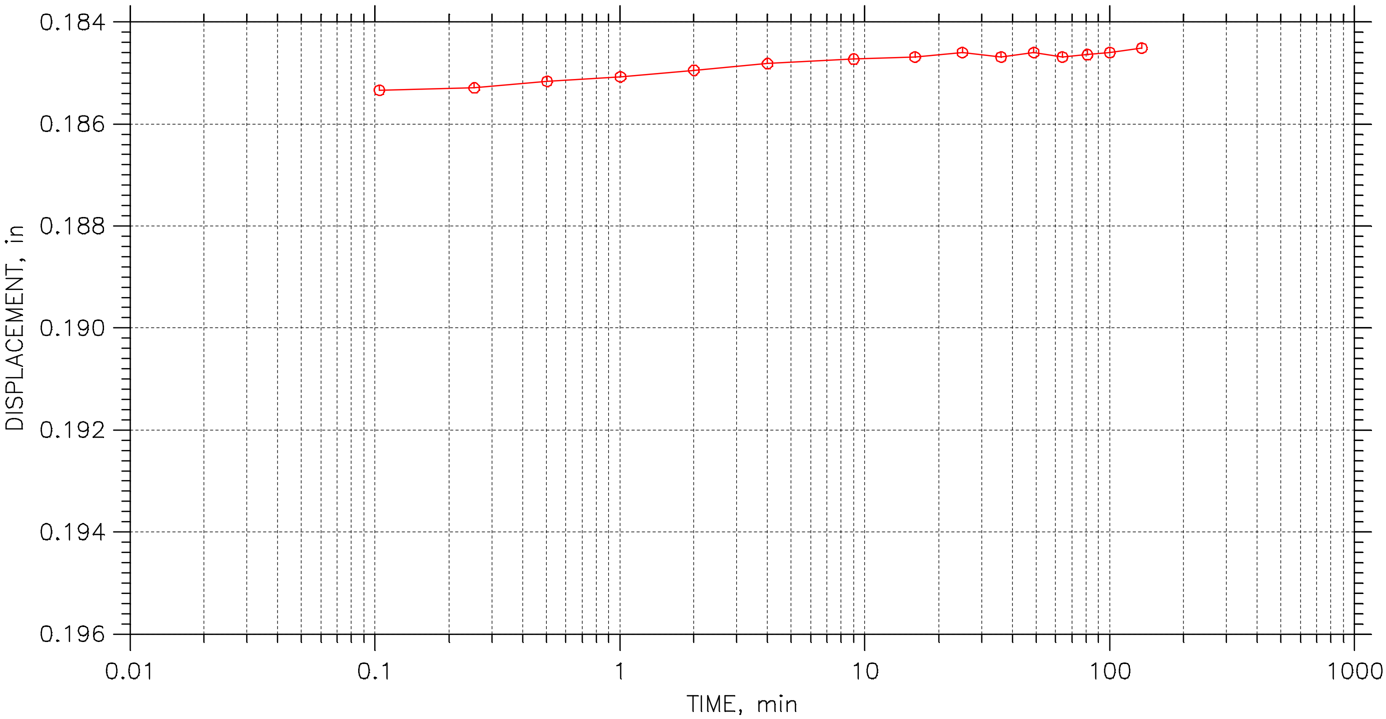
Mon, 21-DEC-2015 16:26:05

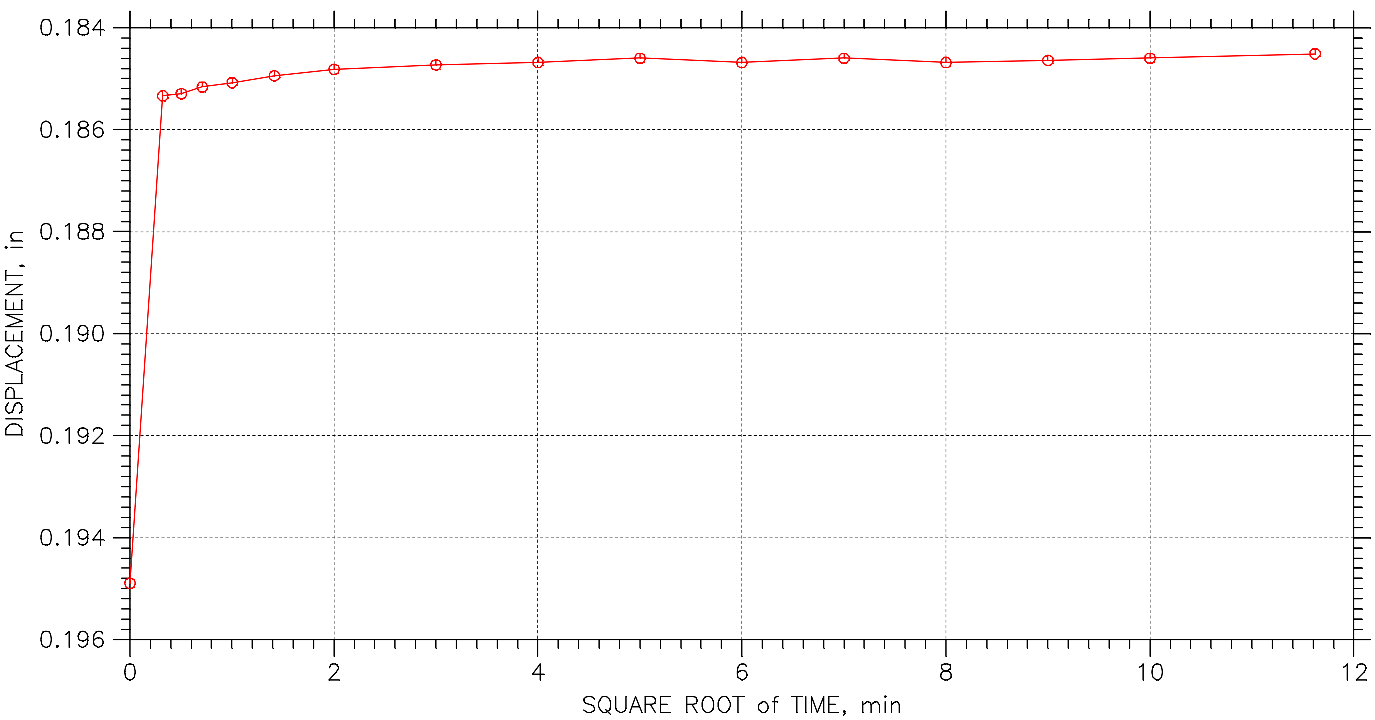
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 19 of 23

Stress: 16. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		
	240		

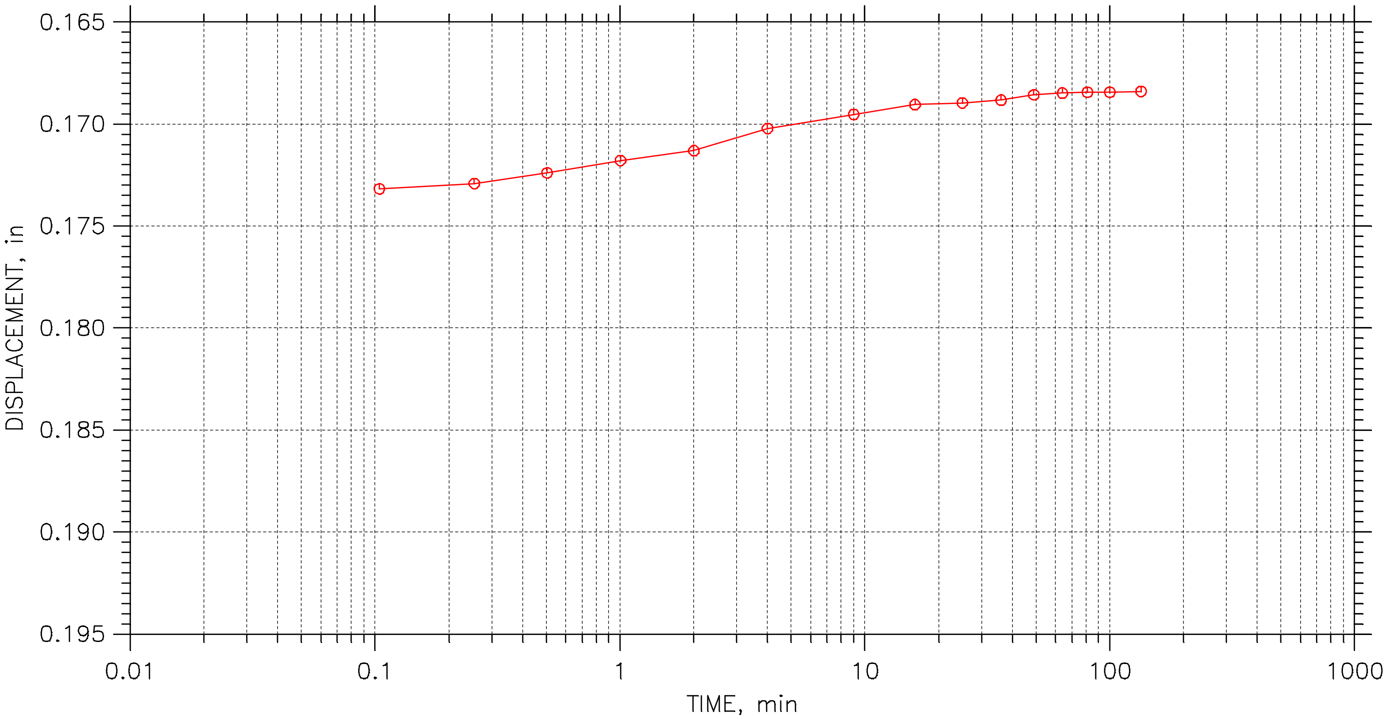
Mon, 21-DEC-2015 16:26:06

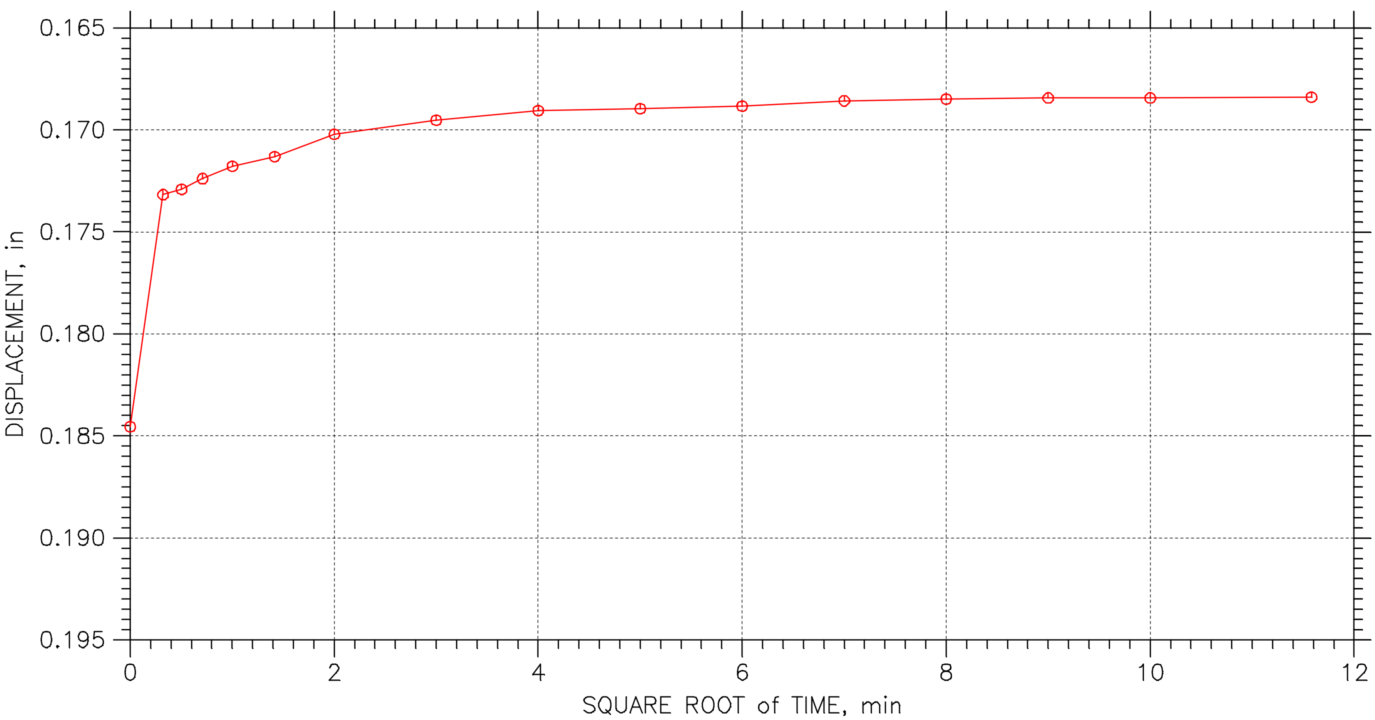
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 20 of 23

Stress: 4. tsf





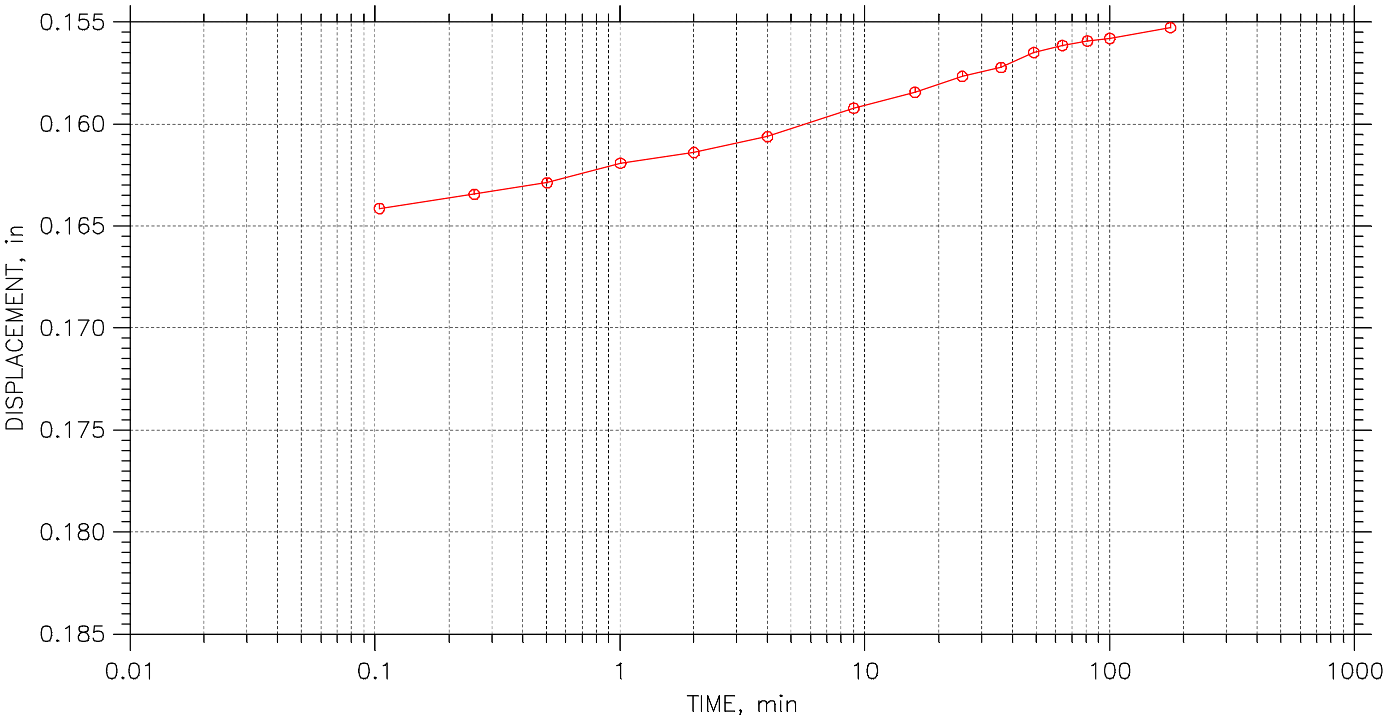
Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		
	241		

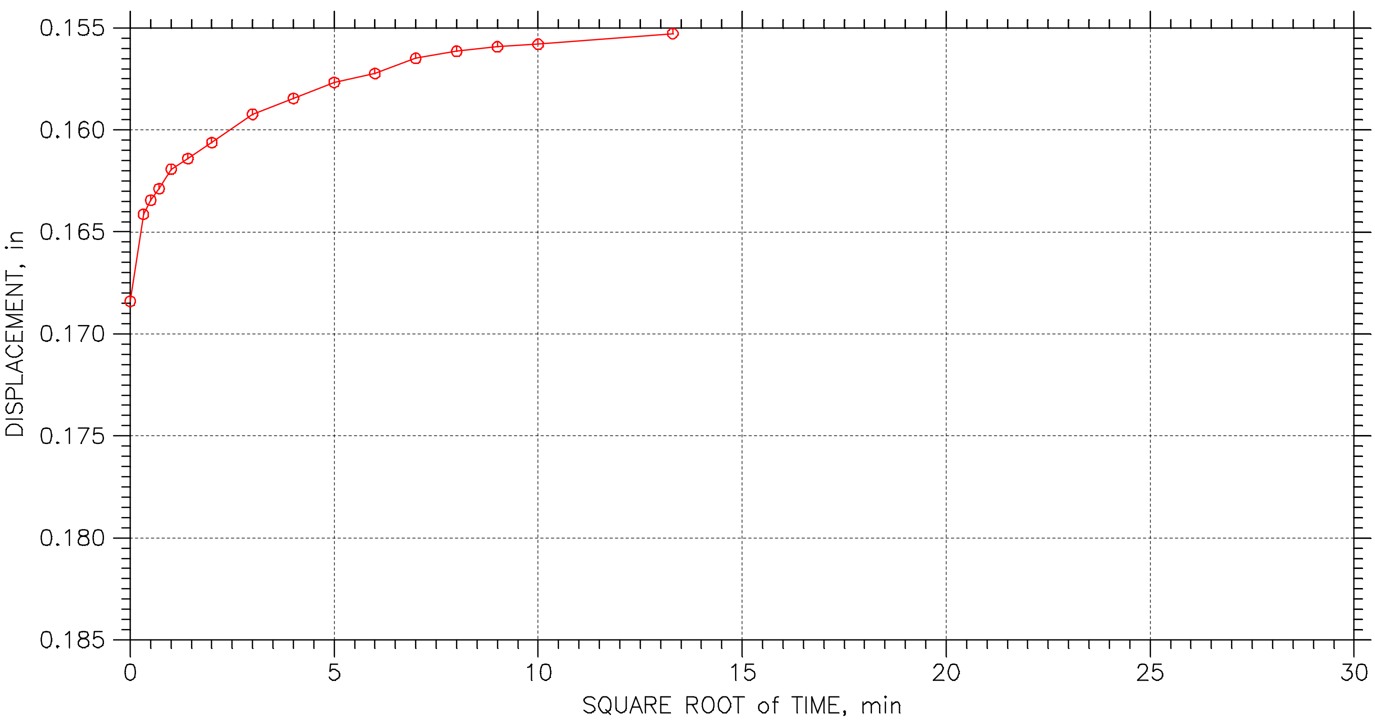
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 21 of 23

Stress: 1. tsf





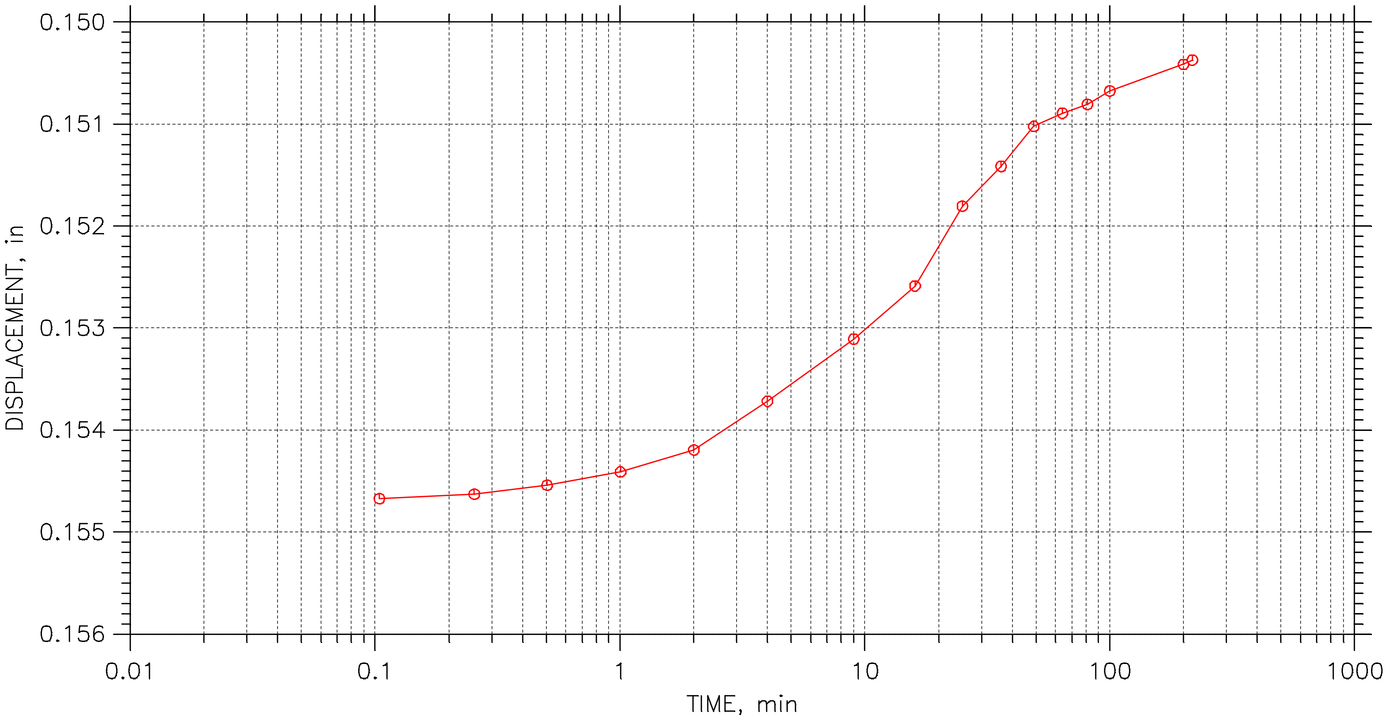
Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		
	242		

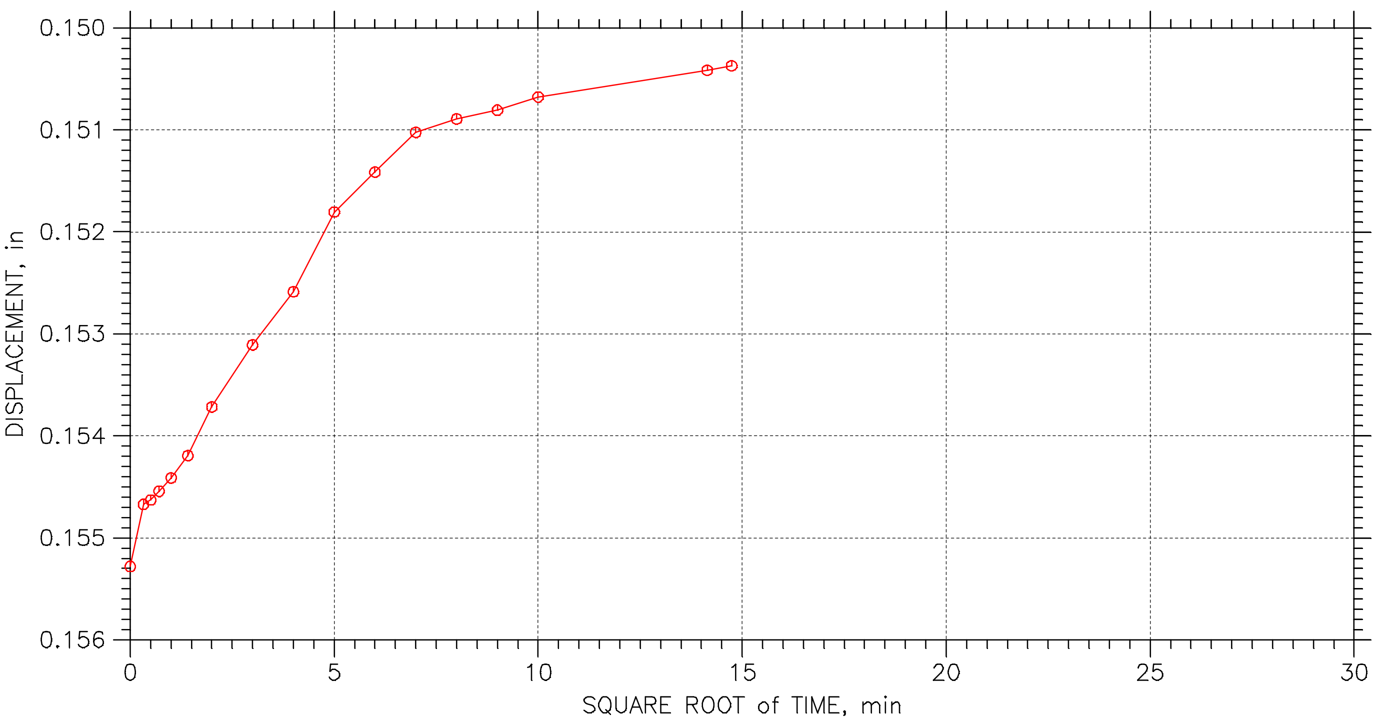
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 22 of 23

Stress: 0.5 tsf





Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		

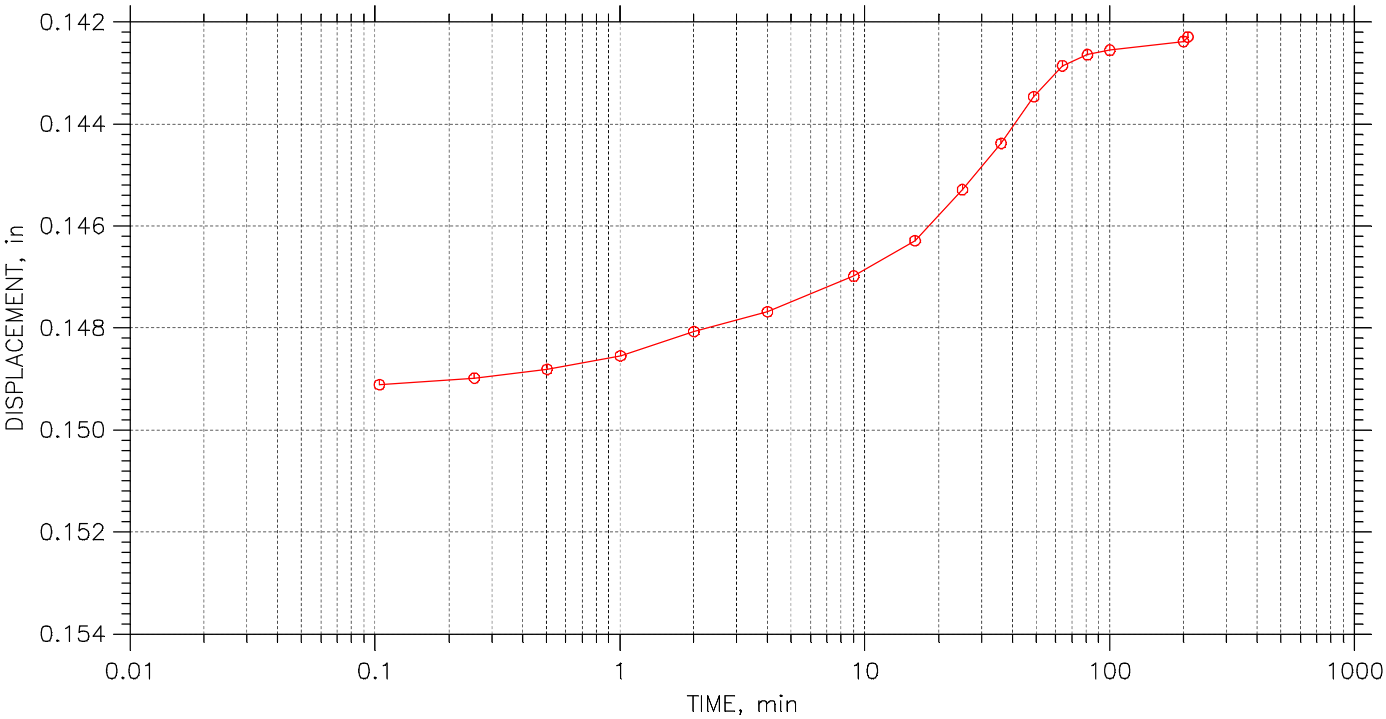
Mon, 21-DEC-2015 16:26:10

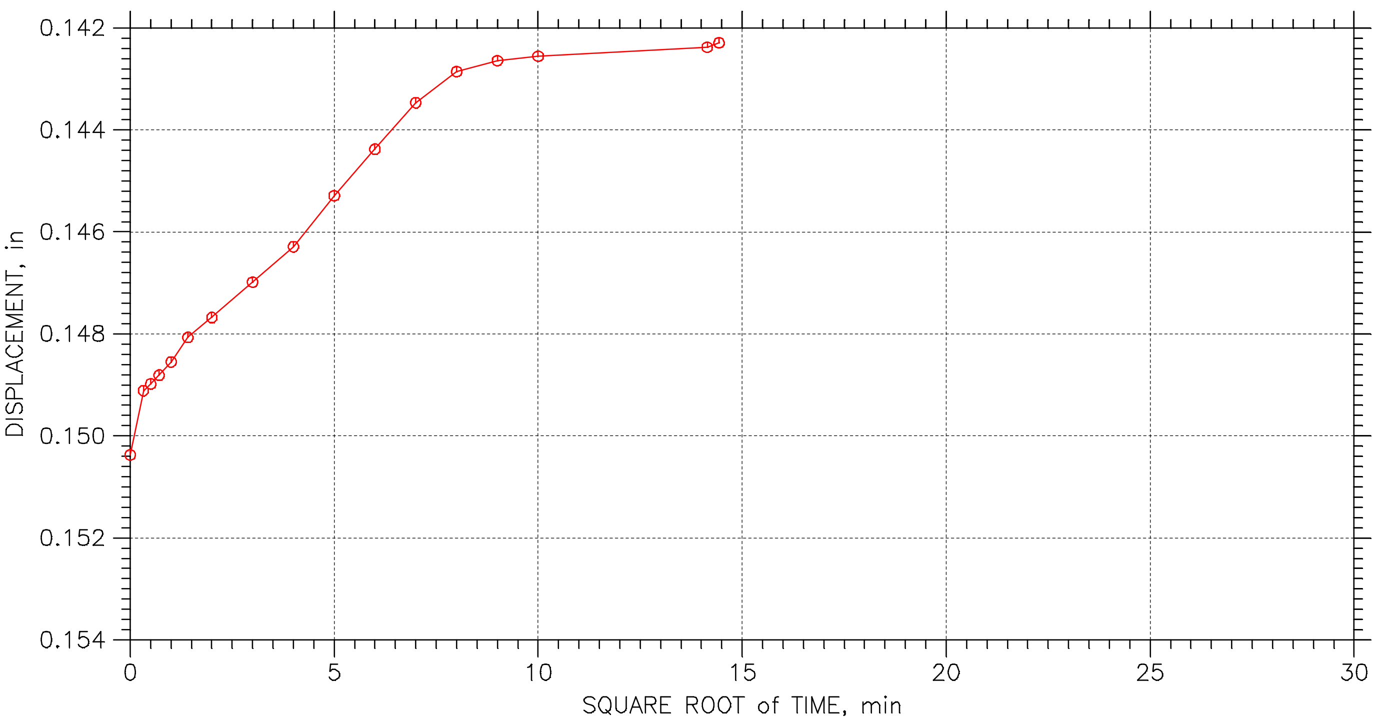
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 23 of 23

Stress: 0.125 tsf

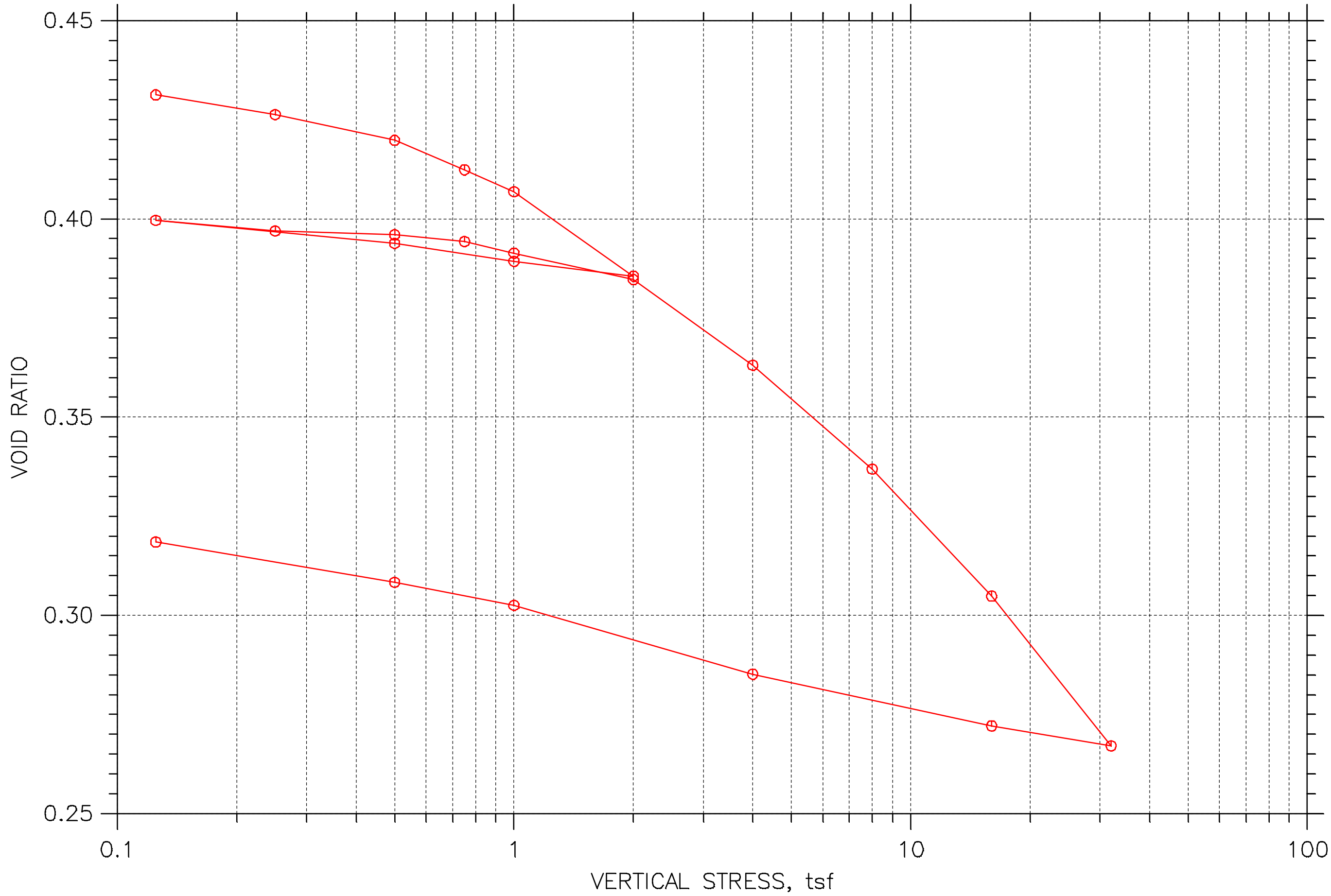


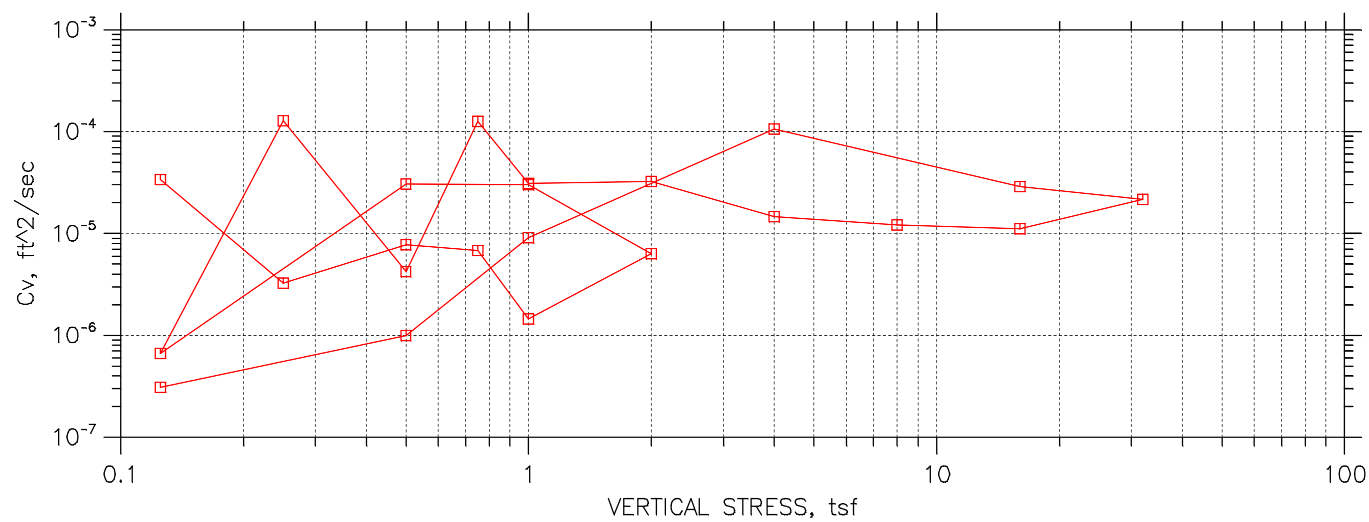


Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-016 S-7	Tested By: HP	Checked By: BCM
	Sample No.: S-7	Test Date: 12/13/15	Depth: 30.0'-22.0'
	Test No.: HENB016S7	Sample Type: 3.0'' ST	Elevation: ----
	Description: VERY DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL		
	Remarks: Pc = 2.1 tsf Cc = 0.235 Ccr = 0.056 TEST PERFORMED AS PER ASTM D 2435		
	244		

Mon, 21-DEC-2015 16:26:12

ONE DIMENSIONAL CONSOLIDATION TEST
ASTM D2435





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

Mon, 21-DEC-2015 16:29:50

CONSOLIDATION TEST DATA

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN B020
Tested By: HP
Checked By: BCM
Sample No.: S-5
Test Date: 12/14/15
Depth: 9.5'-11.5'
Test No.: HENB020
Sample Type: 3.0" ST
Elevation: -----

Soil Description: BROWN SANDY LEAN CLAY AND GRAVEL
Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435

Estimated Specific Gravity: 2.72
Liquid Limit: 0
Initial Height: 0.75 in
Initial Void Ratio: 0.44
Plastic Limit: 0
Specimen Diameter: 2.50 in
Final Void Ratio: 0.32
Plasticity Index: 0

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	X-1	RING	RING	X-9
Wt. Container + Wet Soil, gm	111.2	202.4	200.77	169.91
Wt. Container + Dry Soil, gm	102.93	187.19	187.19	152.25
Wt. Container, gm	44.86	73.34	73.34	4.21
Wt. Dry Soil, gm	58.07	113.85	113.85	148.04
Water Content, %	14.24	13.36	11.93	11.93
Void Ratio	---	0.44	0.32	---
Degree of Saturation, %	---	82.94	101.88	---
Dry Unit Weight, pcf	---	118.07	128.79	---

CONSOLIDATION TEST DATA

Project: DYNERGY HENNEPIN
Boring No.: HEN B020
Sample No.: S-5
Test No.: HENB020

Location: HENNEPIN, IL
Tested By: HP
Test Date: 12/14/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: BCM
Depth: 9.5'-11.5'
Elevation: -----

Soil Description: BROWN SANDY LEAN CLAY AND GRAVEL
Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435

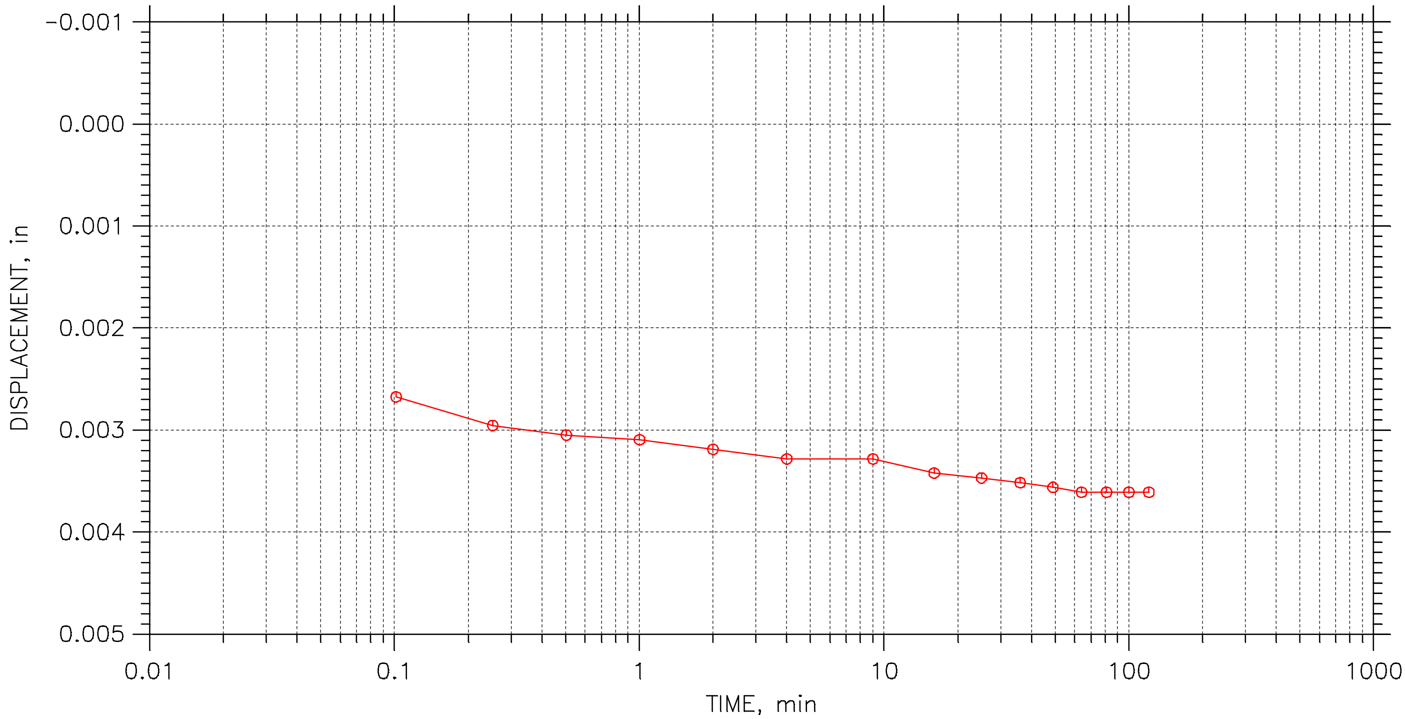
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. ft^2/sec	Coefficient of Consolidation Log ft^2/sec	Coefficient of Consolidation Ave. ft^2/sec
1	0.125	0.00361	0.431	0.48	0.1	0.0	3.40e-005	0.00e+000	3.40e-005
2	0.25	0.006166	0.426	0.82	1.0	0.0	3.26e-006	0.00e+000	3.26e-006
3	0.5	0.009553	0.420	1.28	0.4	0.0	7.74e-006	0.00e+000	7.74e-006
4	0.75	0.01341	0.412	1.79	0.5	0.0	6.84e-006	0.00e+000	6.84e-006
5	1	0.01633	0.407	2.18	2.1	0.5	1.46e-006	6.72e-006	2.40e-006
6	2	0.02736	0.386	3.66	0.5	0.0	6.30e-006	0.00e+000	6.30e-006
7	1	0.02531	0.389	3.39	0.1	0.0	3.04e-005	0.00e+000	3.04e-005
8	0.5	0.02311	0.394	3.09	0.1	0.0	3.06e-005	0.00e+000	3.06e-005
9	0.125	0.02032	0.399	2.72	0.9	0.0	3.23e-006	0.00e+000	3.23e-006
10	0.25	0.02154	0.397	2.88	0.1	0.0	3.18e-005	0.00e+000	3.18e-005
11	0.5	0.02194	0.396	2.94	0.2	0.0	1.52e-005	0.00e+000	1.52e-005
12	0.75	0.02305	0.394	3.08	0.1	0.0	3.12e-005	0.00e+000	3.12e-005
13	1	0.02438	0.391	3.26	0.1	0.0	2.54e-005	0.00e+000	2.54e-005
14	2	0.02792	0.384	3.73	0.1	0.0	3.25e-005	0.00e+000	3.25e-005
15	4	0.03906	0.363	5.22	0.2	0.0	1.45e-005	0.00e+000	1.45e-005
16	8	0.05266	0.337	7.04	0.2	0.0	1.22e-005	0.00e+000	1.22e-005
17	16	0.06932	0.305	9.27	0.2	0.0	1.11e-005	0.00e+000	1.11e-005
18	32	0.08893	0.267	11.90	0.1	0.0	2.17e-005	0.00e+000	2.17e-005
19	16	0.08627	0.272	11.54	0.1	0.0	2.47e-005	0.00e+000	2.47e-005
20	4	0.07955	0.285	10.64	0.0	0.0	1.06e-004	0.00e+000	1.06e-004
21	1	0.07068	0.302	9.45	0.3	0.0	9.06e-006	0.00e+000	9.06e-006
22	0.5	0.06777	0.308	9.07	9.7	0.0	2.72e-007	0.00e+000	2.72e-007
23	0.125	0.06223	0.318	8.32	8.3	8.9	3.20e-007	3.00e-007	3.10e-007

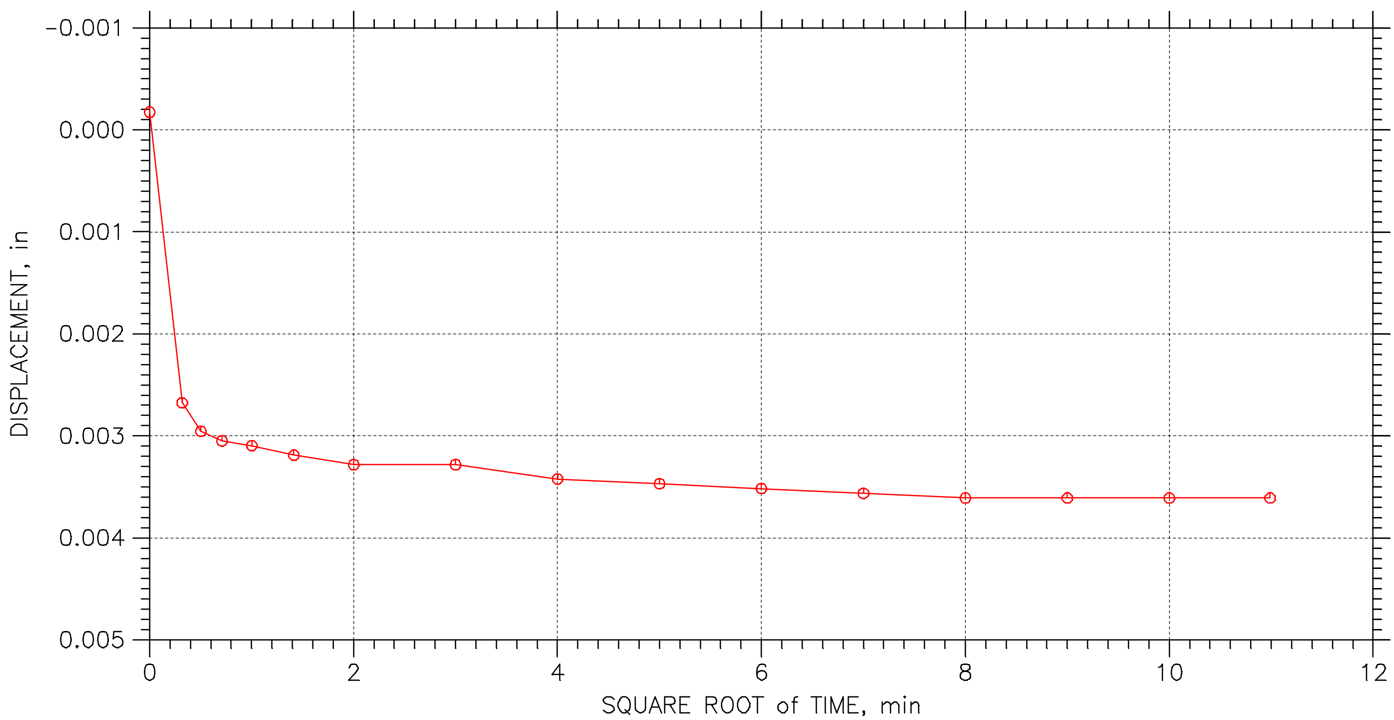
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 1 of 23

Stress: 0.125 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

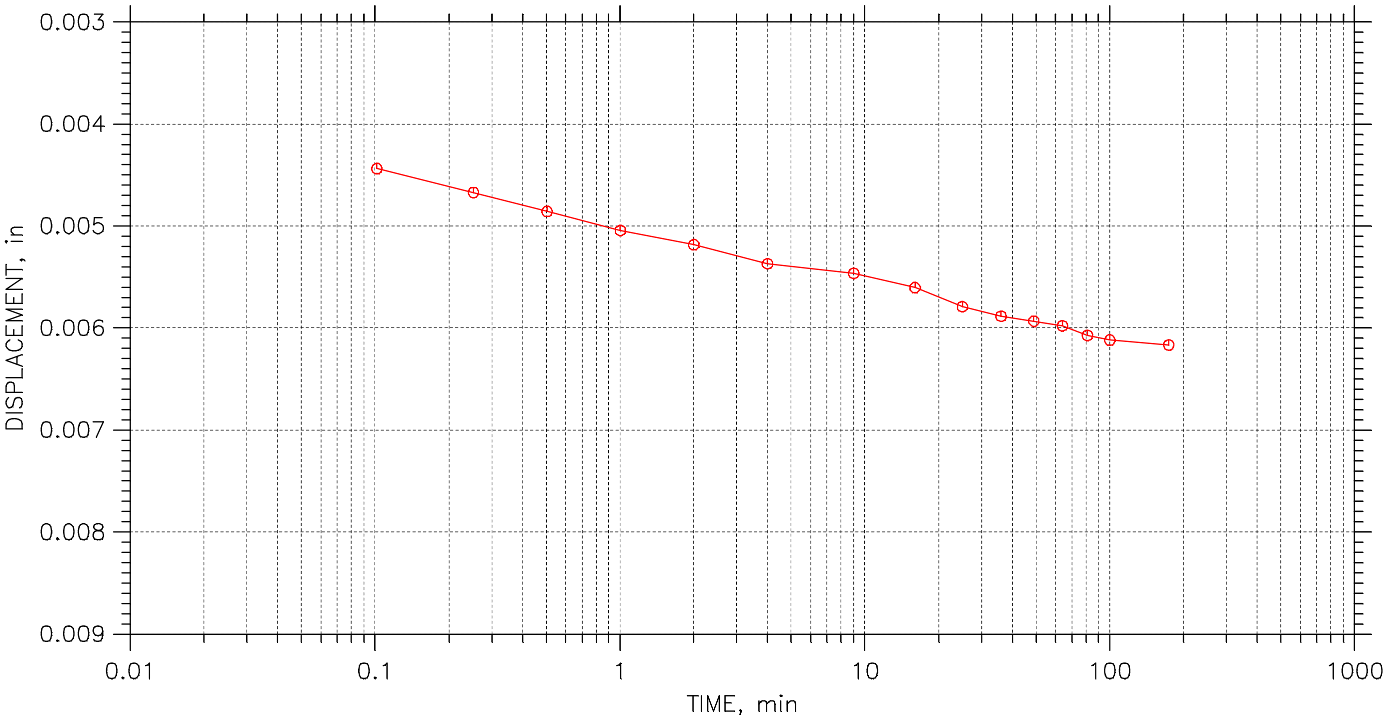
Mon, 21-DEC-2015 16:42:53

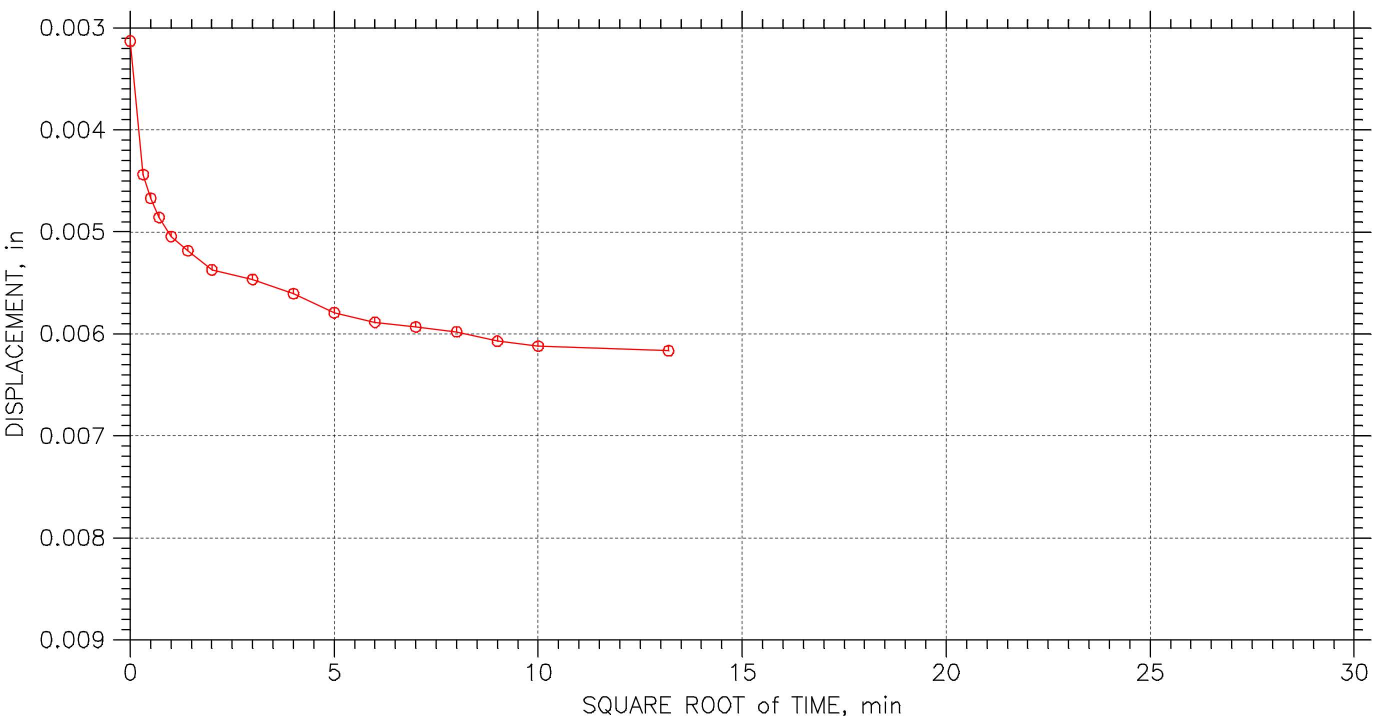
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 2 of 23

Stress: 0.25 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

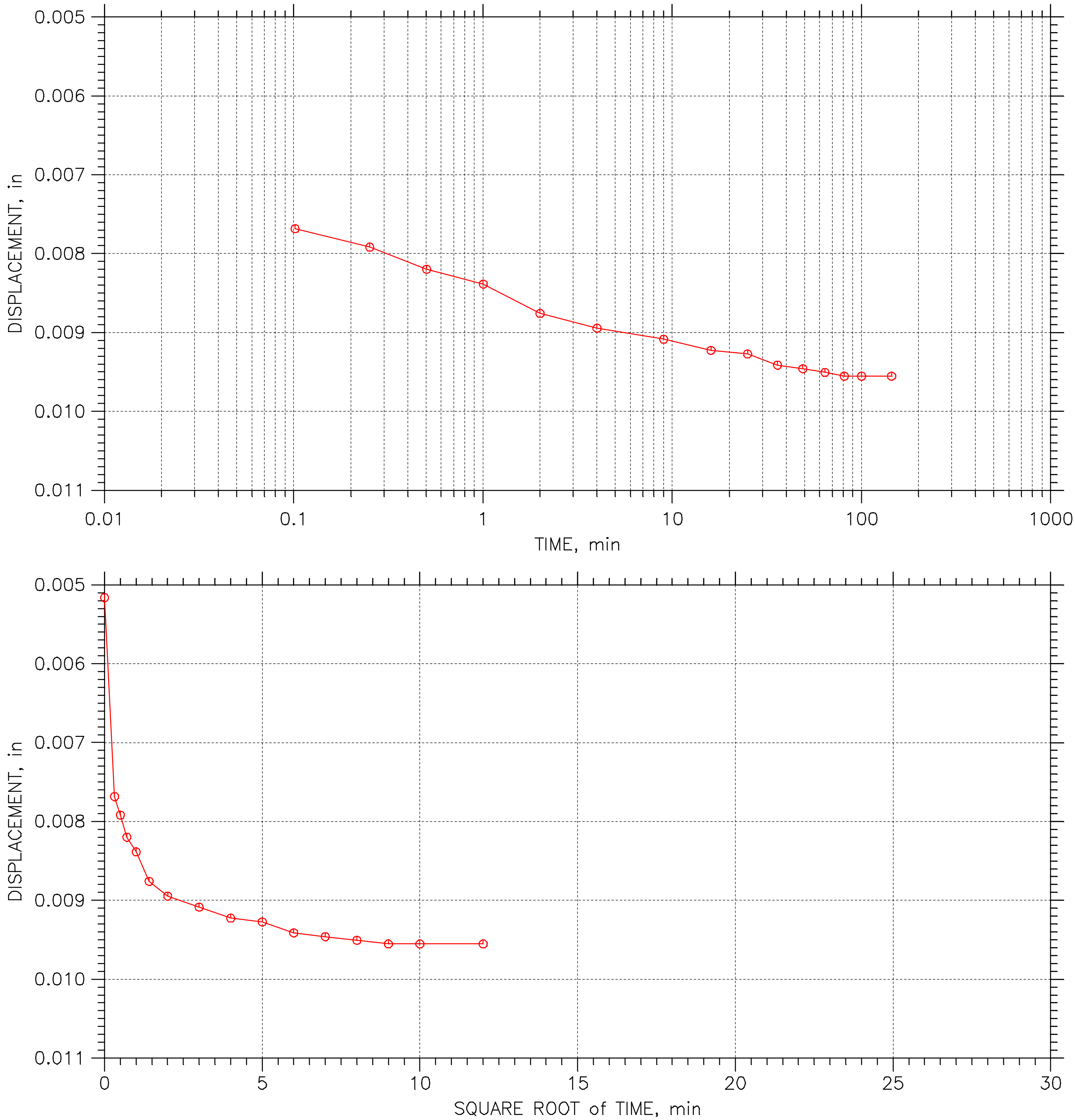
Mon, 21-DEC-2015 16:42:54

CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 3 of 23

Stress: 0.5 tsf



Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

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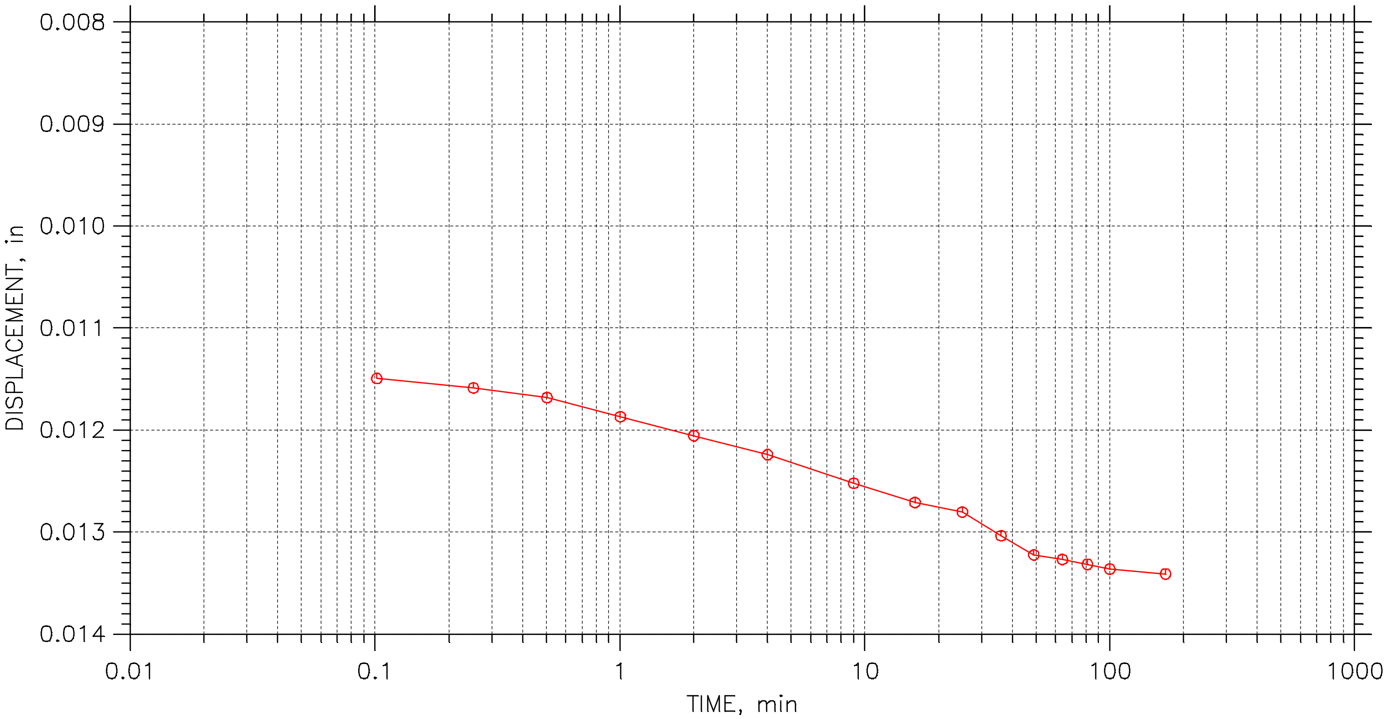
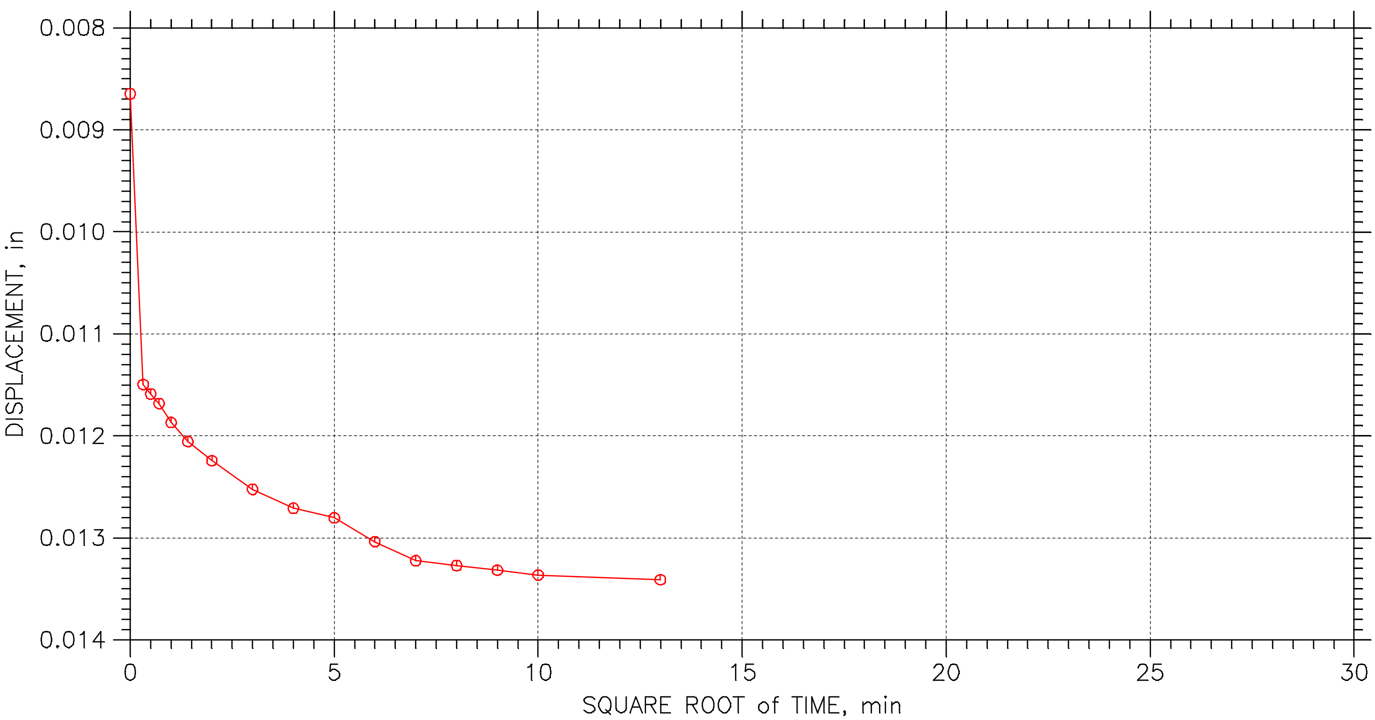
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 4 of 23

Stress: 0.75 tsf





Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

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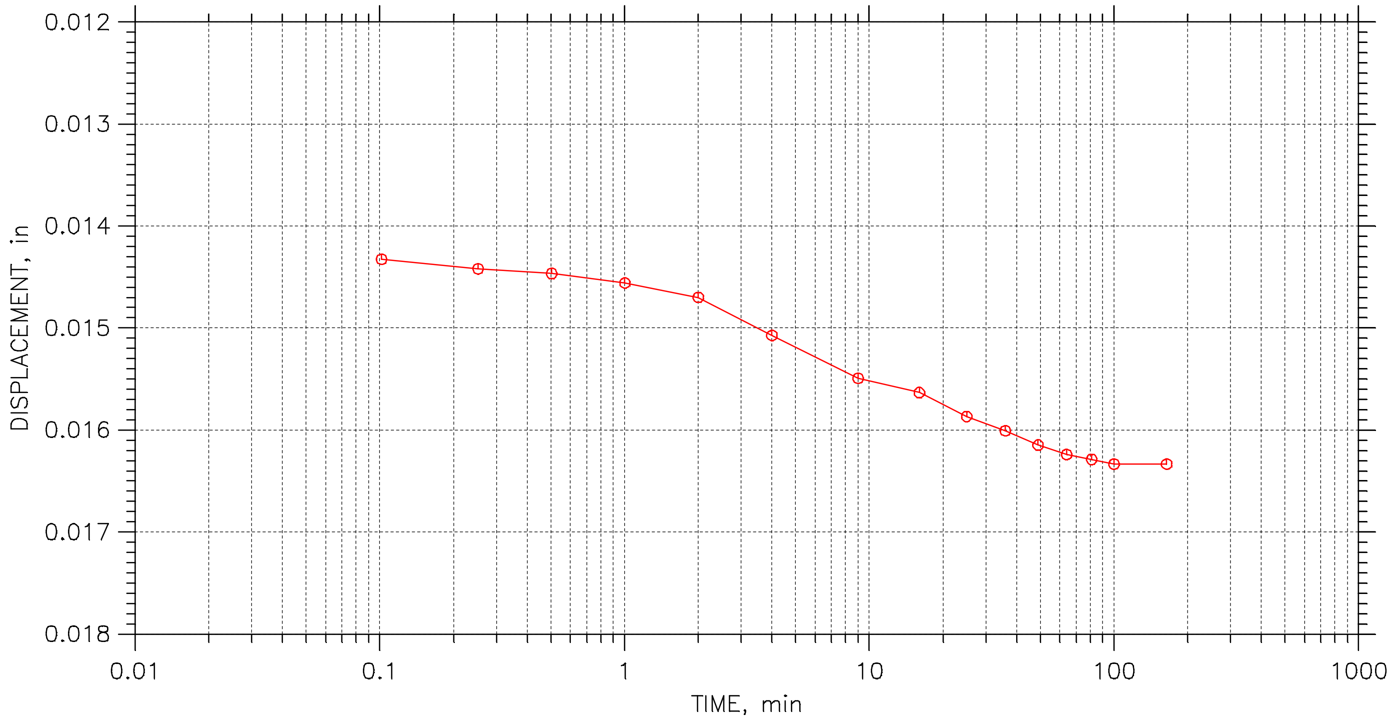
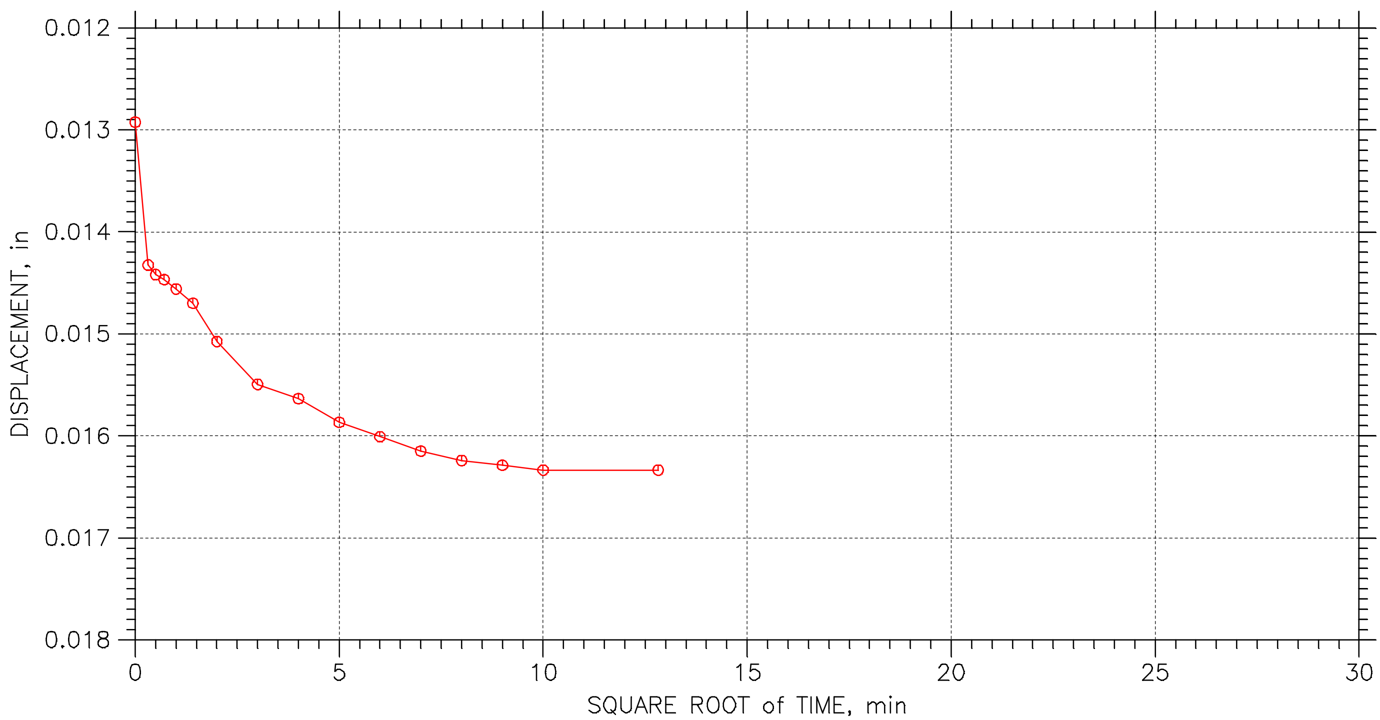
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 5 of 23

Stress: 1. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

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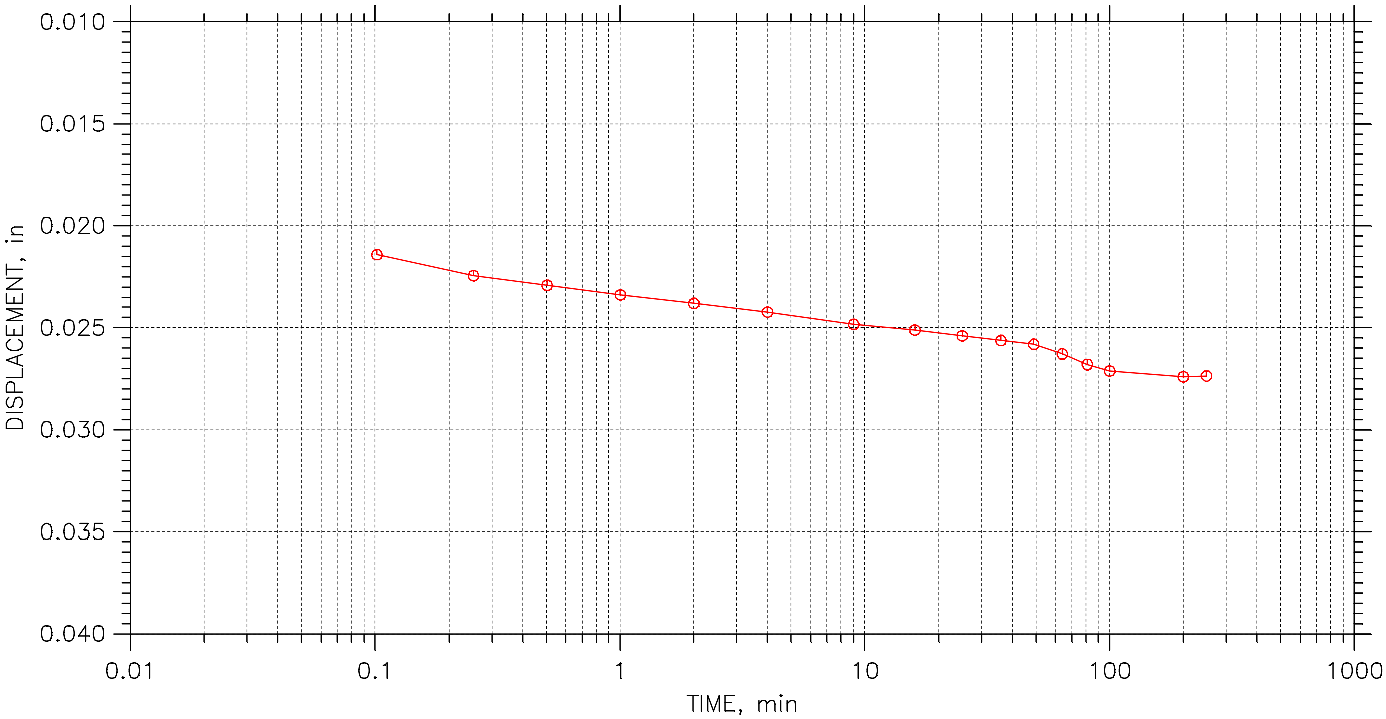
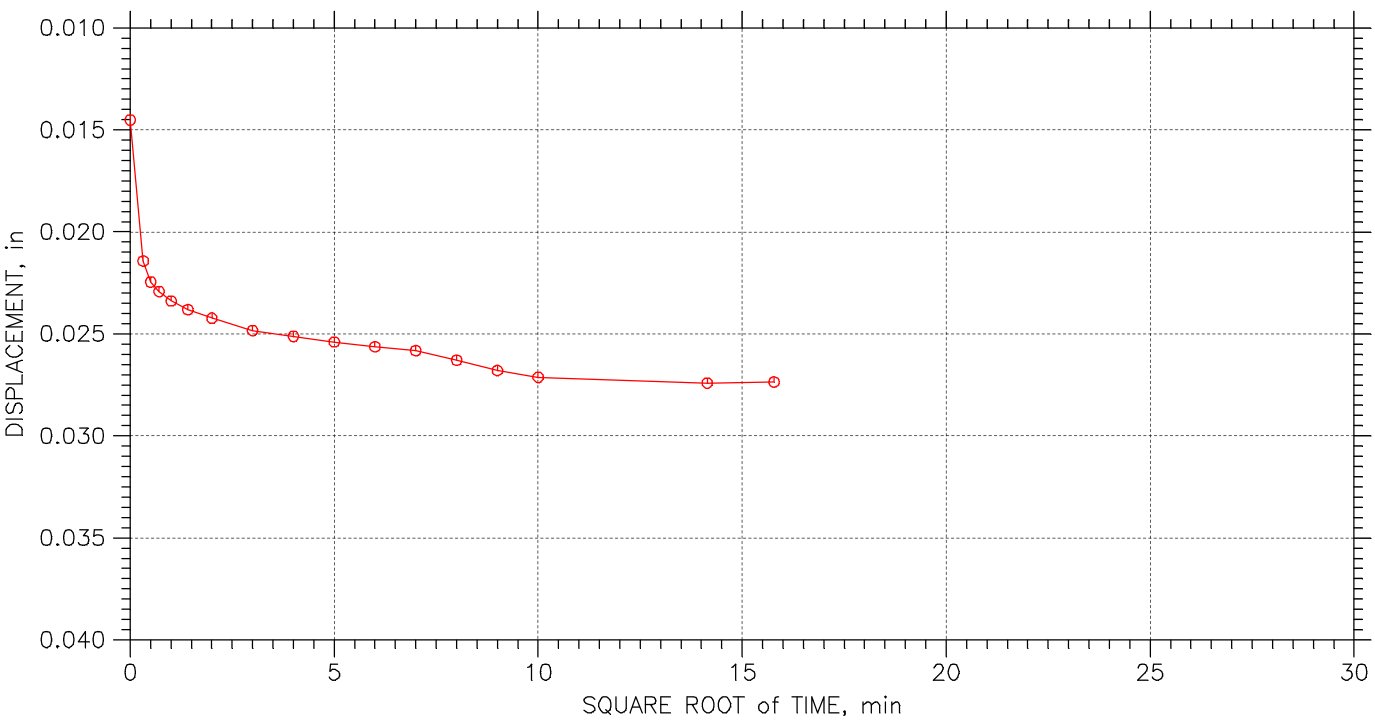
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 6 of 23

Stress: 2. tsf





Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

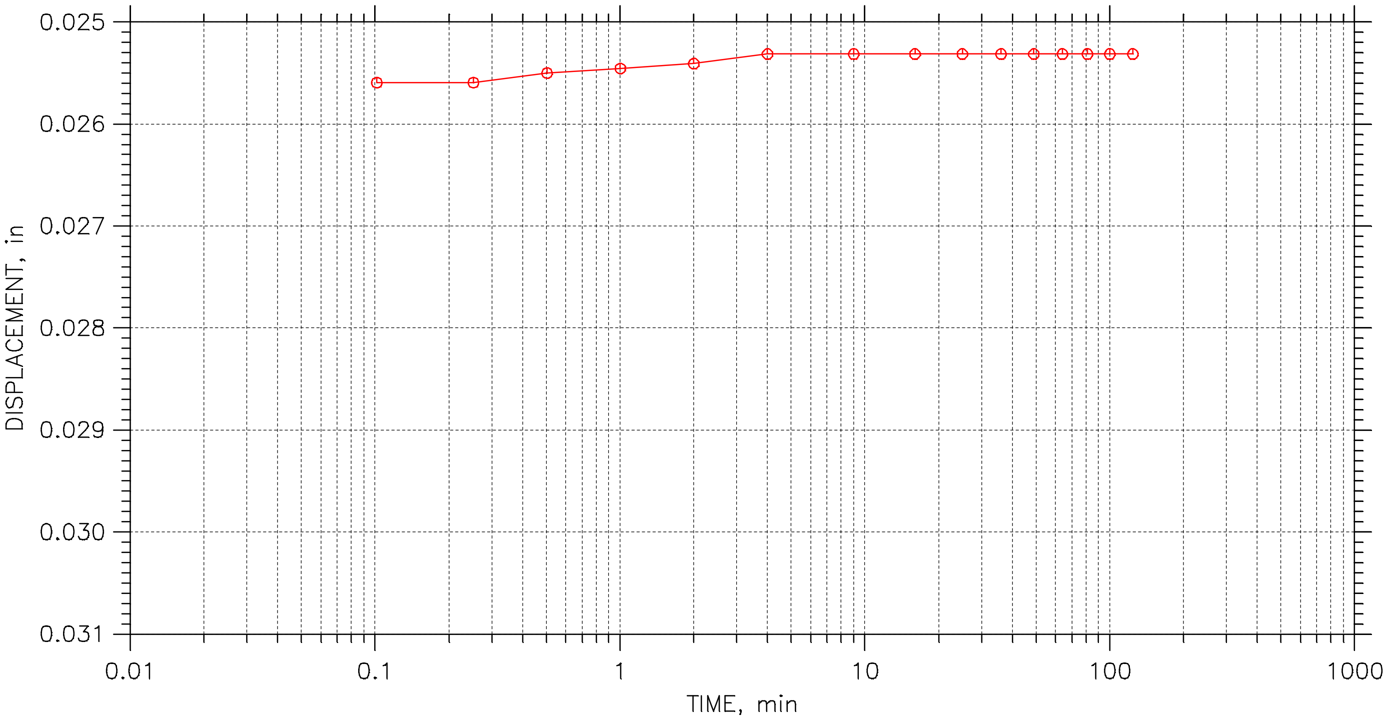
Mon, 21-DEC-2015 16:43:00

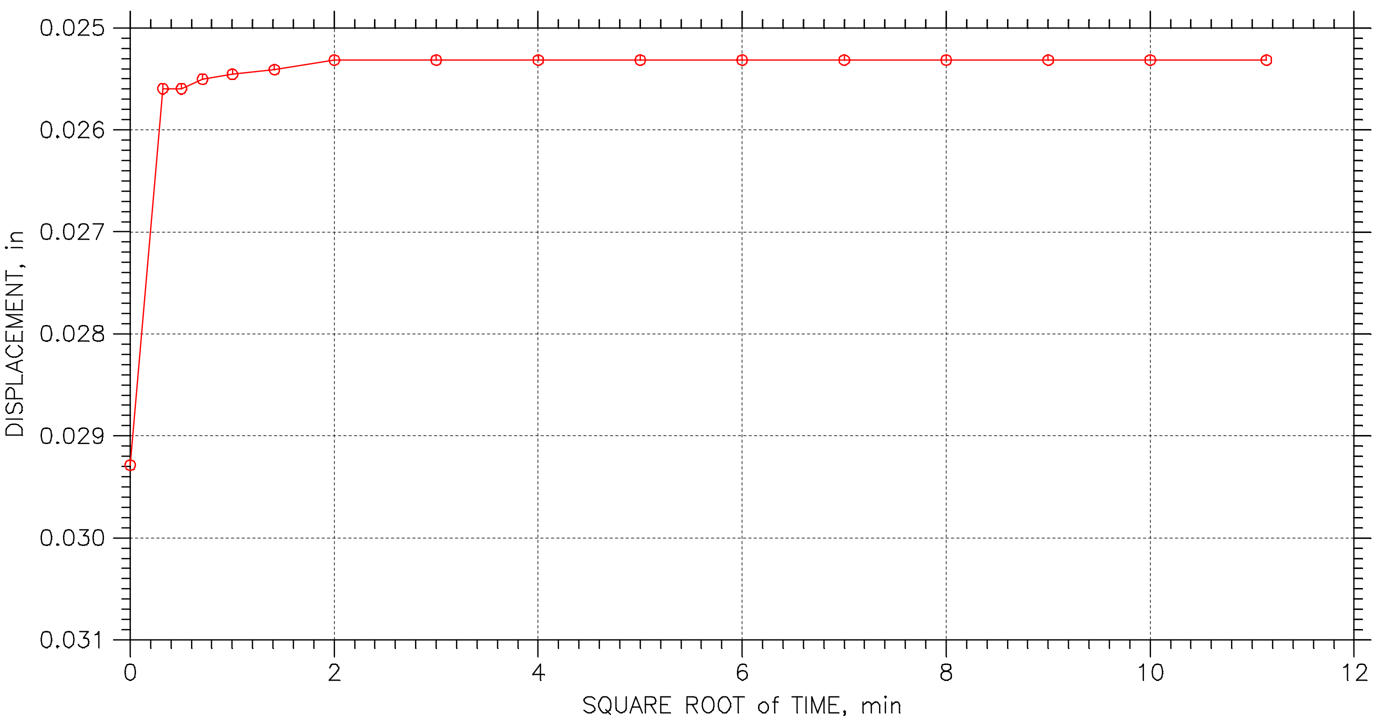
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 7 of 23

Stress: 1. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		
	254		

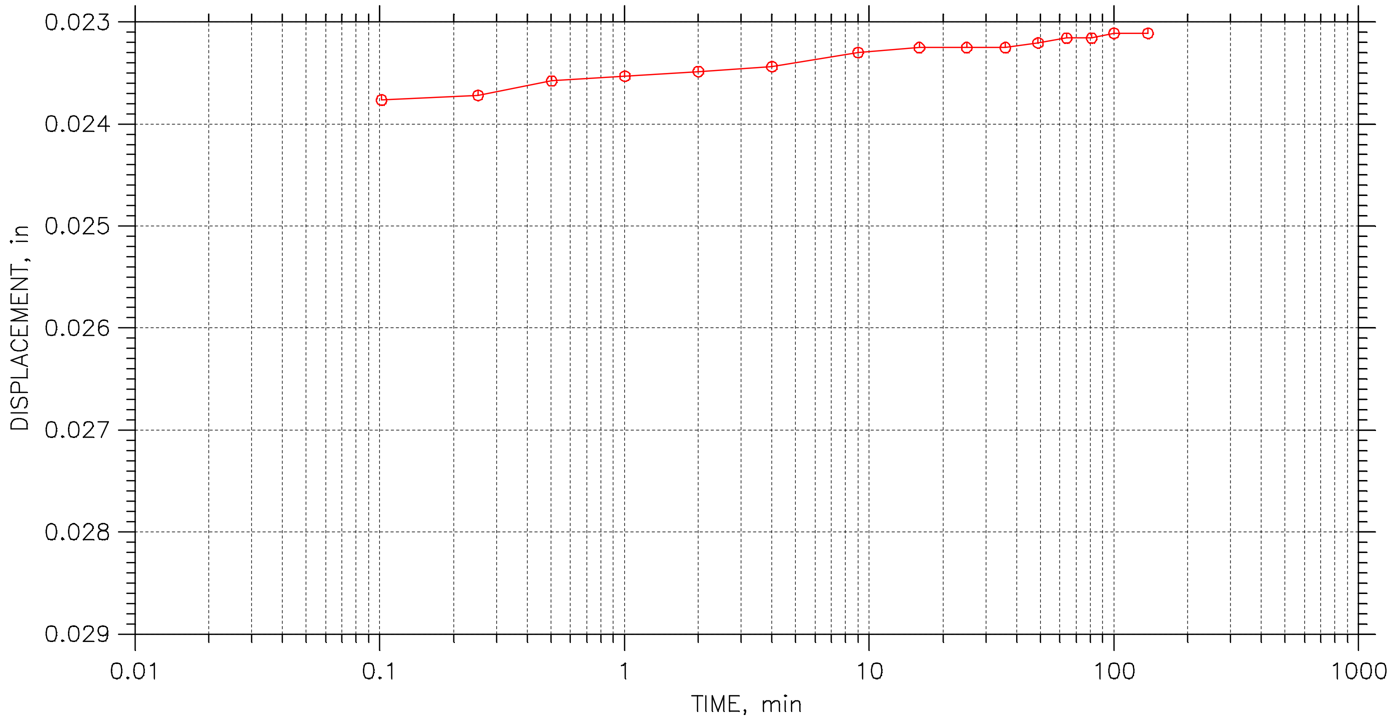
Mon, 21-DEC-2015 16:43:01

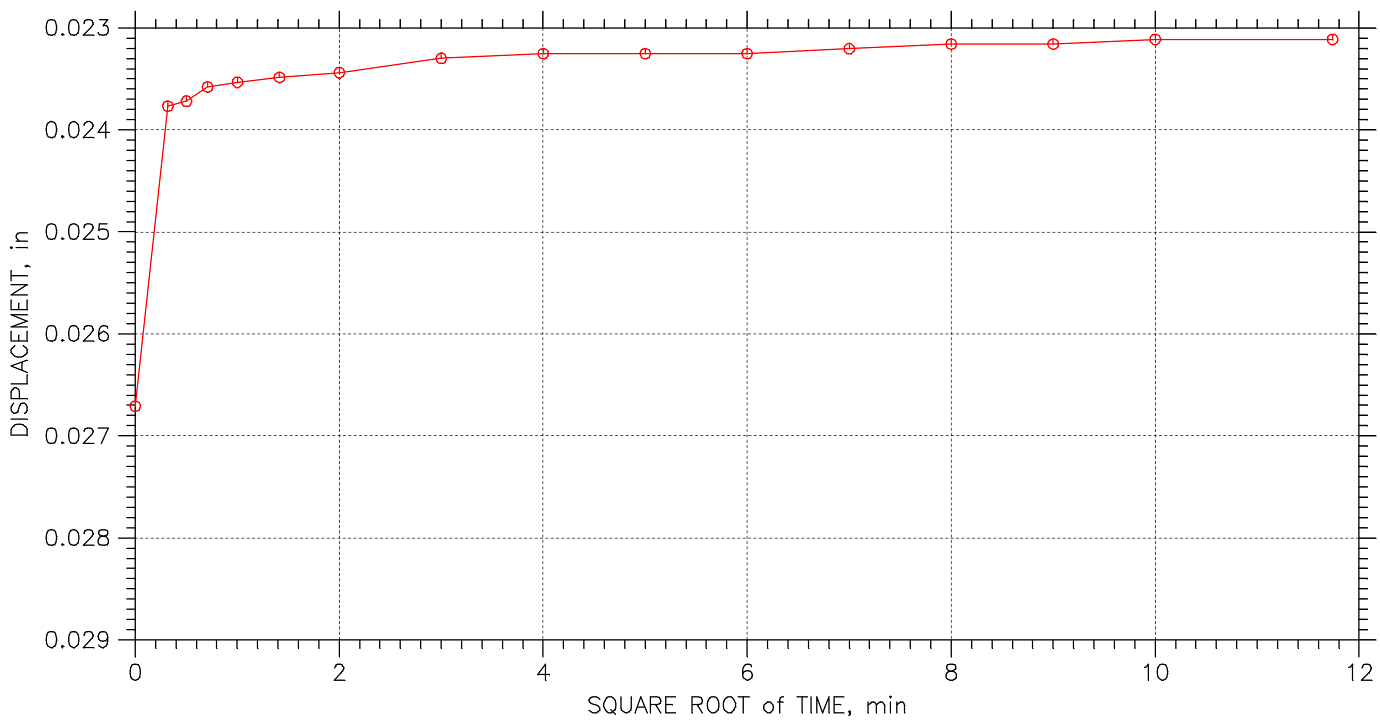
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 8 of 23

Stress: 0.5 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

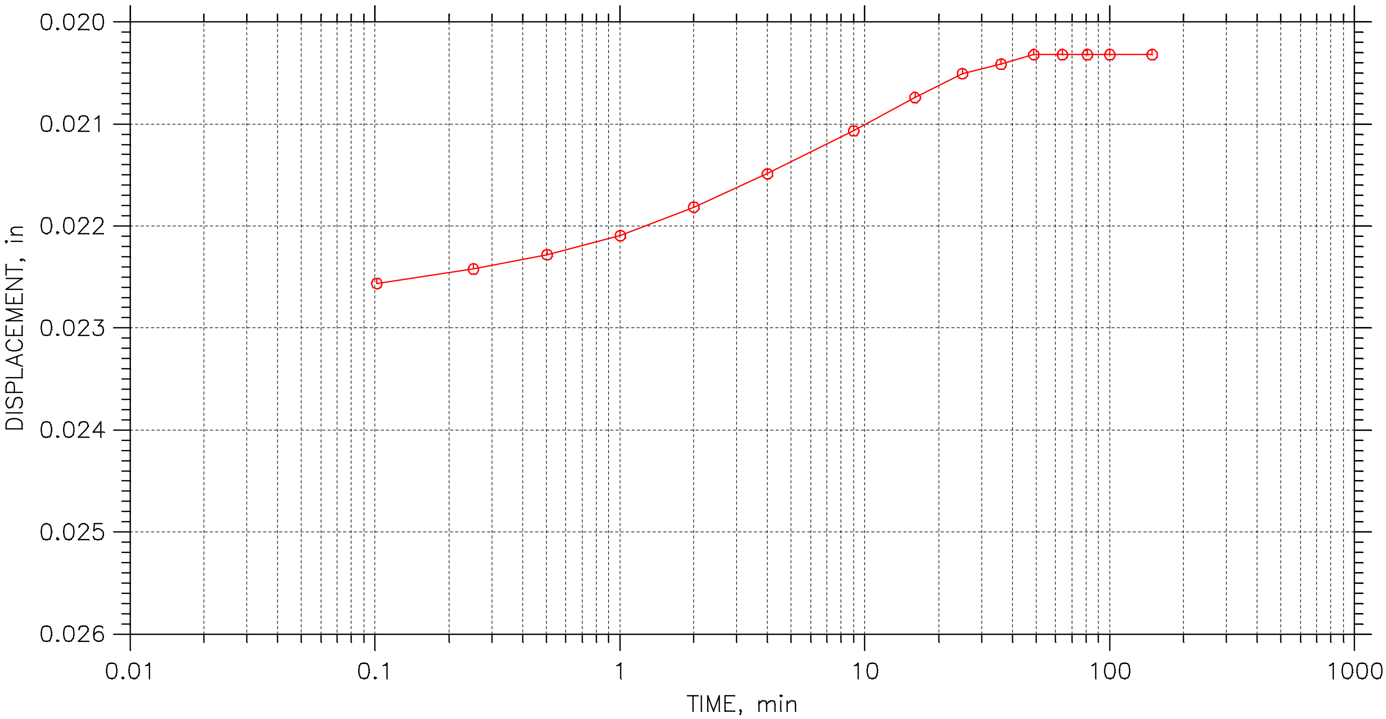
Mon, 21-DEC-2015 16:43:03

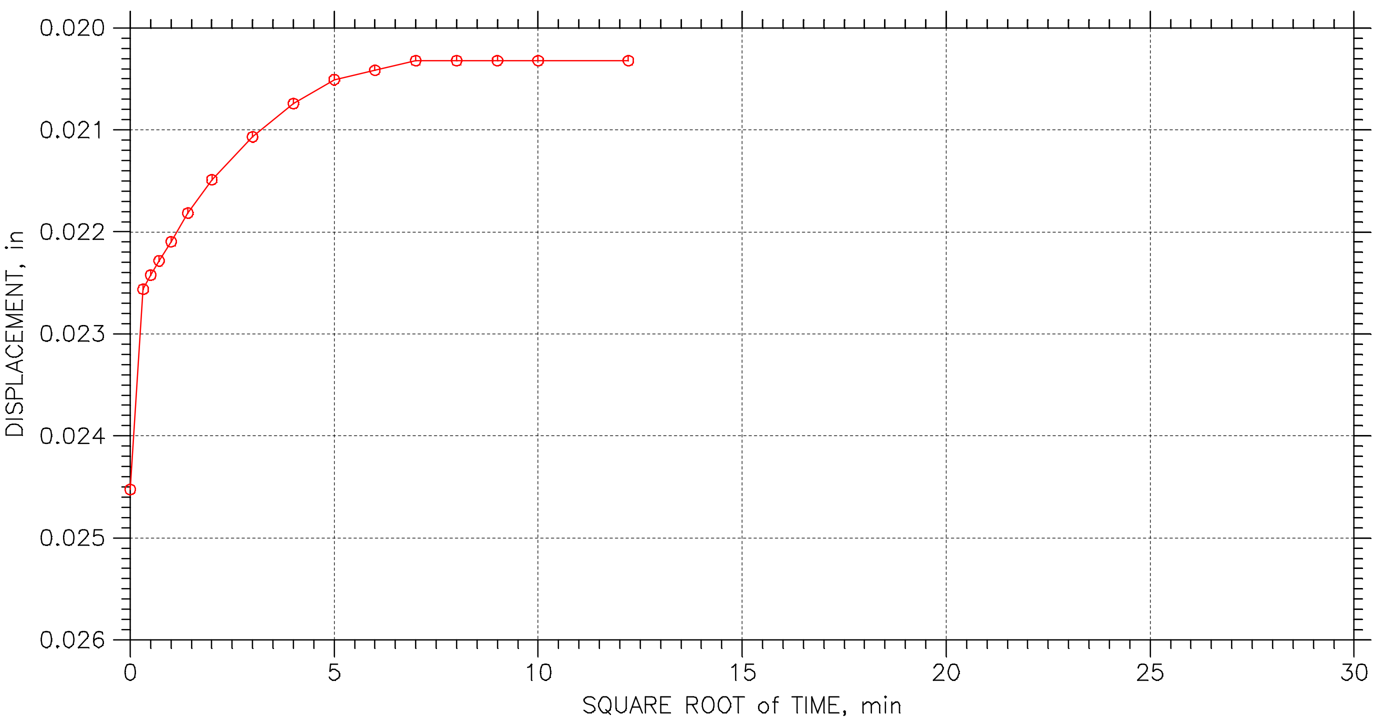
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 9 of 23

Stress: 0.125 tsf





Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		
	256		

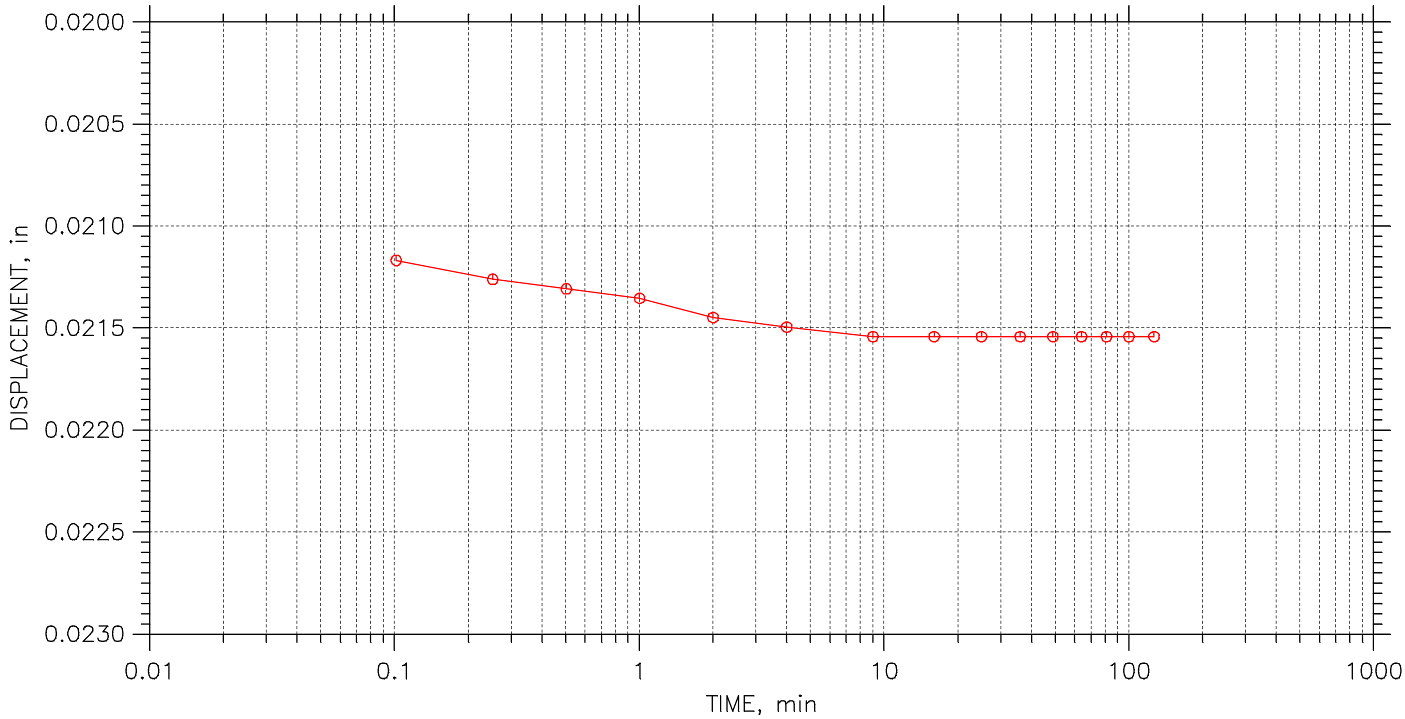
Mon, 21-DEC-2015 16:43:04

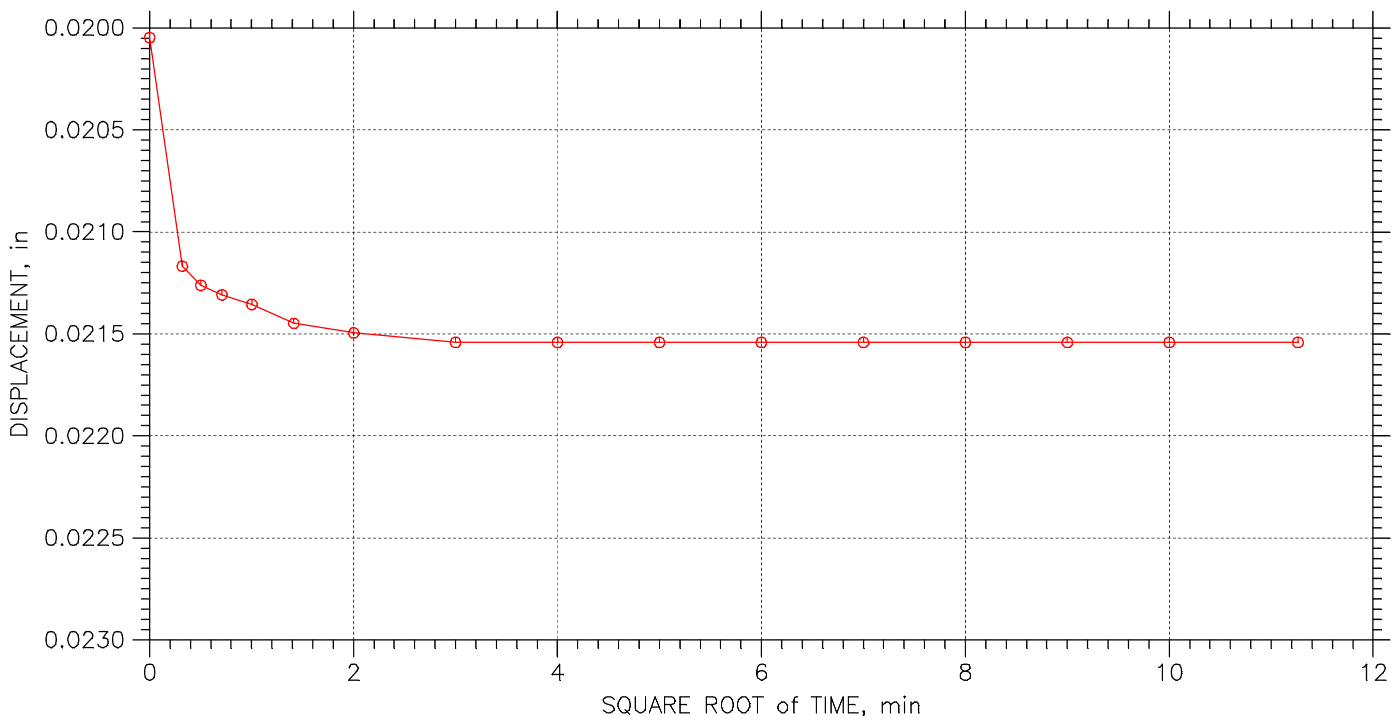
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 10 of 23

Stress: 0.25 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

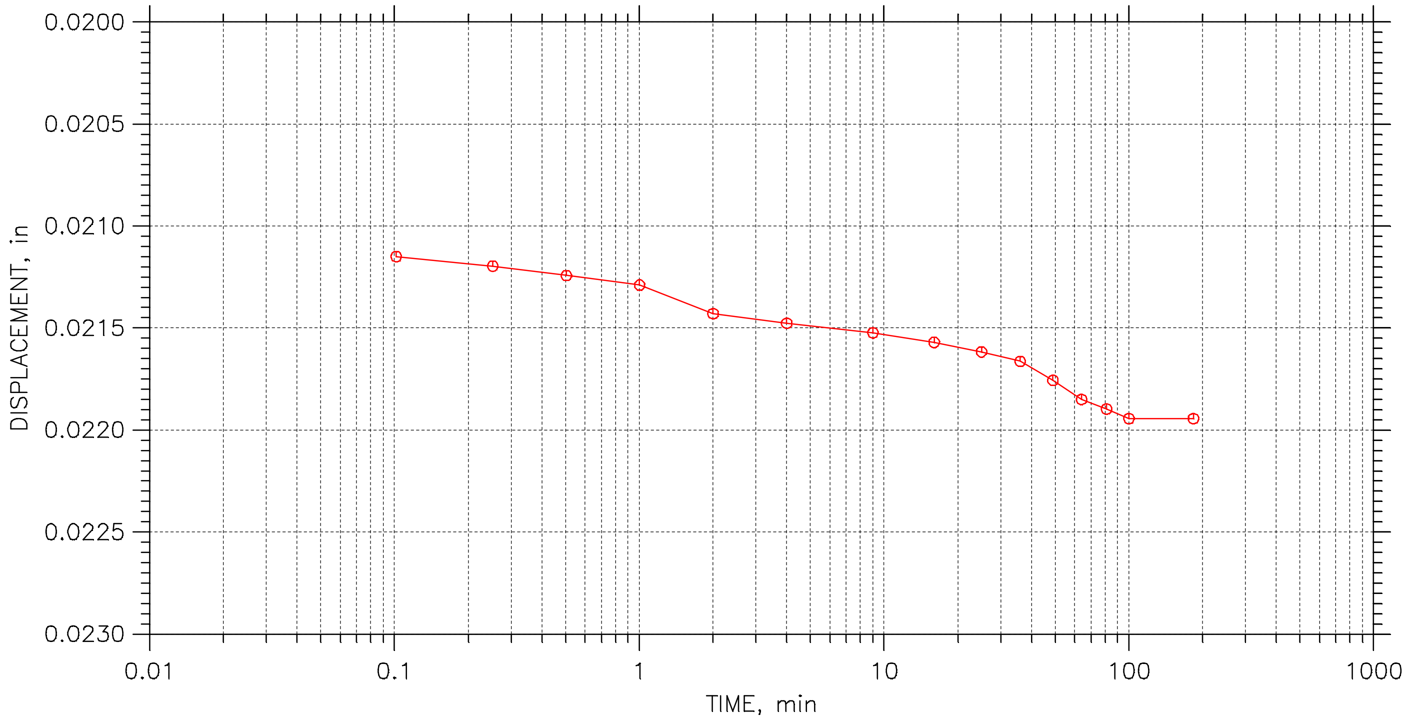
Mon, 21-DEC-2015 16:43:05

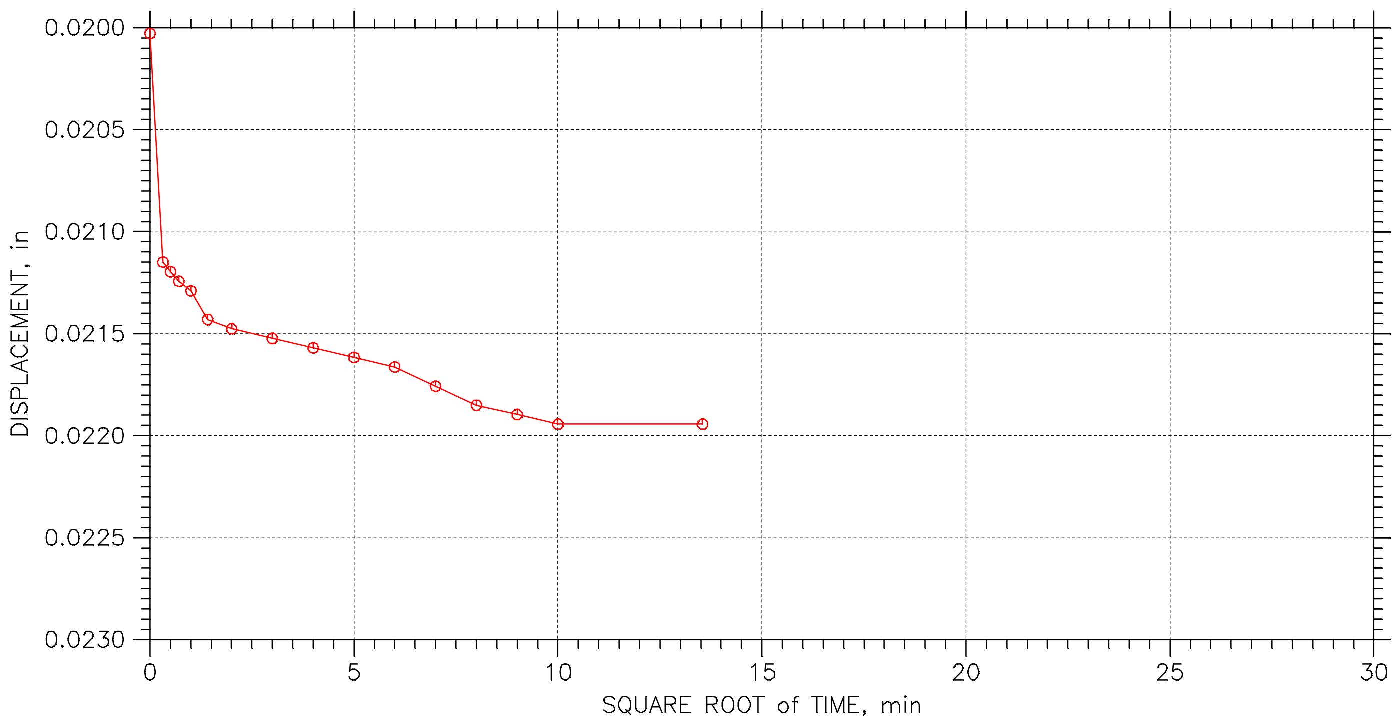
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 11 of 23

Stress: 0.5 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		
	258		

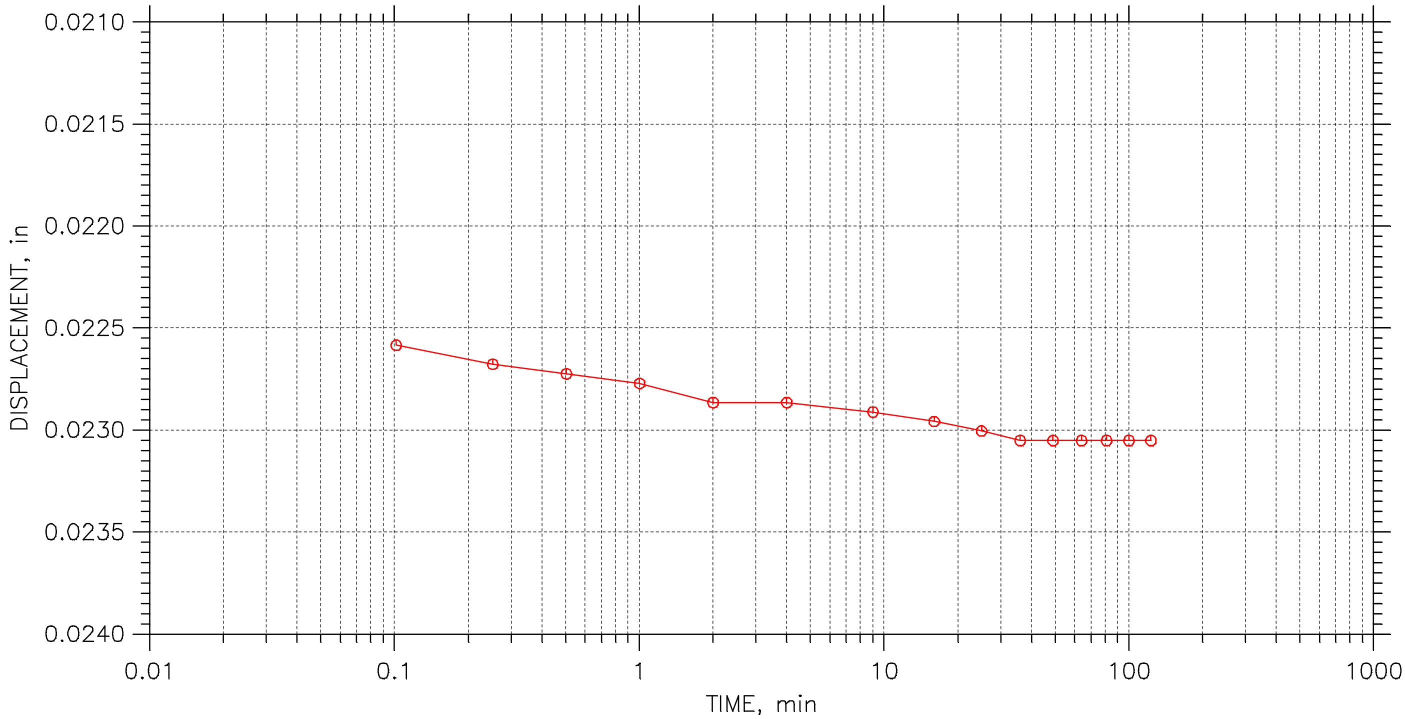
Mon, 21-DEC-2015 16:43:07

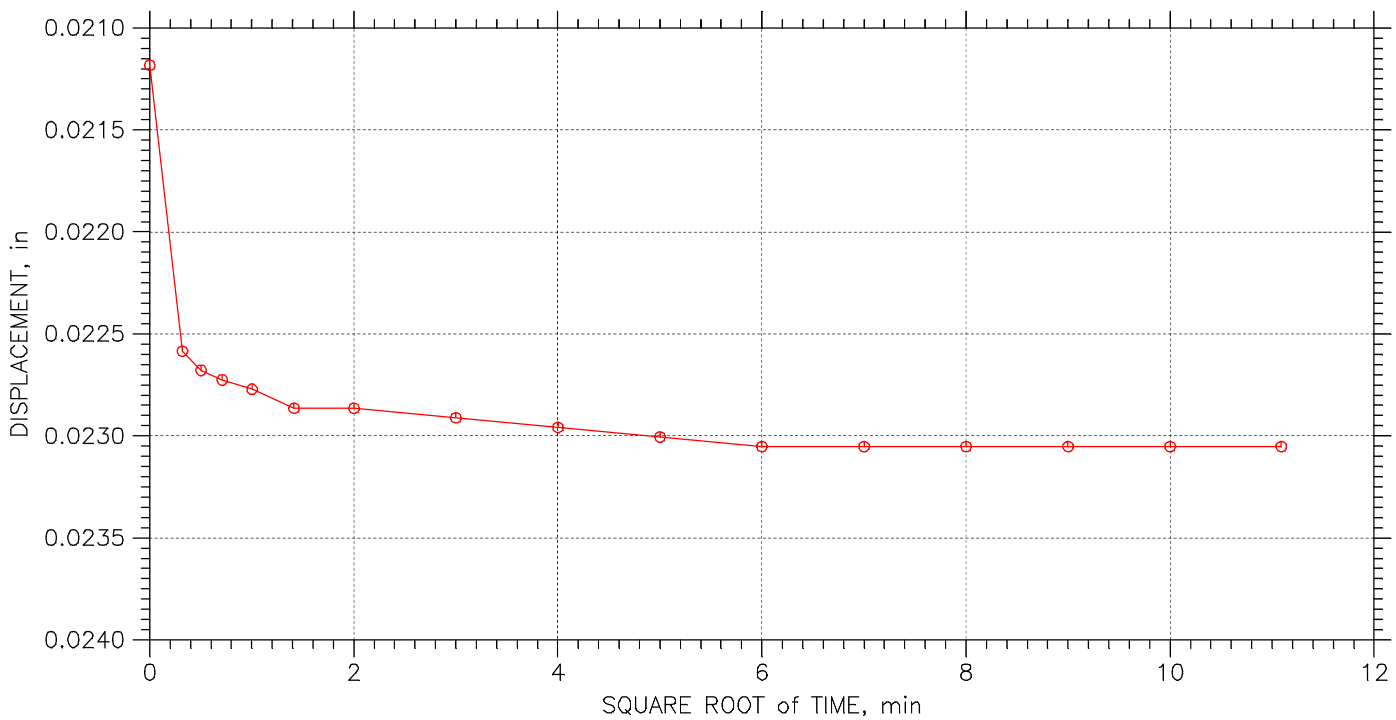
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 12 of 23

Stress: 0.75 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

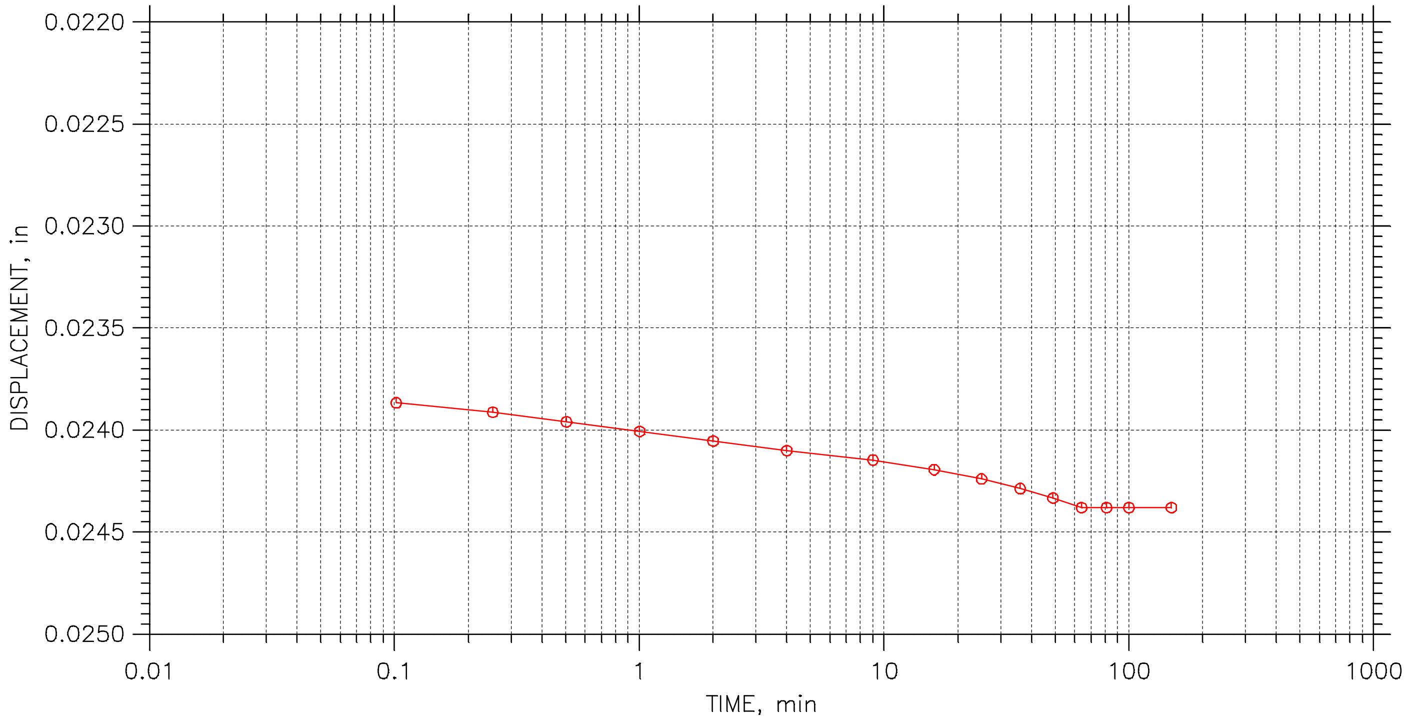
Mon, 21-DEC-2015 16:43:08

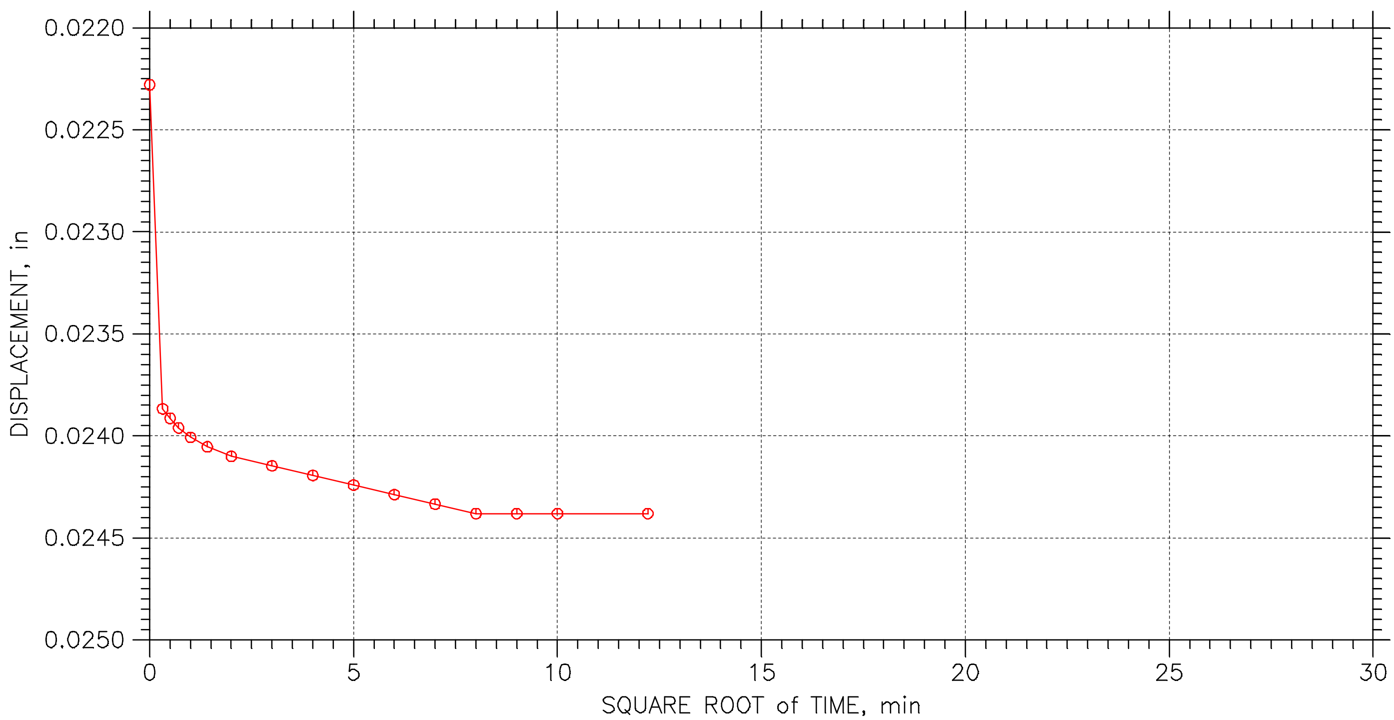
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 13 of 23

Stress: 1. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		
	260		

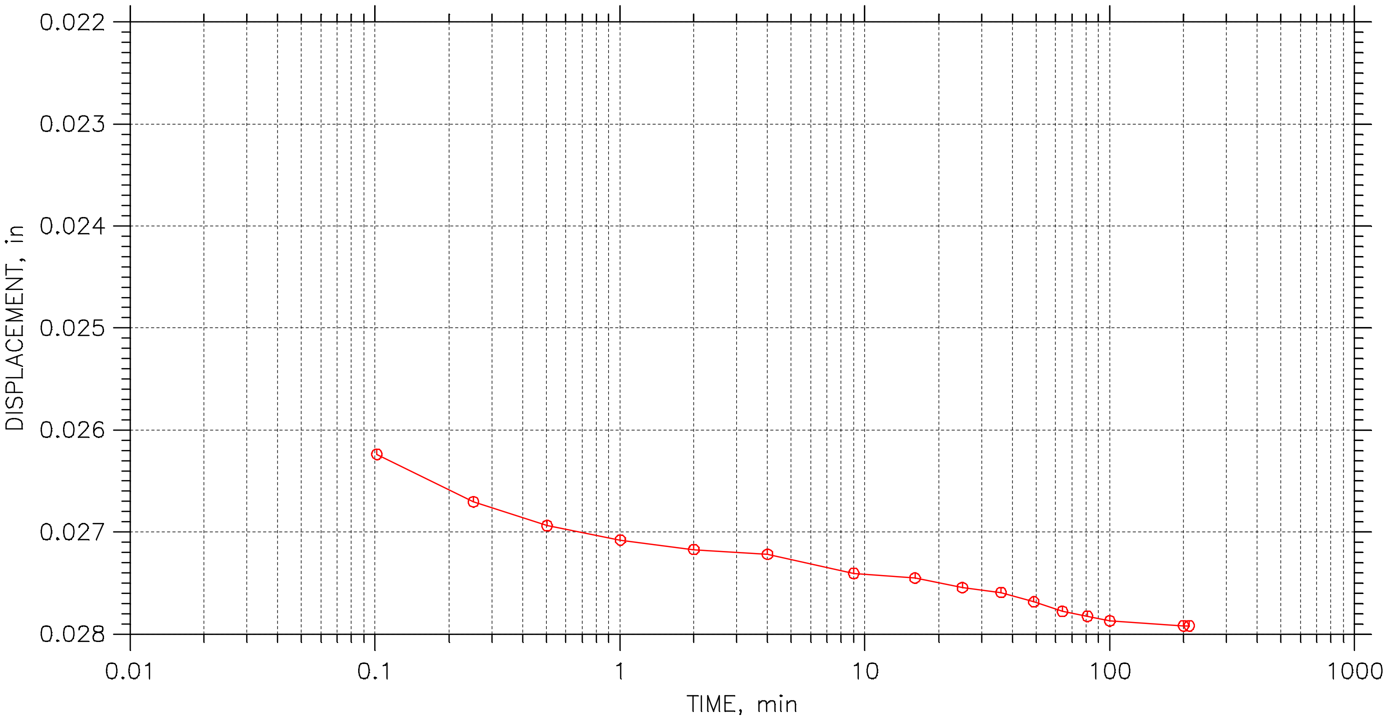
Mon, 21-DEC-2015 16:43:10

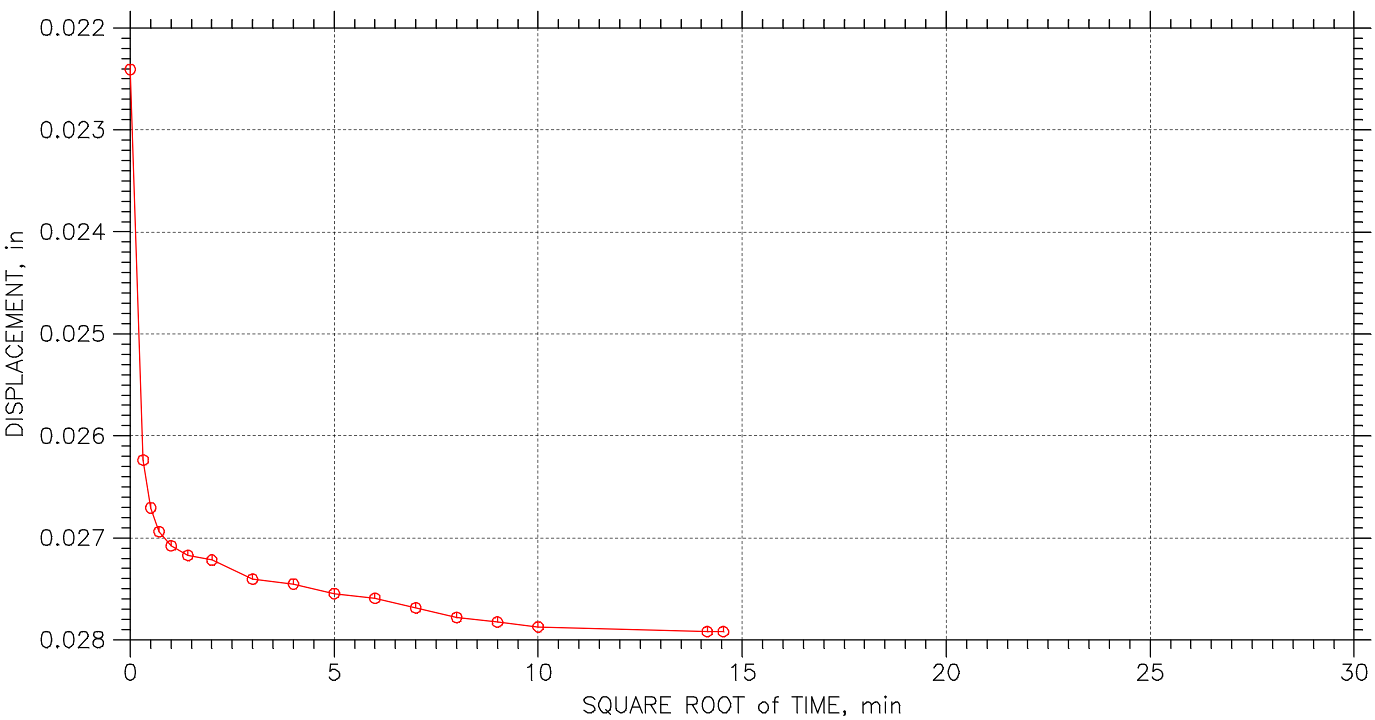
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 14 of 23

Stress: 2. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

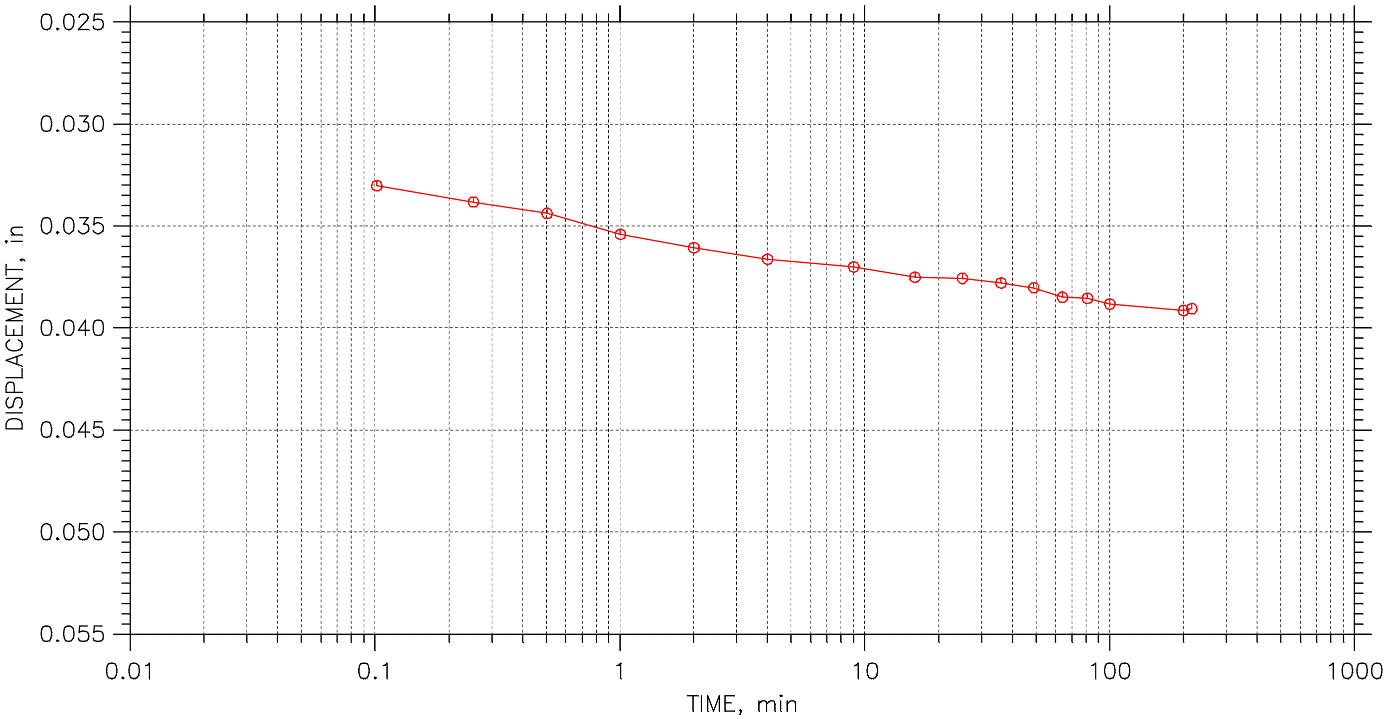
Mon, 21-DEC-2015 16:43:11

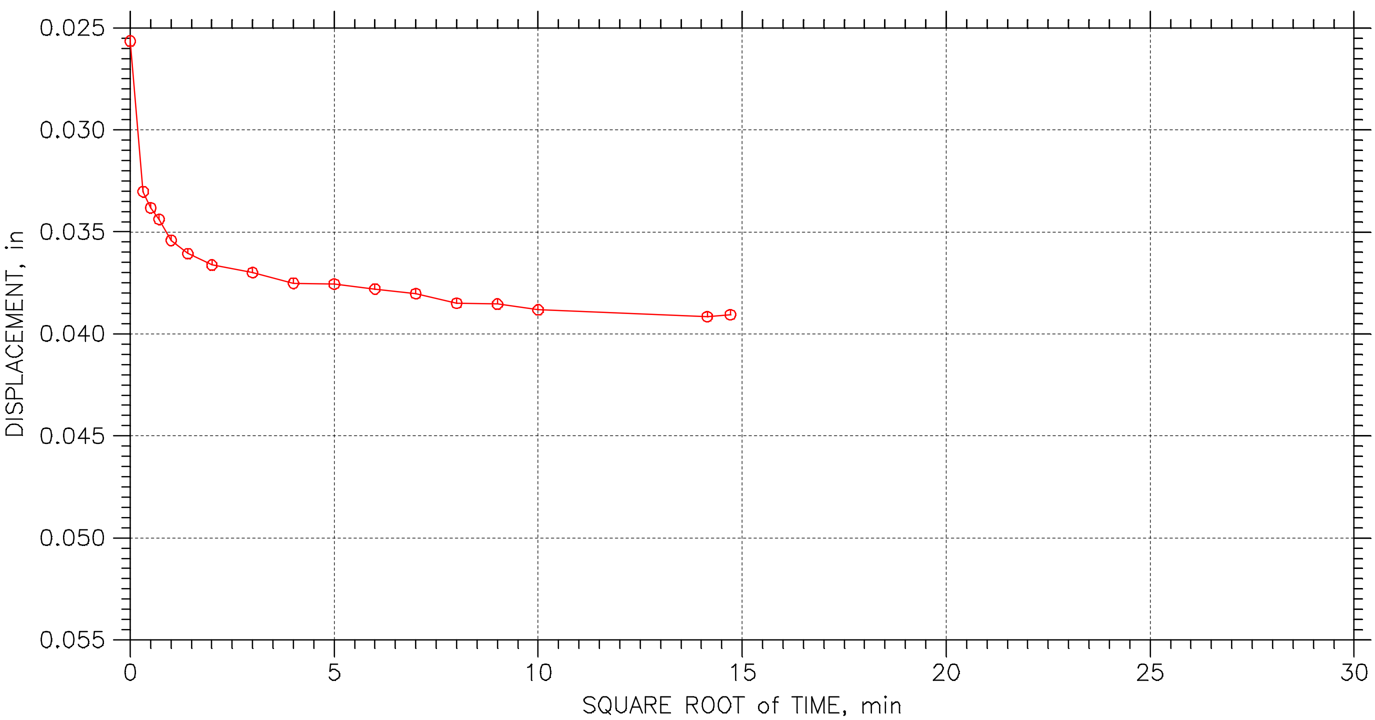
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 15 of 23

Stress: 4. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

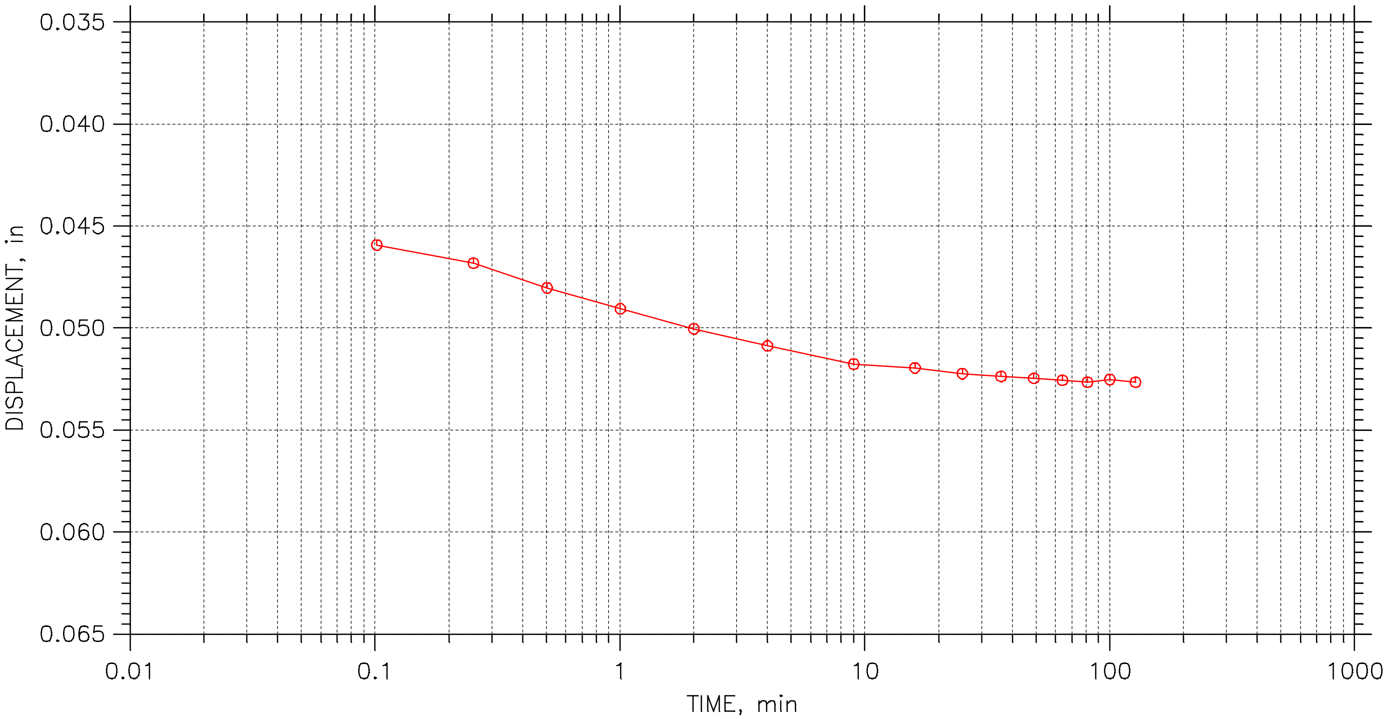
Mon, 21-DEC-2015 16:43:12

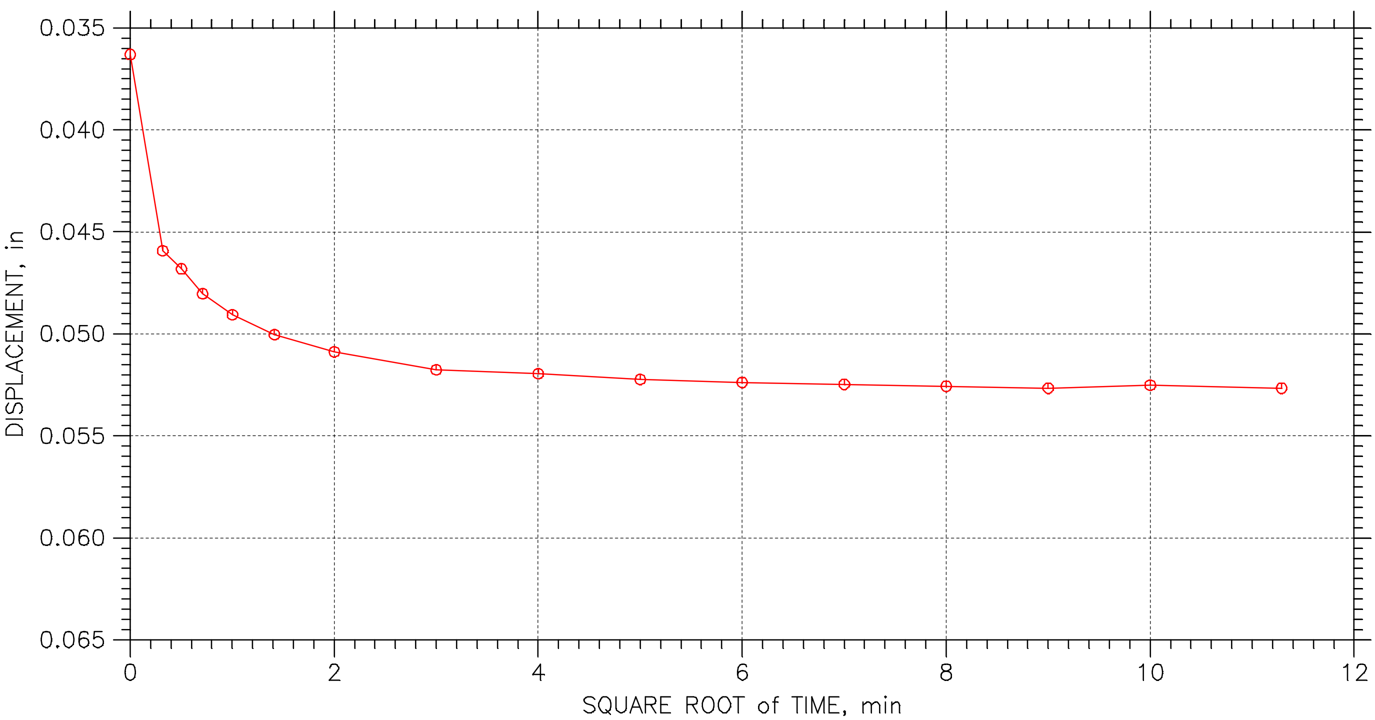
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 16 of 23

Stress: 8. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

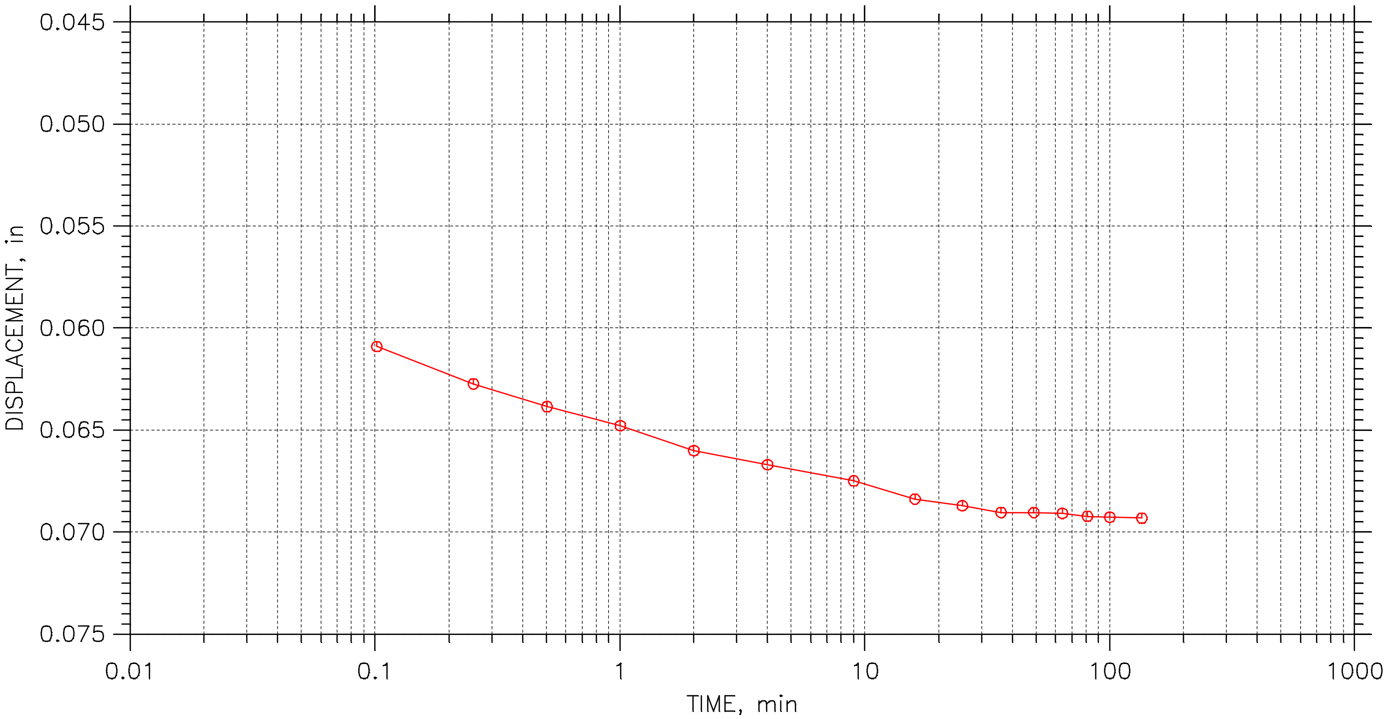
Mon, 21-DEC-2015 16:43:14

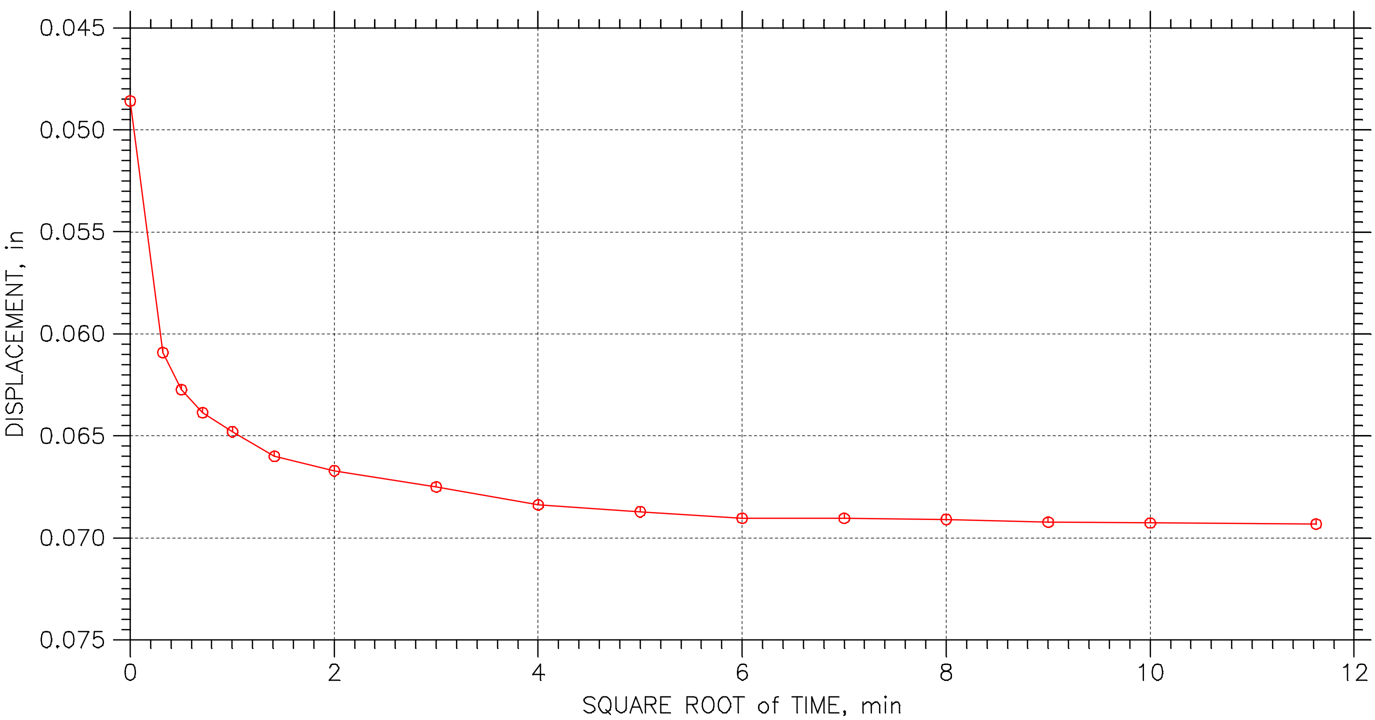
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 17 of 23

Stress: 16. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

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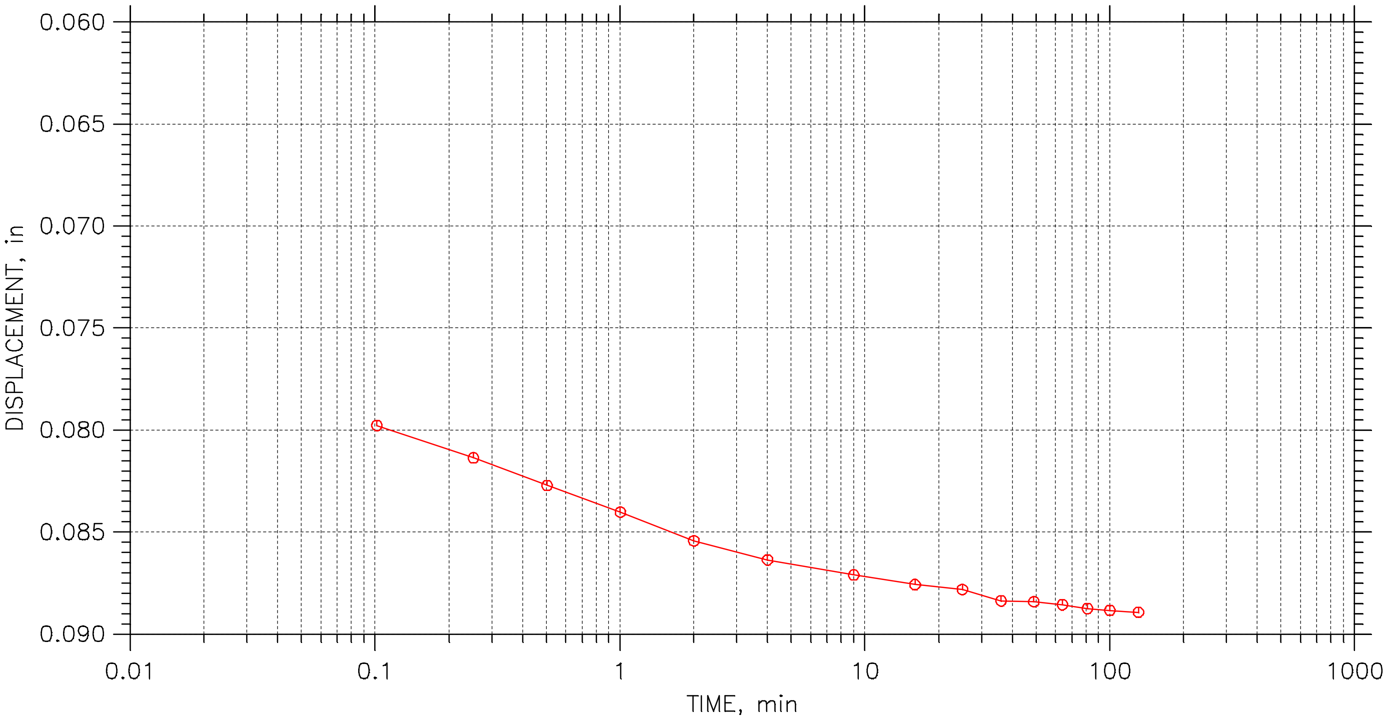
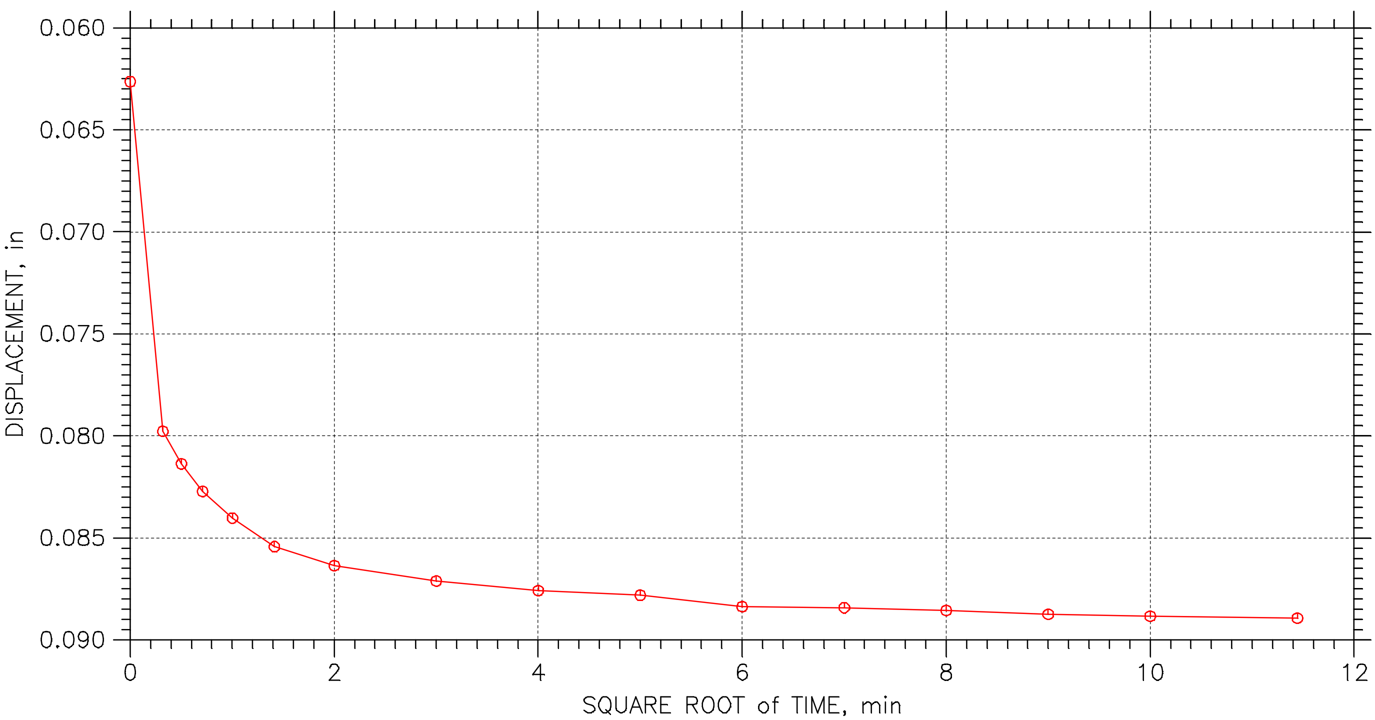
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 18 of 23

Stress: 32. tsf





Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

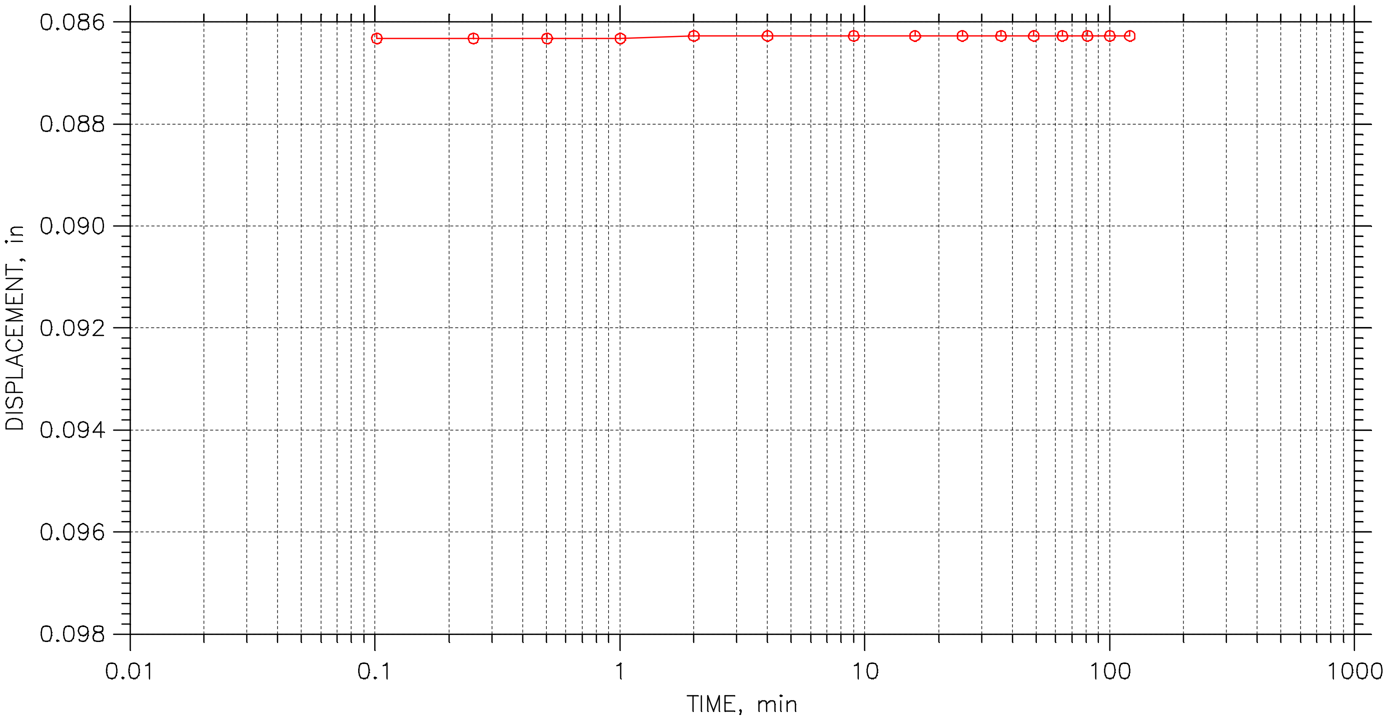
Mon, 21-DEC-2015 16:43:17

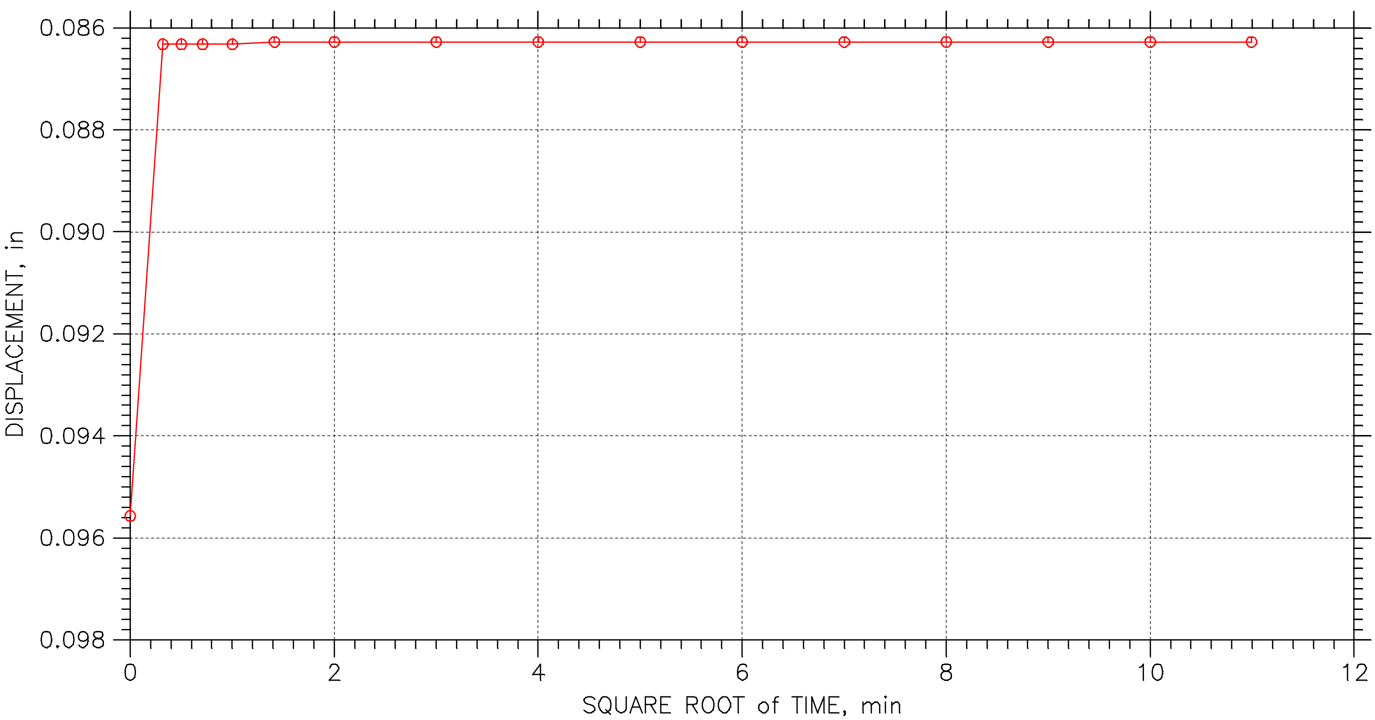
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 19 of 23

Stress: 16. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		
	266		

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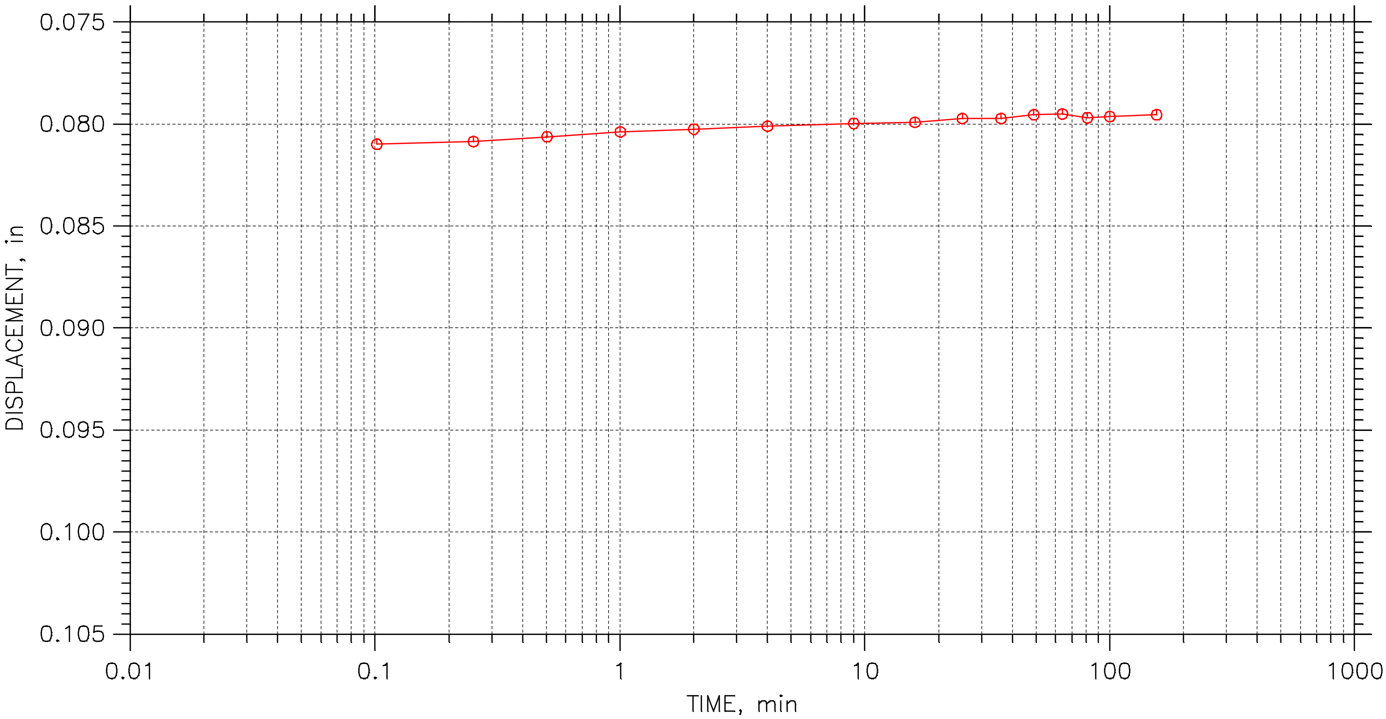
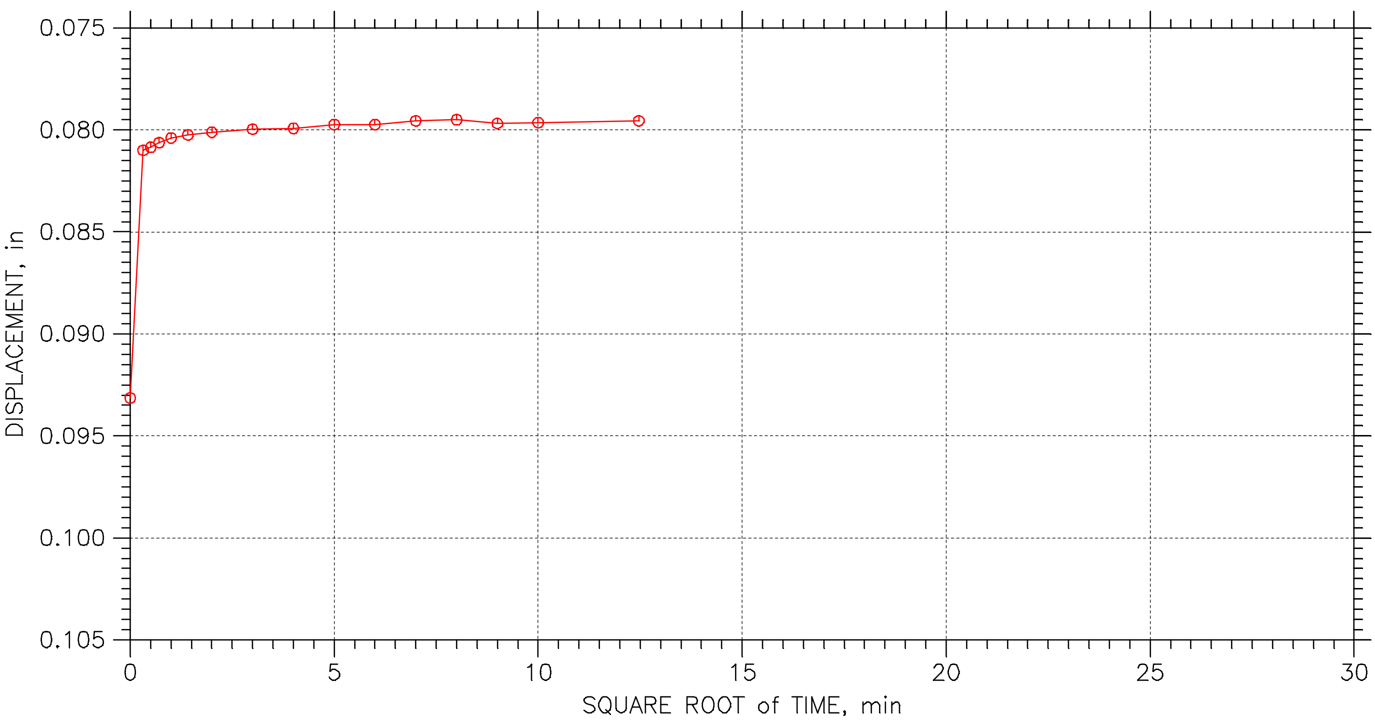
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 20 of 23

Stress: 4. tsf





Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

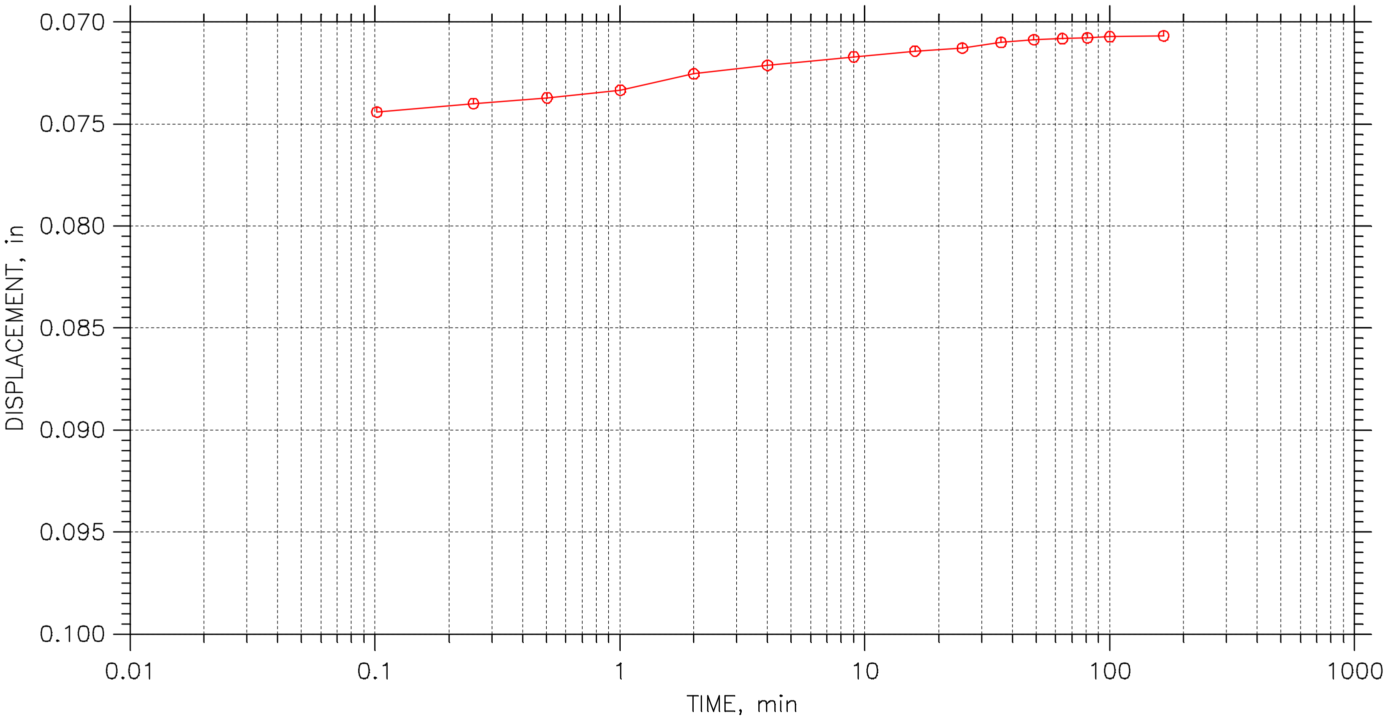
Mon, 21-DEC-2015 16:43:19

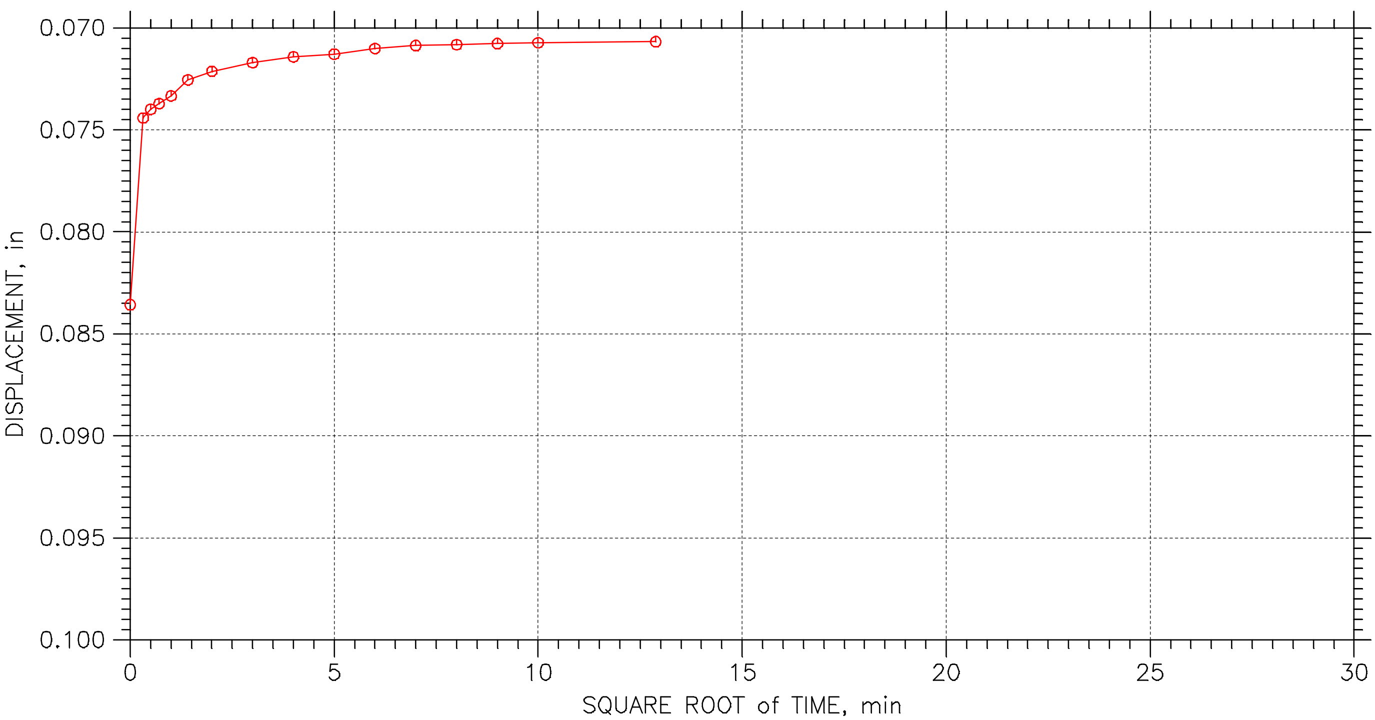
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 21 of 23

Stress: 1. tsf





Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		

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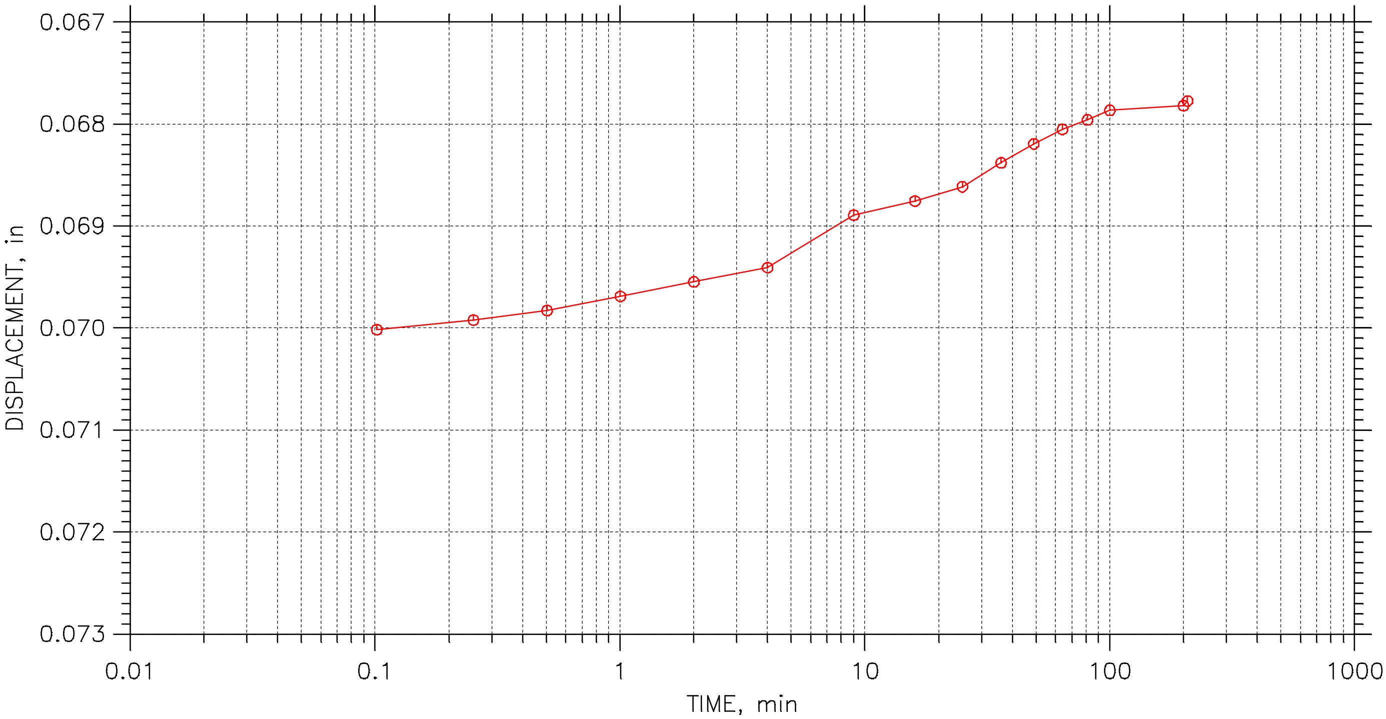
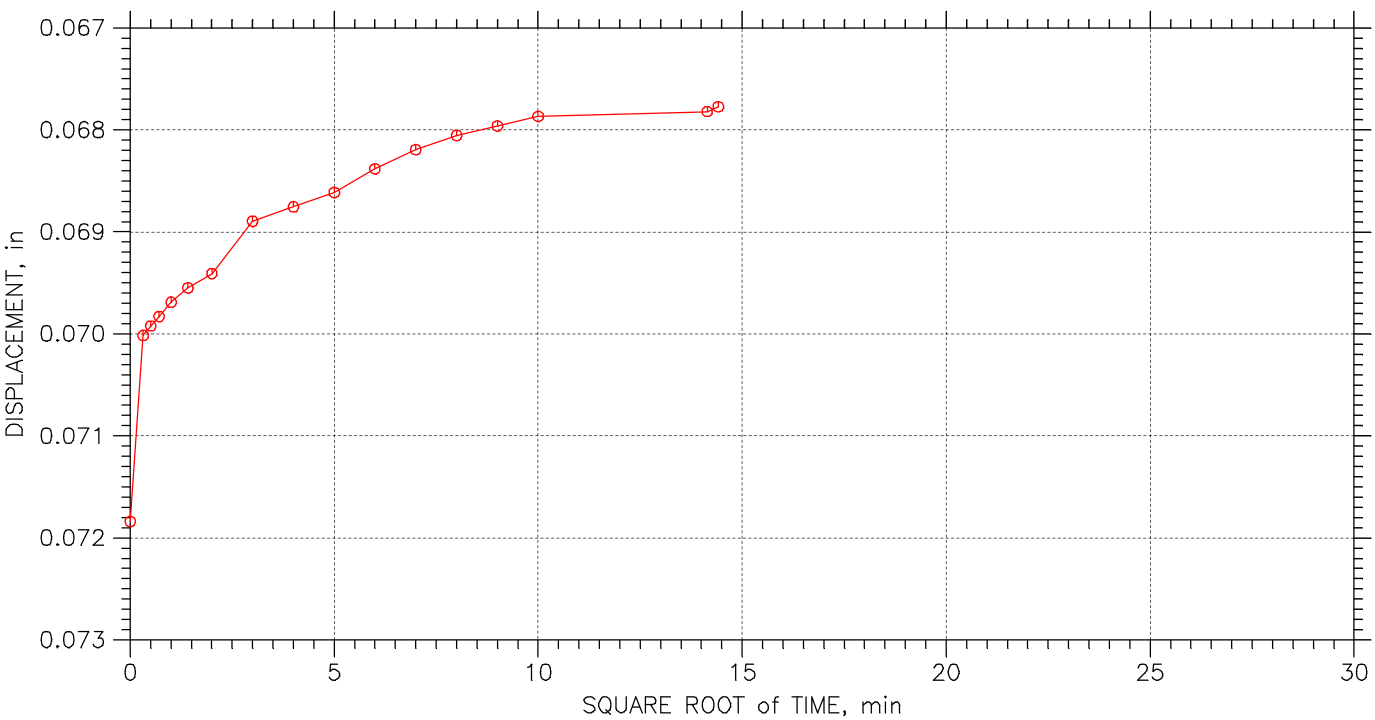
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 22 of 23

Stress: 0.5 tsf





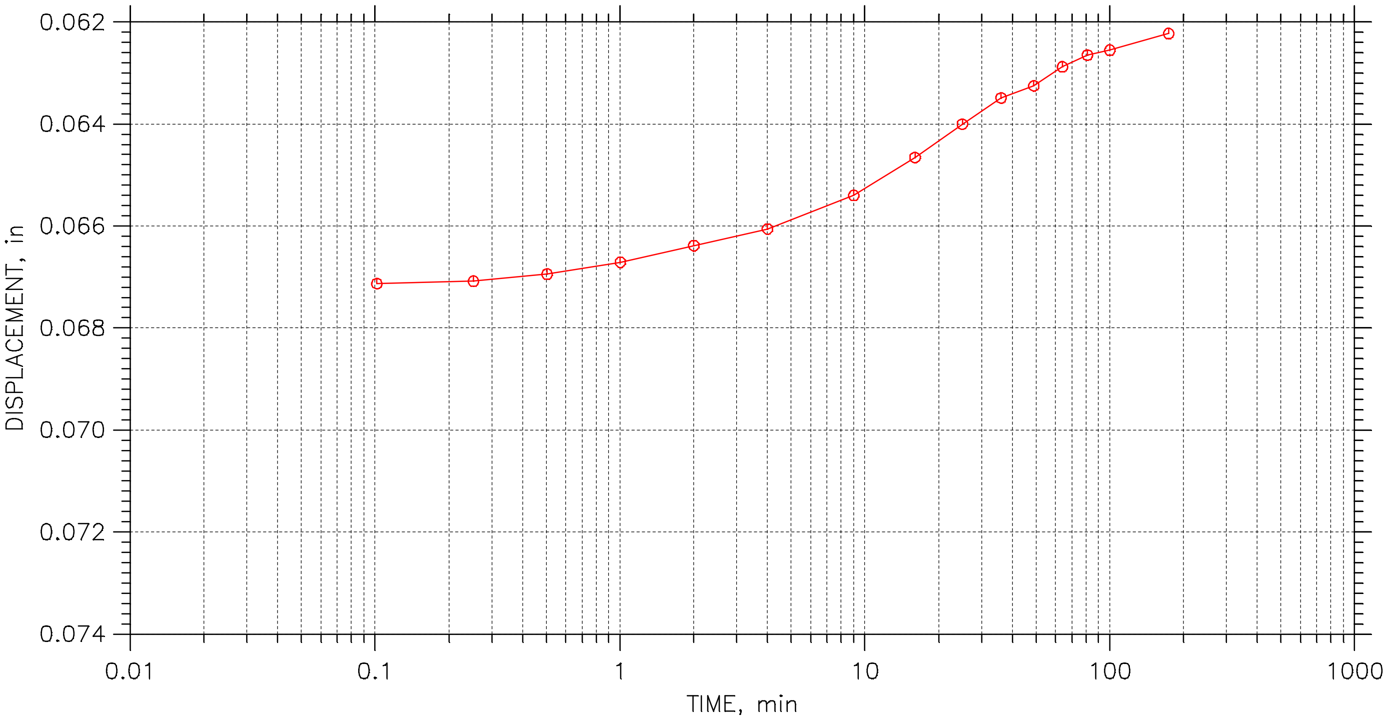
Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		
	269		

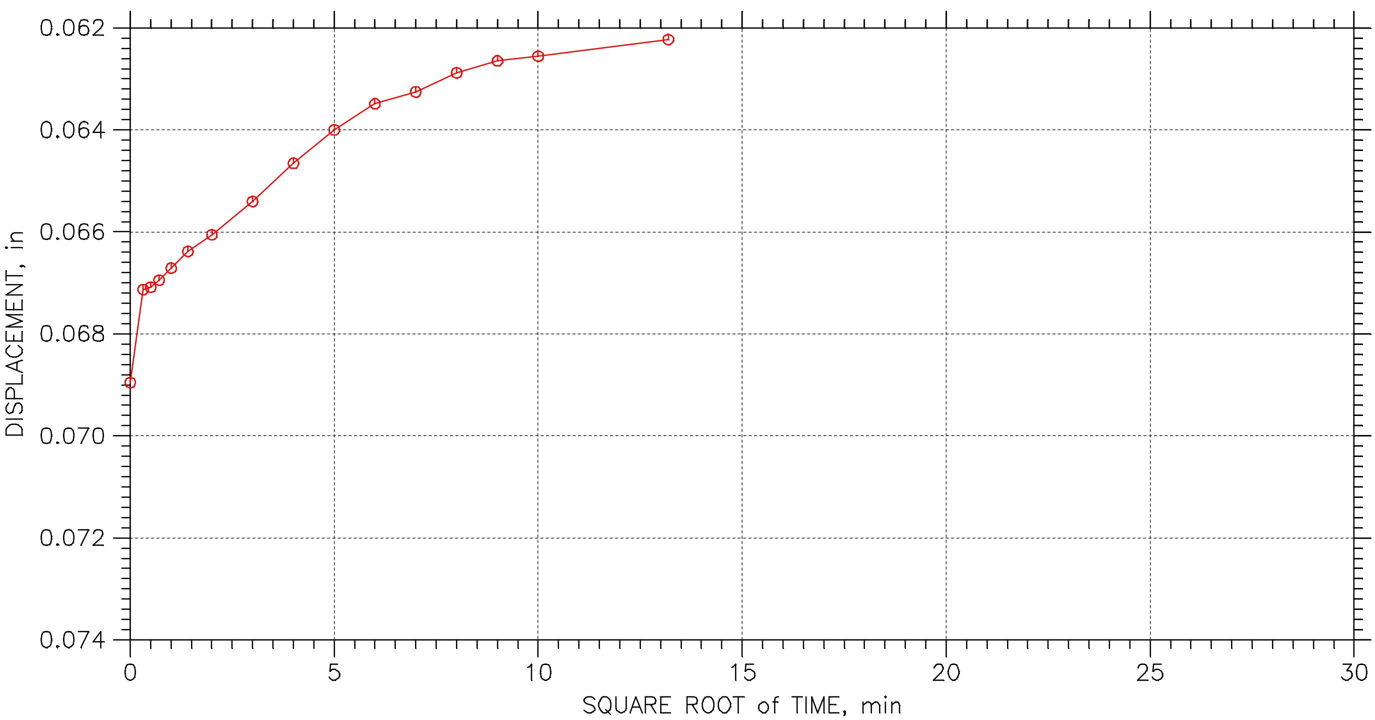
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 23 of 23

Stress: 0.125 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN B020	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 12/14/15	Depth: 9.5'-11.5'
	Test No.: HENB020	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN SANDY LEAN CLAY AND GRAVEL		
	Remarks: Pc = 1.8 tsf Cc = 0.116 Ccr = 0.021 TEST PERFORMED AS PER ASTM D2435		
	270		

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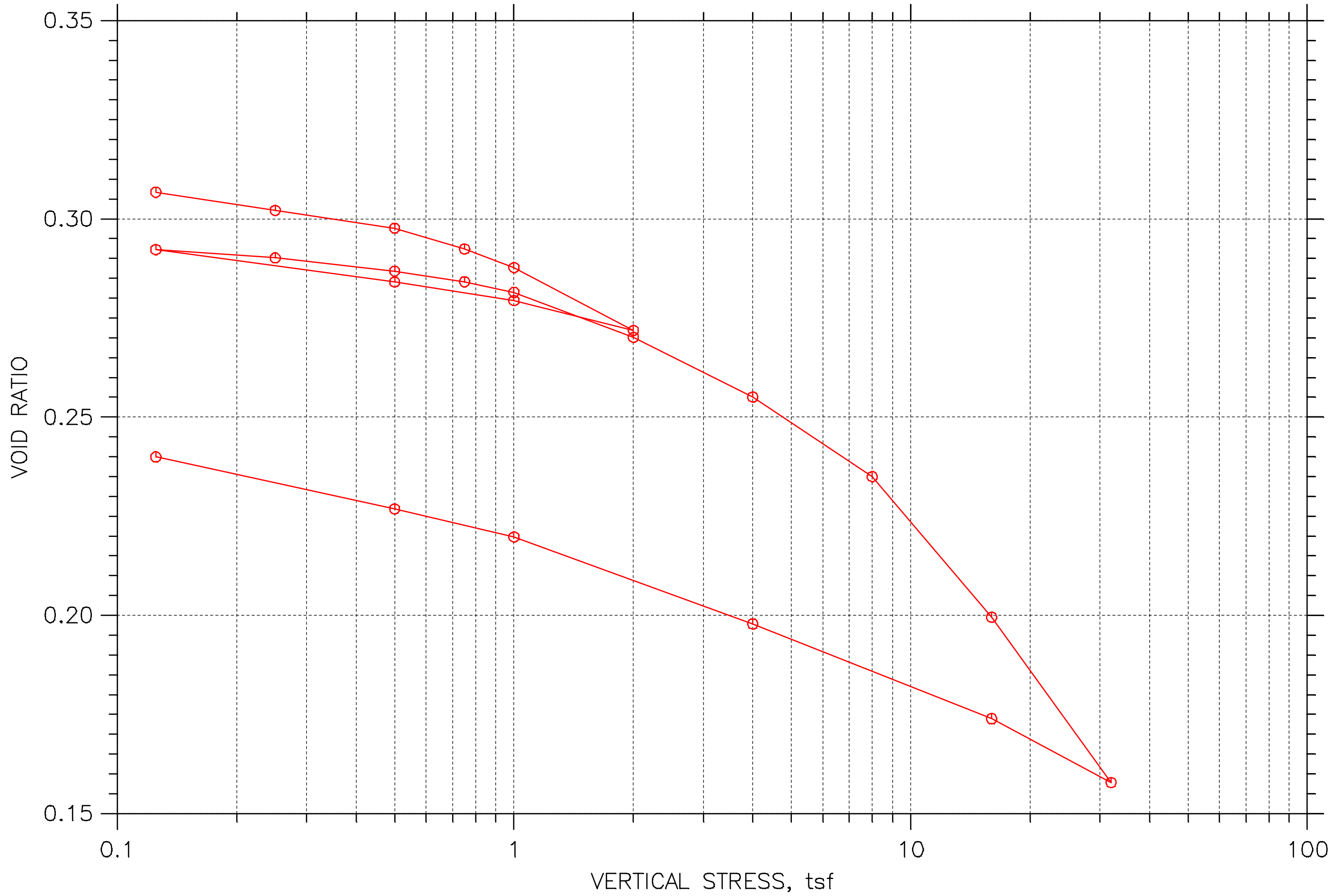
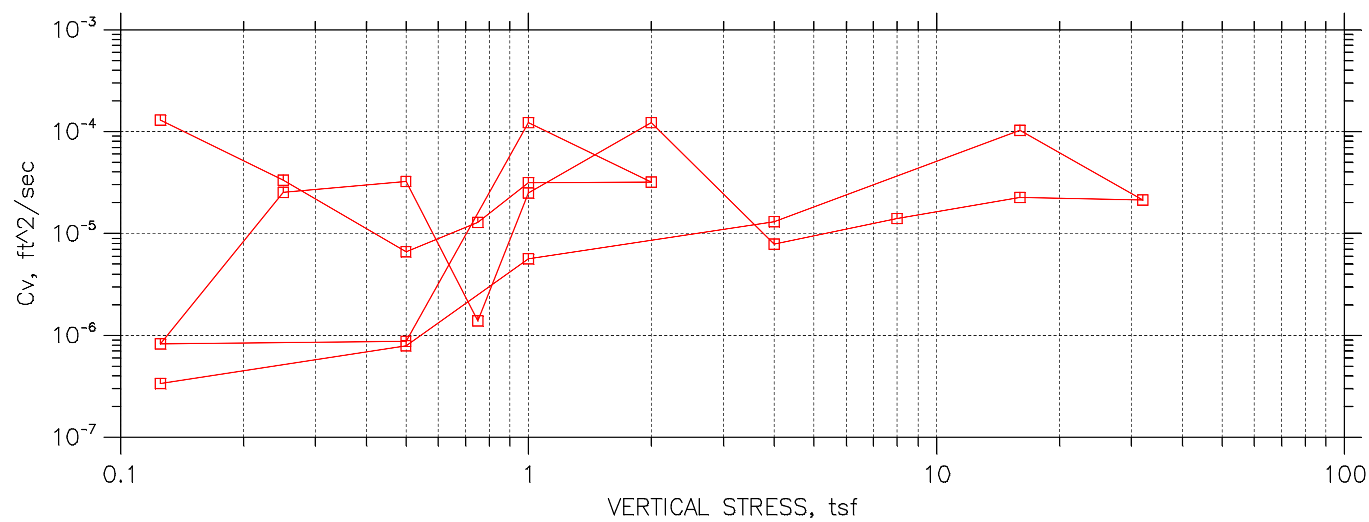
ONE DIMENSIONAL CONSOLIDATION TEST
ASTM D2435





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

Mon, 21-DEC-2015 16:47:42

CONSOLIDATION TEST DATA

Terracon
Consulting Engineers & Scientists

Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
Test No.: HENB029S3	Sample Type: 3.0" ST	Elevation: -----

Soil Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435

Estimated Specific Gravity: 2.72	Liquid Limit: 22	Initial Height: 0.74 in
Initial Void Ratio: 0.31	Plastic Limit: 15	Specimen Diameter: 2.49 in
Final Void Ratio: 0.24	Plasticity Index: 7	

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	X-7	RING	RING	118
Wt. Container + Wet Soil, gm	167.52	207.79	207.7	156.24
Wt. Container + Dry Soil, gm	155.54	196.84	196.84	145.48
Wt. Container, gm	44.63	74.87	74.87	24.64
Wt. Dry Soil, gm	110.91	121.97	121.97	120.84
Water Content, %	10.80	8.98	8.90	8.90
Void Ratio	---	0.31	0.24	---
Degree of Saturation, %	---	77.94	100.93	---
Dry Unit Weight, pcf	---	129.29	136.94	---

CONSOLIDATION TEST DATA

Project: DYNERGY HENNEPIN
Boring No.: HEN-029 S-3
Sample No.: S-3
Test No.: HENB029S3

Location: HENNEPIN, IL
Tested By: HP
Test Date: 12/14/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: BCM
Depth: 5.0'-7.0'
Elevation: -----

Soil Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435

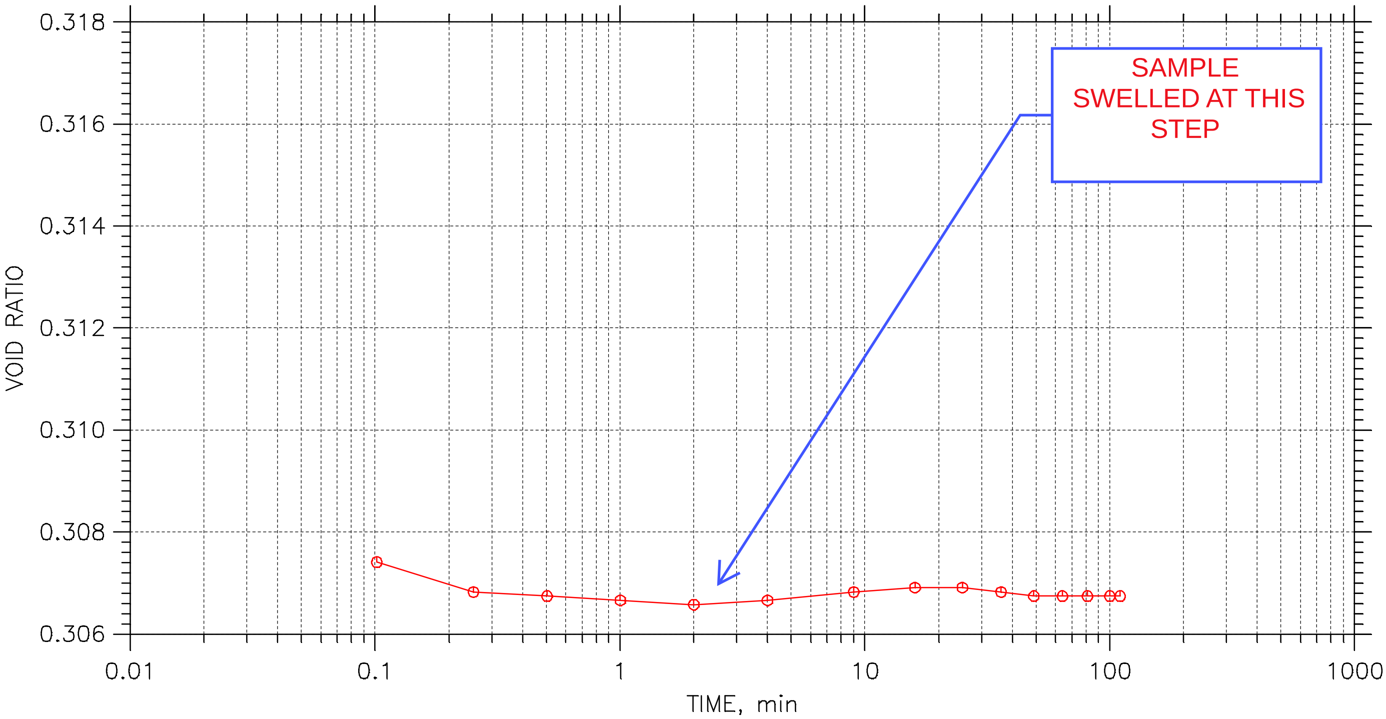
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. ft^2/sec	Coefficient of Consolidation Log ft^2/sec	Coefficient of Consolidation Ave. ft^2/sec
1	0.125	0.00369	0.307	0.50	0.0	0.0	1.30e-004	0.00e+000	1.30e-004
2	0.25	0.006259	0.302	0.85	0.1	0.0	3.32e-005	0.00e+000	3.32e-005
3	0.5	0.008782	0.298	1.19	0.5	0.0	6.59e-006	0.00e+000	6.59e-006
4	0.75	0.01172	0.292	1.59	0.2	0.0	1.28e-005	0.00e+000	1.28e-005
5	1	0.01434	0.288	1.95	0.1	0.0	3.13e-005	0.00e+000	3.13e-005
6	2	0.02322	0.272	3.16	0.1	0.0	3.18e-005	0.00e+000	3.18e-005
7	1	0.01901	0.279	2.58	0.0	0.0	1.23e-004	0.00e+000	1.23e-004
8	0.5	0.0164	0.284	2.23	3.4	0.0	8.69e-007	0.00e+000	8.69e-007
9	0.125	0.01182	0.292	1.61	3.6	0.0	8.29e-007	0.00e+000	8.29e-007
10	0.25	0.01299	0.290	1.76	0.1	0.0	2.54e-005	0.00e+000	2.54e-005
11	0.5	0.01485	0.287	2.02	0.1	0.0	3.22e-005	0.00e+000	3.22e-005
12	0.75	0.01635	0.284	2.22	2.1	0.0	1.38e-006	0.00e+000	1.38e-006
13	1	0.01784	0.281	2.43	0.1	0.0	2.51e-005	0.00e+000	2.51e-005
14	2	0.0242	0.270	3.29	0.0	0.0	1.23e-004	0.00e+000	1.23e-004
15	4	0.03265	0.255	4.44	0.4	0.0	7.87e-006	0.00e+000	7.87e-006
16	8	0.04391	0.235	5.97	0.2	0.0	1.39e-005	0.00e+000	1.39e-005
17	16	0.06376	0.200	8.67	0.1	0.0	2.26e-005	0.00e+000	2.26e-005
18	32	0.08712	0.158	11.84	0.1	0.0	2.12e-005	0.00e+000	2.12e-005
19	16	0.0781	0.174	10.61	0.0	0.0	1.03e-004	0.00e+000	1.03e-004
20	4	0.0647	0.198	8.79	0.2	0.0	1.30e-005	0.00e+000	1.30e-005
21	1	0.05241	0.220	7.12	0.5	0.0	5.63e-006	0.00e+000	5.63e-006
22	0.5	0.04844	0.227	6.58	3.4	0.0	7.92e-007	0.00e+000	7.92e-007
23	0.125	0.04111	0.240	5.59	8.1	0.0	3.37e-007	0.00e+000	3.37e-007

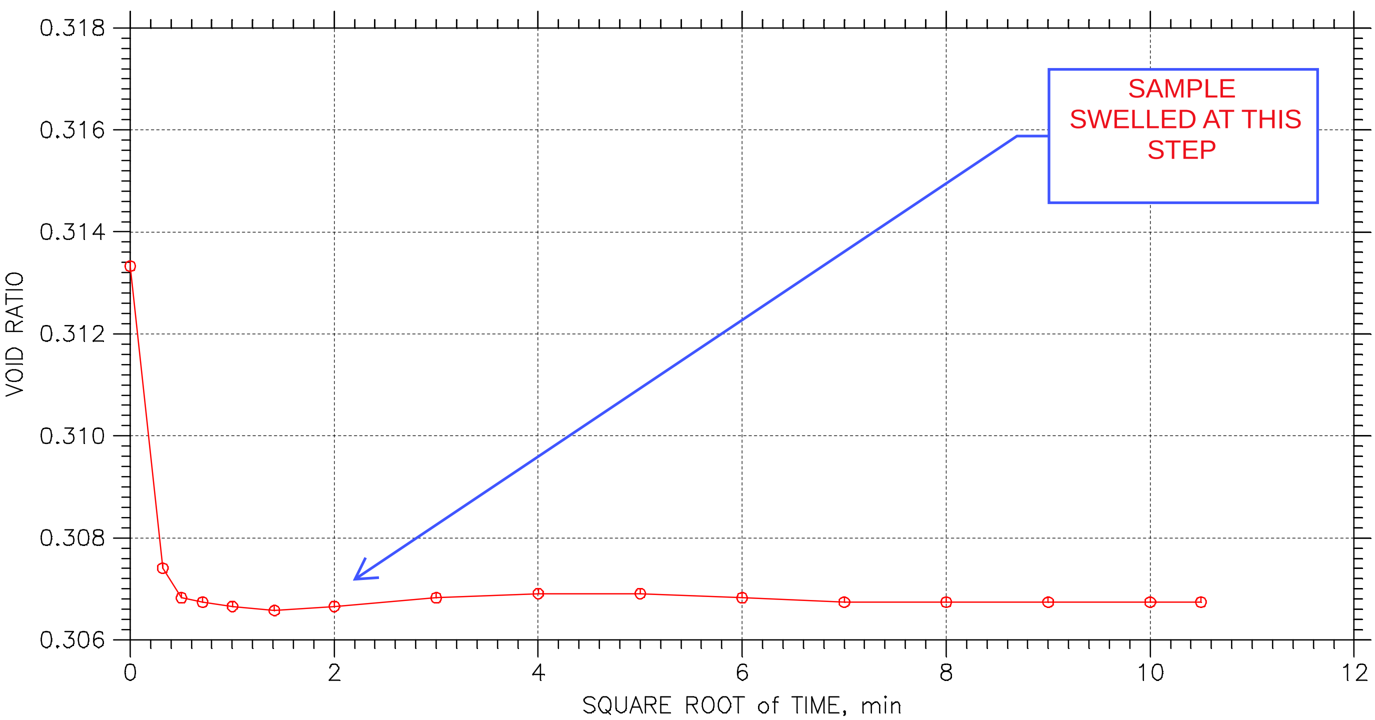
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 1 of 23

Stress: 0.125 tsf





Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

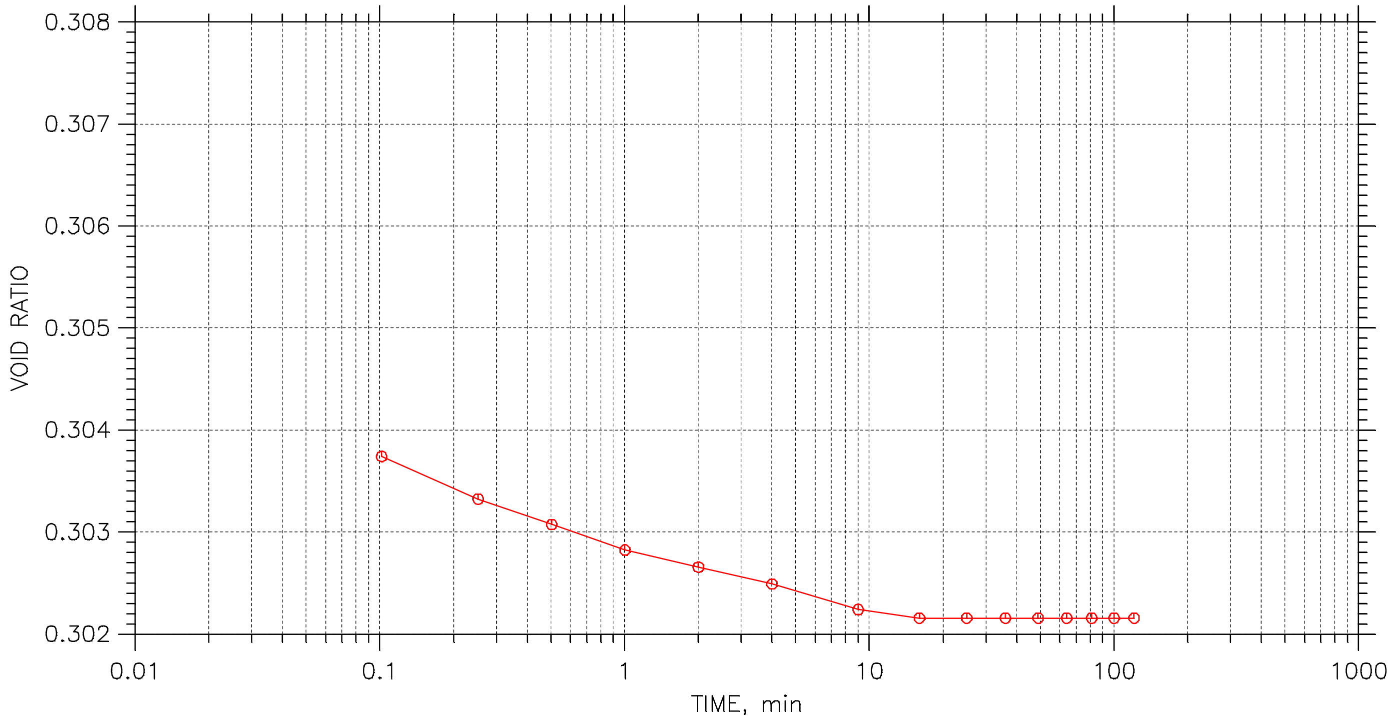
Mon, 21-DEC-2015 16:48:15

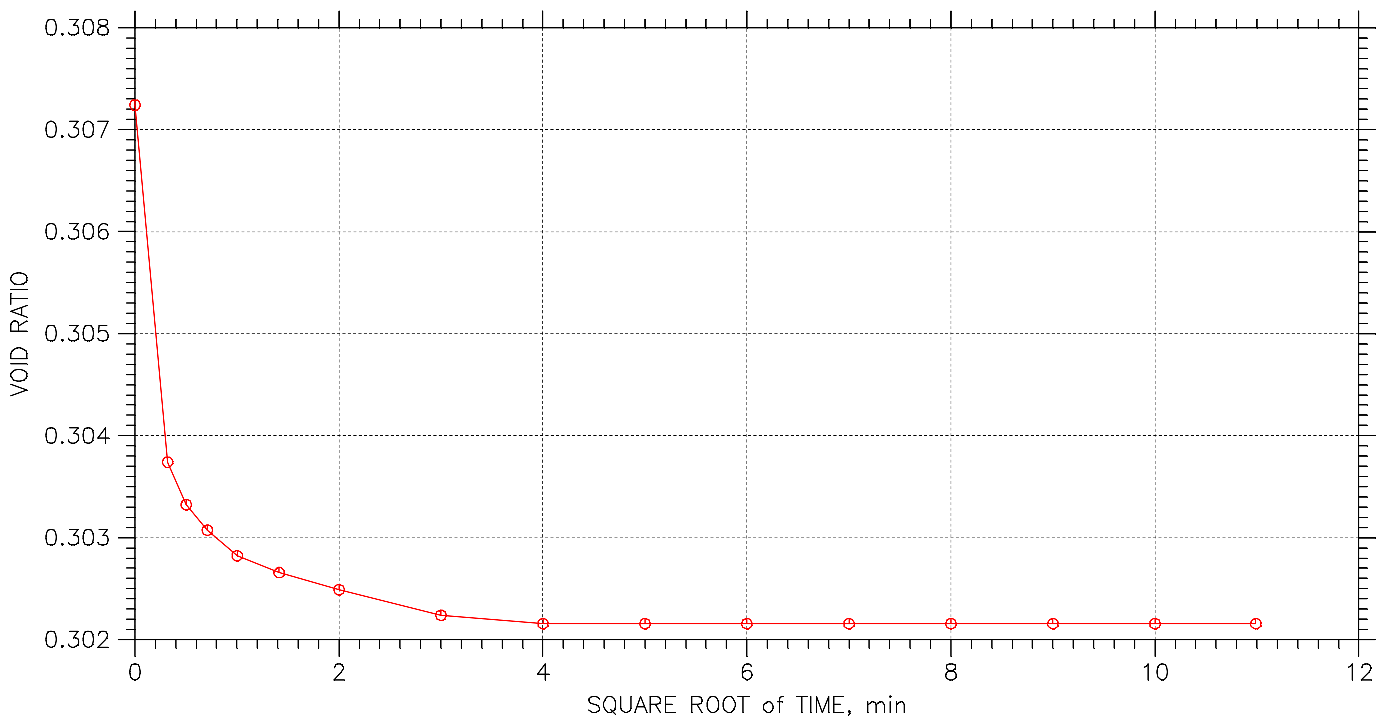
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 2 of 23

Stress: 0.25 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		
	275		

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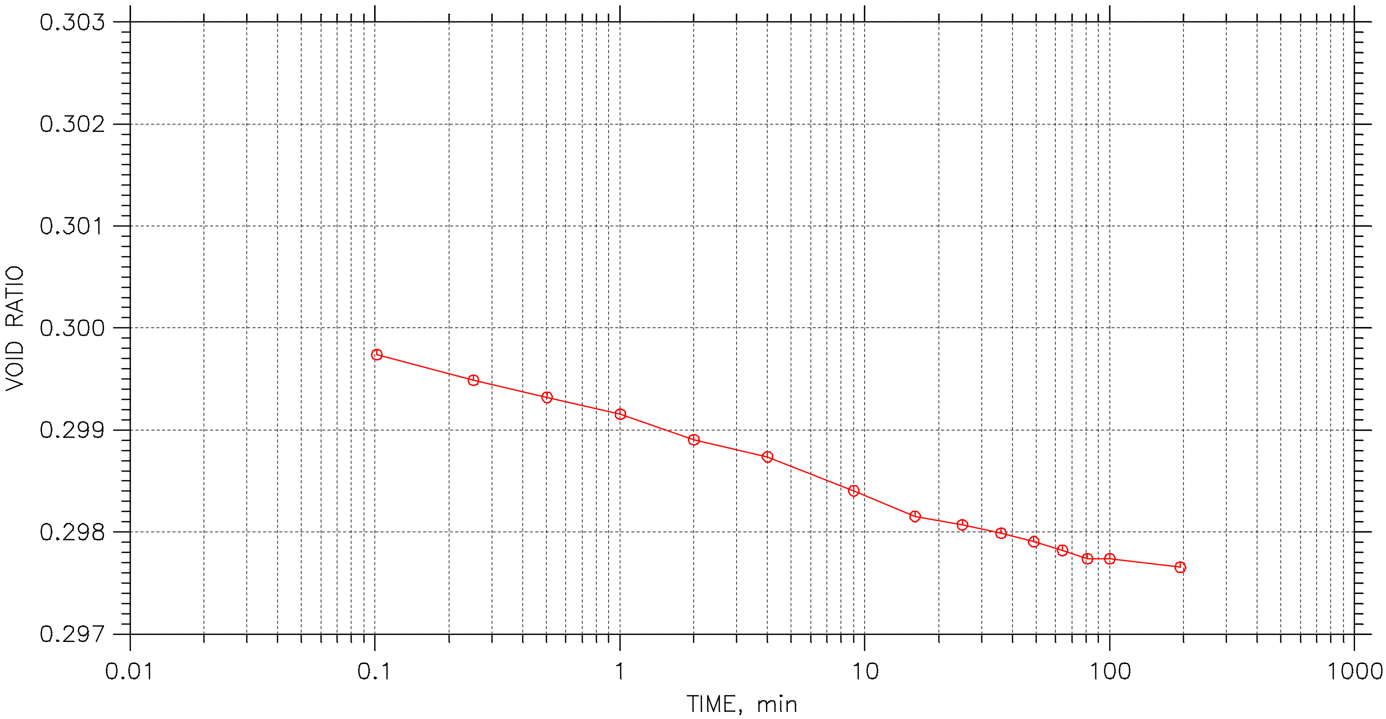
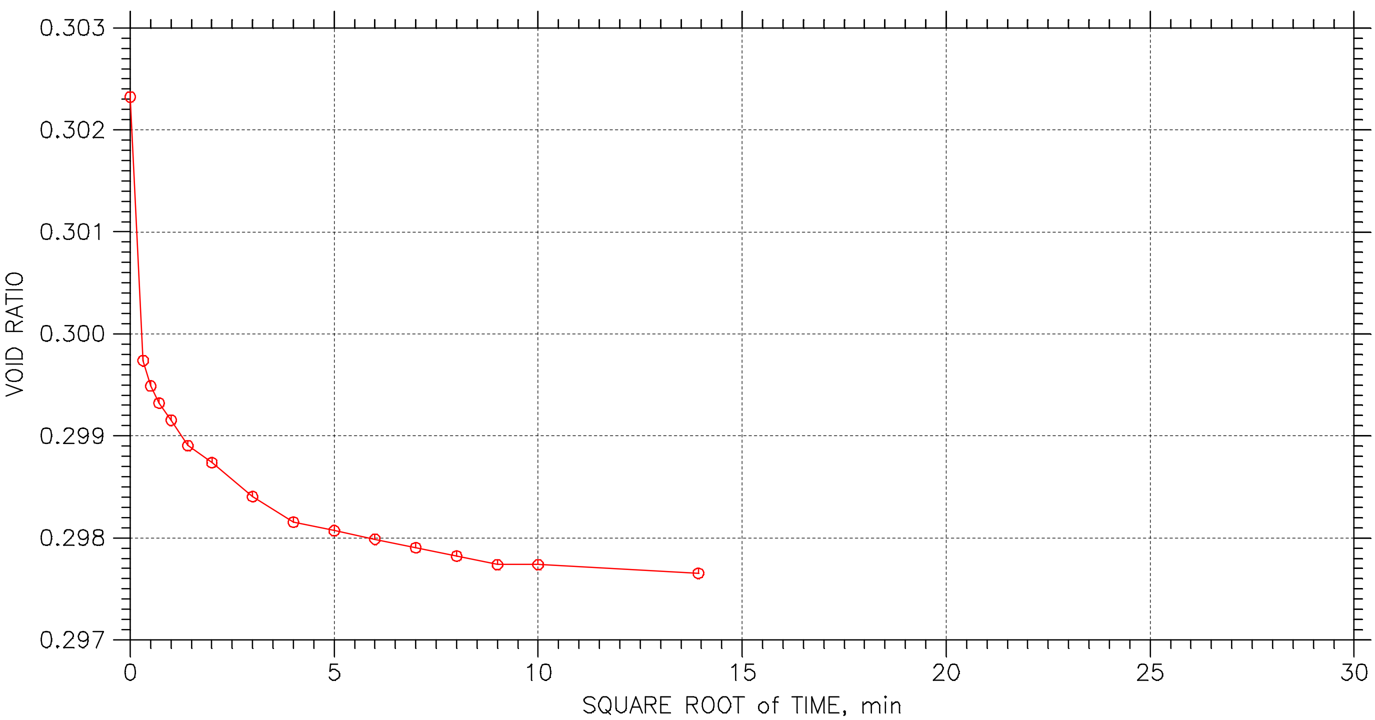
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 3 of 23

Stress: 0.5 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

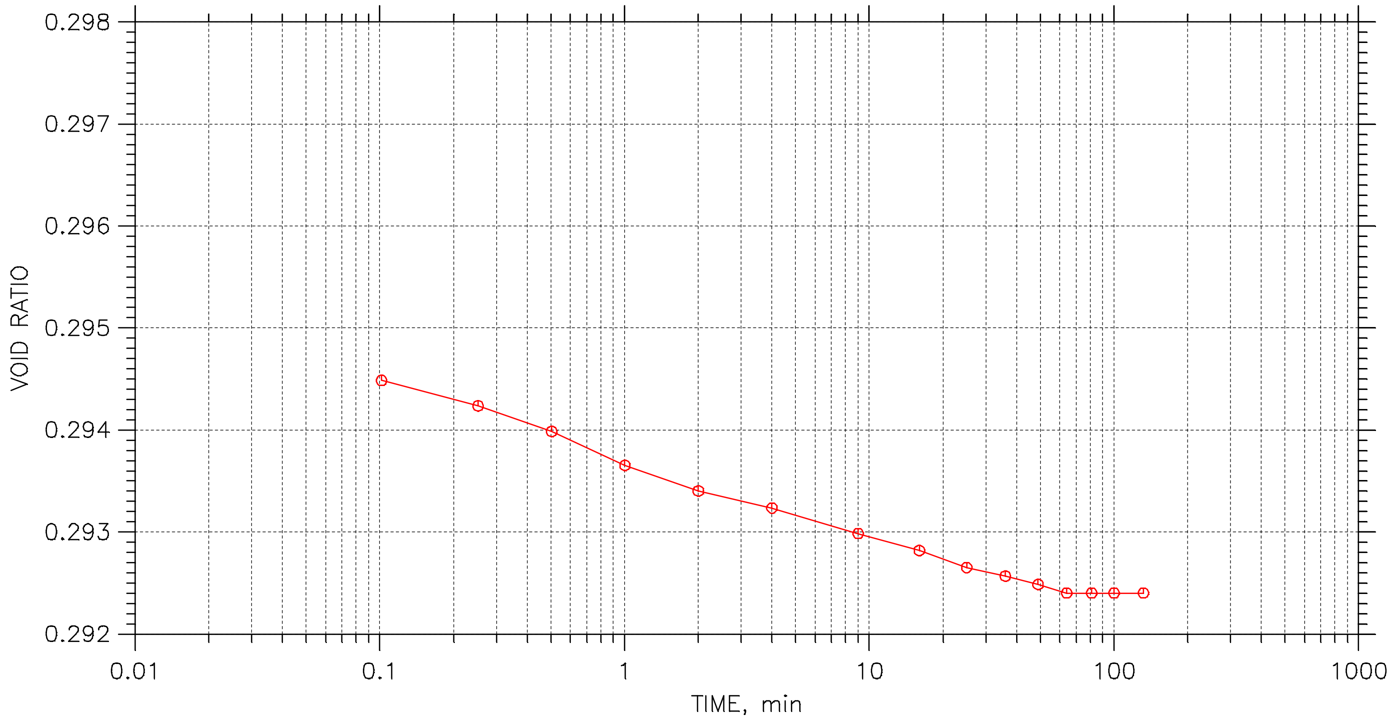
Mon, 21-DEC-2015 16:48:17

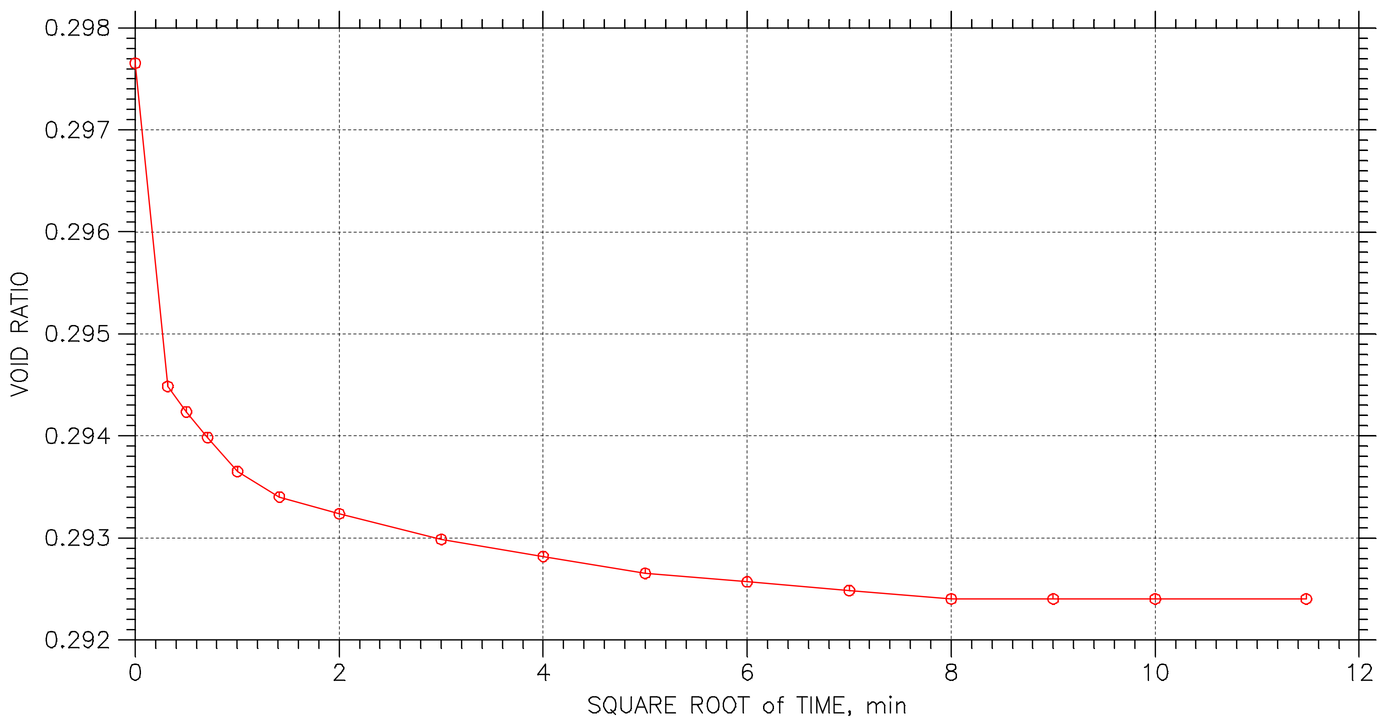
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 4 of 23

Stress: 0.75 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		
	277		

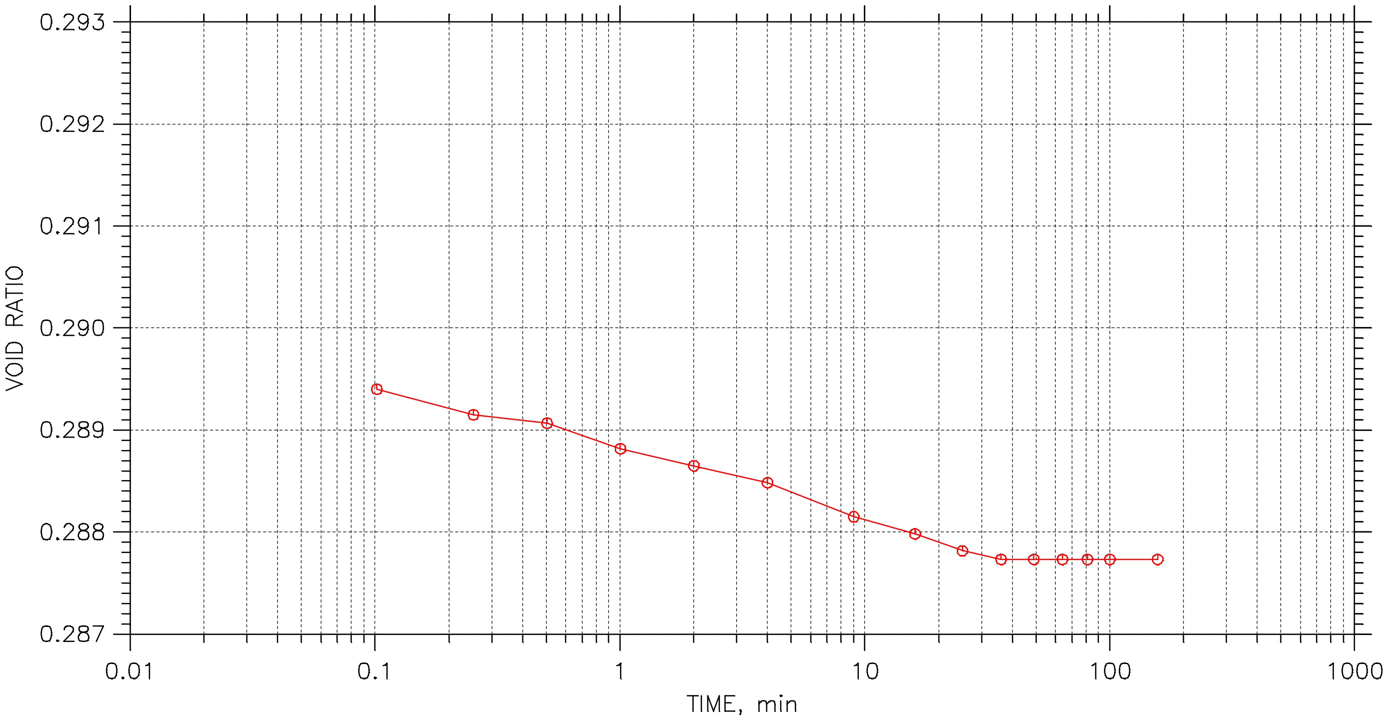
Mon, 21-DEC-2015 16:48:19

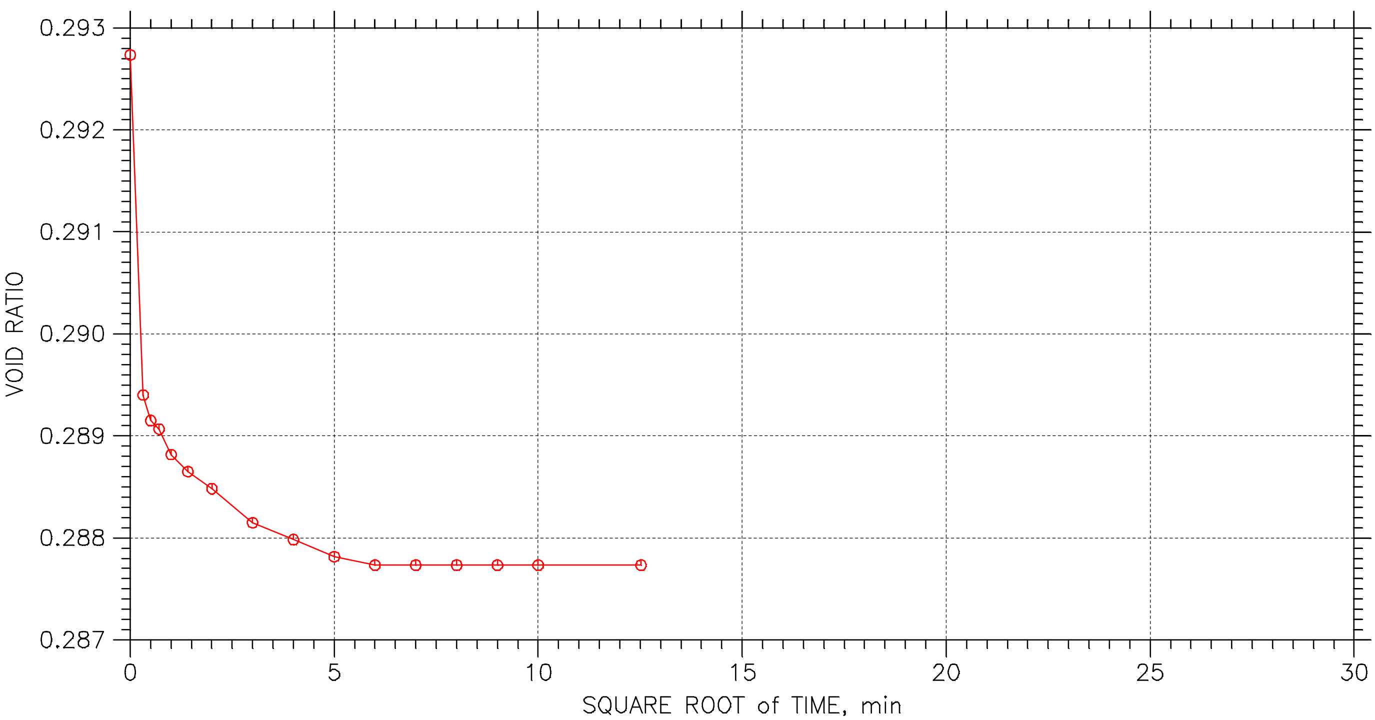
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 5 of 23

Stress: 1. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

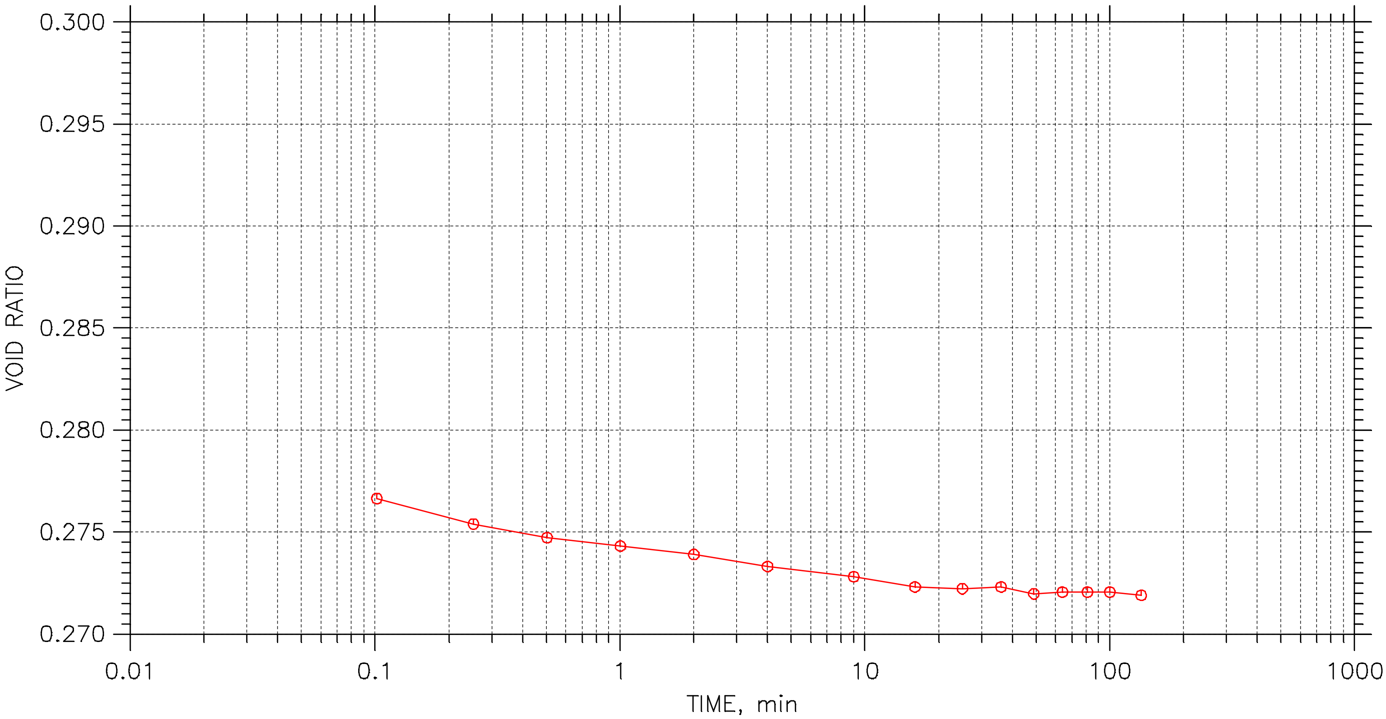
Mon, 21-DEC-2015 16:48:20

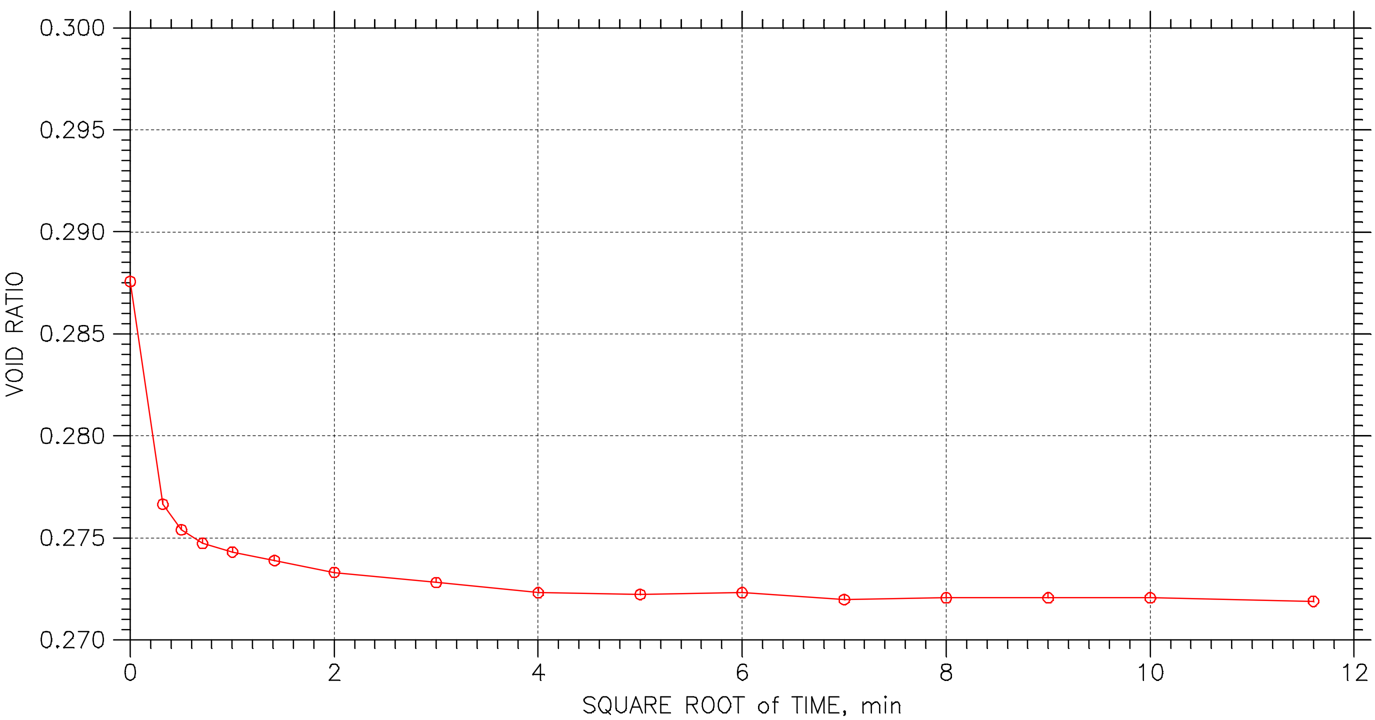
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 6 of 23

Stress: 2. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

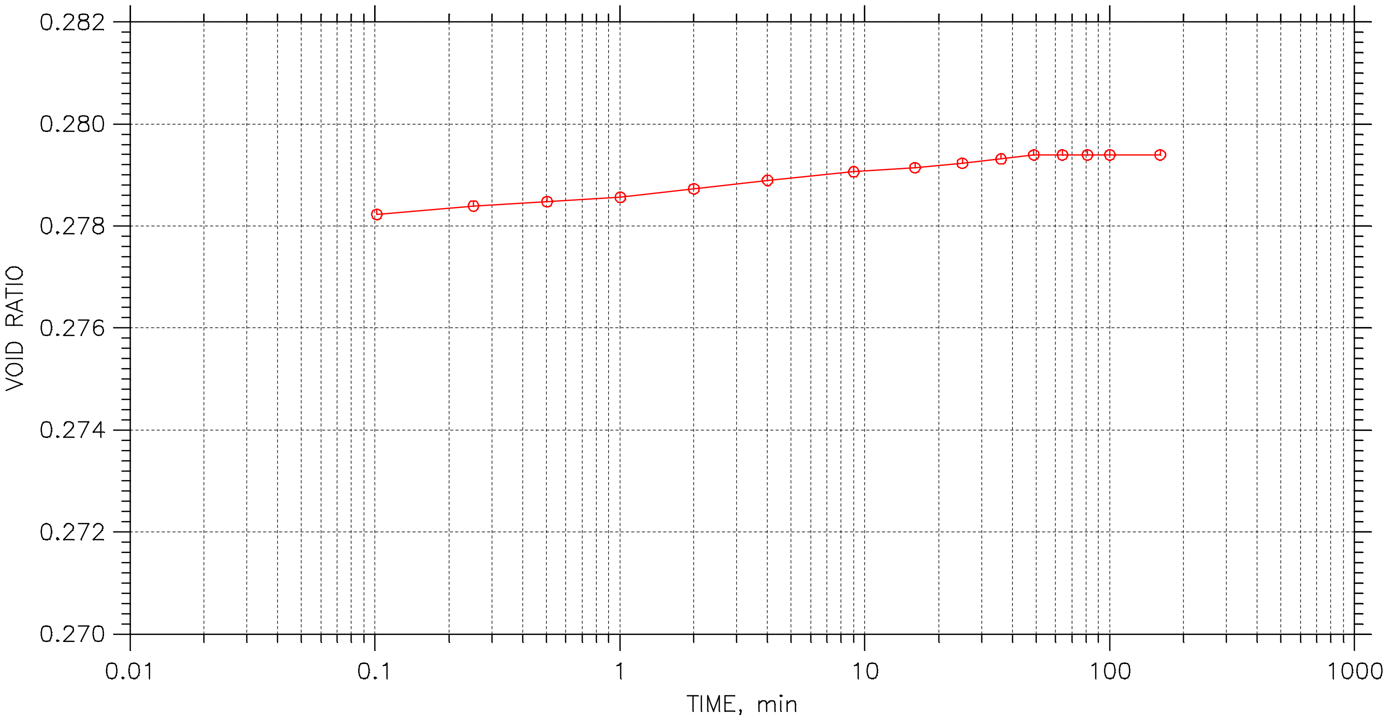
Mon, 21-DEC-2015 16:48:21

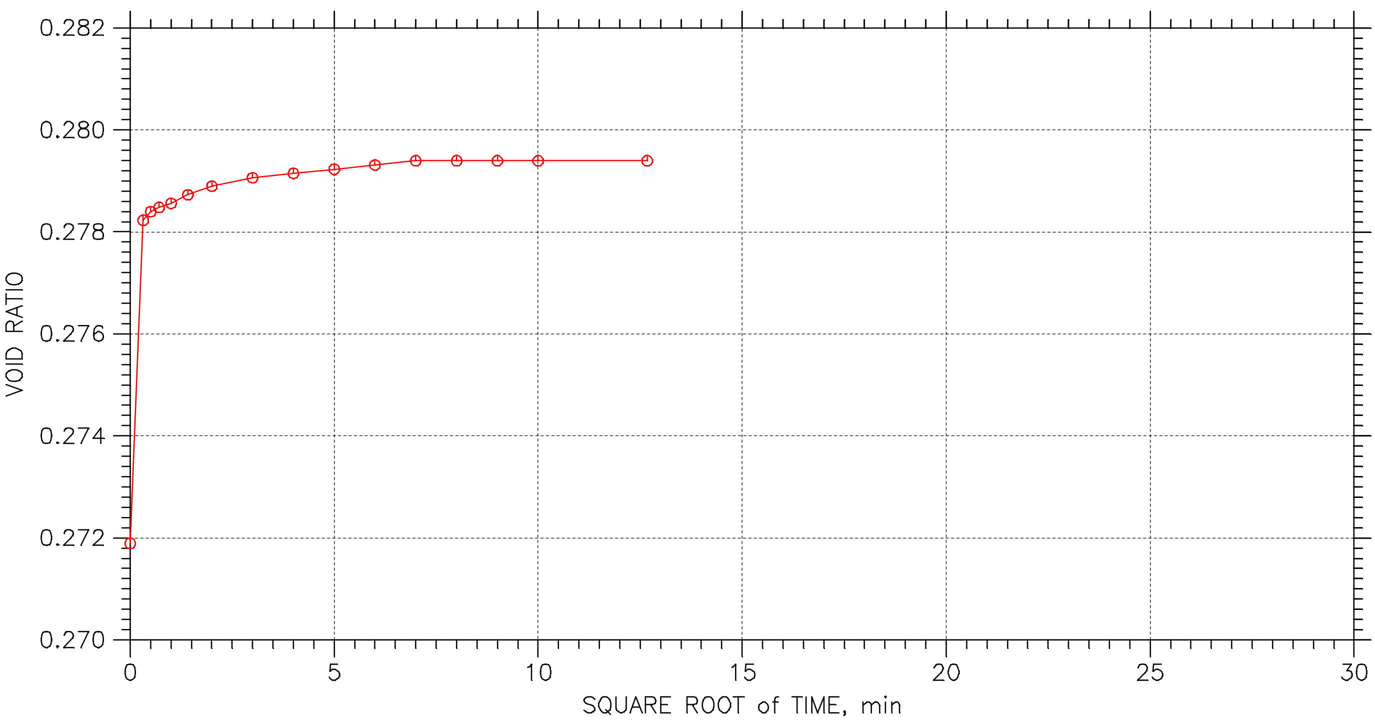
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 7 of 23

Stress: 1. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

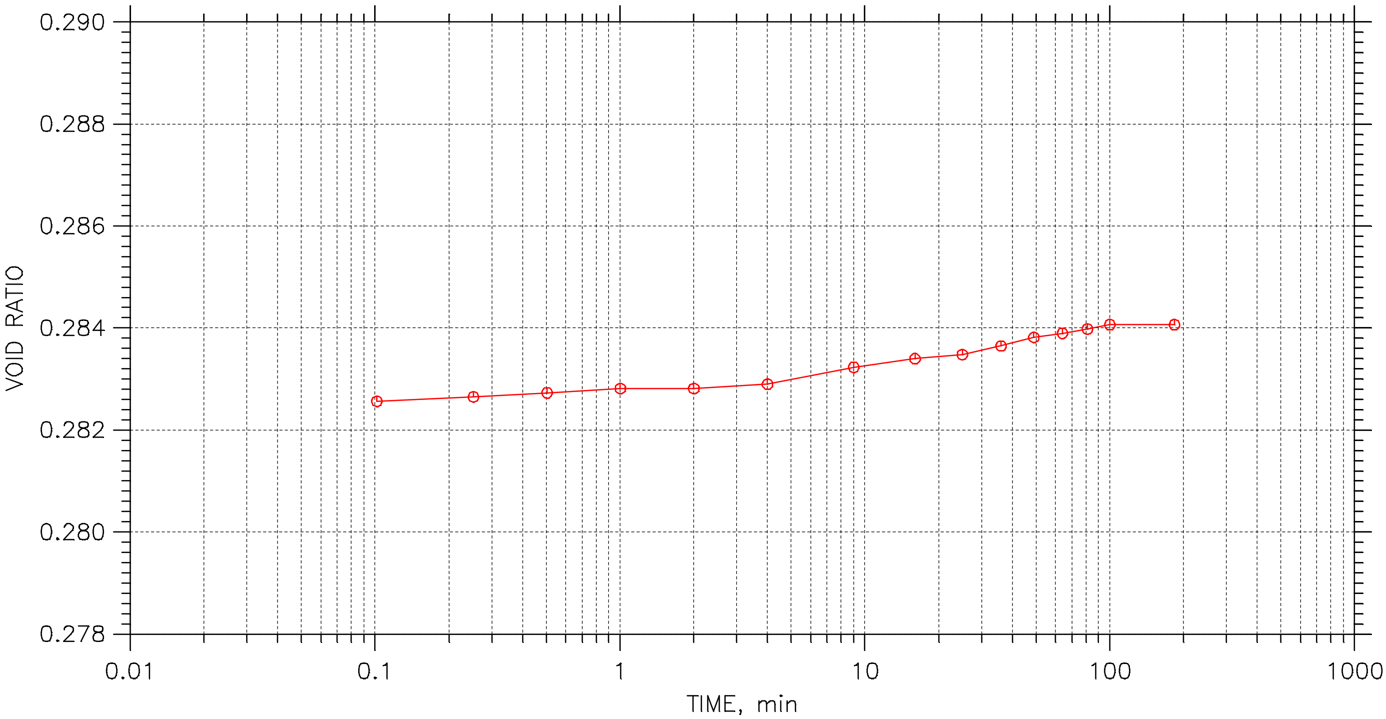
Mon, 21-DEC-2015 16:48:23

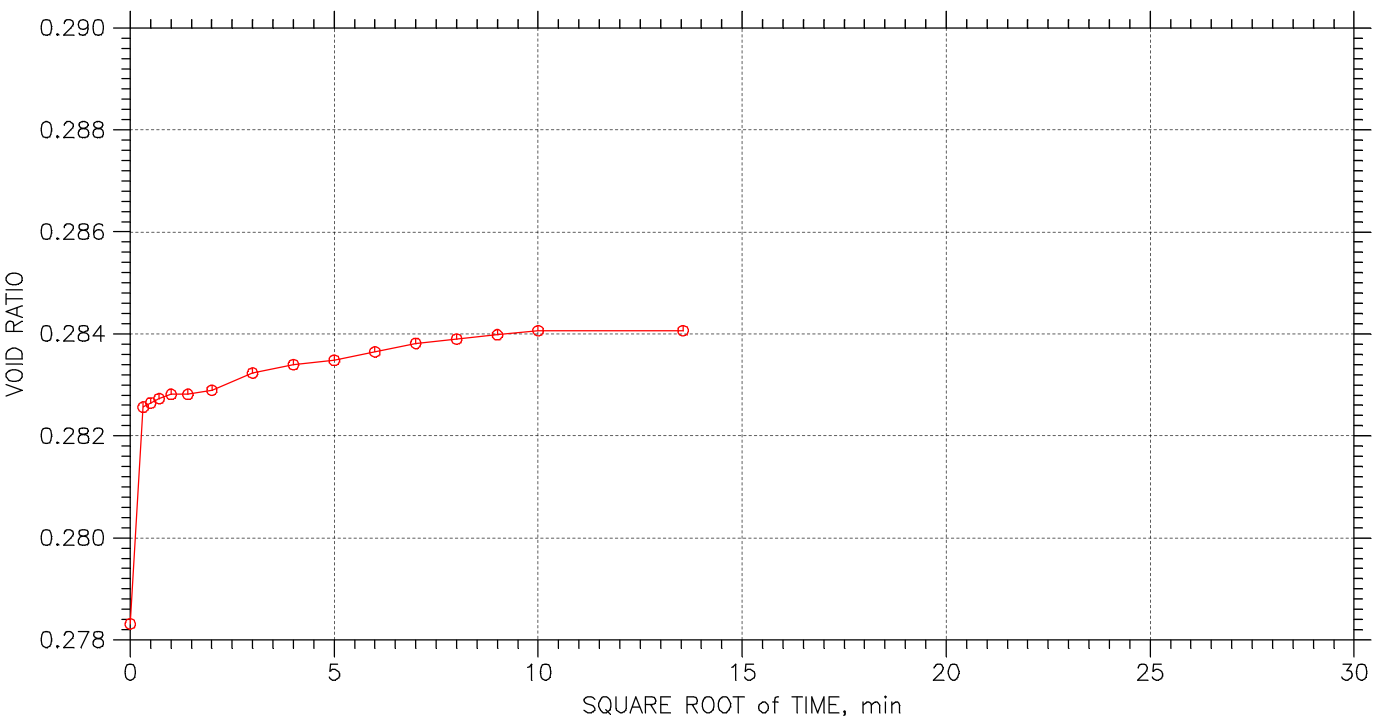
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 8 of 23

Stress: 0.5 tsf





Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

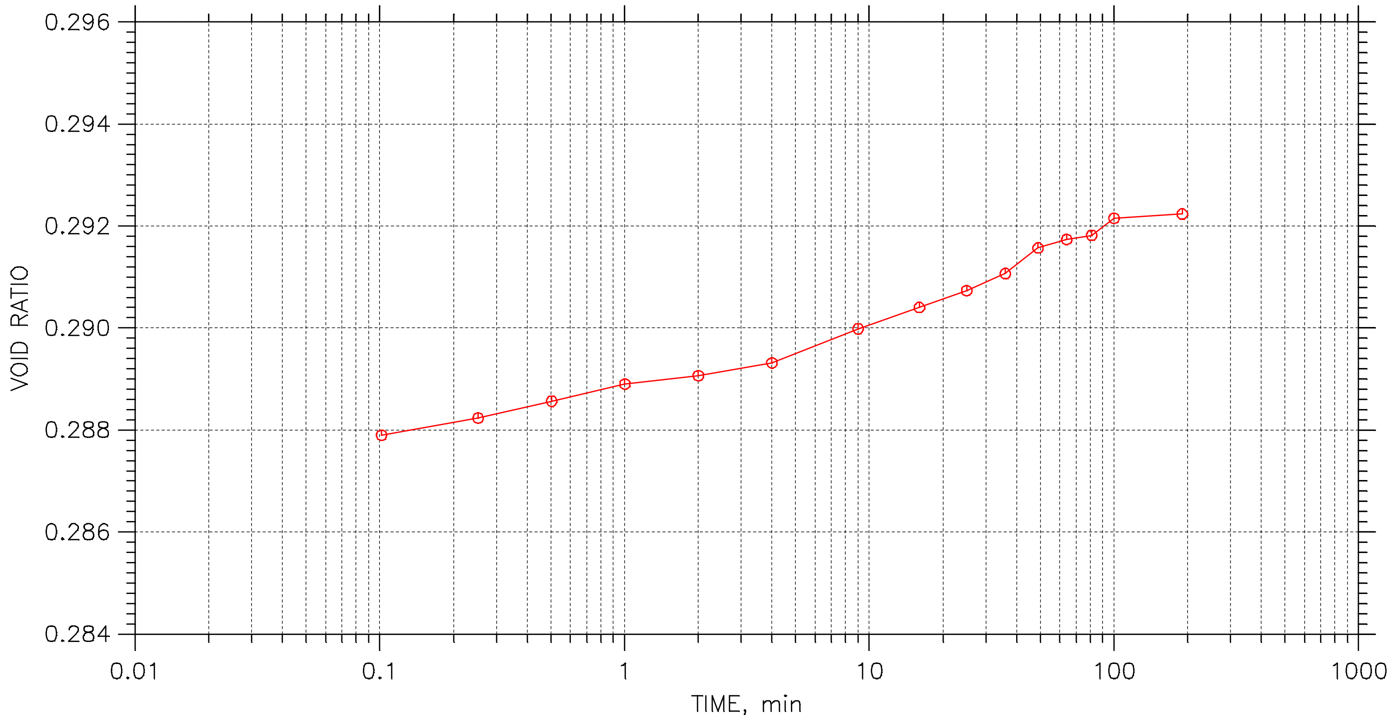
Mon, 21-DEC-2015 16:48:24

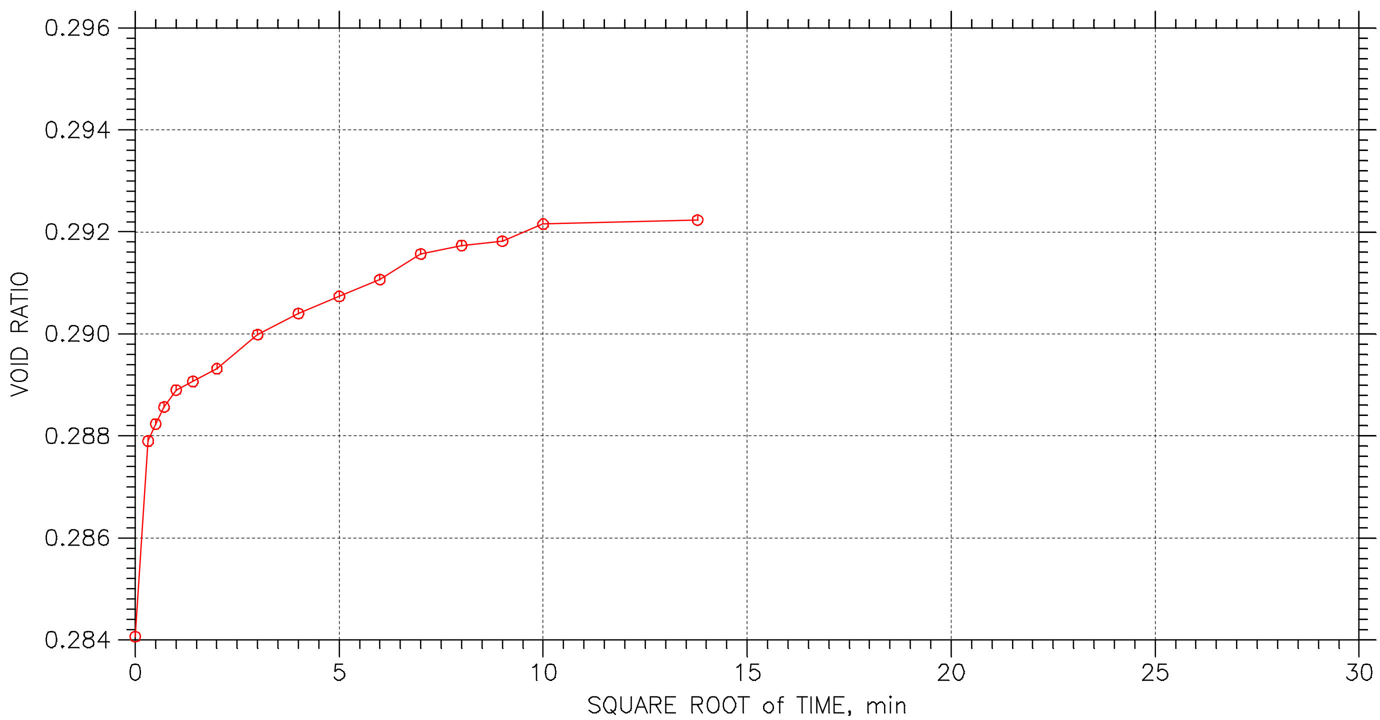
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 9 of 23

Stress: 0.125 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

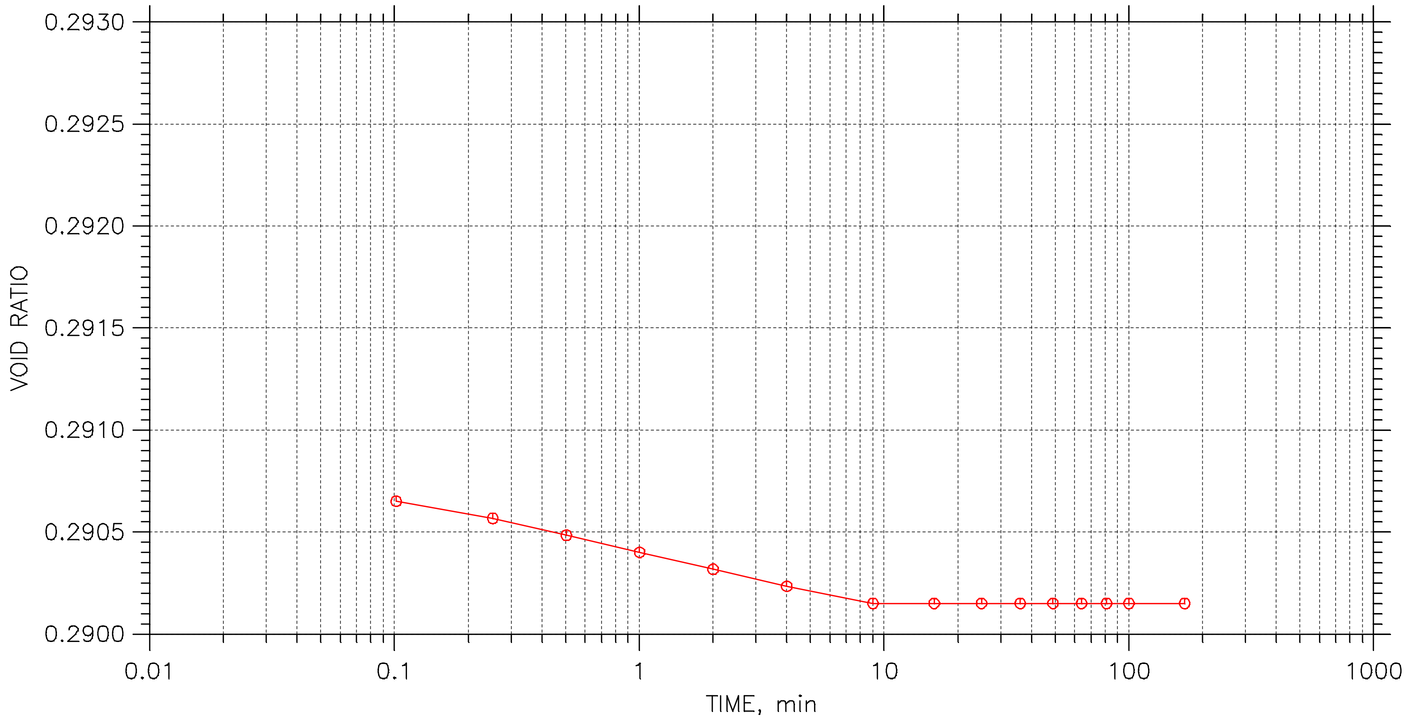
Mon, 21-DEC-2015 16:48:26

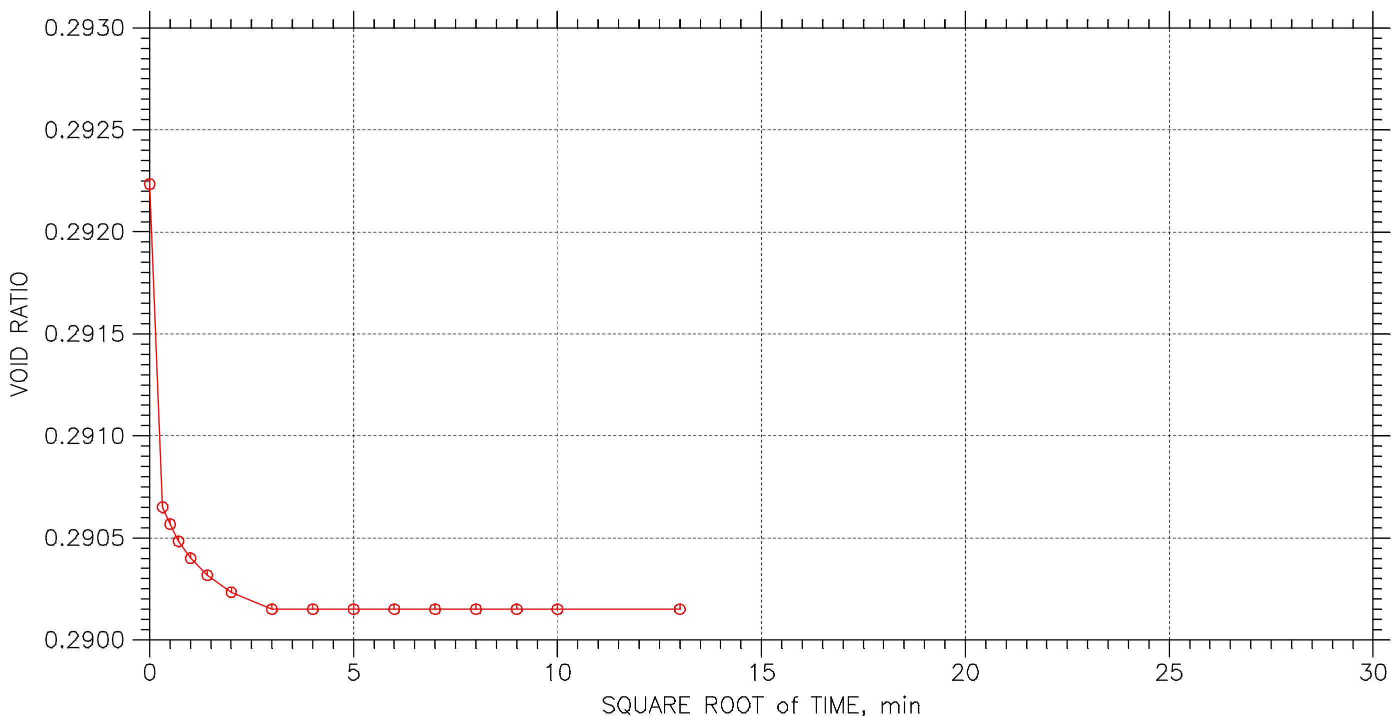
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 10 of 23

Stress: 0.25 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

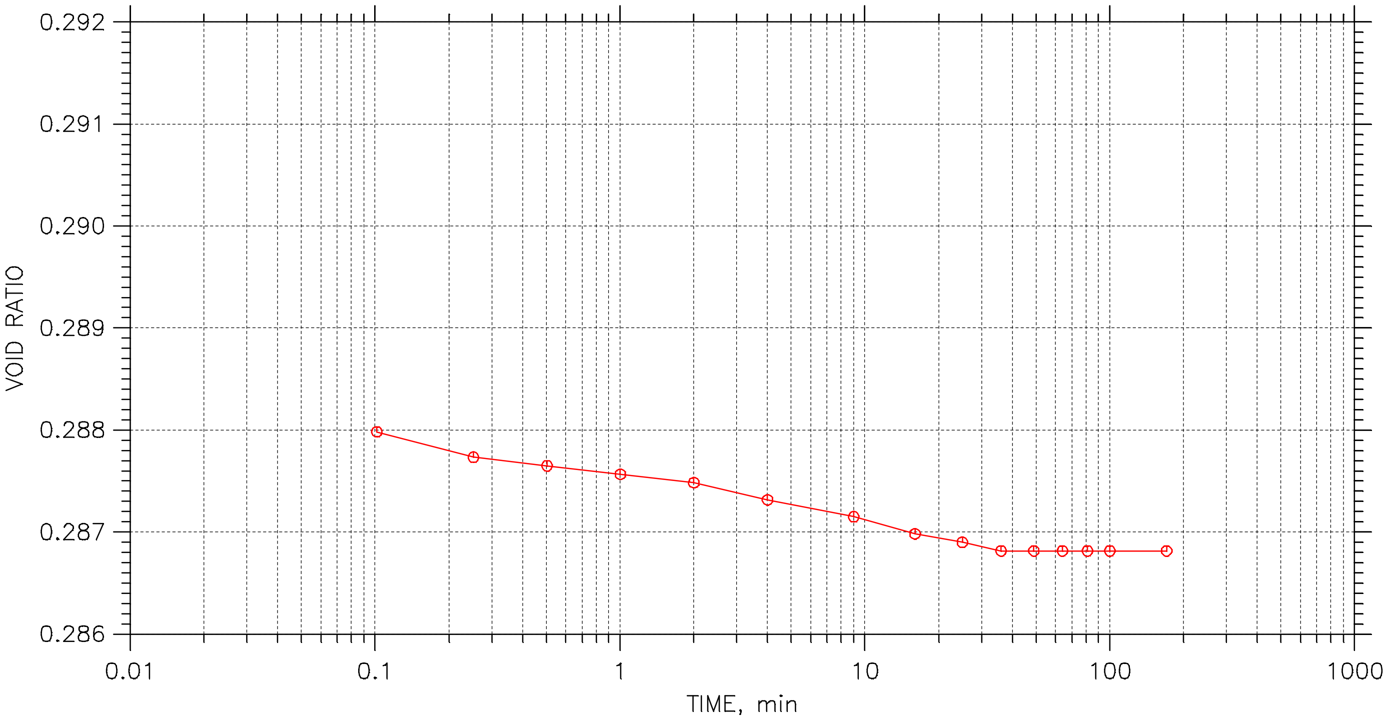
Mon, 21-DEC-2015 16:48:27

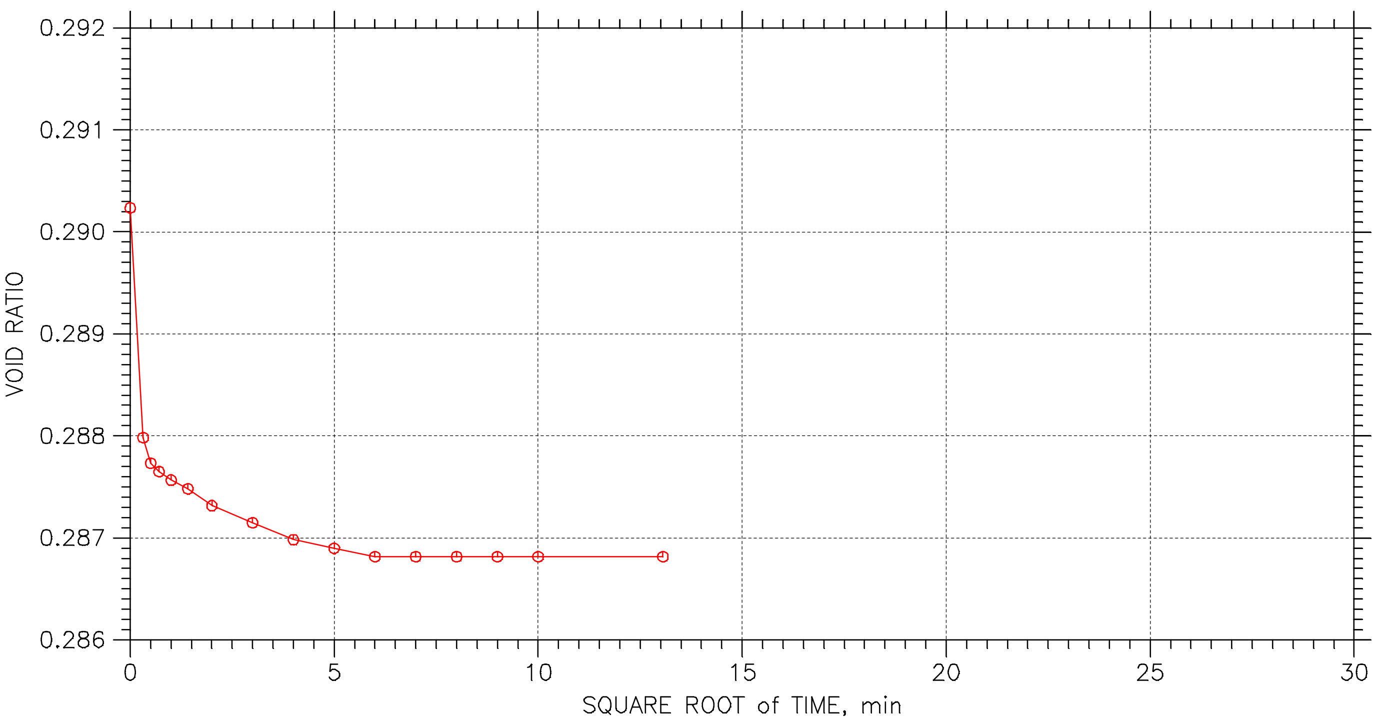
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 11 of 23

Stress: 0.5 tsf





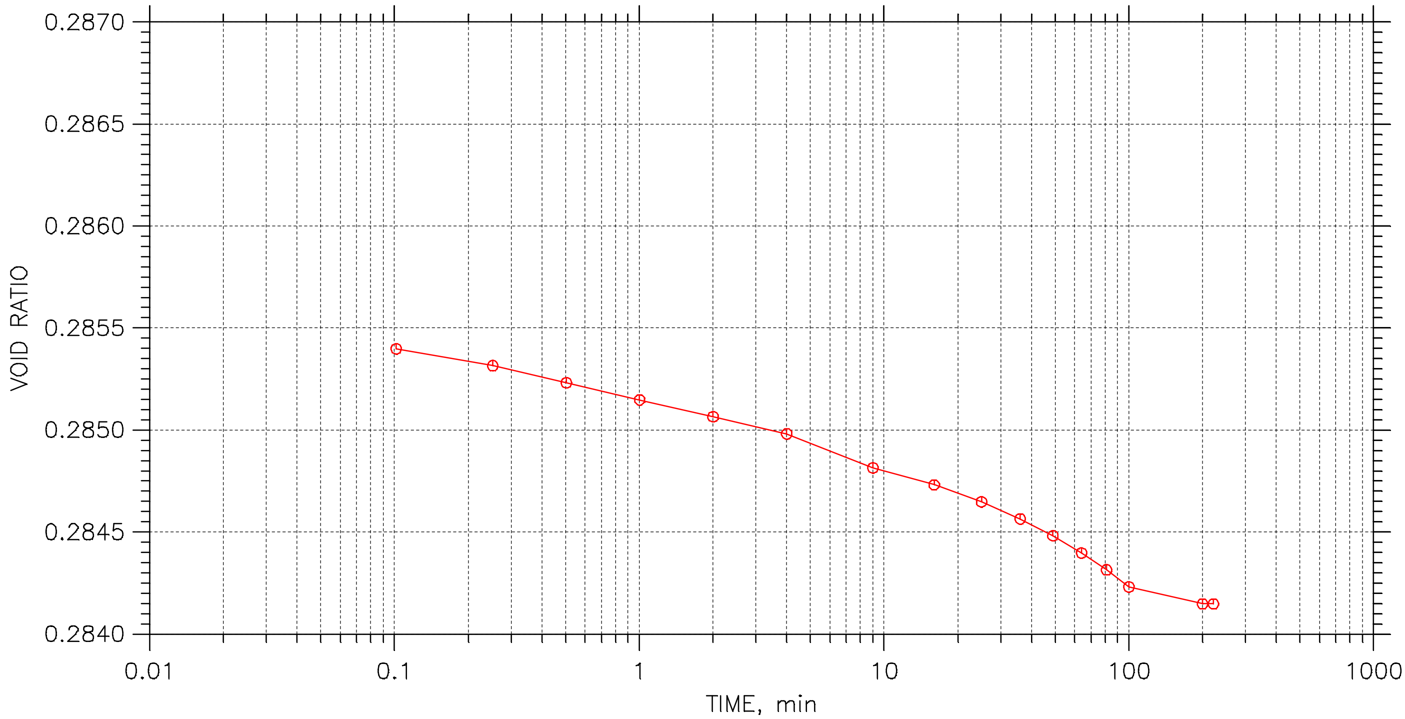
Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		
	284		

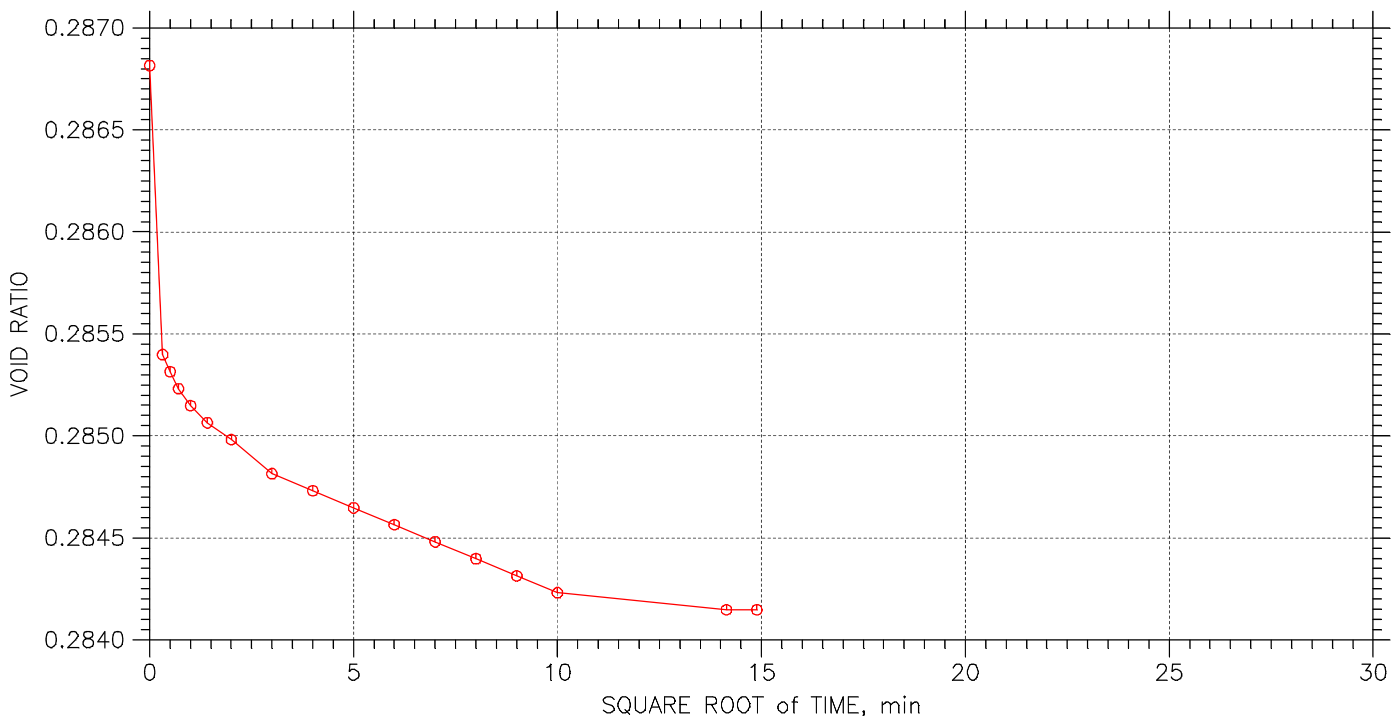
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 12 of 23

Stress: 0.75 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

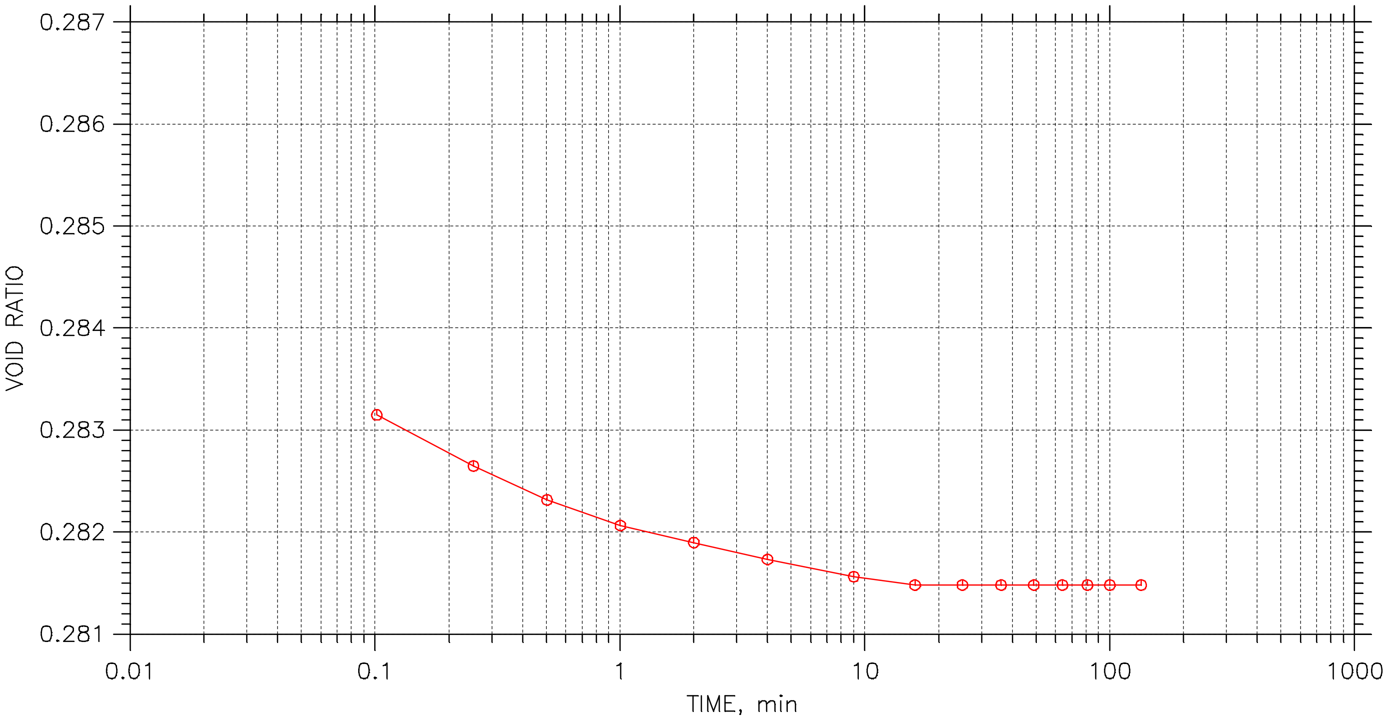
Mon, 21-DEC-2015 16:48:30

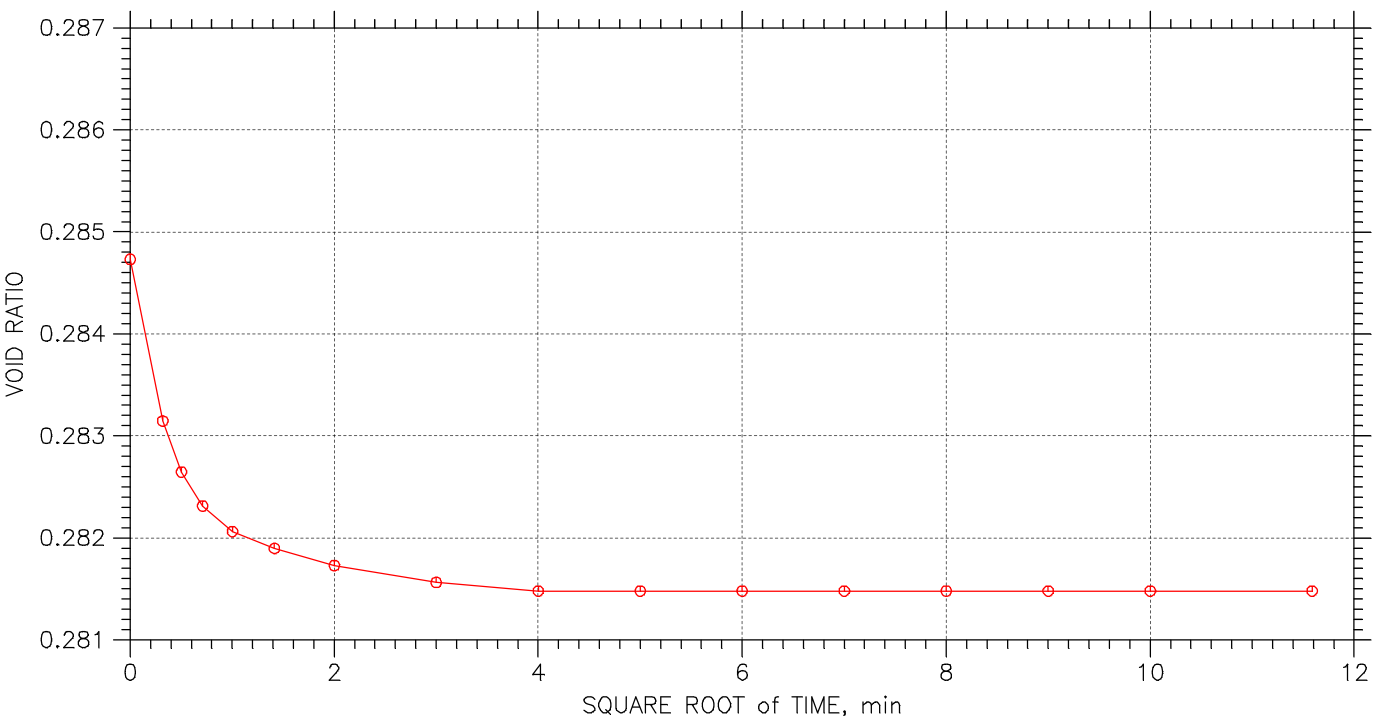
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 13 of 23

Stress: 1. tsf





Terracon Consulting Engineers & Scientists			
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	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

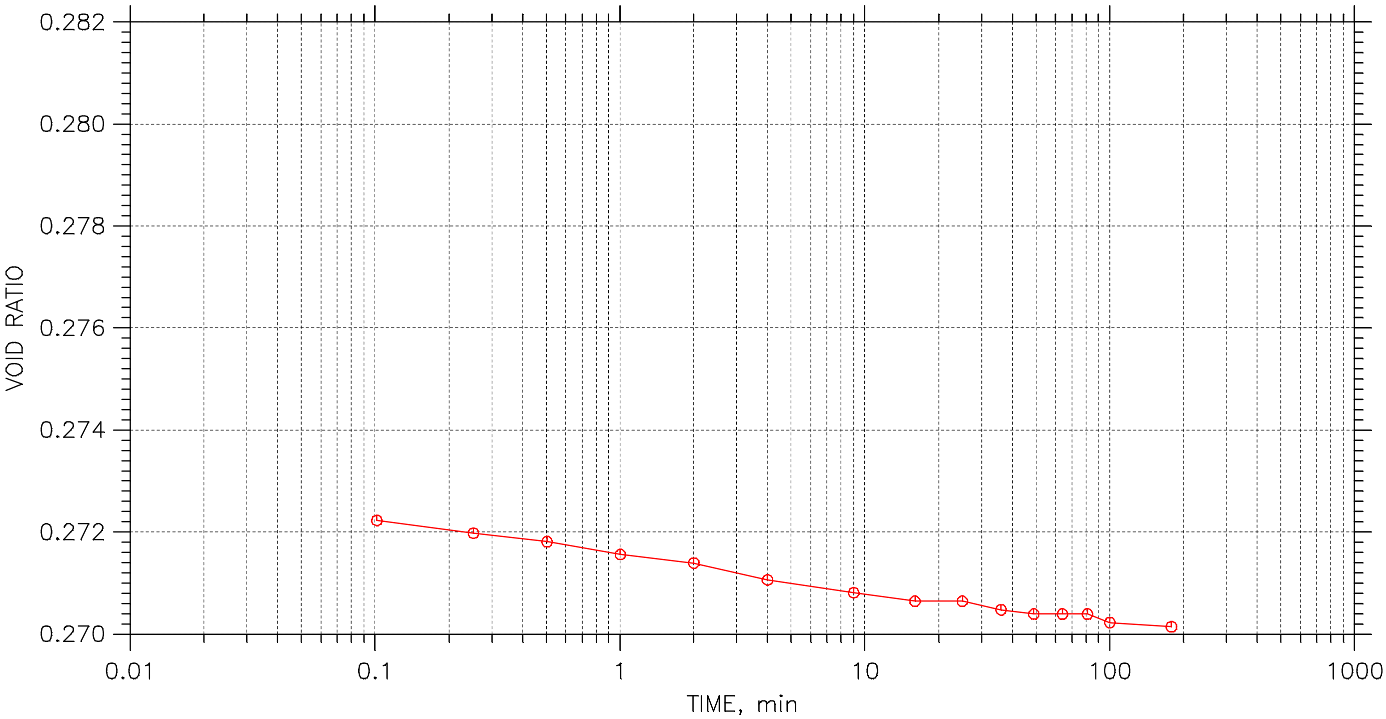
Mon, 21-DEC-2015 16:48:31

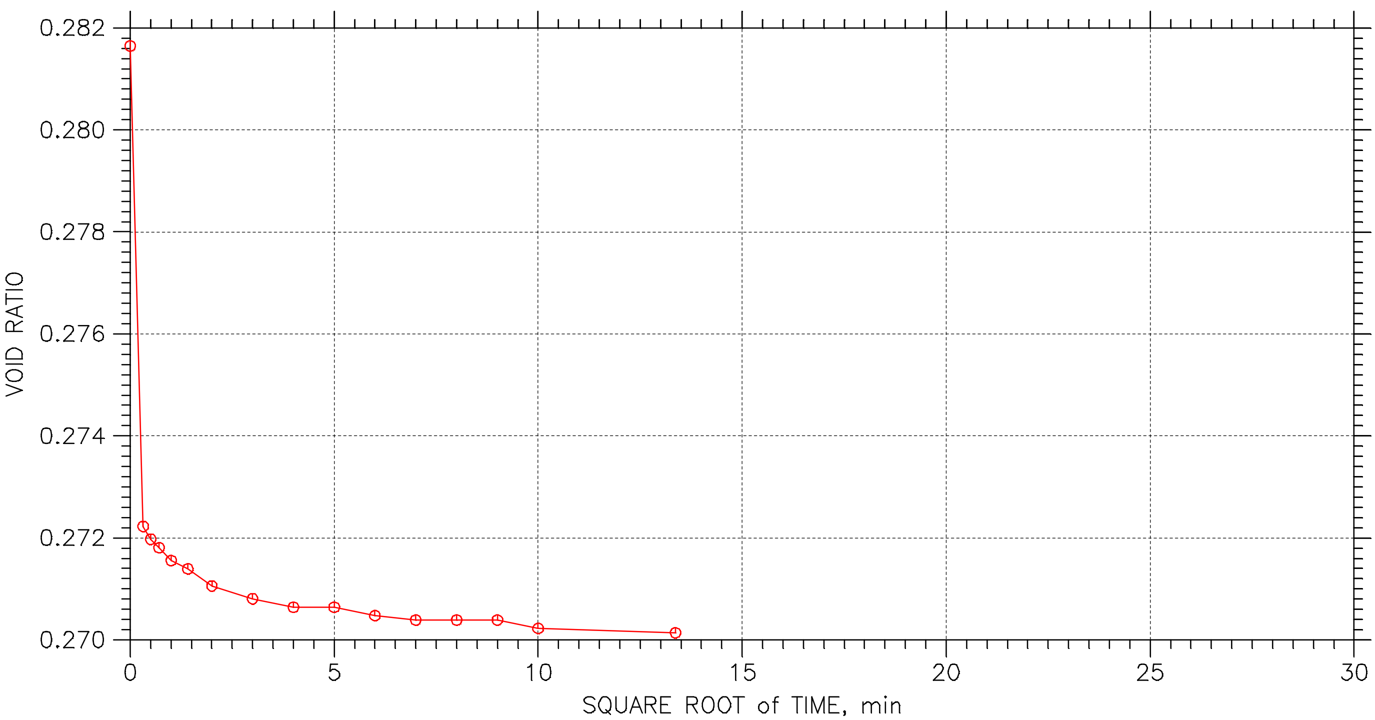
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 14 of 23

Stress: 2. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

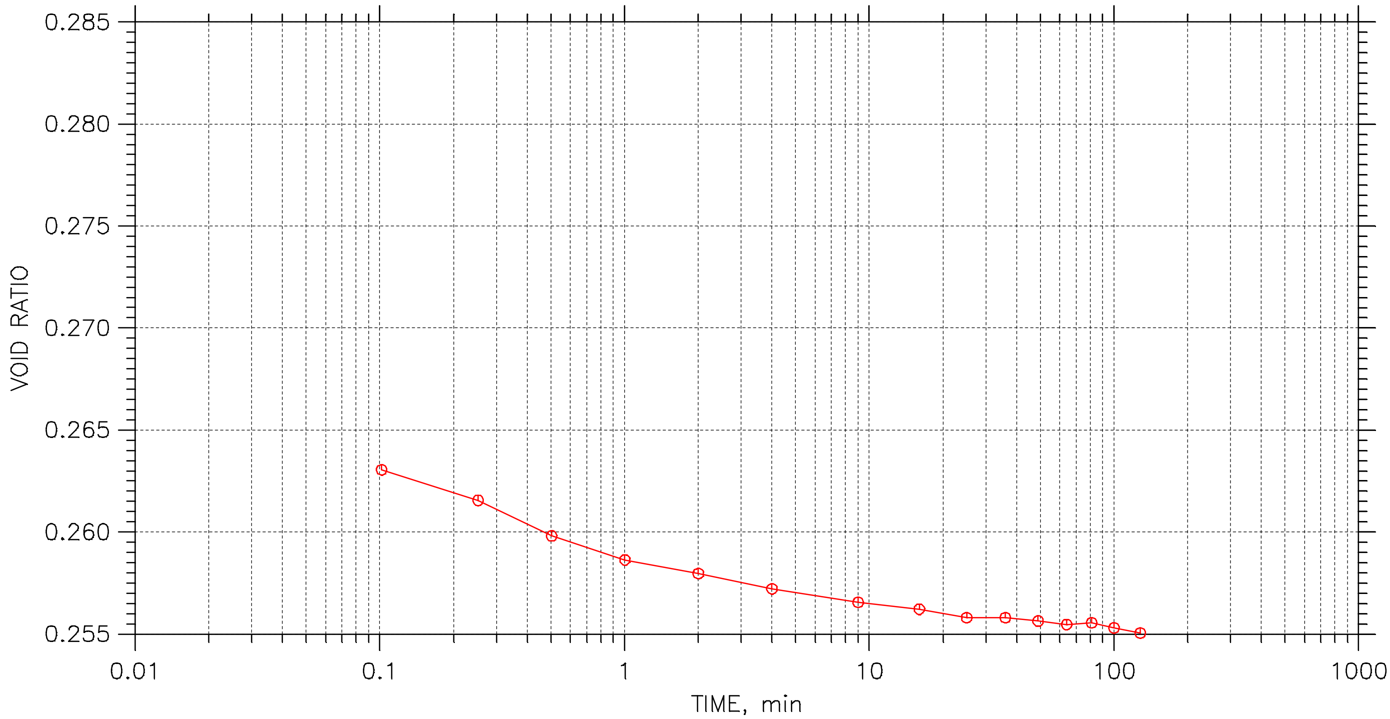
Mon, 21-DEC-2015 16:48:33

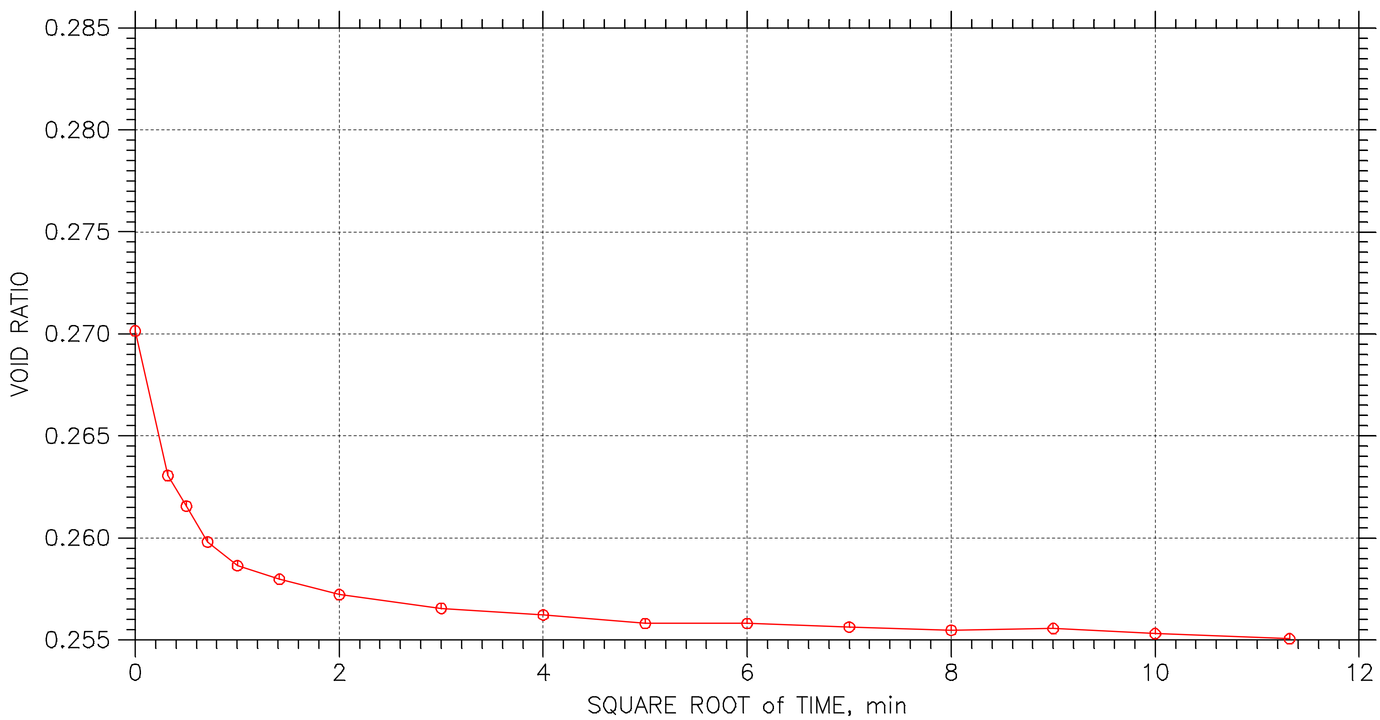
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 15 of 23

Stress: 4. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

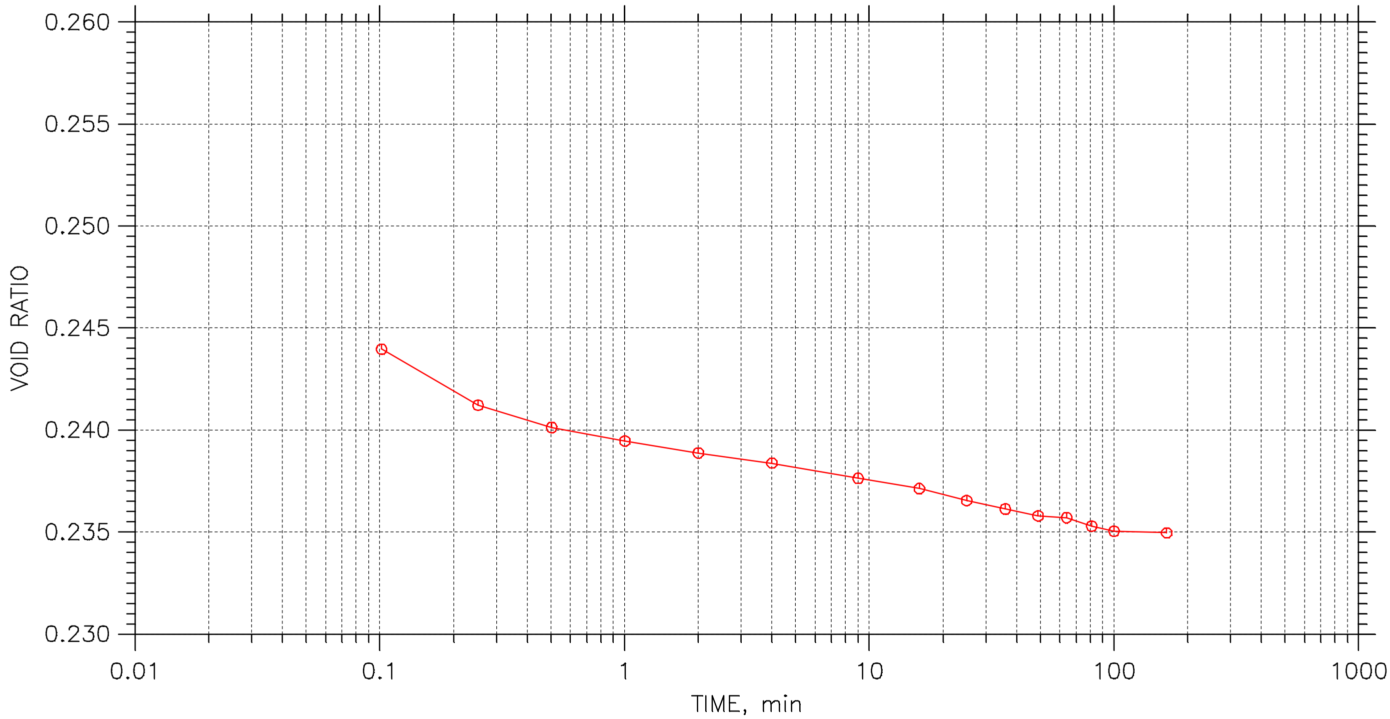
Mon, 21-DEC-2015 16:48:34

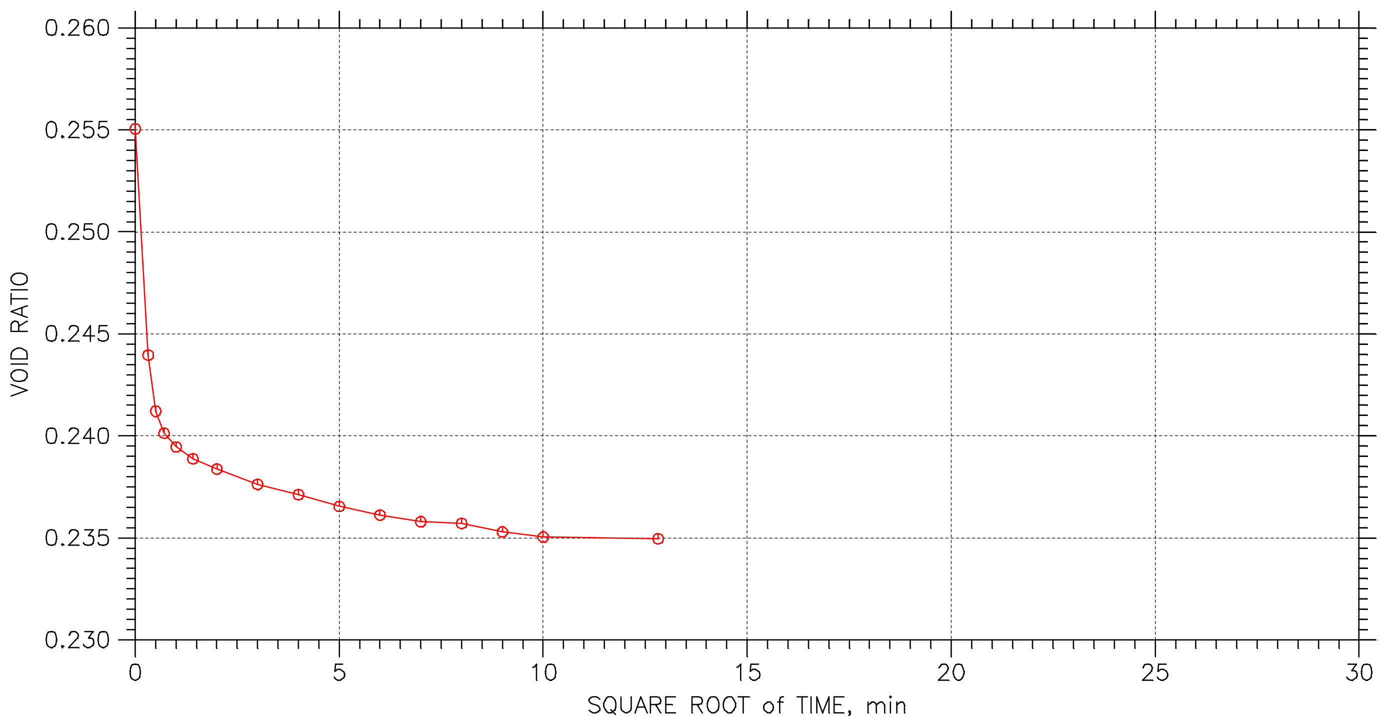
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 16 of 23

Stress: 8. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

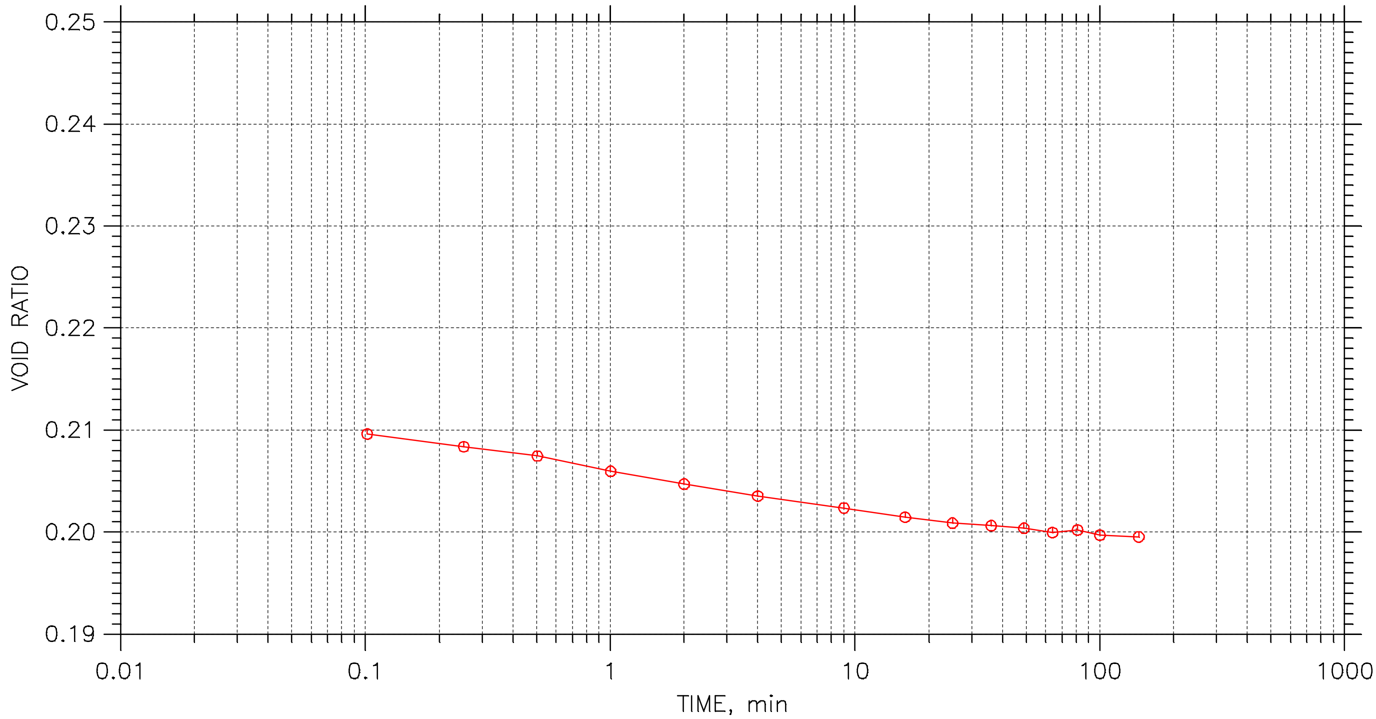
Mon, 21-DEC-2015 16:48:36

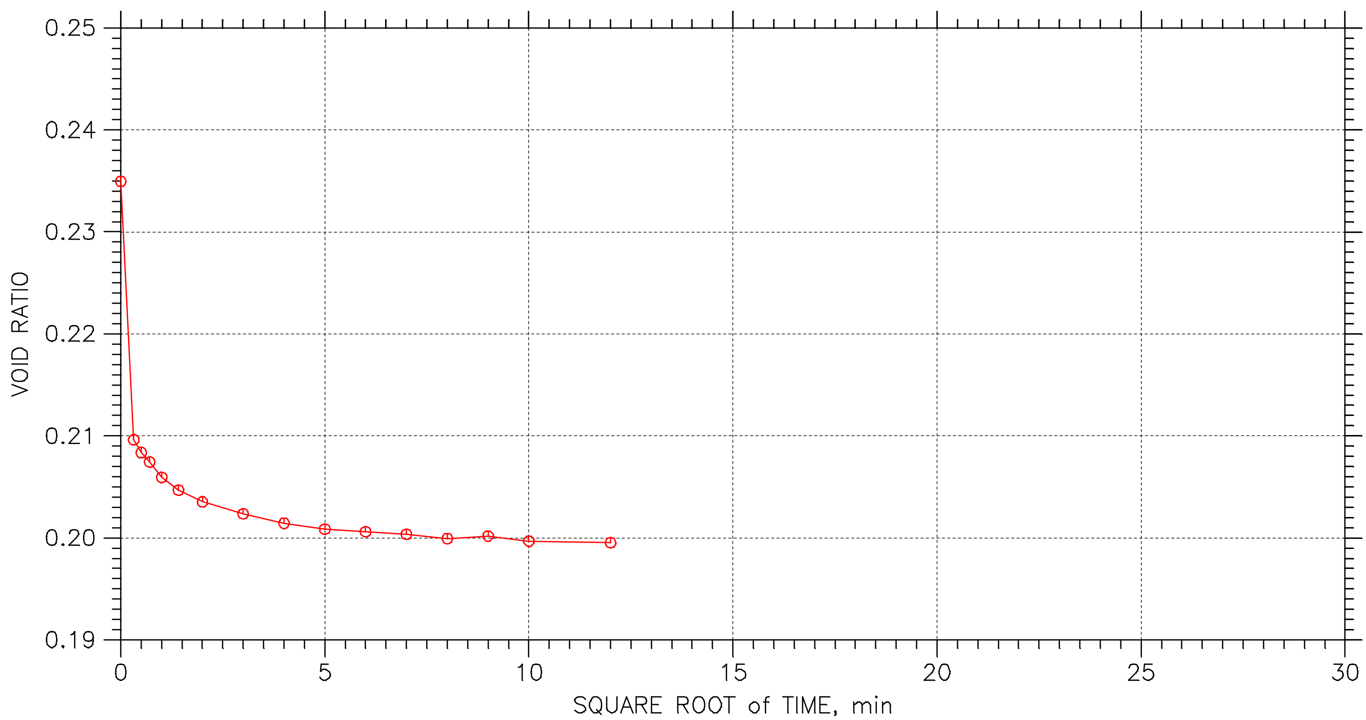
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 17 of 23

Stress: 16. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

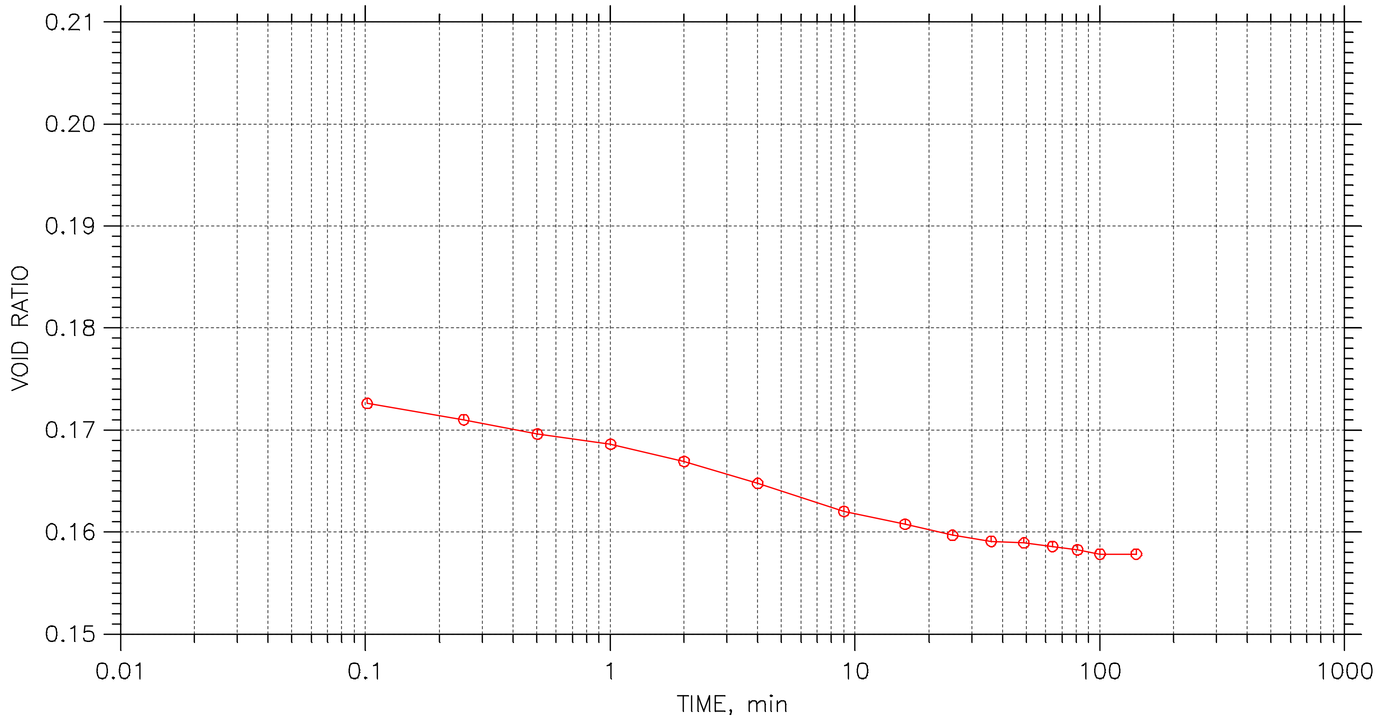
Mon, 21-DEC-2015 16:48:37

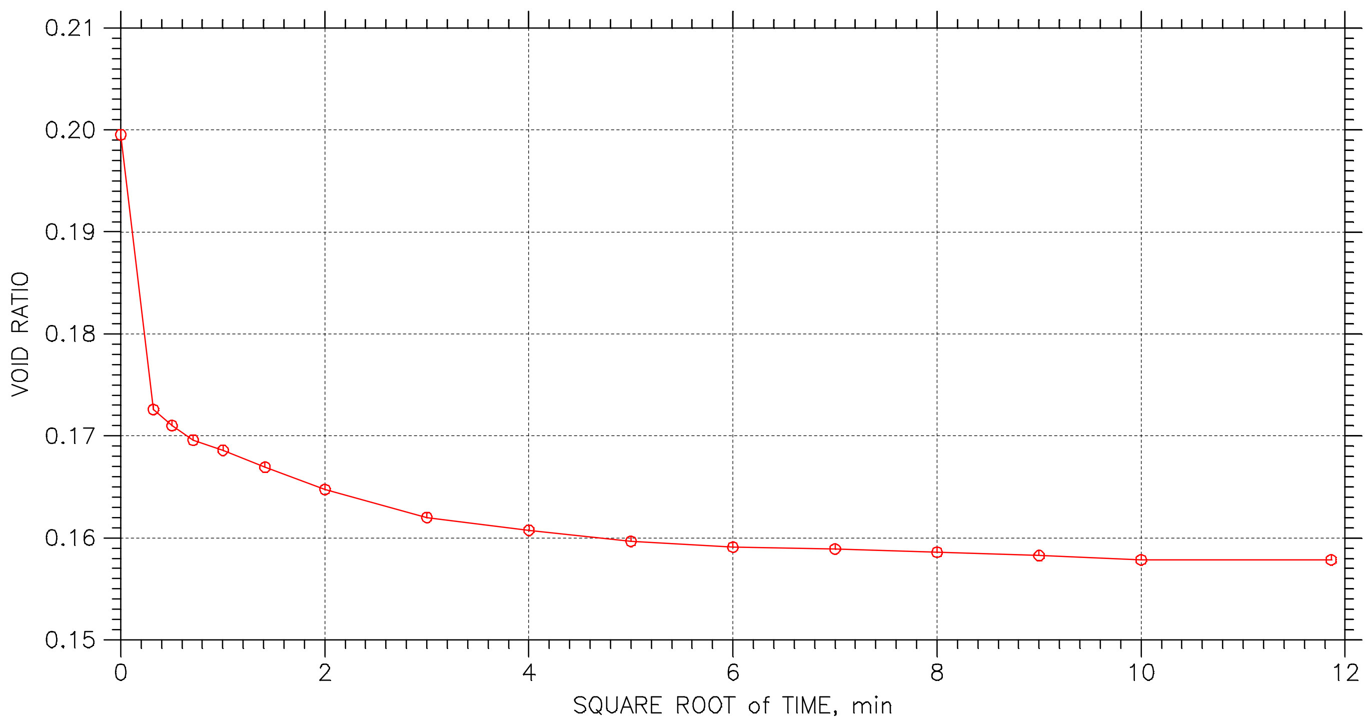
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 18 of 23

Stress: 32. tsf





Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

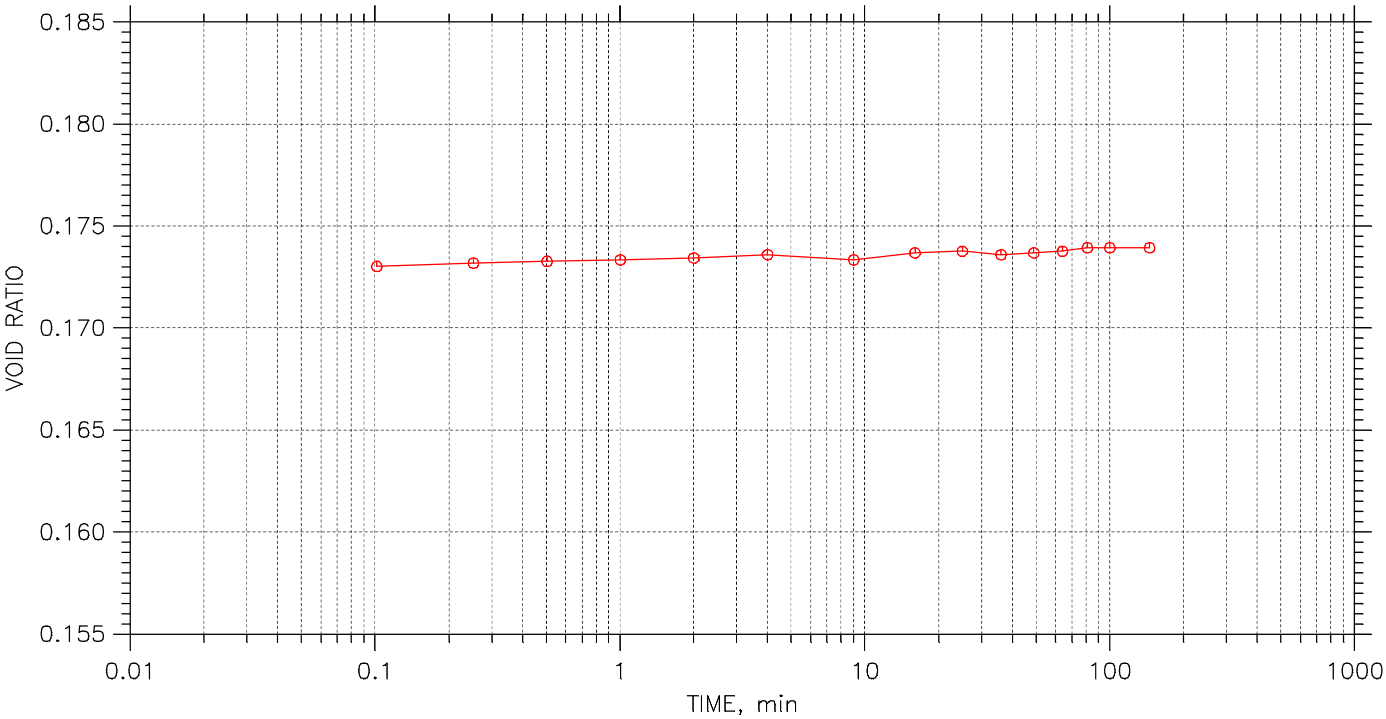
Mon, 21-DEC-2015 16:48:38

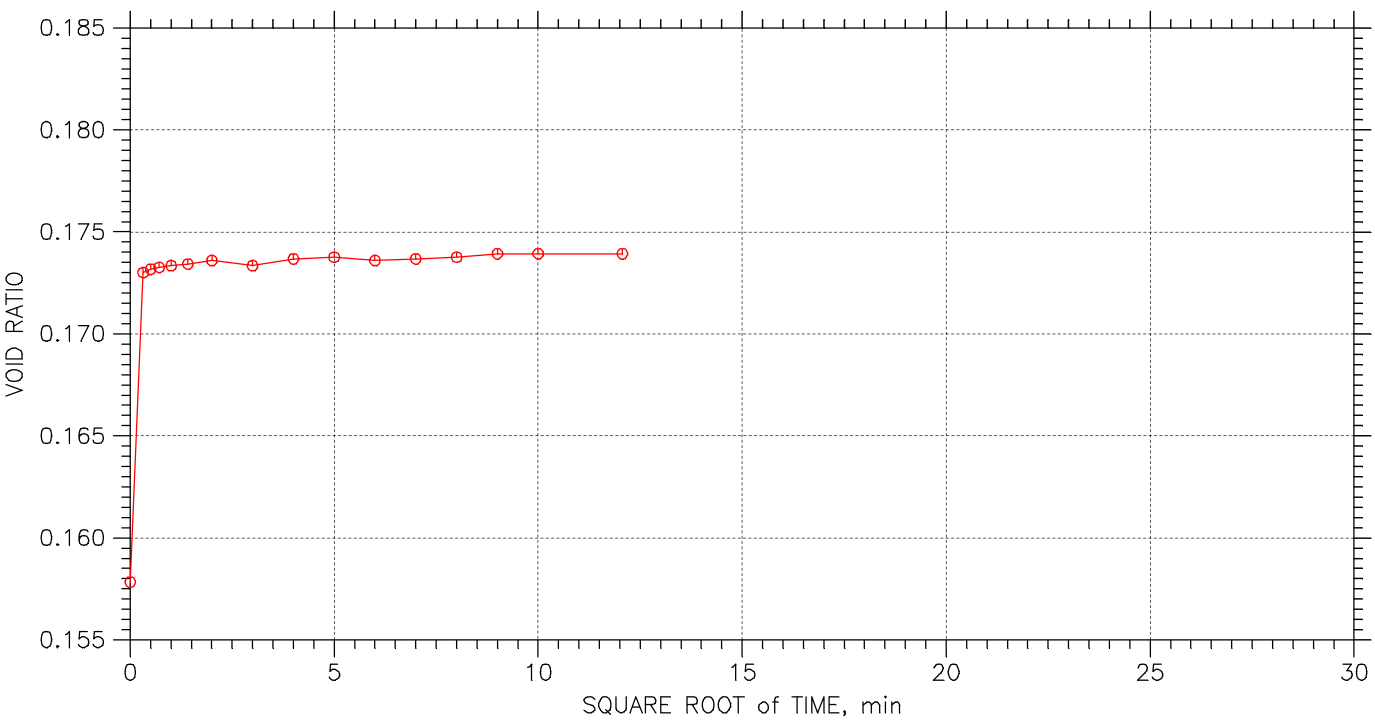
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 19 of 23

Stress: 16. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

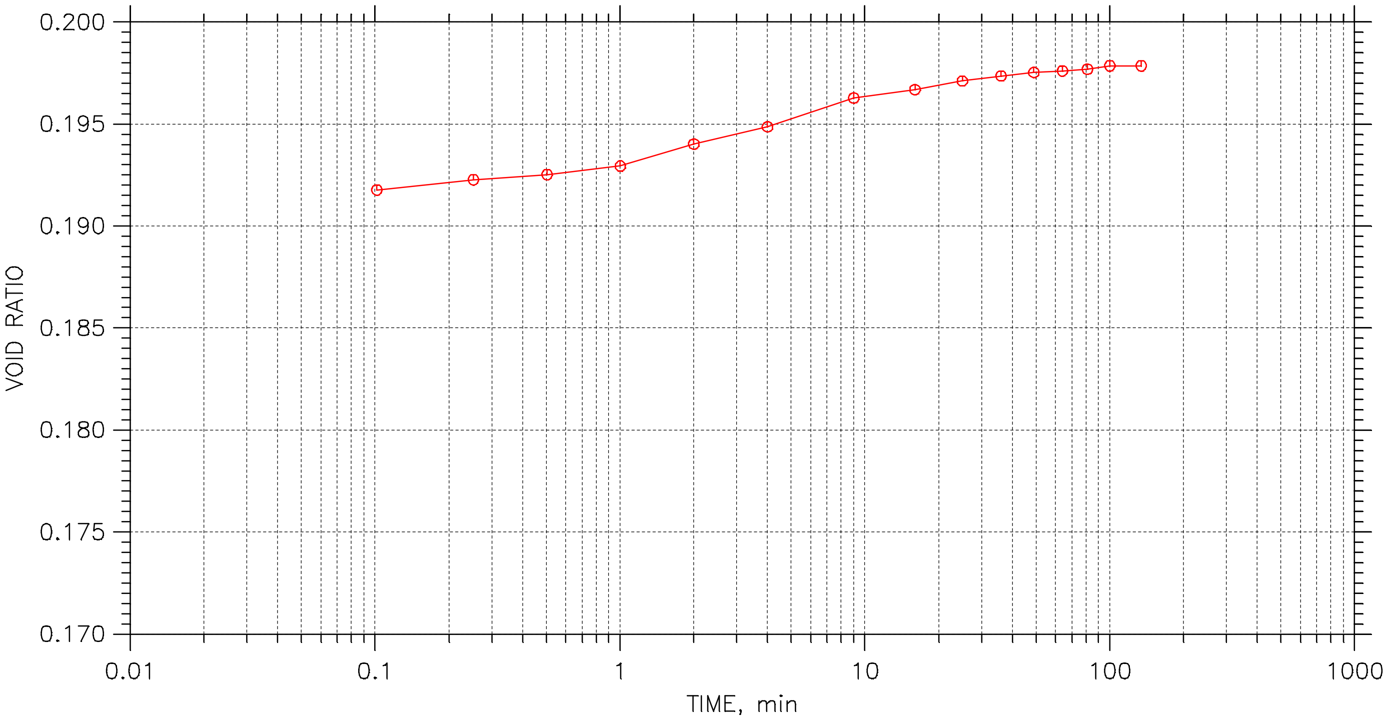
Mon, 21-DEC-2015 16:48:40

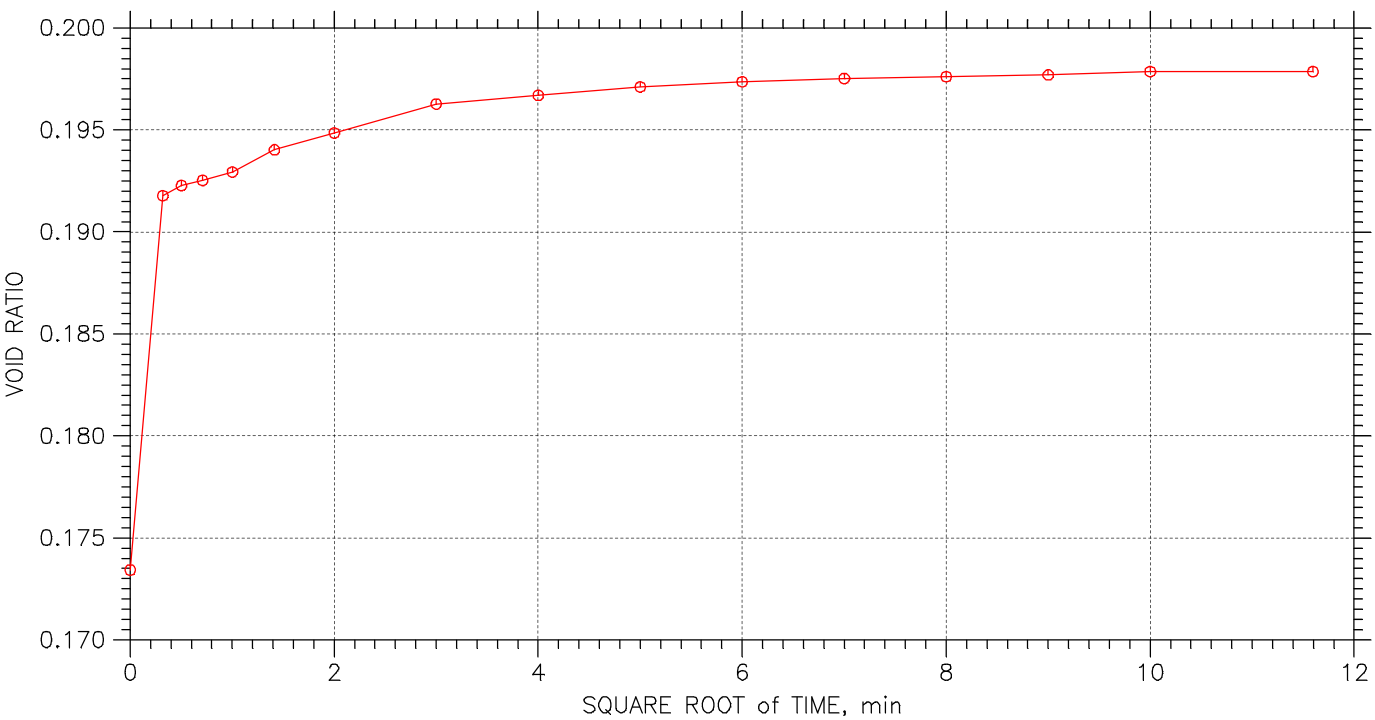
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 20 of 23

Stress: 4. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

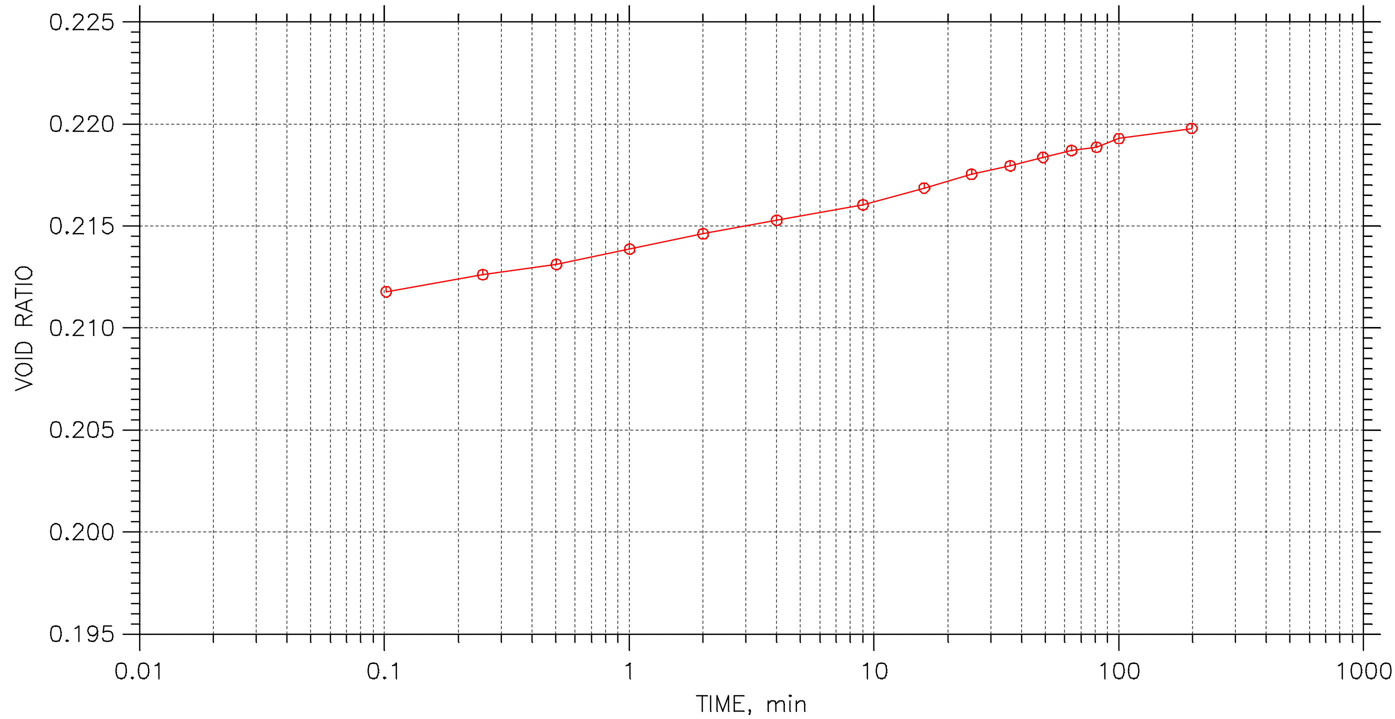
Mon, 21-DEC-2015 16:48:41

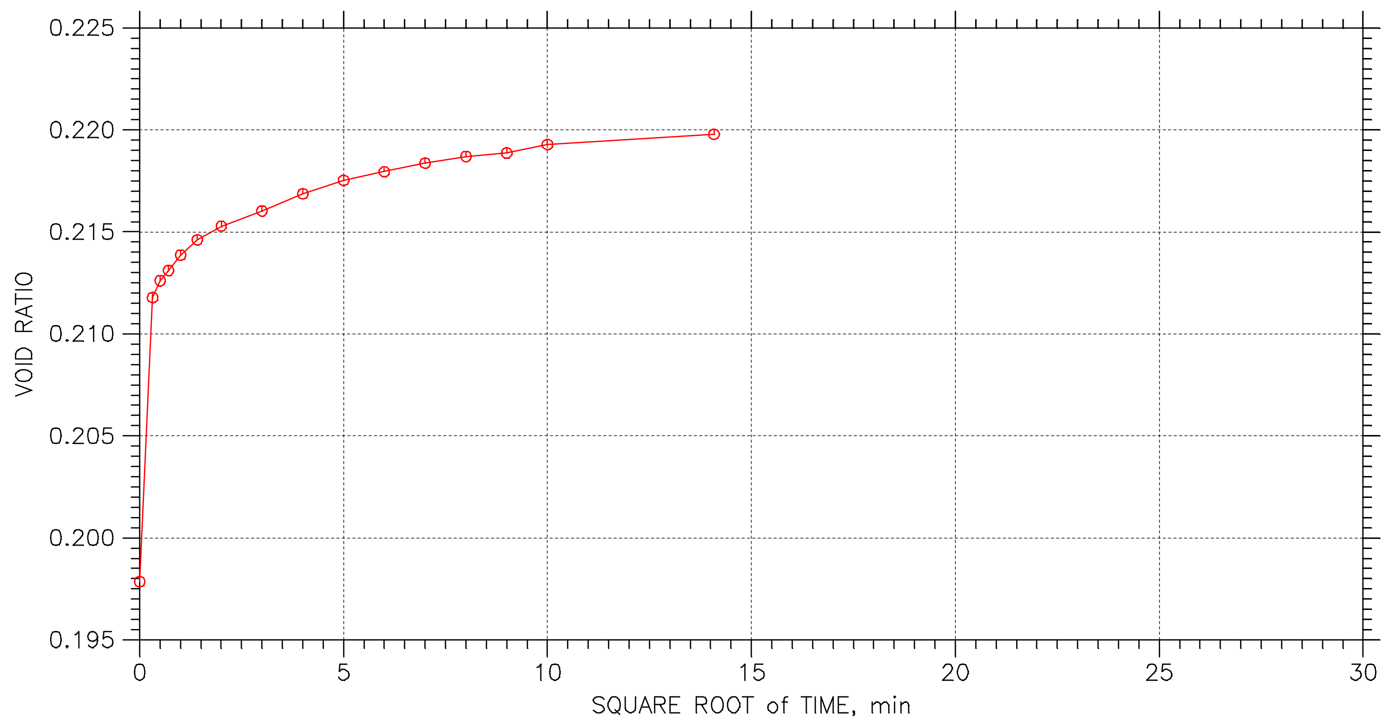
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 21 of 23

Stress: 1. tsf





Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

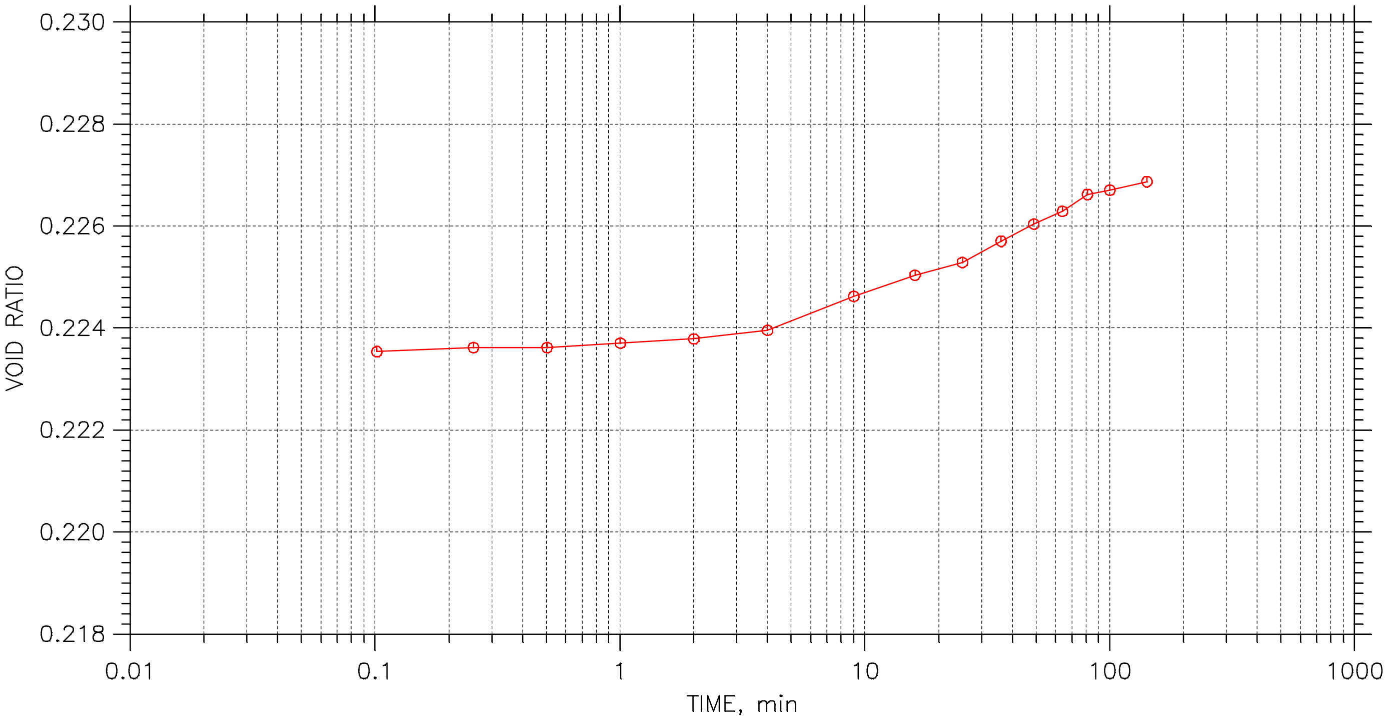
Mon, 21-DEC-2015 16:48:42

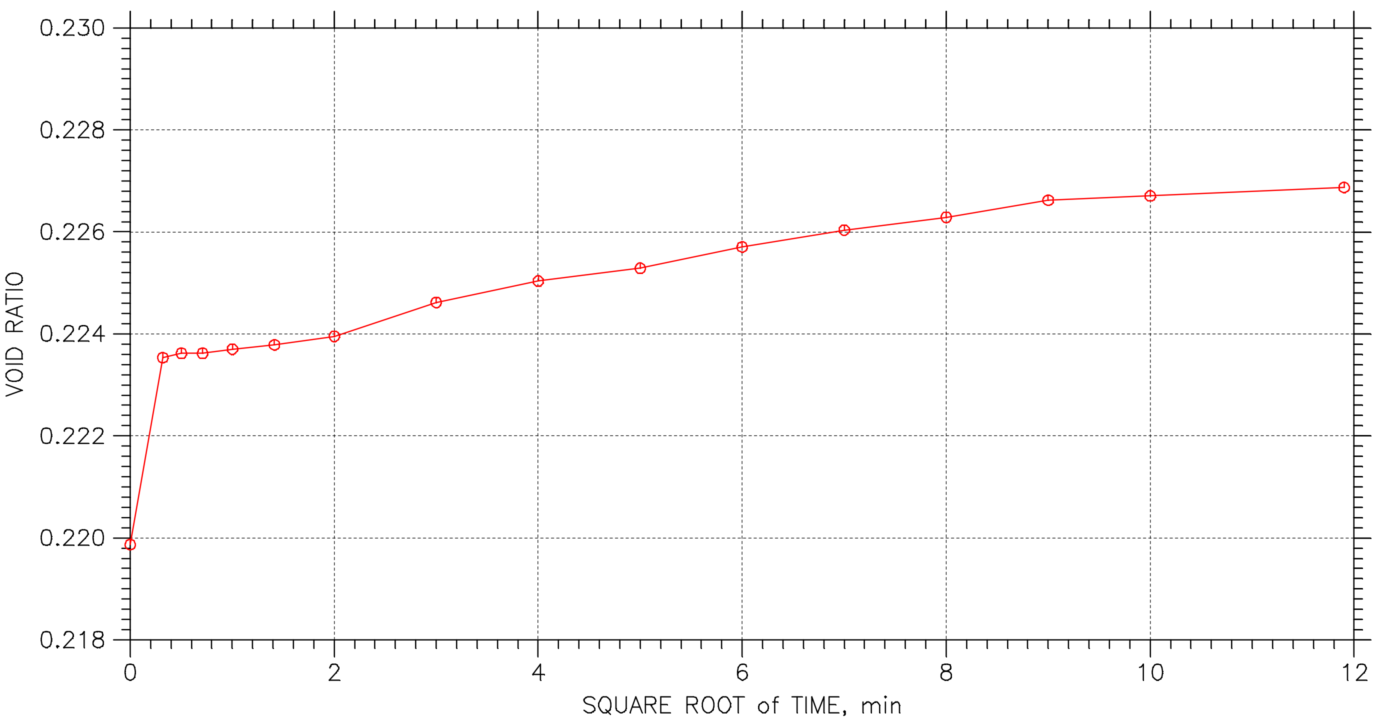
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 22 of 23

Stress: 0.5 tsf





Terracon Consulting Engineers & Scientists			
	Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

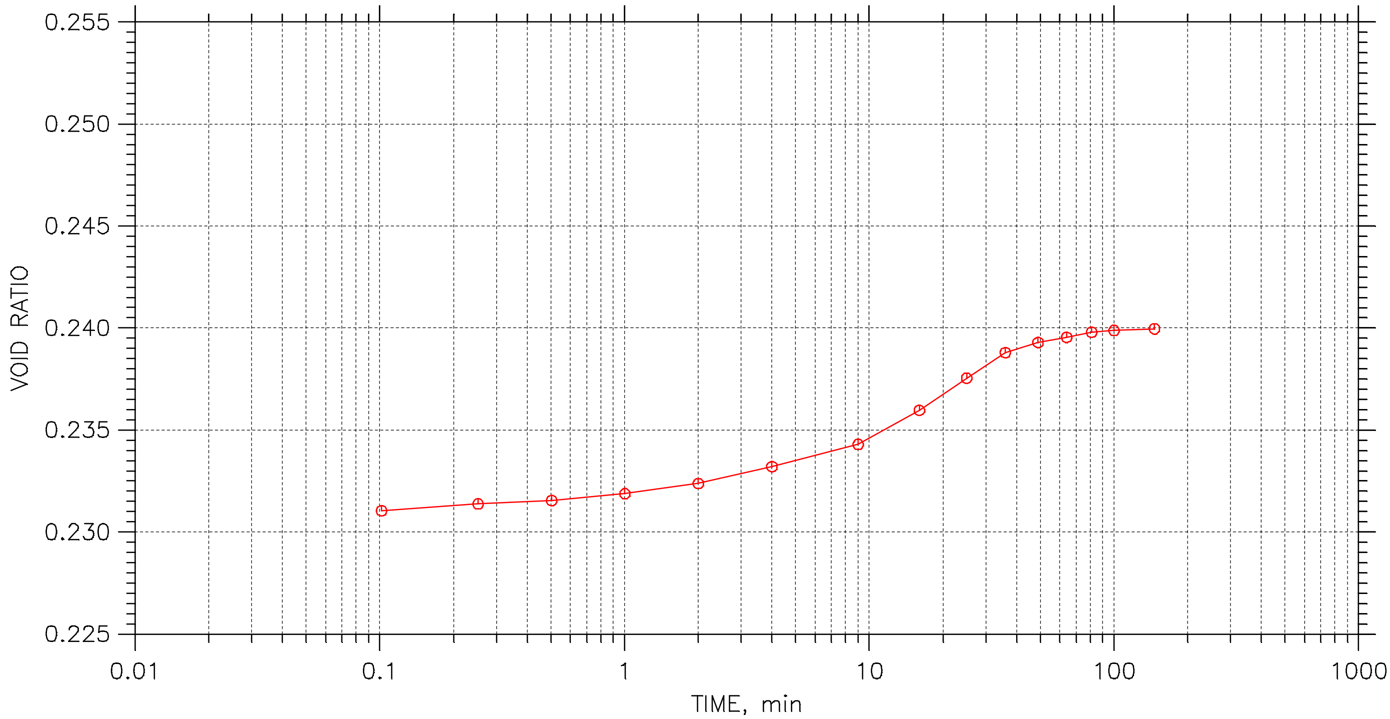
Mon, 21-DEC-2015 16:48:44

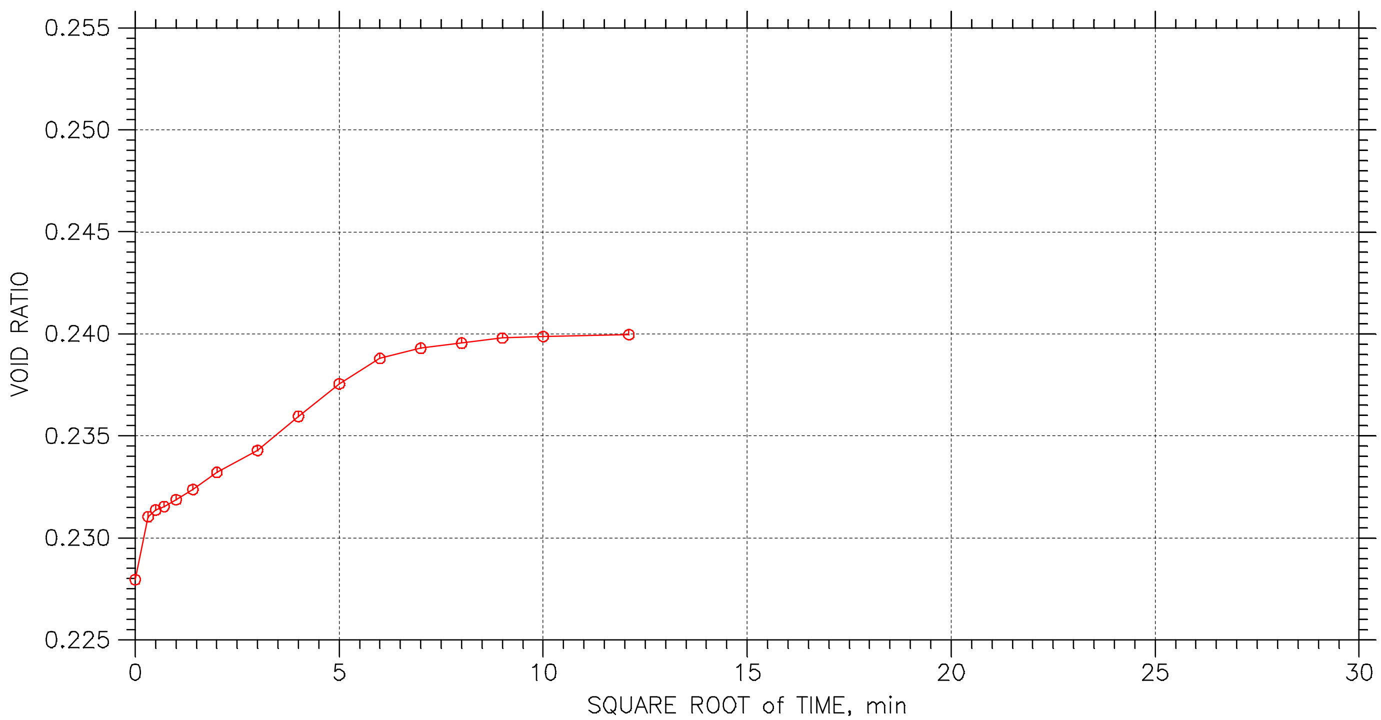
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 23 of 23

Stress: 0.125 tsf





Terracon Consulting Engineers & Scientists			
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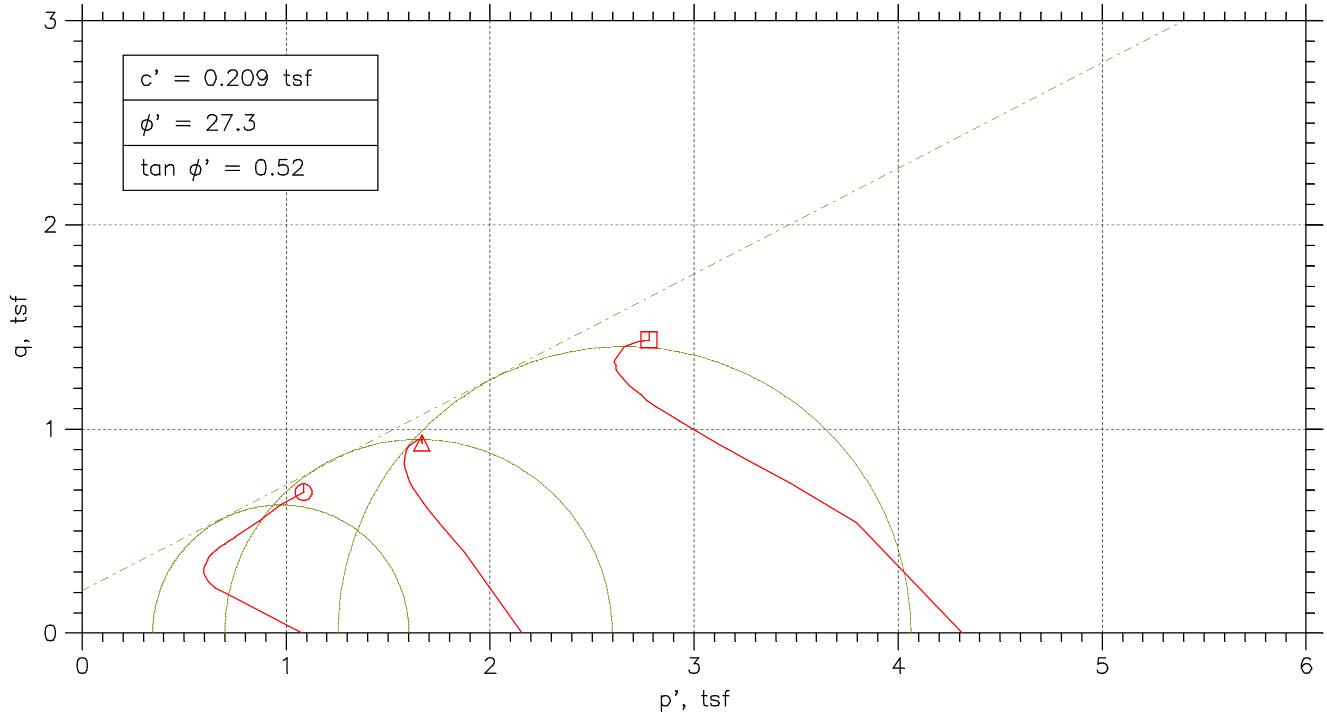
	Boring No.: HEN-029 S-3	Tested By: HP	Checked By: BCM
	Sample No.: S-3	Test Date: 12/14/15	Depth: 5.0'-7.0'
	Test No.: HENB029S3	Sample Type: 3.0'' ST	Elevation: -----
	Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
	Remarks: Pc = 3.1 tsf Cc = 0.128 Ccr = 0.034 TEST PERFORMED AS PER ASTM D2435		

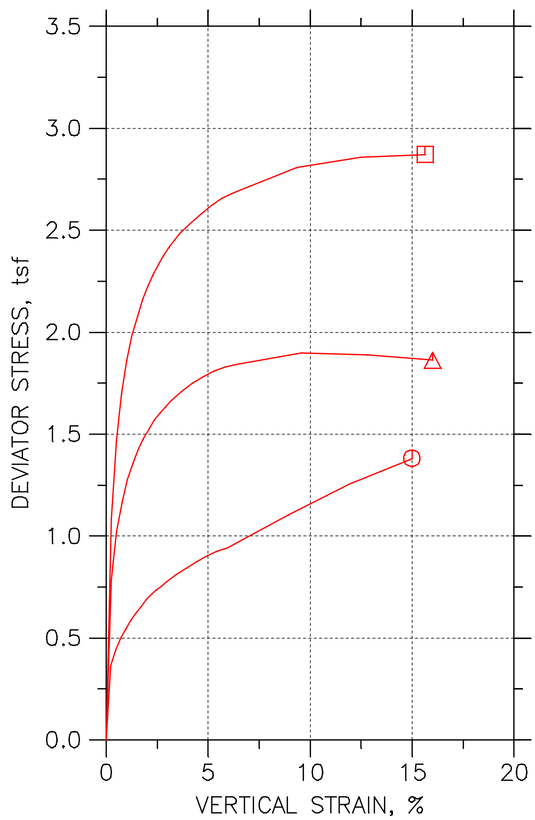
Mon, 21-DEC-2015 16:48:45

Consolidated Undrained Triaxial Compression Tests
ASTM D 4767

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

Terracon
Consulting Engineers & Scientists

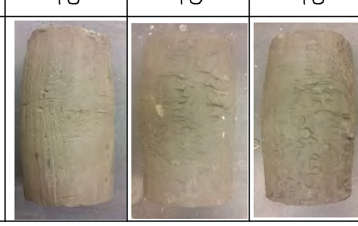




Symbol		○	△	□	
Test No.		15.0 PSI	30.0 PSI	60.0 PSI	
Initial	Diameter, in	2.8094	2.7933	2.8169	
	Height, in	5.8933	5.7862	5.9791	
	Water Content, %	18.24	19.46	31.44	
	Dry Density, pcf	113.4	98.63	90.07	
	Saturation, %	99.86	73.35	96.60	
	Void Ratio	0.49693	0.72163	0.88521	
Before Shear	Water Content, %	17.26	23.33	24.34	
	Dry Density, pcf	115.6	103.9	102.2	
	Saturation, %	100.00	100.00	100.00	
	Void Ratio	0.46942	0.63453	0.66201	
	Back Press., tsf	5.0445	5.0434	5.0461	
Minor Prin. Stress, tsf		1.0755	2.1566	4.3139	
Max. Dev. Stress, tsf		1.3812	1.8986	2.8714	
Time to Failure, min		302.24	180	300	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value		0.99	0.97	0.97	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		41	41	41	
Plastic Limit		23	23	23	
Plasticity Index		18	18	18	

Failure Sketch

NOTE: SAMPLE TRANSITIONS INTO FLY ASH



Project: DYNERGY HENNEPIN

Location: HENNEPIN, IL

Project No.: MR155233

Boring No.: HEN-002 S8

Sample Type: 3.0'' ST

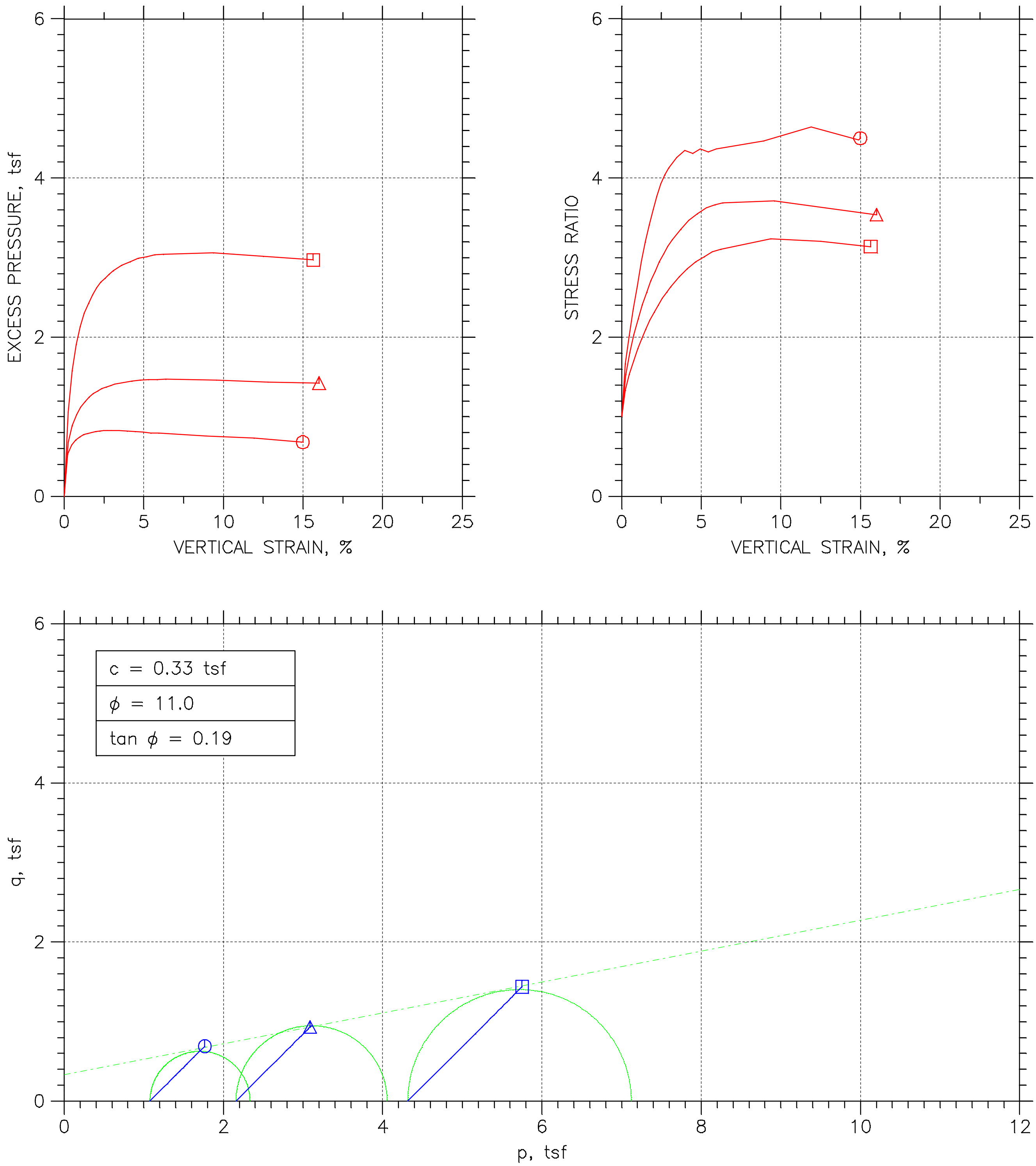
Description: DARK GRAY LEAN CLAY WITH SAND AND GRAVEL CL - FLY ASH NOTED

Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Tue, 22-DEC-2015 09:43:10

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

Terracon
Consulting Engineers & Scientists



Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
Boring No.: HEN-002 S8	Tested By: BCM	Checked By: WPQ
Sample No.: S-8	Test Date: 12/16/15	Depth: 25.0'-27.0'
Test No.: HEN-002 S8	Sample Type: 3.0" ST	Elevation: -----
Description: DARK GRAY LEAN CLAY WITH SAND AND GRAVEL CL - FLY ASH NOTED		
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767		

Tue, 22-DEC-2015 09:44:39

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-002 S8
Sample No.: S-8
Test No.: 15.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-27.0'
Elevation: -----

Soil Description: DARK GRAY LEAN CLAY WITH SAND AND GRAVEL CL - FLY ASH NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.89 in
Specimen Area: 6.20 in^2
Specimen Volume: 36.53 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 41

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.1991	0	0	5.0445	6.12	6.12
2	5.0042	0.23264	6.2136	31.483	0.36481	5.574	6.12	6.4848
3	10	0.47992	6.229	38.274	0.4424	5.6893	6.12	6.5624
4	15	0.72426	6.2444	43.434	0.50081	5.7504	6.12	6.6208
5	20	0.973	6.2601	47.488	0.54618	5.787	6.12	6.6662
6	25	1.2247	6.276	51.331	0.58888	5.8179	6.12	6.7089
7	30	1.4763	6.292	54.49	0.62353	5.8365	6.12	6.7435
8	35	1.7265	6.3081	57.333	0.65439	5.8487	6.12	6.7744
9	40	1.9782	6.3243	60.544	0.68928	5.8557	6.12	6.8093
10	45	2.224	6.3402	62.966	0.71505	5.8621	6.12	6.8351
11	50	2.4683	6.356	65.019	0.73652	5.8685	6.12	6.8565
12	55	2.7112	6.3719	66.651	0.75313	5.872	6.12	6.8731
13	60	2.9556	6.388	68.704	0.77438	5.8726	6.12	6.8944
14	70	3.4516	6.4208	72.39	0.81175	5.8708	6.12	6.9317
15	80	3.9564	6.4545	75.759	0.84509	5.8673	6.12	6.9651
16	90	4.4568	6.4883	78.76	0.87399	5.8557	6.12	6.994
17	100	4.9455	6.5217	81.866	0.90381	5.8516	6.12	7.0238
18	110	5.4371	6.5556	84.183	0.92458	5.8423	6.12	7.0446
19	120	5.9375	6.5905	86.288	0.94269	5.84	6.12	7.0627
20	180	8.9296	6.807	104.29	1.1032	5.8016	6.12	7.2232
21	240	11.909	7.0372	122.77	1.2561	5.7748	6.12	7.3761
22	300	14.874	7.2824	138.94	1.3736	5.7248	6.12	7.4936
23	302.24	14.986	7.2919	139.88	1.3812	5.7253	6.12	7.5012

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-002 S8
Sample No.: S-8
Test No.: 15.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-27.0'
Elevation: -----

Soil Description: DARK GRAY LEAN CLAY WITH SAND AND GRAVEL CL - FLY ASH NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.89 in
Specimen Area: 6.20 in^2
Specimen Volume: 36.53 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 41

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	6.12	6.12	0	0.000	1.0755	1.0755	1.000	1.0755	0
2	0.23	6.4848	6.12	0.52953	1.452	0.91076	0.54595	1.668	0.72836	0.1824
3	0.48	6.5624	6.12	0.64475	1.457	0.87314	0.43074	2.027	0.65194	0.2212
4	0.72	6.6208	6.12	0.70585	1.409	0.87045	0.36964	2.355	0.62004	0.2504
5	0.97	6.6662	6.12	0.74251	1.359	0.87916	0.33298	2.640	0.60607	0.27309
6	1.22	6.7089	6.12	0.77335	1.313	0.89102	0.30214	2.949	0.59658	0.29444
7	1.48	6.7435	6.12	0.79197	1.270	0.90704	0.28352	3.199	0.59528	0.31176
8	1.73	6.7744	6.12	0.80419	1.229	0.92569	0.2713	3.412	0.59849	0.3272
9	1.98	6.8093	6.12	0.81117	1.177	0.95359	0.26431	3.608	0.60895	0.34464
10	2.22	6.8351	6.12	0.81757	1.143	0.97296	0.25791	3.772	0.61544	0.35753
11	2.47	6.8565	6.12	0.82397	1.119	0.98803	0.25151	3.928	0.61977	0.36826
12	2.71	6.8731	6.12	0.82747	1.099	1.0012	0.24802	4.037	0.62459	0.37657
13	2.96	6.8944	6.12	0.82805	1.069	1.0218	0.24744	4.130	0.63463	0.38719
14	3.45	6.9317	6.12	0.8263	1.018	1.0609	0.24918	4.258	0.65506	0.40587
15	3.96	6.9651	6.12	0.82281	0.974	1.0978	0.25268	4.345	0.67522	0.42255
16	4.46	6.994	6.12	0.81117	0.928	1.1383	0.26431	4.307	0.70131	0.43699
17	4.95	7.0238	6.12	0.8071	0.893	1.1722	0.26839	4.368	0.72029	0.45191
18	5.44	7.0446	6.12	0.79779	0.863	1.2023	0.2777	4.329	0.73999	0.46229
19	5.94	7.0627	6.12	0.79546	0.844	1.2227	0.28002	4.366	0.75137	0.47135
20	8.93	7.2232	6.12	0.75706	0.686	1.4216	0.31843	4.464	0.87001	0.55158
21	11.91	7.3761	6.12	0.73029	0.581	1.6013	0.3452	4.639	0.97326	0.62807
22	14.87	7.4936	6.12	0.68024	0.495	1.7689	0.39524	4.475	1.0821	0.68682
23	14.99	7.5012	6.12	0.68083	0.493	1.7759	0.39466	4.500	1.0853	0.6906

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-002 S8
Sample No.: S8
Test No.: 30.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-27.0'
Elevation: ----

Soil Description: DARK GRAY LEAN CLAY WITH SAND AND GRAVEL CL - FLY ASH NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.79 in
Specimen Area: 6.13 in^2
Specimen Volume: 35.46 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 41

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.1281	0	0	5.0434	7.2	7.2
2	5.0038	0.25301	6.1437	66.941	0.7845	5.7164	7.2	7.9845
3	10.004	0.51759	6.16	87.336	1.0208	5.9351	7.2	8.2208
4	15.004	0.77886	6.1762	100.19	1.1679	6.0704	7.2	8.3679
5	20.004	1.0451	6.1928	109.71	1.2756	6.1648	7.2	8.4756
6	25.004	1.3064	6.2092	117.13	1.3582	6.236	7.2	8.5582
7	30.004	1.5693	6.2258	123.08	1.4233	6.2908	7.2	8.6233
8	35.004	1.8322	6.2425	128.19	1.4785	6.3334	7.2	8.6785
9	40.004	2.1001	6.2596	132.6	1.5252	6.3666	7.2	8.7252
10	45.004	2.368	6.2768	136.69	1.568	6.394	7.2	8.768
11	50.004	2.6376	6.2941	140.15	1.6032	6.4168	7.2	8.8032
12	55.004	2.9071	6.3116	143.34	1.6352	6.436	7.2	8.8352
13	60.004	3.1766	6.3292	146.09	1.6619	6.4518	7.2	8.8619
14	70.004	3.7025	6.3637	151.14	1.7101	6.4739	7.2	8.9101
15	80.004	4.2283	6.3987	155.56	1.7504	6.4908	7.2	8.9504
16	90	4.7641	6.4347	159.14	1.7806	6.5013	7.2	8.9806
17	100	5.3032	6.4713	162.59	1.809	6.5101	7.2	9.009
18	110	5.839	6.5081	165.27	1.8284	6.513	7.2	9.0284
19	120	6.3665	6.5448	167.45	1.8421	6.5147	7.2	9.0421
20	180	9.5729	6.7769	178.7	1.8986	6.5007	7.2	9.0986
21	240	12.794	7.0272	184.33	1.8886	6.4803	7.2	9.0886
22	300	15.999	7.2953	188.74	1.8627	6.4663	7.2	9.0627

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-002 S8
Sample No.: S8
Test No.: 30.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-27.0'
Elevation: ----

Soil Description: DARK GRAY LEAN CLAY WITH SAND AND GRAVEL CL - FLY ASH NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.79 in
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Specimen Volume: 35.46 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 41

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	7.2	7.2	0	0.000	2.1566	2.1566	1.000	2.1566	0
2	0.25	7.9845	7.2	0.67299	0.858	2.2681	1.4836	1.529	1.8759	0.39225
3	0.52	8.2208	7.2	0.89169	0.874	2.2857	1.2649	1.807	1.7753	0.51041
4	0.78	8.3679	7.2	1.027	0.879	2.2976	1.1296	2.034	1.7136	0.58397
5	1.05	8.4756	7.2	1.1215	0.879	2.3107	1.0352	2.232	1.6729	0.63778
6	1.31	8.5582	7.2	1.1926	0.878	2.3222	0.96402	2.409	1.6431	0.6791
7	1.57	8.6233	7.2	1.2474	0.876	2.3325	0.9092	2.565	1.6209	0.71167
8	1.83	8.6785	7.2	1.29	0.872	2.3452	0.86662	2.706	1.6059	0.73927
9	2.10	8.7252	7.2	1.3232	0.868	2.3586	0.83338	2.830	1.596	0.76262
10	2.37	8.768	7.2	1.3507	0.861	2.374	0.80597	2.945	1.59	0.784
11	2.64	8.8032	7.2	1.3734	0.857	2.3864	0.78323	3.047	1.5848	0.80159
12	2.91	8.8352	7.2	1.3926	0.852	2.3992	0.76398	3.140	1.5816	0.8176
13	3.18	8.8619	7.2	1.4084	0.847	2.4102	0.74824	3.221	1.5792	0.83097
14	3.70	8.9101	7.2	1.4305	0.837	2.4361	0.72608	3.355	1.5811	0.85503
15	4.23	8.9504	7.2	1.4475	0.827	2.4595	0.70916	3.468	1.5843	0.87518
16	4.76	8.9806	7.2	1.458	0.819	2.4793	0.69867	3.549	1.589	0.89031
17	5.30	9.009	7.2	1.4667	0.811	2.4989	0.68992	3.622	1.5944	0.90448
18	5.84	9.0284	7.2	1.4696	0.804	2.5154	0.687	3.661	1.6012	0.91422
19	6.37	9.0421	7.2	1.4714	0.799	2.5274	0.68525	3.688	1.6063	0.92105
20	9.57	9.0986	7.2	1.4574	0.768	2.5978	0.69925	3.715	1.6485	0.94929
21	12.79	9.0886	7.2	1.437	0.761	2.6083	0.71966	3.624	1.664	0.9443
22	16.00	9.0627	7.2	1.423	0.764	2.5964	0.73366	3.539	1.665	0.93136

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-002 S8
Sample No.: S-8
Test No.: 60.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-27.0'
Elevation: ----

Soil Description: DARK GRAY LEAN CLAY WITH SAND AND GRAVEL CL - FLY ASH NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.98 in
Specimen Area: 6.23 in^2
Specimen Volume: 37.26 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 41

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2322	0	0	5.0461	9.36	9.36
2	5.004	0.24293	6.2474	93.936	1.0826	6.1049	9.36	10.443
3	10.004	0.49961	6.2635	127.82	1.4693	6.625	9.36	10.829
4	15.004	0.75323	6.2795	148.22	1.6995	6.9512	9.36	11.059
5	20.004	1.0084	6.2957	162.75	1.8613	7.1795	9.36	11.221
6	25.004	1.2666	6.3122	173.87	1.9832	7.3449	9.36	11.343
7	30.004	1.5248	6.3287	182.68	2.0783	7.4724	9.36	11.438
8	35.004	1.7845	6.3454	190.5	2.1615	7.5784	9.36	11.521
9	40.004	2.0427	6.3622	196.63	2.2253	7.6646	9.36	11.585
10	45.004	2.304	6.3792	202.14	2.2815	7.7345	9.36	11.641
11	50.004	2.5668	6.3964	207.49	2.3356	7.7887	9.36	11.696
12	55.004	2.8281	6.4136	211.79	2.3776	7.8388	9.36	11.738
13	60.004	3.0909	6.431	215.83	2.4164	7.8825	9.36	11.776
14	70.004	3.6118	6.4657	223.22	2.4857	7.9477	9.36	11.846
15	80.004	4.1328	6.5009	228.94	2.5356	7.9954	9.36	11.896
16	90.004	4.6508	6.5362	234.24	2.5803	8.0345	9.36	11.94
17	100	5.1748	6.5723	239.48	2.6235	8.0554	9.36	11.984
18	110	5.6958	6.6086	243.78	2.656	8.0793	9.36	12.016
19	120	6.2184	6.6454	247.51	2.6816	8.0863	9.36	12.042
20	180	9.352	6.8752	268.01	2.8068	8.1049	9.36	12.167
21	240	12.498	7.1223	282.81	2.8589	8.0642	9.36	12.219
22	300	15.636	7.3873	294.61	2.8714	8.017	9.36	12.231

Project: DYNERGY HENNEPIN
Boring No.: HEN-002 S8
Sample No.: S-8
Test No.: 60.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-27.0'
Elevation: ----

Soil Description: DARK GRAY LEAN CLAY WITH SAND AND GRAVEL CL - FLY ASH NOTED
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Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 41

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	9.36	9.36	0	0.000	4.3139	4.3139	1.000	4.3139	0
2	0.24	10.443	9.36	1.0588	0.978	4.3377	3.2551	1.333	3.7964	0.5413
3	0.50	10.829	9.36	1.5789	1.075	4.2043	2.735	1.537	3.4696	0.73465
4	0.75	11.059	9.36	1.9051	1.121	4.1083	2.4088	1.706	3.2586	0.84974
5	1.01	11.221	9.36	2.1334	1.146	4.0418	2.1805	1.854	3.1112	0.93063
6	1.27	11.343	9.36	2.2988	1.159	3.9984	2.0151	1.984	3.0067	0.99162
7	1.52	11.438	9.36	2.4264	1.167	3.9659	1.8876	2.101	2.9267	1.0392
8	1.78	11.521	9.36	2.5324	1.172	3.9431	1.7816	2.213	2.8623	1.0807
9	2.04	11.585	9.36	2.6186	1.177	3.9206	1.6954	2.313	2.808	1.1126
10	2.30	11.641	9.36	2.6884	1.178	3.907	1.6255	2.404	2.7662	1.1407
11	2.57	11.696	9.36	2.7426	1.174	3.9069	1.5713	2.486	2.7391	1.1678
12	2.83	11.738	9.36	2.7927	1.175	3.8988	1.5212	2.563	2.71	1.1888
13	3.09	11.776	9.36	2.8364	1.174	3.8939	1.4775	2.635	2.6857	1.2082
14	3.61	11.846	9.36	2.9016	1.167	3.898	1.4123	2.760	2.6552	1.2429
15	4.13	11.896	9.36	2.9494	1.163	3.9002	1.3646	2.858	2.6324	1.2678
16	4.65	11.94	9.36	2.9884	1.158	3.9058	1.3255	2.947	2.6157	1.2901
17	5.17	11.984	9.36	3.0094	1.147	3.9281	1.3046	3.011	2.6163	1.3118
18	5.70	12.016	9.36	3.0332	1.142	3.9367	1.2807	3.074	2.6087	1.328
19	6.22	12.042	9.36	3.0402	1.134	3.9553	1.2737	3.105	2.6145	1.3408
20	9.35	12.167	9.36	3.0589	1.090	4.0618	1.2551	3.236	2.6584	1.4034
21	12.50	12.219	9.36	3.0181	1.056	4.1547	1.2958	3.206	2.7253	1.4294
22	15.64	12.231	9.36	2.9709	1.035	4.2144	1.343	3.138	2.7787	1.4357

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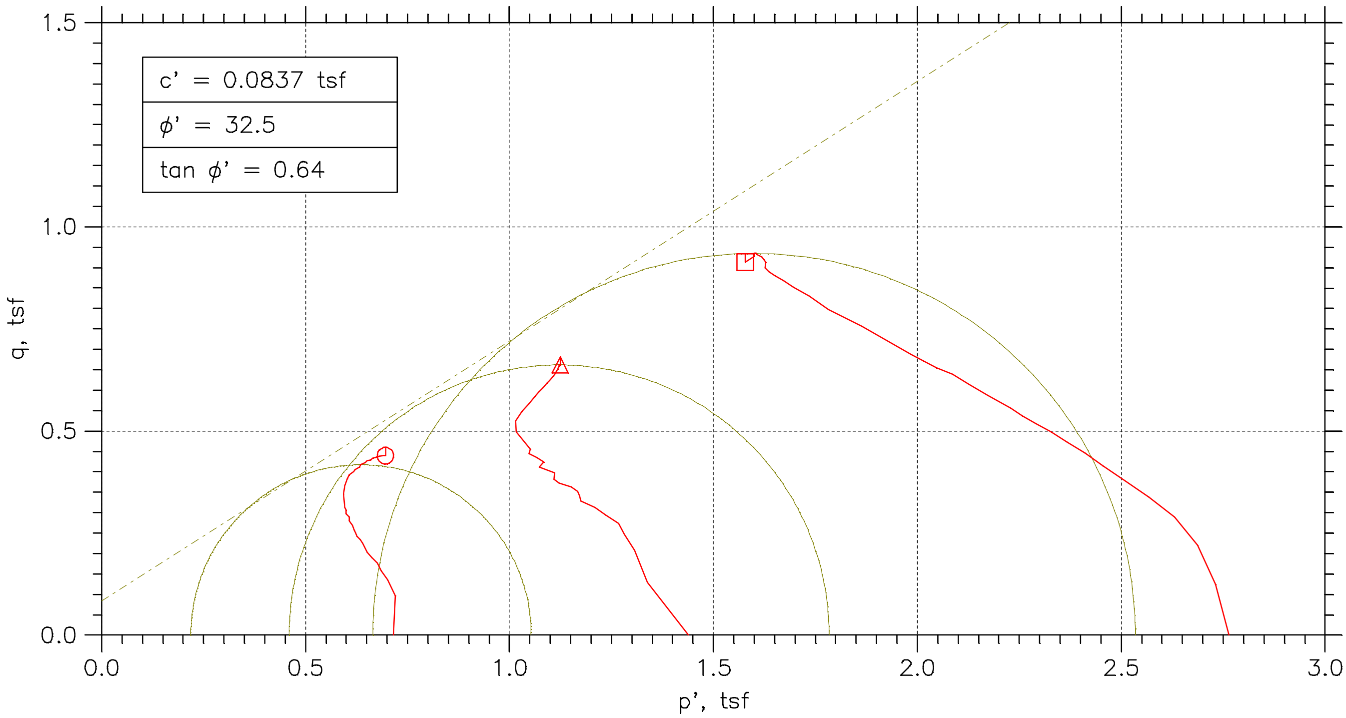
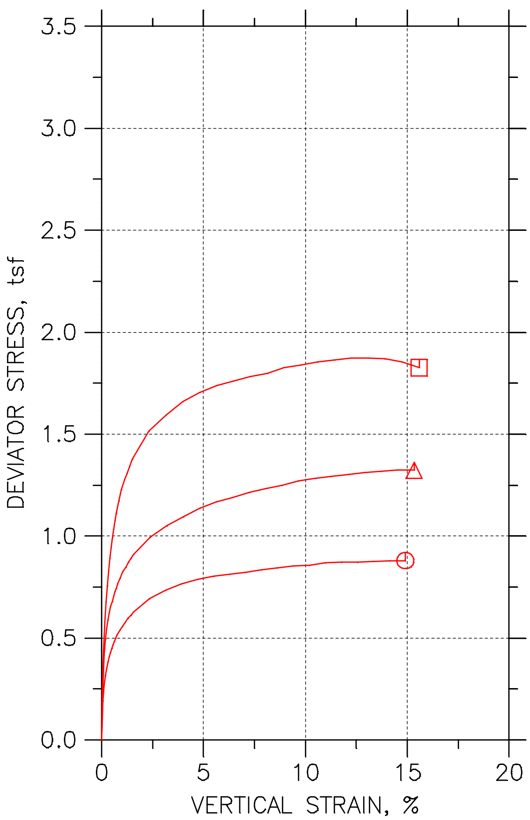
CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767





		○	△	□	
Symbol		○	△	□	
Test No.		10.0 PSI	20.0 PSI	40.0 PSI	
Initial	Diameter, in	2.8071	2.7992	2.802	
	Height, in	5.9681	6.1213	6.0421	
	Water Content, %	34.07	34.53	33.55	
	Dry Density, pcf	86.29	87.22	79.75	
	Saturation, %	95.76	99.18	80.83	
	Void Ratio	0.96775	0.94695	1.1292	
Before Shear	Water Content, %	32.71	29.92	32.67	
	Dry Density, pcf	89.86	93.61	89.91	
	Saturation, %	100.00	100.00	100.00	
	Void Ratio	0.88973	0.81387	0.8885	
	Back Press., tsf	5.0445	5.0422	5.1556	
Minor Prin. Stress, tsf		0.71549	1.4378	2.7644	
Max. Dev. Stress, tsf		0.87949	1.3239	1.8718	
Time to Failure, min		1080	1080	900	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value		0.97	0.95	0.99	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		38	38	38	
Plastic Limit		21	21	21	
Plasticity Index		17	17	17	

Failure Sketch

Project: DYNERGY HENNEPIN

Location: HENNEPIN, IL

Project No.: MR155233

Boring No.: HEN-016 S7

Sample Type: 3.0'' ST

Description: VERY DARK GRAY CLAY WITH SAND AND GRAVEL - ORGANICS AND ASH NOTED

Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Tue, 22-DEC-2015 10:05:37

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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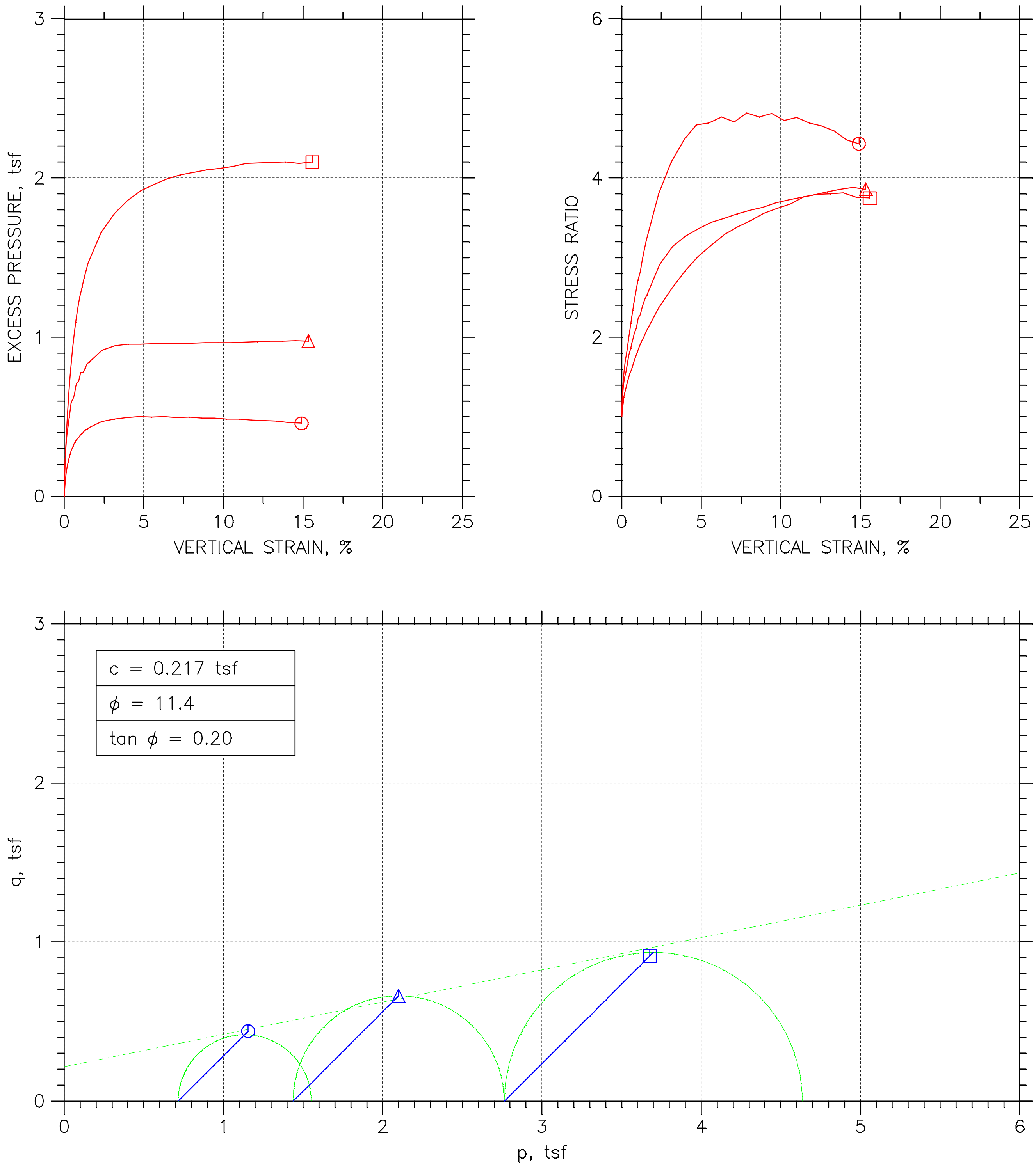

Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
Boring No.: HEN-016 S7	Tested By: BCM	Checked By: WPQ
Sample No.: S-7	Test Date: 12/16/15	Depth: 20.0'-22.0'
Test No.: HEN-016 S7	Sample Type: 3.0" ST	Elevation: -----
Description: VERY DARK GRAY CLAY WITH SAND AND GRAVEL - ORGANICS AND ASH NOTED		
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767		

Tue, 22-DEC-2015 10:06:48

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-016 S7
Sample No.: S-7
Test No.: 10.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 20.0'-22.0'
Elevation: -----

Soil Description: VERY DARK GRAY CLAY WITH SAND AND GRAVEL - ORGANICS AND ASH NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.97 in
Specimen Area: 6.19 in^2
Specimen Volume: 36.94 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 38

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.1887	0	0	5.0445	5.76	5.76
2	5	0.057793	6.1923	16.531	0.19221	5.1359	5.76	5.9522
3	10	0.12136	6.1962	23.217	0.26978	5.1929	5.76	6.0298
4	15	0.18494	6.2002	27.218	0.31608	5.2319	5.76	6.0761
5	20	0.24851	6.2041	30.325	0.35192	5.2604	5.76	6.1119
6	25	0.31208	6.2081	32.904	0.38162	5.2895	5.76	6.1416
7	30	0.3771	6.2122	35.063	0.40639	5.3116	5.76	6.1664
8	35	0.44211	6.2162	37.116	0.4299	5.3308	5.76	6.1899
9	40	0.50713	6.2203	38.853	0.44973	5.3454	5.76	6.2097
10	45	0.57215	6.2243	40.433	0.46771	5.3593	5.76	6.2277
11	50	0.63716	6.2284	41.907	0.48444	5.3756	5.76	6.2444
12	55	0.70363	6.2326	43.223	0.49932	5.3873	5.76	6.2593
13	60	0.76864	6.2367	44.487	0.51358	5.3977	5.76	6.2736
14	70	0.90012	6.2449	46.751	0.539	5.4152	5.76	6.299
15	80	1.033	6.2533	48.593	0.5595	5.4326	5.76	6.3195
16	90	1.1645	6.2616	50.331	0.57873	5.442	5.76	6.3387
17	100	1.2974	6.2701	51.805	0.59488	5.4588	5.76	6.3549
18	110	1.4318	6.2786	53.437	0.61278	5.4676	5.76	6.3728
19	120	1.5647	6.2871	54.753	0.62703	5.4775	5.76	6.387
20	180	2.3464	6.3374	60.965	0.69263	5.5135	5.76	6.4526
21	240	3.128	6.3886	65.019	0.73277	5.531	5.76	6.4928
22	300	3.9256	6.4416	68.546	0.76617	5.5403	5.76	6.5262
23	360	4.7029	6.4941	70.968	0.78682	5.5455	5.76	6.5468
24	420	5.4845	6.5478	72.969	0.80236	5.5426	5.76	6.5624
25	480	6.2806	6.6035	74.443	0.81168	5.5444	5.76	6.5717
26	540	7.0637	6.6591	76.022	0.82197	5.538	5.76	6.582
27	600	7.8468	6.7157	77.865	0.8348	5.5415	5.76	6.5948
28	660	8.6386	6.7739	79.497	0.84498	5.5356	5.76	6.605
29	720	9.4144	6.8319	80.971	0.85334	5.5362	5.76	6.6133
30	780	10.195	6.8913	82.077	0.85754	5.5298	5.76	6.6175
31	840	10.991	6.9529	83.814	0.86793	5.5292	5.76	6.6279
32	900	11.769	7.0143	84.867	0.87114	5.524	5.76	6.6311
33	960	12.555	7.0773	85.762	0.87249	5.5211	5.76	6.6325
34	1020	13.35	7.1422	86.815	0.87517	5.5164	5.76	6.6352
35	1080	14.12	7.2063	88.026	0.87949	5.5071	5.76	6.6395
36	1140	14.906	7.2728	88.815	0.87926	5.5036	5.76	6.6393

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-016 S7
Sample No.: S-7
Test No.: 10.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 20.0'-22.0'
Elevation: -----

Soil Description: VERY DARK GRAY CLAY WITH SAND AND GRAVEL - ORGANICS AND ASH NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.97 in
Specimen Area: 6.19 in^2
Specimen Volume: 36.94 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 38

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	5.76	5.76	0	0.000	0.71549	0.71549	1.000	0.71549	0
2	0.06	5.9522	5.76	0.091359	0.475	0.81634	0.62413	1.308	0.72023	0.096107
3	0.12	6.0298	5.76	0.14839	0.550	0.83688	0.5671	1.476	0.70199	0.13489
4	0.18	6.0761	5.76	0.18737	0.593	0.84419	0.52811	1.599	0.68615	0.15804
5	0.25	6.1119	5.76	0.21589	0.613	0.85152	0.4996	1.704	0.67556	0.17596
6	0.31	6.1416	5.76	0.24498	0.642	0.85212	0.4705	1.811	0.66131	0.19081
7	0.38	6.1664	5.76	0.26709	0.657	0.85478	0.44839	1.906	0.65158	0.20319
8	0.44	6.1899	5.76	0.2863	0.666	0.85909	0.42919	2.002	0.64414	0.21495
9	0.51	6.2097	5.76	0.30084	0.669	0.86437	0.41464	2.085	0.63951	0.22487
10	0.57	6.2277	5.76	0.31481	0.673	0.86838	0.40068	2.167	0.63453	0.23385
11	0.64	6.2444	5.76	0.3311	0.683	0.86882	0.38438	2.260	0.6266	0.24222
12	0.70	6.2593	5.76	0.34274	0.686	0.87207	0.37274	2.340	0.62241	0.24966
13	0.77	6.2736	5.76	0.35321	0.688	0.87585	0.36227	2.418	0.61906	0.25679
14	0.90	6.299	5.76	0.37067	0.688	0.88382	0.34481	2.563	0.61431	0.2695
15	1.03	6.3195	5.76	0.38813	0.694	0.88685	0.32736	2.709	0.6071	0.27975
16	1.16	6.3387	5.76	0.39744	0.687	0.89678	0.31805	2.820	0.60741	0.28936
17	1.30	6.3549	5.76	0.41431	0.696	0.89605	0.30117	2.975	0.59861	0.29744
18	1.43	6.3728	5.76	0.42304	0.690	0.90523	0.29244	3.095	0.59883	0.30639
19	1.56	6.387	5.76	0.43294	0.690	0.90958	0.28255	3.219	0.59607	0.31352
20	2.35	6.4526	5.76	0.46901	0.677	0.9391	0.24647	3.810	0.59279	0.34632
21	3.13	6.4928	5.76	0.48647	0.664	0.96179	0.22901	4.200	0.5954	0.36639
22	3.93	6.5262	5.76	0.49578	0.647	0.98587	0.2197	4.487	0.60279	0.38308
23	4.70	6.5468	5.76	0.50102	0.637	1.0013	0.21447	4.669	0.60788	0.39341
24	5.48	6.5624	5.76	0.49811	0.621	1.0197	0.21738	4.691	0.61856	0.40118
25	6.28	6.5717	5.76	0.49985	0.616	1.0273	0.21563	4.764	0.62147	0.40584
26	7.06	6.582	5.76	0.49345	0.600	1.044	0.22203	4.702	0.63302	0.41099
27	7.85	6.5948	5.76	0.49694	0.595	1.0533	0.21854	4.820	0.63594	0.4174
28	8.64	6.605	5.76	0.49113	0.581	1.0693	0.22436	4.766	0.64685	0.42249
29	9.41	6.6133	5.76	0.49171	0.576	1.0771	0.22378	4.813	0.65045	0.42667
30	10.19	6.6175	5.76	0.48531	0.566	1.0877	0.23018	4.726	0.65895	0.42877
31	10.99	6.6279	5.76	0.48472	0.558	1.0987	0.23076	4.761	0.66472	0.43396
32	11.77	6.6311	5.76	0.47949	0.550	1.1071	0.236	4.691	0.67157	0.43557
33	12.56	6.6325	5.76	0.47658	0.546	1.1114	0.23891	4.652	0.67515	0.43624
34	13.35	6.6352	5.76	0.47192	0.539	1.1187	0.24356	4.593	0.68115	0.43759
35	14.12	6.6395	5.76	0.46261	0.526	1.1324	0.25287	4.478	0.69262	0.43975
36	14.91	6.6393	5.76	0.45912	0.522	1.1356	0.25636	4.430	0.69599	0.43963

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-016 S7
Sample No.: S-7
Test No.: 20.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 20.0'-22.0'
Elevation: ----

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Soil Description: VERY DARK GRAY CLAY WITH SAND AND GRAVEL - ORGANICS AND ASH NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.12 in
Specimen Area: 6.15 in^2
Specimen Volume: 37.67 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 38

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.1541	0	0	5.0422	6.48	6.48
2	5.0039	0.051583	6.1572	22.233	0.25998	5.2726	6.48	6.74
3	10.004	0.11723	6.1613	35.573	0.4157	5.3816	6.48	6.8957
4	15.004	0.18289	6.1653	42.348	0.49455	5.4452	6.48	6.9746
5	20.004	0.2501	6.1695	47.007	0.54859	5.486	6.48	7.0286
6	25.004	0.31731	6.1736	50.448	0.58834	5.5379	6.48	7.0683
7	30.004	0.38453	6.1778	53.571	0.62435	5.5828	6.48	7.1043
8	35.004	0.45174	6.182	56.271	0.65537	5.633	6.48	7.1354
9	40.004	0.52052	6.1863	58.547	0.68141	5.6487	6.48	7.1614
10	45.004	0.58617	6.1903	60.558	0.70435	5.6645	6.48	7.1844
11	50.004	0.65495	6.1946	62.517	0.72663	5.6919	6.48	7.2066
12	55.004	0.72216	6.1988	64.105	0.74459	5.7309	6.48	7.2246
13	60.004	0.78782	6.2029	65.852	0.76437	5.7537	6.48	7.2444
14	70	0.91756	6.211	68.605	0.79528	5.7665	6.48	7.2753
15	80	1.0504	6.2194	71.145	0.82363	5.819	6.48	7.3036
16	90	1.1817	6.2277	73.316	0.84763	5.8202	6.48	7.3276
17	100	1.313	6.2359	75.433	0.87095	5.8488	6.48	7.351
18	110	1.4459	6.2443	77.18	0.88992	5.8767	6.48	7.3699
19	120	1.5803	6.2529	78.98	0.90943	5.8843	6.48	7.3894
20	180	2.3947	6.305	87.079	0.99439	5.9607	6.48	7.4744
21	240	3.2075	6.358	92.69	1.0497	5.9899	6.48	7.5297
22	300	4.0032	6.4107	97.613	1.0963	5.9969	6.48	7.5763
23	360	4.816	6.4654	101.85	1.1342	5.9992	6.48	7.6142
24	420	5.6319	6.5213	105.82	1.1683	6.0015	6.48	7.6483
25	480	6.4323	6.5771	108.68	1.1897	6.0033	6.48	7.6697
26	540	7.2467	6.6349	111.8	1.2132	6.0039	6.48	7.6932
27	600	8.0579	6.6934	114.61	1.2328	6.005	6.48	7.7128
28	660	8.8551	6.752	116.99	1.2475	6.0062	6.48	7.7275
29	720	9.6695	6.8128	120.16	1.2699	6.0074	6.48	7.7499
30	780	10.479	6.8744	122.44	1.2824	6.0091	6.48	7.7624
31	840	11.28	6.9365	124.56	1.2929	6.0115	6.48	7.7729
32	900	12.1	7.0012	126.67	1.3027	6.0132	6.48	7.7827
33	960	12.91	7.0663	128.85	1.3128	6.0155	6.48	7.7928
34	1020	13.702	7.1312	130.65	1.3191	6.0185	6.48	7.7991
35	1080	14.526	7.1999	132.39	1.3239	6.0202	6.48	7.8039
36	1140	15.334	7.2687	133.56	1.323	6.0173	6.48	7.803

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-016 S7
Sample No.: S-7
Test No.: 20.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 20.0'-22.0'
Elevation: ----

Soil Description: VERY DARK GRAY CLAY WITH SAND AND GRAVEL - ORGANICS AND ASH NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.12 in
Specimen Area: 6.15 in^2
Specimen Volume: 37.67 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 38

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	6.48	6.48	0	0.000	1.4378	1.4378	1.000	1.4378	0
2	0.05	6.74	6.48	0.23036	0.886	1.4674	1.2074	1.215	1.3374	0.12999
3	0.12	6.8957	6.48	0.33941	0.816	1.5141	1.0984	1.378	1.3062	0.20785
4	0.18	6.9746	6.48	0.40298	0.815	1.5294	1.0348	1.478	1.2821	0.24728
5	0.25	7.0286	6.48	0.4438	0.809	1.5426	0.99399	1.552	1.2683	0.27429
6	0.32	7.0683	6.48	0.49571	0.843	1.5304	0.94209	1.625	1.2363	0.29417
7	0.38	7.1043	6.48	0.54061	0.866	1.5215	0.89718	1.696	1.2094	0.31217
8	0.45	7.1354	6.48	0.59077	0.901	1.5024	0.84703	1.774	1.1747	0.32768
9	0.52	7.1614	6.48	0.60651	0.890	1.5127	0.83128	1.820	1.172	0.3407
10	0.59	7.1844	6.48	0.62226	0.883	1.5199	0.81554	1.864	1.1677	0.35218
11	0.65	7.2066	6.48	0.64967	0.894	1.5148	0.78813	1.922	1.1514	0.36332
12	0.72	7.2246	6.48	0.68874	0.925	1.4936	0.74905	1.994	1.1213	0.37229
13	0.79	7.2444	6.48	0.71148	0.931	1.4907	0.72631	2.052	1.1085	0.38219
14	0.92	7.2753	6.48	0.72431	0.911	1.5088	0.71348	2.115	1.1111	0.39764
15	1.05	7.3036	6.48	0.7768	0.943	1.4846	0.66099	2.246	1.0728	0.41181
16	1.18	7.3276	6.48	0.77797	0.918	1.5075	0.65983	2.285	1.0836	0.42381
17	1.31	7.351	6.48	0.80654	0.926	1.5022	0.63125	2.380	1.0667	0.43548
18	1.45	7.3699	6.48	0.83454	0.938	1.4932	0.60326	2.475	1.0482	0.44496
19	1.58	7.3894	6.48	0.84212	0.926	1.5051	0.59568	2.527	1.0504	0.45472
20	2.39	7.4744	6.48	0.91851	0.924	1.5137	0.51928	2.915	1.0165	0.4972
21	3.21	7.5297	6.48	0.94767	0.903	1.5398	0.49012	3.142	1.0149	0.52483
22	4.00	7.5763	6.48	0.95467	0.871	1.5794	0.48312	3.269	1.0313	0.54816
23	4.82	7.6142	6.48	0.957	0.844	1.615	0.48079	3.359	1.0479	0.5671
24	5.63	7.6483	6.48	0.95934	0.821	1.6468	0.47846	3.442	1.0626	0.58415
25	6.43	7.6697	6.48	0.96109	0.808	1.6664	0.47671	3.496	1.0716	0.59484
26	7.25	7.6932	6.48	0.96167	0.793	1.6894	0.47612	3.548	1.0827	0.60661
27	8.06	7.7128	6.48	0.96284	0.781	1.7078	0.47496	3.596	1.0914	0.6164
28	8.86	7.7275	6.48	0.964	0.773	1.7213	0.47379	3.633	1.0975	0.62375
29	9.67	7.7499	6.48	0.96517	0.760	1.7426	0.47262	3.687	1.1076	0.63496
30	10.48	7.7624	6.48	0.96692	0.754	1.7533	0.47087	3.723	1.1121	0.64119
31	11.28	7.7729	6.48	0.96925	0.750	1.7614	0.46854	3.759	1.115	0.64645
32	12.10	7.7827	6.48	0.971	0.745	1.7695	0.46679	3.791	1.1181	0.65136
33	12.91	7.7928	6.48	0.97333	0.741	1.7773	0.46446	3.827	1.1209	0.65641
34	13.70	7.7991	6.48	0.97625	0.740	1.7806	0.46154	3.858	1.1211	0.65953
35	14.53	7.8039	6.48	0.978	0.739	1.7837	0.45979	3.879	1.1218	0.66197
36	15.33	7.803	6.48	0.97508	0.737	1.7857	0.46271	3.859	1.1242	0.66148

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-016 S7
Sample No.: S-7
Test No.: 40.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 20.0'-22.0'
Elevation: ----

Soil Description: VERY DARK GRAY CLAY WITH SAND AND GRAVEL - ORGANICS AND ASH NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.04 in
Specimen Area: 6.17 in^2
Specimen Volume: 37.26 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 38

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.1662	0	0	5.1556	7.92	7.92
2	5.0003	0.042334	6.1688	21.452	0.25038	5.314	7.92	8.1704
3	10	0.093739	6.172	37.711	0.43992	5.4532	7.92	8.3599
4	15	0.15119	6.1755	49.512	0.57726	5.5784	7.92	8.4973
5	20	0.21167	6.1793	58.061	0.67652	5.6902	7.92	8.5965
6	25	0.27366	6.1831	65.037	0.75733	5.7904	7.92	8.6773
7	30	0.33716	6.187	71.173	0.82826	5.8784	7.92	8.7483
8	35	0.40066	6.191	76.785	0.893	5.9558	7.92	8.813
9	40	0.46567	6.195	81.296	0.94484	6.0245	7.92	8.8648
10	45.001	0.52917	6.199	85.702	0.99541	6.0898	7.92	8.9154
11	50.001	0.59419	6.203	89.216	1.0355	6.1474	7.92	8.9555
12	55.001	0.6592	6.2071	92.73	1.0756	6.2004	7.92	8.9956
13	60.001	0.72421	6.2112	96.034	1.1132	6.2482	7.92	9.0332
14	70.001	0.85575	6.2194	101.38	1.1737	6.3344	7.92	9.0937
15	80.001	0.98729	6.2277	106.31	1.2291	6.4078	7.92	9.1491
16	90.001	1.1203	6.236	110.56	1.2765	6.4718	7.92	9.1965
17	100	1.2519	6.2444	113.55	1.3093	6.5278	7.92	9.2293
18	110	1.3849	6.2528	116.65	1.3432	6.5767	7.92	9.2632
19	120	1.518	6.2612	119.64	1.3757	6.6233	7.92	9.2957
20	180	2.3344	6.3136	132.8	1.5145	6.8143	7.92	9.4345
21	240	3.169	6.368	141.04	1.5946	6.9349	7.92	9.5146
22	300	3.987	6.4222	148.06	1.66	7.0152	7.92	9.58
23	360	4.8125	6.4779	153.26	1.7034	7.0752	7.92	9.6234
24	420	5.6486	6.5353	157.66	1.737	7.116	7.92	9.657
25	480	6.462	6.5922	161.28	1.7615	7.1509	7.92	9.6815
26	540	7.2875	6.6509	164.48	1.7806	7.1742	7.92	9.7006
27	600	8.1266	6.7116	167.63	1.7983	7.1923	7.92	9.7183
28	660	8.9355	6.7712	171.82	1.827	7.2051	7.92	9.747
29	720	9.7625	6.8333	174.6	1.8397	7.2168	7.92	9.7597
30	780	10.606	6.8978	177.54	1.8532	7.2272	7.92	9.7732
31	840	11.424	6.9615	180.22	1.8639	7.2459	7.92	9.7839
32	900	12.251	7.0271	182.68	1.8718	7.2505	7.92	9.7918
33	960	13.09	7.0949	184.41	1.8714	7.2523	7.92	9.7914
34	1020	13.905	7.1621	185.98	1.8697	7.2552	7.92	9.7897
35	1080	14.744	7.2326	186.35	1.8551	7.2476	7.92	9.7751
36	1140	15.58	7.3042	185.3	1.8266	7.2552	7.92	9.7466

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-016 S7
Sample No.: S-7
Test No.: 40.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 20.0'-22.0'
Elevation: ----

Soil Description: VERY DARK GRAY CLAY WITH SAND AND GRAVEL - ORGANICS AND ASH NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.04 in
Specimen Area: 6.17 in^2
Specimen Volume: 37.26 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 38

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	7.92	7.92	0	0.000	2.7644	2.7644	1.000	2.7644	0
2	0.04	8.1704	7.92	0.15842	0.633	2.8564	2.606	1.096	2.7312	0.12519
3	0.09	8.3599	7.92	0.29762	0.677	2.9067	2.4668	1.178	2.6868	0.21996
4	0.15	8.4973	7.92	0.42284	0.732	2.9188	2.3416	1.247	2.6302	0.28863
5	0.21	8.5965	7.92	0.53466	0.790	2.9063	2.2298	1.303	2.568	0.33826
6	0.27	8.6773	7.92	0.63484	0.838	2.8869	2.1296	1.356	2.5083	0.37867
7	0.34	8.7483	7.92	0.72278	0.873	2.8699	2.0416	1.406	2.4558	0.41413
8	0.40	8.813	7.92	0.80024	0.896	2.8572	1.9642	1.455	2.4107	0.4465
9	0.47	8.8648	7.92	0.86897	0.920	2.8403	1.8955	1.498	2.3679	0.47242
10	0.53	8.9154	7.92	0.9342	0.939	2.8256	1.8302	1.544	2.3279	0.4977
11	0.59	8.9555	7.92	0.99186	0.958	2.8081	1.7726	1.584	2.2903	0.51777
12	0.66	8.9956	7.92	1.0449	0.971	2.7952	1.7196	1.626	2.2574	0.53782
13	0.72	9.0332	7.92	1.0926	0.981	2.785	1.6718	1.666	2.2284	0.55662
14	0.86	9.0937	7.92	1.1788	1.004	2.7593	1.5856	1.740	2.1725	0.58685
15	0.99	9.1491	7.92	1.2522	1.019	2.7414	1.5122	1.813	2.1268	0.61457
16	1.12	9.1965	7.92	1.3163	1.031	2.7247	1.4482	1.881	2.0864	0.63827
17	1.25	9.2293	7.92	1.3722	1.048	2.7016	1.3922	1.940	2.0469	0.65465
18	1.38	9.2632	7.92	1.4211	1.058	2.6865	1.3433	2.000	2.0149	0.67159
19	1.52	9.2957	7.92	1.4677	1.067	2.6725	1.2967	2.061	1.9846	0.68787
20	2.33	9.4345	7.92	1.6587	1.095	2.6202	1.1057	2.370	1.8629	0.75723
21	3.17	9.5146	7.92	1.7793	1.116	2.5798	0.98514	2.619	1.7824	0.79731
22	3.99	9.58	7.92	1.8597	1.120	2.5647	0.90476	2.835	1.7347	0.82998
23	4.81	9.6234	7.92	1.9197	1.127	2.5482	0.84477	3.016	1.6965	0.8517
24	5.65	9.657	7.92	1.9604	1.129	2.541	0.804	3.160	1.6725	0.86848
25	6.46	9.6815	7.92	1.9954	1.133	2.5306	0.76906	3.290	1.6498	0.88076
26	7.29	9.7006	7.92	2.0187	1.134	2.5264	0.74576	3.388	1.6361	0.8903
27	8.13	9.7183	7.92	2.0367	1.133	2.526	0.72771	3.471	1.6268	0.89913
28	8.94	9.747	7.92	2.0495	1.122	2.5419	0.71489	3.556	1.6284	0.91352
29	9.76	9.7597	7.92	2.0612	1.120	2.543	0.70324	3.616	1.6231	0.91987
30	10.61	9.7732	7.92	2.0717	1.118	2.546	0.69276	3.675	1.6194	0.9266
31	11.42	9.7839	7.92	2.0903	1.121	2.538	0.67412	3.765	1.6061	0.93195
32	12.25	9.7918	7.92	2.095	1.119	2.5412	0.66946	3.796	1.6053	0.93588
33	13.09	9.7914	7.92	2.0967	1.120	2.5391	0.66772	3.803	1.6034	0.93571
34	13.91	9.7897	7.92	2.0996	1.123	2.5345	0.66481	3.812	1.5997	0.93485
35	14.74	9.7751	7.92	2.092	1.128	2.5275	0.67238	3.759	1.5999	0.92756
36	15.58	9.7466	7.92	2.0996	1.149	2.4914	0.66481	3.748	1.5781	0.91329

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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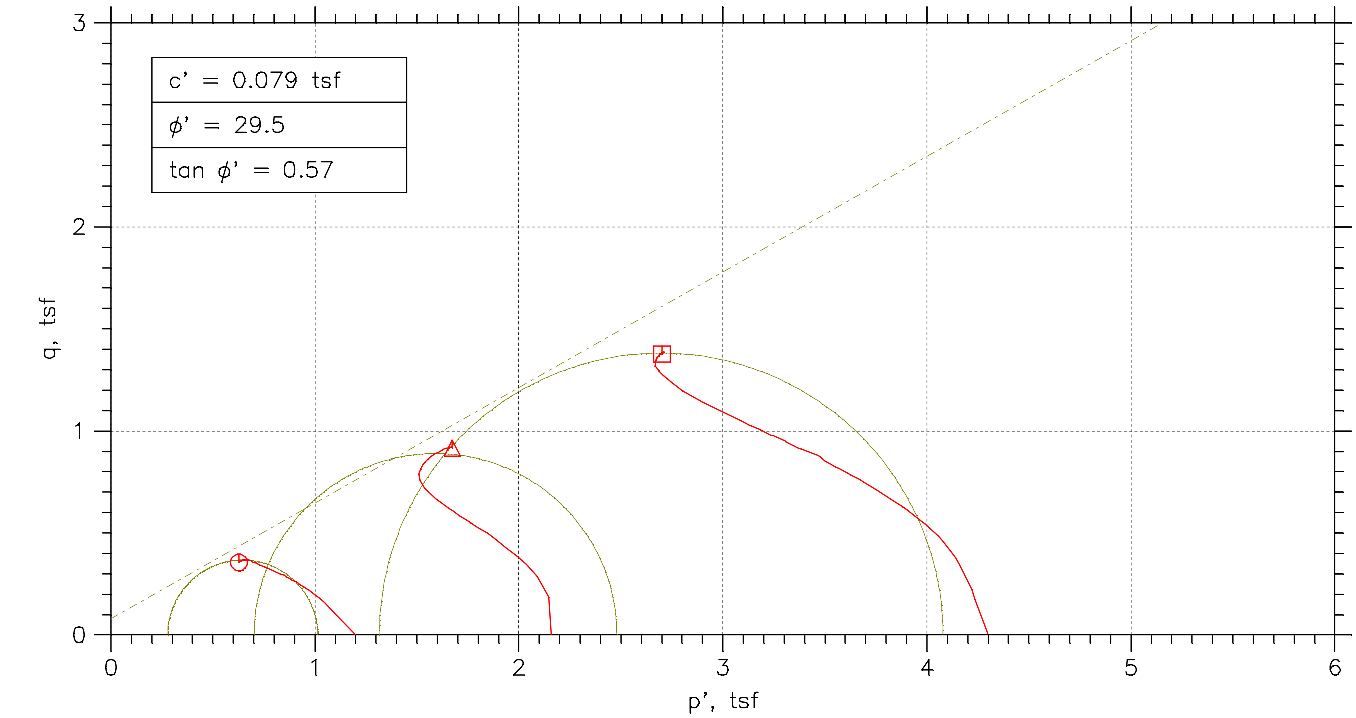

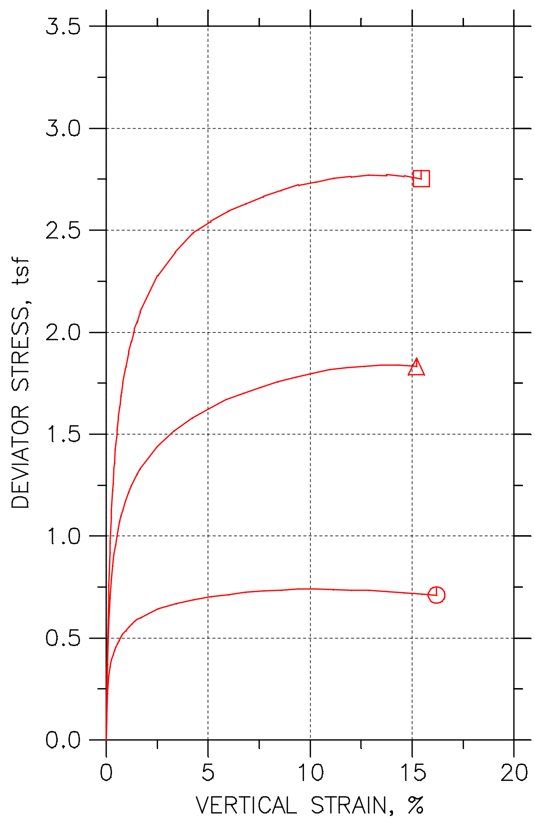

Symbol		○	△	□	
Test No.		15.0 PSI	30.0 PSI	60.0 PSI	
Initial	Diameter, in	2.828	2.8043	2.7835	
	Height, in	5.7787	5.8472	5.7602	
	Water Content, %	23.57	23.55	25.59	
	Dry Density, pcf	92.14	96.79	92.12	
	Saturation, %	76.04	84.91	82.54	
	Void Ratio	0.84297	0.75427	0.84321	
Before Shear	Water Content, %	26.53	21.69	21.75	
	Dry Density, pcf	98.64	106.8	106.7	
	Saturation, %	100.00	100.00	100.00	
	Void Ratio	0.72151	0.59007	0.59162	
	Back Press., tsf	5.0451	5.0416	5.0706	
Minor Prin. Stress, tsf		1.1973	2.1584	4.2894	
Max. Dev. Stress, tsf		0.73973	1.8396	2.773	
Time to Failure, min		660	1020	960	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value		0.99	0.97	0.98	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		41	41	41	
Plastic Limit		23	23	23	
Plasticity Index		18	18	18	

Failure Sketch

Project: DYNERGY HENNEPIN

Location: HENNEPIN, IL

Project No.: MR155233

Boring No.: HEN-016 S10

Sample Type: 3 "ST

Description: VERY DARK GRAY LEAN CLAY WITH SAND CL FLY ASH AND SHELL NOTED

Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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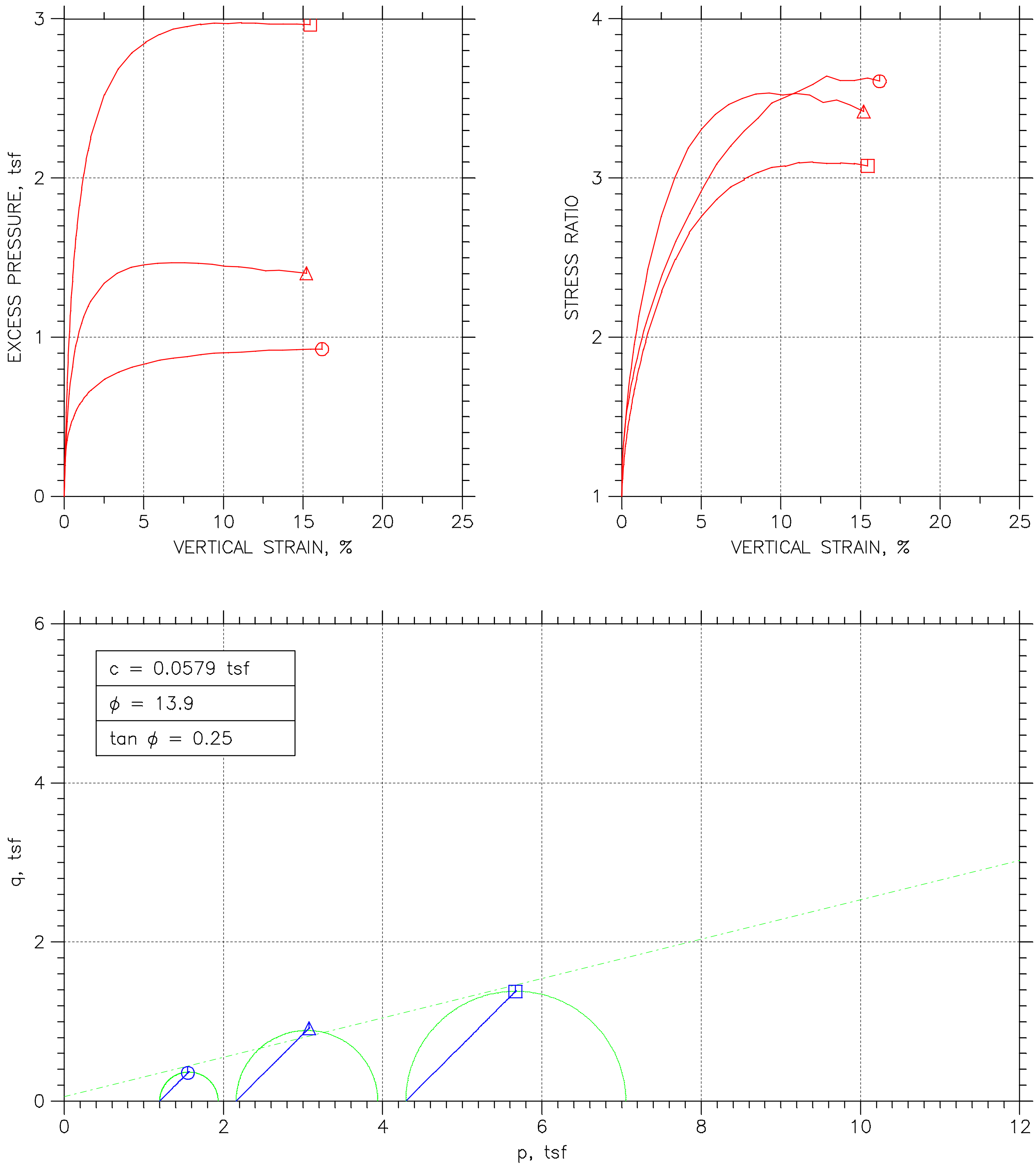

Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
Boring No.: HEN-016 S10	Tested By: BCM	Checked By: WPQ
Sample No.: S-10	Test Date: 12/16/15	Depth: 35.0'-37.0'
Test No.: HEN-016 S10	Sample Type: 3 "ST	Elevation: ----
Description: VERY DARK GRAY LEAN CLAY WITH SAND CL FLY ASH AND SHELL NOTED		
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767		

Tue, 22-DEC-2015 10:44:25

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-016 S10
Sample No.: S-10
Test No.: 15.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3 "ST

Project No.: MR155233
Checked By: WPQ
Depth: 35.0'-37.0'
Elevation: ----

Soil Description: VERY DARK GRAY LEAN CLAY WITH SAND CL FLY ASH AND SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.78 in
Specimen Area: 6.28 in^2
Specimen Volume: 36.30 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 41

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2811	0	0	5.0451	6.2424	6.2424
2	5.0001	0.054641	6.2845	19.902	0.22801	5.2685	6.2424	6.4704
3	10	0.12584	6.289	27.345	0.31307	5.3507	6.2424	6.5555
4	15	0.19373	6.2933	31.283	0.3579	5.3997	6.2424	6.6003
5	20	0.26658	6.2979	34.249	0.39155	5.4364	6.2424	6.634
6	25	0.33778	6.3024	36.622	0.41838	5.4673	6.2424	6.6608
7	30	0.40732	6.3068	38.456	0.43903	5.4918	6.2424	6.6814
8	35	0.48018	6.3114	39.912	0.45532	5.514	6.2424	6.6977
9	40.001	0.55137	6.3159	41.476	0.47282	5.5332	6.2424	6.7152
10	45.001	0.62257	6.3204	42.609	0.48539	5.5525	6.2424	6.7278
11	50.001	0.69377	6.325	43.742	0.49793	5.5694	6.2424	6.7403
12	55.001	0.76166	6.3293	45.036	0.51232	5.5834	6.2424	6.7547
13	60.001	0.83286	6.3338	45.899	0.52176	5.5968	6.2424	6.7642
14	70.001	0.97525	6.3429	47.355	0.53754	5.6242	6.2424	6.7799
15	80.001	1.1176	6.3521	48.92	0.5545	5.6446	6.2424	6.7969
16	90.001	1.26	6.3612	50.214	0.56835	5.6662	6.2424	6.8108
17	100	1.4008	6.3703	51.616	0.58339	5.6825	6.2424	6.8258
18	110	1.5448	6.3796	52.479	0.59228	5.6995	6.2424	6.8347
19	120	1.6889	6.389	53.234	0.59992	5.7129	6.2424	6.8423
20	180	2.5532	6.4456	57.495	0.64224	5.7817	6.2424	6.8846
21	240	3.4126	6.503	60.462	0.66942	5.8248	6.2424	6.9118
22	300	4.2653	6.5609	62.511	0.686	5.8563	6.2424	6.9284
23	360	5.1329	6.6209	64.615	0.70266	5.8802	6.2424	6.9451
24	420	5.9889	6.6812	66.125	0.7126	5.9012	6.2424	6.955
25	480	6.8466	6.7427	67.851	0.72452	5.9135	6.2424	6.9669
26	540	7.7093	6.8058	69.092	0.73094	5.924	6.2424	6.9733
27	600	8.5637	6.8693	70.008	0.73378	5.9339	6.2424	6.9762
28	660	9.428	6.9349	71.249	0.73973	5.9432	6.2424	6.9821
29	720	10.292	7.0017	71.896	0.73932	5.9479	6.2424	6.9817
30	780	11.145	7.0689	72.436	0.73779	5.9526	6.2424	6.9802
31	840	12.008	7.1382	72.813	0.73443	5.9584	6.2424	6.9768
32	900	12.874	7.2092	73.568	0.73475	5.9642	6.2424	6.9771
33	960	13.726	7.2804	73.676	0.72862	5.9636	6.2424	6.971
34	1020	14.596	7.3545	73.73	0.72181	5.966	6.2424	6.9642
35	1080	15.46	7.4297	73.892	0.71607	5.9701	6.2424	6.9585
36	1131.9	16.195	7.4949	73.946	0.71036	5.9701	6.2424	6.9528

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-016 S10
Sample No.: S-10
Test No.: 15.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3 "ST

Project No.: MR155233
Checked By: WPQ
Depth: 35.0'-37.0'
Elevation: ----

Terracon Consulting Engineers & Scientists

Soil Description: VERY DARK GRAY LEAN CLAY WITH SAND CL FLY ASH AND SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.78 in
Specimen Area: 6.28 in^2
Specimen Volume: 36.30 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 41

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	6.2424	6.2424	0	0.000	1.1973	1.1973	1.000	1.1973	0
2	0.05	6.4704	6.2424	0.22336	0.980	1.2019	0.97392	1.234	1.0879	0.11401
3	0.13	6.5555	6.2424	0.30559	0.976	1.2048	0.89169	1.351	1.0482	0.15653
4	0.19	6.6003	6.2424	0.35458	0.991	1.2006	0.8427	1.425	1.0217	0.17895
5	0.27	6.634	6.2424	0.39132	0.999	1.1975	0.80596	1.486	1.0017	0.19578
6	0.34	6.6608	6.2424	0.42223	1.009	1.1934	0.77505	1.540	0.98424	0.20919
7	0.41	6.6814	6.2424	0.44672	1.018	1.1896	0.75056	1.585	0.97007	0.21951
8	0.48	6.6977	6.2424	0.46888	1.030	1.1837	0.7284	1.625	0.95606	0.22766
9	0.55	6.7152	6.2424	0.48812	1.032	1.182	0.70915	1.667	0.94556	0.23641
10	0.62	6.7278	6.2424	0.50737	1.045	1.1753	0.68991	1.704	0.9326	0.24269
11	0.69	6.7403	6.2424	0.52428	1.053	1.1709	0.67299	1.740	0.92196	0.24897
12	0.76	6.7547	6.2424	0.53828	1.051	1.1713	0.659	1.777	0.91516	0.25616
13	0.83	6.7642	6.2424	0.55169	1.057	1.1673	0.64559	1.808	0.90647	0.26088
14	0.98	6.7799	6.2424	0.5791	1.077	1.1557	0.61818	1.870	0.88695	0.26877
15	1.12	6.7969	6.2424	0.59951	1.081	1.1523	0.59776	1.928	0.87501	0.27725
16	1.26	6.8108	6.2424	0.62109	1.093	1.1445	0.57619	1.986	0.86036	0.28418
17	1.40	6.8258	6.2424	0.63742	1.093	1.1432	0.55986	2.042	0.85155	0.2917
18	1.54	6.8347	6.2424	0.65433	1.105	1.1352	0.54294	2.091	0.83908	0.29614
19	1.69	6.8423	6.2424	0.66775	1.113	1.1295	0.52953	2.133	0.82949	0.29996
20	2.55	6.8846	6.2424	0.73656	1.147	1.103	0.46072	2.394	0.78184	0.32112
21	3.41	6.9118	6.2424	0.77972	1.165	1.087	0.41756	2.603	0.75227	0.33471
22	4.27	6.9284	6.2424	0.81121	1.183	1.0721	0.38607	2.777	0.72907	0.343
23	5.13	6.9451	6.2424	0.83512	1.189	1.0648	0.36216	2.940	0.71349	0.35133
24	5.99	6.955	6.2424	0.85611	1.201	1.0538	0.34116	3.089	0.69746	0.3563
25	6.85	6.9669	6.2424	0.86836	1.199	1.0534	0.32892	3.203	0.69118	0.36226
26	7.71	6.9733	6.2424	0.87886	1.202	1.0494	0.31842	3.296	0.68389	0.36547
27	8.56	6.9762	6.2424	0.88877	1.211	1.0423	0.30851	3.379	0.6754	0.36689
28	9.43	6.9821	6.2424	0.8981	1.214	1.0389	0.29917	3.473	0.66904	0.36986
29	10.29	6.9817	6.2424	0.90277	1.221	1.0338	0.29451	3.510	0.66417	0.36966
30	11.15	6.9802	6.2424	0.90743	1.230	1.0276	0.28984	3.545	0.65874	0.36889
31	12.01	6.9768	6.2424	0.91327	1.243	1.0184	0.28401	3.586	0.65123	0.36722
32	12.87	6.9771	6.2424	0.9191	1.251	1.0129	0.27818	3.641	0.64555	0.36737
33	13.73	6.971	6.2424	0.91851	1.261	1.0074	0.27876	3.614	0.64307	0.36431
34	14.60	6.9642	6.2424	0.92085	1.276	0.99824	0.27643	3.611	0.63733	0.3609
35	15.46	6.9585	6.2424	0.92493	1.292	0.98842	0.27235	3.629	0.63038	0.35804
36	16.20	6.9528	6.2424	0.92493	1.302	0.98271	0.27235	3.608	0.62753	0.35518

Project: DYNERGY HENNEPIN
Boring No.: HEN-016 S10
Sample No.: S-10
Test No.: 30.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/17/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-37.0'
Elevation: ----

Soil Description: VERY DARK GRAY LEAN CLAY WITH SAND CL FLY ASH AND SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.85 in
Specimen Area: 6.18 in^2
Specimen Volume: 36.12 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 41

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.1766	0	0	5.0416	7.2	7.2
2	5.0037	0.054	6.1799	31.761	0.37004	5.2399	7.2	7.57
3	10.004	0.11946	6.184	49.071	0.57134	5.3956	7.2	7.7713
4	15.004	0.18655	6.1881	59.764	0.69537	5.5105	7.2	7.8954
5	20.004	0.25528	6.1924	67.387	0.78352	5.605	7.2	7.9835
6	25.004	0.32237	6.1966	73.369	0.8525	5.686	7.2	8.0525
7	30.004	0.39109	6.2008	78.503	0.91153	5.7543	7.2	8.1115
8	35.004	0.45982	6.2051	82.844	0.96127	5.812	7.2	8.1613
9	40.004	0.52855	6.2094	86.444	1.0023	5.8575	7.2	8.2023
10	45.004	0.60055	6.2139	89.726	1.0396	5.9088	7.2	8.2396
11	50.004	0.66764	6.2181	92.584	1.072	5.9508	7.2	8.272
12	55.004	0.73473	6.2223	95.019	1.0995	5.9875	7.2	8.2995
13	60.004	0.80837	6.2269	97.507	1.1274	6.019	7.2	8.3274
14	70.004	0.94583	6.2356	101.48	1.1717	6.0791	7.2	8.3717
15	80.004	1.0882	6.2445	105.18	1.2128	6.1287	7.2	8.4128
16	90.004	1.2306	6.2535	108.25	1.2464	6.1695	7.2	8.4464
17	110	1.5153	6.2716	113.44	1.3023	6.2366	7.2	8.5023
18	120	1.6577	6.2807	115.93	1.329	6.2681	7.2	8.529
19	180	2.5037	6.3352	126.62	1.4391	6.3818	7.2	8.6391
20	240	3.3431	6.3902	134.46	1.515	6.443	7.2	8.715
21	300	4.2006	6.4474	141.18	1.5766	6.4798	7.2	8.7766
22	360	5.04	6.5044	146.84	1.6255	6.4955	7.2	8.8255
23	420	5.8779	6.5623	152.03	1.668	6.5048	7.2	8.868
24	480	6.7321	6.6224	156.32	1.6995	6.5095	7.2	8.8995
25	540	7.5781	6.683	160.45	1.7286	6.5083	7.2	8.9286
26	600	8.4224	6.7446	164.47	1.7557	6.5054	7.2	8.9557
27	660	9.2734	6.8079	168.18	1.7786	6.4984	7.2	8.9786
28	720	10.116	6.8717	171.56	1.7976	6.4868	7.2	8.9976
29	780	10.964	6.9372	174.9	1.8153	6.4827	7.2	9.0153
30	840	11.811	7.0038	177.7	1.8268	6.4757	7.2	9.0268
31	900	12.661	7.0719	179.98	1.8324	6.4599	7.2	9.0324
32	960	13.502	7.1407	182.42	1.8393	6.4611	7.2	9.0393
33	1020	14.359	7.2122	184.27	1.8396	6.4518	7.2	9.0396
34	1080	15.204	7.284	185.33	1.8319	6.4424	7.2	9.0319

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-016 S10
Sample No.: S-10
Test No.: 30.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/17/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-37.0'
Elevation: ----

Soil Description: VERY DARK GRAY LEAN CLAY WITH SAND CL FLY ASH AND SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.85 in
Specimen Area: 6.18 in^2
Specimen Volume: 36.12 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 41

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	7.2	7.2	0	0.000	2.1584	2.1584	1.000	2.1584	0
2	0.05	7.57	7.2	0.19828	0.536	2.3301	1.9601	1.189	2.1451	0.18502
3	0.12	7.7713	7.2	0.35399	0.620	2.3757	1.8044	1.317	2.0901	0.28567
4	0.19	7.8954	7.2	0.46888	0.674	2.3849	1.6895	1.412	2.0372	0.34768
5	0.26	7.9835	7.2	0.56336	0.719	2.3785	1.595	1.491	1.9868	0.39176
6	0.32	8.0525	7.2	0.64442	0.756	2.3665	1.514	1.563	1.9402	0.42625
7	0.39	8.1115	7.2	0.71265	0.782	2.3573	1.4457	1.631	1.9015	0.45577
8	0.46	8.1613	7.2	0.77039	0.801	2.3493	1.388	1.693	1.8686	0.48063
9	0.53	8.2023	7.2	0.81587	0.814	2.3448	1.3425	1.747	1.8437	0.50117
10	0.60	8.2396	7.2	0.86719	0.834	2.3308	1.2912	1.805	1.811	0.51982
11	0.67	8.272	7.2	0.90918	0.848	2.3212	1.2492	1.858	1.7852	0.53602
12	0.73	8.2995	7.2	0.94592	0.860	2.3119	1.2125	1.907	1.7622	0.54975
13	0.81	8.3274	7.2	0.97742	0.867	2.3084	1.181	1.955	1.7447	0.56372
14	0.95	8.3717	7.2	1.0375	0.885	2.2926	1.1209	2.045	1.7068	0.58586
15	1.09	8.4128	7.2	1.0871	0.896	2.2841	1.0713	2.132	1.6777	0.60638
16	1.23	8.4464	7.2	1.1279	0.905	2.2769	1.0305	2.209	1.6537	0.62319
17	1.52	8.5023	7.2	1.1949	0.918	2.2658	0.96343	2.352	1.6146	0.65117
18	1.66	8.529	7.2	1.2264	0.923	2.2609	0.93194	2.426	1.5964	0.66449
19	2.50	8.6391	7.2	1.3402	0.931	2.2573	0.81822	2.759	1.5378	0.71953
20	3.34	8.715	7.2	1.4014	0.925	2.2719	0.75699	3.001	1.5145	0.75748
21	4.20	8.7766	7.2	1.4381	0.912	2.2968	0.72025	3.189	1.5085	0.78829
22	5.04	8.8255	7.2	1.4539	0.894	2.33	0.7045	3.307	1.5172	0.81273
23	5.88	8.868	7.2	1.4632	0.877	2.3632	0.69517	3.399	1.5292	0.83402
24	6.73	8.8995	7.2	1.4679	0.864	2.39	0.6905	3.461	1.5403	0.84976
25	7.58	8.9286	7.2	1.4667	0.848	2.4203	0.69167	3.499	1.556	0.8643
26	8.42	8.9557	7.2	1.4638	0.834	2.4503	0.69458	3.528	1.5725	0.87787
27	9.27	8.9786	7.2	1.4568	0.819	2.4802	0.70158	3.535	1.5909	0.88931
28	10.12	8.9976	7.2	1.4451	0.804	2.5108	0.71325	3.520	1.612	0.8988
29	10.96	9.0153	7.2	1.441	0.794	2.5326	0.71733	3.531	1.625	0.90763
30	11.81	9.0268	7.2	1.434	0.785	2.5511	0.72433	3.522	1.6377	0.91341
31	12.66	9.0324	7.2	1.4183	0.774	2.5725	0.74007	3.476	1.6563	0.9162
32	13.50	9.0393	7.2	1.4195	0.772	2.5782	0.73891	3.489	1.6586	0.91965
33	14.36	9.0396	7.2	1.4101	0.767	2.5878	0.74824	3.459	1.668	0.91979
34	15.20	9.0319	7.2	1.4008	0.765	2.5895	0.75757	3.418	1.6735	0.91595

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-016 S10
Sample No.: S-10
Test No.: 60.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/17/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 35.0'-37.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: VERY DARK GRAY LEAN CLAY WITH SAND CL FLY ASH AND SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.76 in
Specimen Area: 6.09 in^2
Specimen Volume: 35.05 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 41

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.085	1.2705	0.015032	5.0706	9.36	9.375
2	5.0035	0.047279	6.0879	29.485	0.34871	5.2986	9.36	9.7087
3	5.0001	0.063039	6.0888	37.849	0.44756	5.3655	9.36	9.8076
4	10.004	0.11189	6.0918	57.964	0.68509	5.5412	9.36	10.045
5	10	0.12923	6.0929	64.052	0.75691	5.5964	9.36	10.117
6	15.004	0.17966	6.096	77.815	0.91908	5.7401	9.36	10.279
7	15	0.197	6.097	81.838	0.96643	5.7855	9.36	10.326
8	20.004	0.24585	6.1	92.214	1.0884	5.9146	9.36	10.448
9	20	0.26476	6.1012	95.39	1.1257	5.9576	9.36	10.486
10	25.004	0.31519	6.1042	103.81	1.2244	6.0699	9.36	10.584
11	25	0.3341	6.1054	106.51	1.256	6.1071	9.36	10.616
12	30.004	0.38611	6.1086	113.02	1.3321	6.2054	9.36	10.692
13	30	0.40345	6.1097	115.03	1.3556	6.2368	9.36	10.716
14	35.004	0.45545	6.1129	120.9	1.4241	6.3229	9.36	10.784
15	35	0.47279	6.1139	122.97	1.4481	6.3496	9.36	10.808
16	40.004	0.52322	6.117	127.42	1.4997	6.4229	9.36	10.86
17	40	0.54213	6.1182	129.32	1.5219	6.4485	9.36	10.882
18	45.004	0.59572	6.1215	133.82	1.574	6.5218	9.36	10.934
19	45	0.61305	6.1225	134.93	1.5868	6.5451	9.36	10.947
20	50.004	0.66506	6.1257	138.9	1.6326	6.6096	9.36	10.993
21	50	0.68397	6.1269	140.17	1.6472	6.6317	9.36	11.007
22	55.004	0.73598	6.1301	143.67	1.6874	6.6899	9.36	11.047
23	55	0.75331	6.1312	145.15	1.7045	6.7097	9.36	11.065
24	60.004	0.80374	6.1343	148.85	1.7471	6.7574	9.36	11.107
25	60	0.82108	6.1354	149.81	1.758	6.7731	9.36	11.118
26	70.004	0.94558	6.1431	155.37	1.821	6.8865	9.36	11.181
27	70	0.96449	6.1443	156.27	1.8312	6.9033	9.36	11.191
28	80.004	1.0874	6.1519	161.82	1.8939	6.997	9.36	11.254
29	80	1.1063	6.1531	162.78	1.9047	7.0086	9.36	11.265
30	90.004	1.2277	6.1606	167.06	1.9525	7.0889	9.36	11.313
31	90	1.2466	6.1618	167.44	1.9565	7.1017	9.36	11.316
32	100	1.3727	6.1697	172.09	2.0083	7.1802	9.36	11.368
33	100	1.39	6.1708	172.78	2.016	7.1907	9.36	11.376
34	110	1.5145	6.1786	175.85	2.0492	7.243	9.36	11.409
35	110	1.5334	6.1798	176.43	2.0556	7.2552	9.36	11.416
36	120	1.6563	6.1875	180.19	2.0968	7.3175	9.36	11.457
37	120	1.6753	6.1887	180.72	2.1025	7.3274	9.36	11.463
38	180	2.5168	6.2421	197.34	2.2763	7.5908	9.36	11.636
39	180	2.5357	6.2433	197.56	2.2783	7.5961	9.36	11.638
40	240	3.3789	6.2978	209.2	2.3917	7.7543	9.36	11.752
41	240	3.3978	6.299	209.36	2.3931	7.7549	9.36	11.753
42	300	4.2409	6.3545	219.21	2.4837	7.8566	9.36	11.844
43	300	4.2598	6.3558	219.52	2.4868	7.8601	9.36	11.847
44	360	5.103	6.4122	226.41	2.5422	7.9229	9.36	11.902
45	360	5.1235	6.4136	226.62	2.544	7.9253	9.36	11.904
46	420	5.9698	6.4713	232.81	2.5903	7.9706	9.36	11.95
47	420	5.9871	6.4725	233.13	2.5933	7.9712	9.36	11.953
48	480	6.8271	6.5309	238.42	2.6285	8.0055	9.36	11.988
49	480	6.8444	6.5321	238.63	2.6303	8.0073	9.36	11.99
50	540	7.686	6.5916	243.77	2.6627	8.0207	9.36	12.023
51	540	7.7049	6.593	244.14	2.6662	8.023	9.36	12.026
52	600	8.5543	6.6542	249.06	2.6949	8.0364	9.36	12.055
53	600	8.5733	6.6556	249.11	2.6949	8.0352	9.36	12.055
54	660	9.4117	6.7172	253.99	2.7224	8.0433	9.36	12.082
55	660	9.4306	6.7186	253.77	2.7196	8.0433	9.36	12.08
56	720	10.267	6.7813	257.8	2.7371	8.041	9.36	12.097
57	720	10.286	6.7827	257.64	2.7349	8.0416	9.36	12.095
58	780	11.136	6.8475	262.03	2.7552	8.0474	9.36	12.115
59	780	11.153	6.8489	261.93	2.7535	8.0451	9.36	12.114
60	840	11.998	6.9146	265.37	2.7632	8.0445	9.36	12.123
61	840	12.017	6.9161	265.26	2.7615	8.0439	9.36	12.121
62	900	12.861	6.9831	268.54	2.7688	8.0364	9.36	12.129
63	900	12.88	6.9847	268.6	2.7688	8.0364	9.36	12.129
64	960	13.731	7.0536	270.98	2.766	8.0375	9.36	12.126
65	960	13.75	7.0551	271.72	2.773	8.0369	9.36	12.133
66	1020	14.592	7.1246	273.41	2.763	8.0369	9.36	12.123
67	1020	14.611	7.1262	273.73	2.7656	8.0381	9.36	12.126
68	1080	15.451	7.197	275.11	2.7522	8.0346	9.36	12.112

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-016 S10
Sample No.: S-10
Test No.: 60.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/17/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 35.0'-37.0'
Elevation: ----

Terracon Consulting Engineers & Scientists

Soil Description: VERY DARK GRAY LEAN CLAY WITH SAND CL FLY ASH AND SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.76 in
Specimen Area: 6.09 in^2
Specimen Volume: 35.05 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 41

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	9.375	9.36	0	0.000	4.3044	4.2894	1.004	4.2969	0.0075162
2	0.05	9.7087	9.36	0.228	0.683	4.4101	4.0614	1.086	4.2357	0.17436
3	0.06	9.8076	9.36	0.29489	0.682	4.442	3.9945	1.112	4.2183	0.22378
4	0.11	10.045	9.36	0.47054	0.702	4.5039	3.8188	1.179	4.1614	0.34254
5	0.13	10.117	9.36	0.52579	0.709	4.5205	3.7636	1.201	4.142	0.37845
6	0.18	10.279	9.36	0.66945	0.741	4.539	3.6199	1.254	4.0795	0.45954
7	0.20	10.326	9.36	0.71482	0.751	4.541	3.5745	1.270	4.0578	0.48322
8	0.25	10.448	9.36	0.84394	0.786	4.5338	3.4454	1.316	3.9896	0.54421
9	0.26	10.486	9.36	0.88698	0.799	4.5281	3.4024	1.331	3.9652	0.56285
10	0.32	10.584	9.36	0.99924	0.826	4.5145	3.2901	1.372	3.9023	0.6122
11	0.33	10.616	9.36	1.0365	0.835	4.5089	3.2529	1.386	3.8809	0.62801
12	0.39	10.692	9.36	1.1348	0.862	4.4867	3.1546	1.422	3.8207	0.66605
13	0.40	10.716	9.36	1.1662	0.870	4.4788	3.1232	1.434	3.801	0.67779
14	0.46	10.784	9.36	1.2522	0.889	4.4612	3.0371	1.469	3.7492	0.71204
15	0.47	10.808	9.36	1.279	0.892	4.4585	3.0104	1.481	3.7344	0.72407
16	0.52	10.86	9.36	1.3523	0.911	4.4368	2.9371	1.511	3.6869	0.74987
17	0.54	10.882	9.36	1.3779	0.914	4.4334	2.9115	1.523	3.6724	0.76094
18	0.60	10.934	9.36	1.4512	0.931	4.4122	2.8382	1.555	3.6252	0.78699
19	0.61	10.947	9.36	1.4744	0.938	4.4017	2.8149	1.564	3.6083	0.79339
20	0.67	10.993	9.36	1.539	0.951	4.383	2.7504	1.594	3.5667	0.81631
21	0.68	11.007	9.36	1.5611	0.956	4.3755	2.7283	1.604	3.5519	0.82362
22	0.74	11.047	9.36	1.6193	0.968	4.3575	2.6701	1.632	3.5138	0.84371
23	0.75	11.065	9.36	1.639	0.970	4.3549	2.6503	1.643	3.5026	0.85226
24	0.80	11.107	9.36	1.6867	0.974	4.3498	2.6026	1.671	3.4762	0.87357
25	0.82	11.118	9.36	1.7024	0.977	4.345	2.5869	1.680	3.4659	0.87901
26	0.95	11.181	9.36	1.8158	1.005	4.2945	2.4735	1.736	3.384	0.91048
27	0.96	11.191	9.36	1.8327	1.009	4.2878	2.4567	1.745	3.3722	0.91558
28	1.09	11.254	9.36	1.9264	1.025	4.2569	2.363	1.801	3.31	0.94697
29	1.11	11.265	9.36	1.938	1.026	4.2561	2.3514	1.810	3.3037	0.95236
30	1.23	11.313	9.36	2.0183	1.042	4.2236	2.2711	1.860	3.2474	0.97625
31	1.25	11.316	9.36	2.031	1.046	4.2148	2.2583	1.866	3.2365	0.97823
32	1.37	11.368	9.36	2.1096	1.058	4.1881	2.1798	1.921	3.184	1.0042
33	1.39	11.376	9.36	2.12	1.060	4.1853	2.1693	1.929	3.1773	1.008
34	1.51	11.409	9.36	2.1724	1.068	4.1662	2.117	1.968	3.1416	1.0246
35	1.53	11.416	9.36	2.1846	1.071	4.1604	2.1048	1.977	3.1326	1.0278
36	1.66	11.457	9.36	2.2468	1.079	4.1393	2.0425	2.027	3.0909	1.0484
37	1.68	11.463	9.36	2.2567	1.081	4.1352	2.0326	2.034	3.0839	1.0513
38	2.52	11.636	9.36	2.5202	1.115	4.0454	1.7692	2.287	2.9073	1.1381
39	2.54	11.638	9.36	2.5254	1.116	4.0422	1.7639	2.292	2.9031	1.1391
40	3.38	11.752	9.36	2.6836	1.129	3.9974	1.6057	2.489	2.8016	1.1959
41	3.40	11.753	9.36	2.6842	1.129	3.9982	1.6051	2.491	2.8017	1.1965
42	4.24	11.844	9.36	2.786	1.129	3.9871	1.5034	2.652	2.7452	1.2419
43	4.26	11.847	9.36	2.7895	1.129	3.9867	1.4999	2.658	2.7433	1.2434
44	5.10	11.902	9.36	2.8523	1.129	3.9793	1.4371	2.769	2.7082	1.2711
45	5.12	11.904	9.36	2.8546	1.129	3.9788	1.4347	2.773	2.7067	1.272
46	5.97	11.95	9.36	2.9	1.126	3.9796	1.3894	2.864	2.6845	1.2951
47	5.99	11.953	9.36	2.9006	1.125	3.9821	1.3888	2.867	2.6854	1.2967
48	6.83	11.988	9.36	2.9349	1.123	3.983	1.3545	2.941	2.6687	1.3142
49	6.84	11.99	9.36	2.9366	1.123	3.9831	1.3527	2.944	2.6679	1.3152
50	7.69	12.023	9.36	2.95	1.114	4.002	1.3393	2.988	2.6707	1.3313
51	7.70	12.026	9.36	2.9523	1.114	4.0032	1.337	2.994	2.6701	1.3331
52	8.55	12.055	9.36	2.9657	1.107	4.0185	1.3236	3.036	2.6711	1.3474
53	8.57	12.055	9.36	2.9646	1.106	4.0197	1.3248	3.034	2.6723	1.3475
54	9.41	12.082	9.36	2.9727	1.098	4.0391	1.3167	3.068	2.6779	1.3612
55	9.43	12.08	9.36	2.9727	1.099	4.0362	1.3167	3.065	2.6764	1.3598
56	10.27	12.097	9.36	2.9704	1.091	4.0561	1.319	3.075	2.6876	1.3686
57	10.29	12.095	9.36	2.971	1.092	4.0533	1.3184	3.074	2.6858	1.3674
58	11.14	12.115	9.36	2.9768	1.086	4.0678	1.3126	3.099	2.6902	1.3776
59	11.15	12.114	9.36	2.9744	1.086	4.0685	1.3149	3.094	2.6917	1.3768
60	12.00	12.123	9.36	2.9739	1.082	4.0787	1.3155	3.100	2.6971	1.3816
61	12.02	12.121	9.36	2.9733	1.083	4.0776	1.3161	3.098	2.6968	1.3807
62	12.86	12.129	9.36	2.9657	1.077	4.0925	1.3236	3.092	2.708	1.3844
63	12.88	12.129	9.36	2.9657	1.077	4.0924	1.3236	3.092	2.708	1.3844
64	13.73	12.126	9.36	2.9669	1.078	4.0885	1.3225	3.092	2.7055	1.383
65	13.75	12.133	9.36	2.9663	1.076	4.096	1.3231	3.096	2.7096	1.3865
66	14.59	12.123	9.36	2.9663	1.079	4.0861	1.3231	3.088	2.7046	1.3815
67	14.61	12.126	9.36	2.9675	1.079	4.0875	1.3219	3.092	2.7047	1.3828
68	15.45	12.112	9.36	2.964	1.083	4.0776	1.3254	3.077	2.7015	1.3761

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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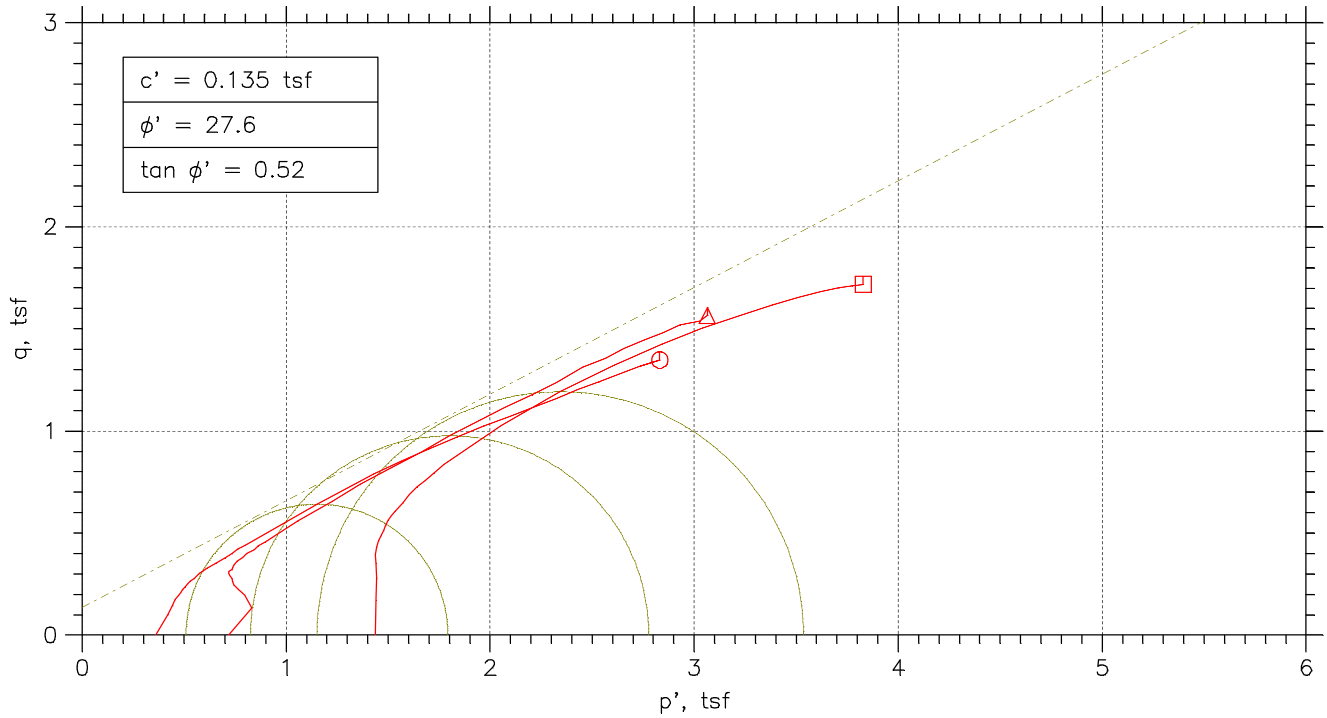
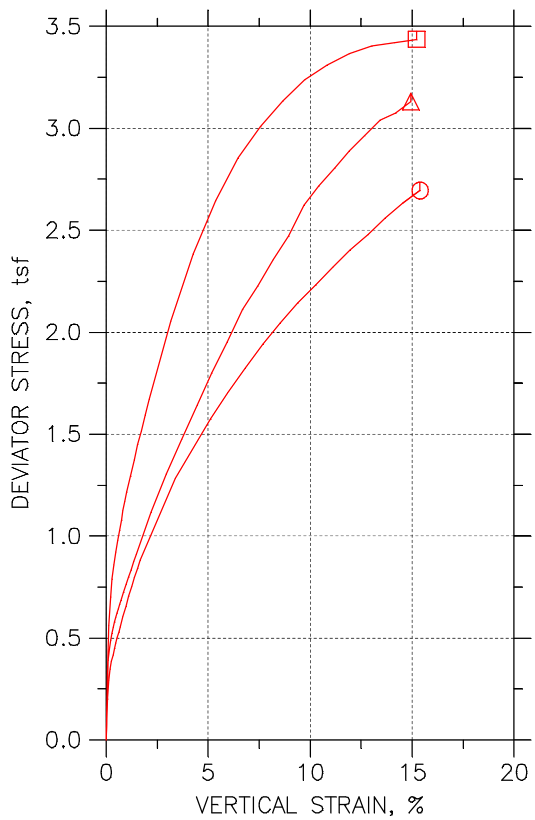
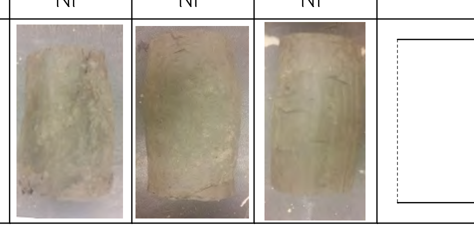




Symbol		⦶	△	⊡	
Test No.		5.0 PSI	10.0 PSI	20.0 PSI	
Initial	Diameter, in	2.8799	2.8646	2.8394	
	Height, in	5.9846	5.9776	5.9764	
	Water Content, %	45.39	45.24	43.38	
	Dry Density, pcf	69.73	70.52	76.64	
	Saturation, %	98.57	100.41	114.22	
	Void Ratio	1.0592	1.0362	0.87359	
Before Shear	Water Content, %	45.39	45.24	43.38	
	Dry Density, pcf	70.25	70.37	71.87	
	Saturation, %	100.00	100.00	100.00	
	Void Ratio	1.044	1.0404	0.99783	
	Back Press., tsf	5.0405	5.0425	5.0416	
Minor Prin. Stress, tsf		0.35947	0.71748	1.4384	
Max. Dev. Stress, tsf		2.6948	3.1306	3.4366	
Time to Failure, min		1080	1200	840	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value		0.98	0.99	0.96	
Estimated Specific Gravity		2.30	2.30	2.30	
Liquid Limit		NP	NP	NP	
Plastic Limit		NP	NP	NP	
Plasticity Index		NP	NP	NP	

Failure Sketch



Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN-018 S-5
Sample Type: 3.0'' ST
Description: DARK GRAY TO GRAY FLY ASH WITH SAND AND GRAVEL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Tue, 22-DEC-2015 13:15:37

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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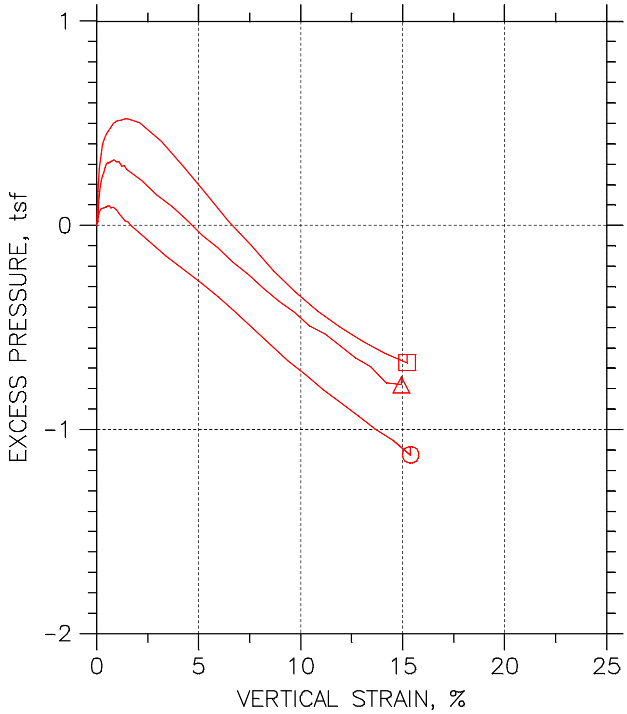

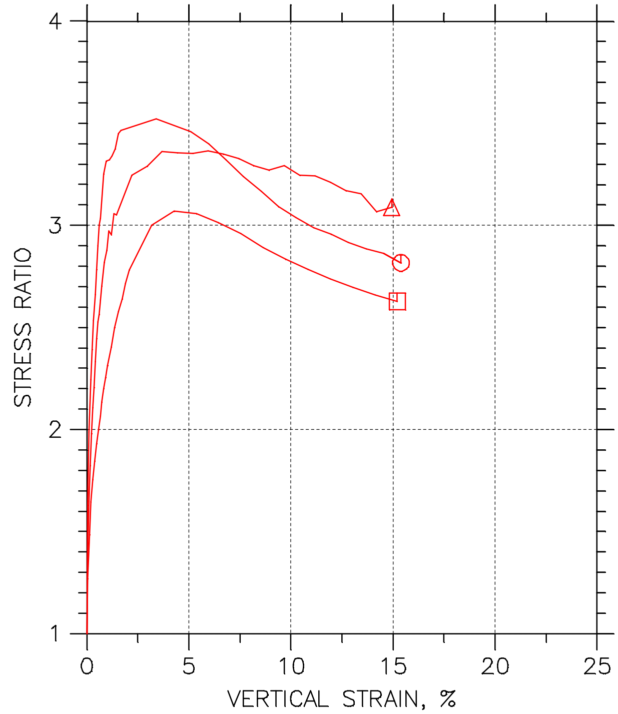

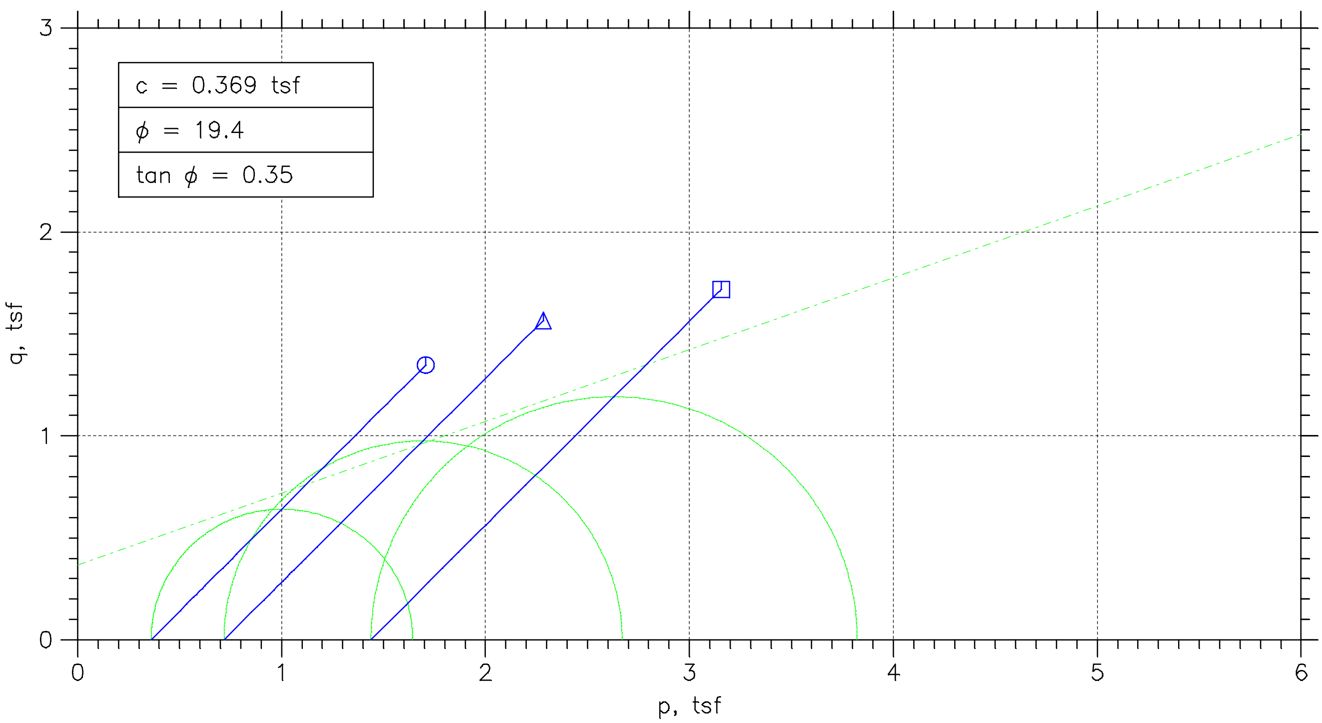

Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
Boring No.: HEN-018 S-5	Tested By: BCM	Checked By: WPQ
Sample No.: S-5	Test Date: 12/16/15	Depth: 10.0'-12.0'
Test No.: HEN-018 S-5	Sample Type: 3.0" ST	Elevation: ----
Description: DARK GRAY TO GRAY FLY ASH WITH SAND AND GRAVEL		
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.		

Tue, 22-DEC-2015 13:16:23

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-018 S-5
Sample No.: S-5
Test No.: 5.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: ----

Terracon Consulting Engineers & Scientists

Soil Description: DARK GRAY TO GRAY FLY ASH WITH SAND AND GRAVEL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.98 in
Specimen Area: 6.51 in^2
Specimen Volume: 38.98 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: NP

Plastic Limit: NP

Estimated Specific Gravity: 2.30

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.5141	0	0	5.0405	5.4	5.4
2	5.001	0.052041	6.5174	18.3	0.20216	5.0794	5.4	5.6022
3	10.001	0.12301	6.5221	26.427	0.29174	5.1044	5.4	5.6917
4	15.001	0.19239	6.5266	31.613	0.34875	5.1201	5.4	5.7487
5	20.001	0.26336	6.5313	35.053	0.38643	5.1224	5.4	5.7864
6	25.001	0.33432	6.5359	37.995	0.41856	5.1271	5.4	5.8186
7	30.001	0.40687	6.5407	40.738	0.44844	5.13	5.4	5.8484
8	35.001	0.47625	6.5452	43.231	0.47556	5.1334	5.4	5.8756
9	40.001	0.54722	6.5499	45.774	0.50317	5.1352	5.4	5.9032
10	45.001	0.61818	6.5546	48.267	0.5302	5.1352	5.4	5.9302
11	50.001	0.68757	6.5591	50.611	0.55555	5.1271	5.4	5.9556
12	60.002	0.82793	6.5684	55.348	0.60669	5.1305	5.4	6.0067
13	70.002	0.96828	6.5777	59.935	0.65605	5.1166	5.4	6.056
14	80.002	1.1086	6.5871	64.522	0.70526	5.0963	5.4	6.1053
15	90.002	1.2506	6.5965	69.06	0.75377	5.0777	5.4	6.1538
16	100	1.3925	6.606	73.149	0.79726	5.0643	5.4	6.1973
17	110	1.536	6.6157	77.237	0.84059	5.0568	5.4	6.2406
18	120	1.6779	6.6252	81.226	0.88273	5.0417	5.4	6.2827
19	240	3.4	6.7433	120.17	1.2831	4.8913	5.4	6.6831
20	360	5.1095	6.8648	150.09	1.5742	4.76	5.4	6.9742
21	420	5.9674	6.9274	163.85	1.703	4.6898	5.4	7.103
22	480	6.8205	6.9909	177.11	1.8241	4.6143	5.4	7.2241
23	540	7.6753	7.0556	190.18	1.9407	4.533	5.4	7.3407
24	600	8.5395	7.1223	202.49	2.047	4.4552	5.4	7.447
25	660	9.391	7.1892	213.96	2.1428	4.3762	5.4	7.5428
26	720	10.252	7.2582	224.88	2.2308	4.3059	5.4	7.6308
27	780	11.108	7.3281	235.9	2.3178	4.2345	5.4	7.7178
28	840	11.958	7.3988	246.92	2.4028	4.1718	5.4	7.8028
29	900	12.826	7.4724	257.29	2.4791	4.1062	5.4	7.8791
30	960	13.68	7.5464	268.41	2.5609	4.0417	5.4	7.9609
31	1020	14.53	7.6215	278.53	2.6313	3.9871	5.4	8.0313
32	1080	15.39	7.6989	288.16	2.6948	3.9163	5.4	8.0948
33	1020	14.53	7.6215	278.53	2.6313	3.9871	5.4	8.0313
34	1080	15.39	7.6989	288.16	2.6948	3.9163	5.4	8.0948
35	1080	15.39	7.6989	288.16	2.6948	3.9163	5.4	8.0948

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-018 S-5
Sample No.: S-5
Test No.: 5.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: ----

Terracon Consulting Engineers & Scientists

Soil Description: DARK GRAY TO GRAY FLY ASH WITH SAND AND GRAVEL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.98 in
Specimen Area: 6.51 in^2
Specimen Volume: 38.98 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: NP

Plastic Limit: NP

Estimated Specific Gravity: 2.30

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	5.4	5.4	0	0.000	0.35947	0.35947	1.000	0.35947	0
2	0.05	5.6022	5.4	0.038907	0.192	0.52273	0.32057	1.631	0.42165	0.10108
3	0.12	5.6917	5.4	0.063878	0.219	0.58734	0.2956	1.987	0.44147	0.14587
4	0.19	5.7487	5.4	0.079557	0.228	0.62866	0.27992	2.246	0.45429	0.17437
5	0.26	5.7864	5.4	0.08188	0.212	0.66402	0.27759	2.392	0.47081	0.19321
6	0.33	5.8186	5.4	0.086525	0.207	0.69151	0.27295	2.533	0.48223	0.20928
7	0.41	5.8484	5.4	0.089429	0.199	0.71849	0.27004	2.661	0.49427	0.22422
8	0.48	5.8756	5.4	0.092913	0.195	0.74212	0.26656	2.784	0.50434	0.23778
9	0.55	5.9032	5.4	0.094655	0.188	0.76799	0.26482	2.900	0.5164	0.25159
10	0.62	5.9302	5.4	0.094655	0.179	0.79502	0.26482	3.002	0.52992	0.2651
11	0.69	5.9556	5.4	0.086525	0.156	0.8285	0.27295	3.035	0.55072	0.27778
12	0.83	6.0067	5.4	0.090009	0.148	0.87616	0.26946	3.251	0.57281	0.30335
13	0.97	6.056	5.4	0.076072	0.116	0.93945	0.2834	3.315	0.61142	0.32802
14	1.11	6.1053	5.4	0.055748	0.079	1.009	0.30373	3.322	0.65636	0.35263
15	1.25	6.1538	5.4	0.037165	0.049	1.0761	0.32231	3.339	0.69919	0.37689
16	1.39	6.1973	5.4	0.023809	0.030	1.1329	0.33566	3.375	0.73429	0.39863
17	1.54	6.2406	5.4	0.01626	0.019	1.1838	0.34321	3.449	0.76351	0.4203
18	1.68	6.2827	5.4	0.0011614	0.001	1.241	0.35831	3.464	0.79968	0.44137
19	3.40	6.6831	5.4	-0.14924	-0.116	1.7918	0.50871	3.522	1.1503	0.64154
20	5.11	6.9742	5.4	-0.28048	-0.178	2.2141	0.63995	3.460	1.427	0.78708
21	5.97	7.103	5.4	-0.35075	-0.206	2.4132	0.71022	3.398	1.5617	0.85148
22	6.82	7.2241	5.4	-0.42624	-0.234	2.6098	0.78571	3.322	1.6978	0.91205
23	7.68	7.3407	5.4	-0.50754	-0.262	2.8077	0.86701	3.238	1.8374	0.97034
24	8.54	7.447	5.4	-0.58535	-0.286	2.9919	0.94482	3.167	1.9683	1.0235
25	9.39	7.5428	5.4	-0.66433	-0.310	3.1666	1.0238	3.093	2.0952	1.0714
26	10.25	7.6308	5.4	-0.73459	-0.329	3.3249	1.0941	3.039	2.2095	1.1154
27	11.11	7.7178	5.4	-0.80602	-0.348	3.4833	1.1655	2.989	2.3244	1.1589
28	11.96	7.8028	5.4	-0.86874	-0.362	3.6311	1.2282	2.956	2.4296	1.2014
29	12.83	7.8791	5.4	-0.93436	-0.377	3.7729	1.2938	2.916	2.5334	1.2396
30	13.68	7.9609	5.4	-0.99881	-0.390	3.9192	1.3583	2.885	2.6387	1.2804
31	14.53	8.0313	5.4	-1.0534	-0.400	4.0442	1.4129	2.862	2.7285	1.3156
32	15.39	8.0948	5.4	-1.1242	-0.417	4.1786	1.4837	2.816	2.8311	1.3474
33	14.53	8.0313	5.4	-1.0534	-0.400	4.0442	1.4129	2.862	2.7285	1.3156
34	15.39	8.0948	5.4	-1.1242	-0.417	4.1786	1.4837	2.816	2.8311	1.3474
35	15.39	8.0948	5.4	-1.1242	-0.417	4.1786	1.4837	2.816	2.8311	1.3474

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-018 S-5
Sample No.: S-5
Test No.: 10.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3" ST

Project No.: MR155233
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: -----

Terracon
Consulting Engineers & Scientists

Soil Description: DARK GRAY TO GRAY FLY ASH WITH SAND AND GRAVEL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.98 in
Specimen Area: 6.44 in^2
Specimen Volume: 38.52 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: NP

Plastic Limit: NP

Estimated Specific Gravity: 2.30

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.4448	0	0	5.0425	5.76	5.76
2	5.0003	0.049768	6.448	23.994	0.26792	5.0618	5.76	6.0279
3	10.001	0.11059	6.4519	35.036	0.39099	5.1571	5.76	6.151
4	15.001	0.17142	6.4558	40.066	0.44685	5.2185	5.76	6.2068
5	20.001	0.23225	6.4598	43.94	0.48975	5.2612	5.76	6.2498
6	25.001	0.29308	6.4637	47.12	0.52487	5.2851	5.76	6.2849
7	30.001	0.35667	6.4678	49.722	0.5535	5.3009	5.76	6.3135
8	35.001	0.42026	6.472	52.15	0.58016	5.3243	5.76	6.3402
9	40.001	0.48109	6.4759	54.289	0.60359	5.3424	5.76	6.3636
10	45.001	0.54191	6.4799	56.139	0.62378	5.3518	5.76	6.3838
11	50.001	0.60274	6.4839	58.047	0.64459	5.3483	5.76	6.4046
12	55.001	0.66633	6.488	59.84	0.66406	5.3535	5.76	6.4241
13	60.001	0.72716	6.492	61.69	0.68418	5.3582	5.76	6.4442
14	70.001	0.84881	6.4999	65.332	0.72368	5.3623	5.76	6.4837
15	80.002	0.97323	6.5081	68.859	0.76179	5.3541	5.76	6.5218
16	90.002	1.0949	6.5161	72.386	0.79983	5.3547	5.76	6.5598
17	100	1.2193	6.5243	75.739	0.83583	5.3325	5.76	6.5958
18	110	1.341	6.5324	79.324	0.87431	5.3348	5.76	6.6343
19	120	1.4626	6.5404	82.677	0.91014	5.3161	5.76	6.6701
20	180	2.2091	6.5904	102.22	1.1167	5.2623	5.76	6.8767
21	240	2.9529	6.6409	120.37	1.3051	5.1898	5.76	7.0651
22	300	3.6939	6.692	137.14	1.4755	5.1355	5.76	7.2355
23	360	4.4487	6.7448	153.62	1.6398	5.0642	5.76	7.3998
24	420	5.1869	6.7973	169.86	1.7993	4.9946	5.76	7.5593
25	480	5.9306	6.8511	185.76	1.9522	4.9349	5.76	7.7122
26	540	6.6882	6.9067	202.59	2.1119	4.8613	5.76	7.8719
27	600	7.4403	6.9628	215.48	2.2282	4.8022	5.76	7.9882
28	660	8.1785	7.0188	229.65	2.3557	4.7327	5.76	8.1157
29	720	8.9361	7.0772	243.12	2.4733	4.6707	5.76	8.2333
30	780	9.6881	7.1361	259.94	2.6227	4.6163	5.76	8.3827
31	840	10.432	7.1954	271.39	2.7156	4.5508	5.76	8.4756
32	900	11.189	7.2568	282.66	2.8045	4.5093	5.76	8.5645
33	960	11.933	7.3181	293.71	2.8897	4.4532	5.76	8.6497
34	1020	12.677	7.3804	303.94	2.9651	4.3942	5.76	8.7251
35	1080	13.443	7.4457	314.29	3.0392	4.3497	5.76	8.7992
36	1140	14.189	7.5105	320.82	3.0756	4.2708	5.76	8.8356
37	1200	14.939	7.5766	329.44	3.1306	4.2609	5.76	8.8906

Project: DYNERGY HENNEPIN
Boring No.: HEN-018 S-5
Sample No.: S-5
Test No.: 10.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3" ST

Project No.: MR155233
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: -----

Soil Description: DARK GRAY TO GRAY FLY ASH WITH SAND AND GRAVEL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.98 in
Specimen Area: 6.44 in^2
Specimen Volume: 38.52 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: NP

Plastic Limit: NP

Estimated Specific Gravity: 2.30

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	5.76	5.76	0	0.000	0.71748	0.71748	1.000	0.71748	0
2	0.05	6.0279	5.76	0.019293	0.072	0.96611	0.69819	1.384	0.83215	0.13396
3	0.11	6.151	5.76	0.11459	0.293	0.99388	0.60289	1.649	0.79839	0.19549
4	0.17	6.2068	5.76	0.17598	0.394	0.98835	0.5415	1.825	0.76493	0.22342
5	0.23	6.2498	5.76	0.21866	0.446	0.98858	0.49882	1.982	0.7437	0.24488
6	0.29	6.2849	5.76	0.24263	0.462	0.99973	0.47485	2.105	0.73729	0.26244
7	0.36	6.3135	5.76	0.25841	0.467	1.0126	0.45907	2.206	0.73582	0.27675
8	0.42	6.3402	5.76	0.2818	0.486	1.0158	0.43568	2.332	0.72577	0.29008
9	0.48	6.3636	5.76	0.29992	0.497	1.0212	0.41756	2.446	0.71936	0.3018
10	0.54	6.3838	5.76	0.30927	0.496	1.032	0.40821	2.528	0.7201	0.31189
11	0.60	6.4046	5.76	0.30577	0.474	1.0563	0.41171	2.566	0.73401	0.32229
12	0.67	6.4241	5.76	0.31103	0.468	1.0705	0.40645	2.634	0.73848	0.33203
13	0.73	6.4442	5.76	0.31571	0.461	1.0859	0.40177	2.703	0.74386	0.34209
14	0.85	6.4837	5.76	0.3198	0.442	1.1214	0.39768	2.820	0.75952	0.36184
15	0.97	6.5218	5.76	0.31161	0.409	1.1677	0.40587	2.877	0.78676	0.3809
16	1.09	6.5598	5.76	0.3122	0.390	1.2051	0.40528	2.974	0.8052	0.39991
17	1.22	6.5958	5.76	0.28998	0.347	1.2633	0.4275	2.955	0.84541	0.41791
18	1.34	6.6343	5.76	0.29232	0.334	1.2995	0.42516	3.056	0.86231	0.43715
19	1.46	6.6701	5.76	0.27361	0.301	1.354	0.44387	3.050	0.89894	0.45507
20	2.21	6.8767	5.76	0.21982	0.197	1.6144	0.49766	3.244	1.056	0.55837
21	2.95	7.0651	5.76	0.14733	0.113	1.8752	0.57015	3.289	1.2227	0.65254
22	3.69	7.2355	5.76	0.092958	0.063	2.1	0.62452	3.363	1.3623	0.73775
23	4.45	7.3998	5.76	0.021632	0.013	2.3357	0.69585	3.357	1.5158	0.81992
24	5.19	7.5593	5.76	-0.04794	-0.027	2.5647	0.76542	3.351	1.665	0.89963
25	5.93	7.7122	5.76	-0.10757	-0.055	2.7773	0.82505	3.366	1.8012	0.97612
26	6.69	7.8719	5.76	-0.18124	-0.086	3.0106	0.89872	3.350	1.9547	1.0559
27	7.44	7.9882	5.76	-0.24029	-0.108	3.186	0.95777	3.326	2.0719	1.1141
28	8.18	8.1157	5.76	-0.30986	-0.132	3.3831	1.0273	3.293	2.2052	1.1779
29	8.94	8.2333	5.76	-0.37183	-0.150	3.5627	1.0893	3.271	2.326	1.2367
30	9.69	8.3827	5.76	-0.4262	-0.163	3.7664	1.1437	3.293	2.455	1.3113
31	10.43	8.4756	5.76	-0.49168	-0.181	3.9248	1.2092	3.246	2.567	1.3578
32	11.19	8.5645	5.76	-0.53319	-0.190	4.0552	1.2507	3.242	2.6529	1.4023
33	11.93	8.6497	5.76	-0.58932	-0.204	4.1965	1.3068	3.211	2.7516	1.4448
34	12.68	8.7251	5.76	-0.64837	-0.219	4.3309	1.3658	3.171	2.8484	1.4826
35	13.44	8.7992	5.76	-0.6928	-0.228	4.4495	1.4103	3.155	2.9299	1.5196
36	14.19	8.8356	5.76	-0.77172	-0.251	4.5648	1.4892	3.065	3.027	1.5378
37	14.94	8.8906	5.76	-0.78166	-0.250	4.6297	1.4991	3.088	3.0644	1.5653

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-018 S-5
Sample No.: S-5
Test No.: 20.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: ----

Soil Description: DARK GRAY TO GRAY FLY ASH WITH SAND AND GRAVEL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.98 in
Specimen Area: 6.33 in^2
Specimen Volume: 37.84 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: NP

Plastic Limit: NP

Estimated Specific Gravity: 2.30

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3319	0	0	5.0416	6.48	6.48
2	5.0042	0.056979	6.3355	29.948	0.34034	5.2096	6.48	6.8203
3	10	0.13295	6.3403	49.51	0.56223	5.3192	6.48	7.0422
4	15	0.21525	6.3456	61.928	0.70267	5.3921	6.48	7.1827
5	20	0.29756	6.3508	69.621	0.78931	5.4364	6.48	7.2693
6	25.001	0.38619	6.3564	75.886	0.85956	5.4656	6.48	7.3396
7	30.001	0.47483	6.3621	81.545	0.92285	5.4878	6.48	7.4028
8	35.001	0.56557	6.3679	86.436	0.9773	5.5041	6.48	7.4573
9	40.001	0.65843	6.3739	90.997	1.0279	5.5169	6.48	7.5079
10	45.001	0.74495	6.3794	95.503	1.0779	5.5315	6.48	7.5579
11	50.001	0.83147	6.385	99.844	1.1259	5.542	6.48	7.6059
12	55.001	0.92011	6.3907	103.8	1.1694	5.5484	6.48	7.6494
13	60.001	1.0109	6.3966	108.03	1.216	5.5542	6.48	7.696
14	70.001	1.1902	6.4082	115.39	1.2965	5.5577	6.48	7.7765
15	80.001	1.3675	6.4197	122.54	1.3743	5.5636	6.48	7.8543
16	90.001	1.549	6.4315	129.41	1.4487	5.5618	6.48	7.9287
17	100	1.7305	6.4434	135.73	1.5166	5.5554	6.48	7.9966
18	110	1.9077	6.455	142.76	1.5923	5.5513	6.48	8.0723
19	120	2.0892	6.467	149.96	1.6695	5.5432	6.48	8.1495
20	180	3.1824	6.54	186.55	2.0538	5.4534	6.48	8.5338
21	240	4.2755	6.6147	219.03	2.3841	5.3286	6.48	8.8641
22	300	5.3666	6.691	245.68	2.6437	5.1956	6.48	9.1237
23	360	6.4598	6.7692	268.26	2.8534	5.0626	6.48	9.3334
24	420	7.5571	6.8495	286.18	3.0082	4.9442	6.48	9.4882
25	480	8.6482	6.9313	301.84	3.1354	4.8206	6.48	9.6154
26	540	9.7392	7.0151	315.3	3.2361	4.7168	6.48	9.7161
27	600	10.837	7.1015	326.51	3.3104	4.6235	6.48	9.7904
28	660	11.93	7.1896	336.18	3.3667	4.5436	6.48	9.8467
29	720	13.031	7.2807	344.26	3.4045	4.4736	6.48	9.8845
30	780	14.125	7.3733	350.25	3.4202	4.4165	6.48	9.9002
31	840	15.213	7.468	356.46	3.4366	4.3692	6.48	9.9166

Project: DYNERGY HENNEPIN
Boring No.: HEN-018 S-5
Sample No.: S-5
Test No.: 20.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: ----

Soil Description: DARK GRAY TO GRAY FLY ASH WITH SAND AND GRAVEL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.98 in
Specimen Area: 6.33 in^2
Specimen Volume: 37.84 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: NP

Plastic Limit: NP

Estimated Specific Gravity: 2.30

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	6.48	6.48	0	0.000	1.4384	1.4384	1.000	1.4384	0
2	0.06	6.8203	6.48	0.16796	0.493	1.6108	1.2704	1.268	1.4406	0.17017
3	0.13	7.0422	6.48	0.2776	0.494	1.723	1.1608	1.484	1.4419	0.28111
4	0.22	7.1827	6.48	0.35049	0.499	1.7906	1.0879	1.646	1.4392	0.35134
5	0.30	7.2693	6.48	0.39482	0.500	1.8329	1.0436	1.756	1.4382	0.39465
6	0.39	7.3396	6.48	0.42397	0.493	1.874	1.0144	1.847	1.4442	0.42978
7	0.47	7.4028	6.48	0.44614	0.483	1.9151	0.99224	1.930	1.4537	0.46142
8	0.57	7.4573	6.48	0.46246	0.473	1.9532	0.97591	2.001	1.4646	0.48865
9	0.66	7.5079	6.48	0.47529	0.462	1.991	0.96308	2.067	1.477	0.51396
10	0.74	7.5579	6.48	0.48987	0.454	2.0264	0.9485	2.136	1.4874	0.53893
11	0.83	7.6059	6.48	0.50037	0.444	2.0639	0.938	2.200	1.5009	0.56294
12	0.92	7.6494	6.48	0.50679	0.433	2.101	0.93159	2.255	1.5163	0.58472
13	1.01	7.696	6.48	0.51262	0.422	2.1418	0.92576	2.314	1.5338	0.608
14	1.19	7.7765	6.48	0.51612	0.398	2.2188	0.92226	2.406	1.5705	0.64827
15	1.37	7.8543	6.48	0.52195	0.380	2.2907	0.91643	2.500	1.6036	0.68716
16	1.55	7.9287	6.48	0.5202	0.359	2.3669	0.91818	2.578	1.6425	0.72434
17	1.73	7.9966	6.48	0.51378	0.339	2.4412	0.92459	2.640	1.6829	0.75832
18	1.91	8.0723	6.48	0.5097	0.320	2.521	0.92867	2.715	1.7248	0.79617
19	2.09	8.1495	6.48	0.50154	0.300	2.6064	0.93684	2.782	1.7716	0.83477
20	3.18	8.5338	6.48	0.41173	0.200	3.0804	1.0266	3.000	2.0535	1.0269
21	4.28	8.8641	6.48	0.28693	0.120	3.5355	1.1514	3.071	2.3435	1.192
22	5.37	9.1237	6.48	0.15396	0.058	3.9281	1.2844	3.058	2.6063	1.3219
23	6.46	9.3334	6.48	0.020995	0.007	4.2708	1.4174	3.013	2.8441	1.4267
24	7.56	9.4882	6.48	-0.097392	-0.032	4.544	1.5358	2.959	3.0399	1.5041
25	8.65	9.6154	6.48	-0.22103	-0.070	4.7948	1.6594	2.889	3.2271	1.5677
26	9.74	9.7161	6.48	-0.32483	-0.100	4.9993	1.7632	2.835	3.3813	1.6181
27	10.84	9.7904	6.48	-0.41814	-0.126	5.1669	1.8565	2.783	3.5117	1.6552
28	11.93	9.8467	6.48	-0.49804	-0.148	5.3031	1.9364	2.739	3.6198	1.6833
29	13.03	9.8845	6.48	-0.56802	-0.167	5.4109	2.0064	2.697	3.7086	1.7022
30	14.12	9.9002	6.48	-0.62517	-0.183	5.4837	2.0635	2.657	3.7736	1.7101
31	15.21	9.9166	6.48	-0.67241	-0.196	5.5474	2.1108	2.628	3.8291	1.7183

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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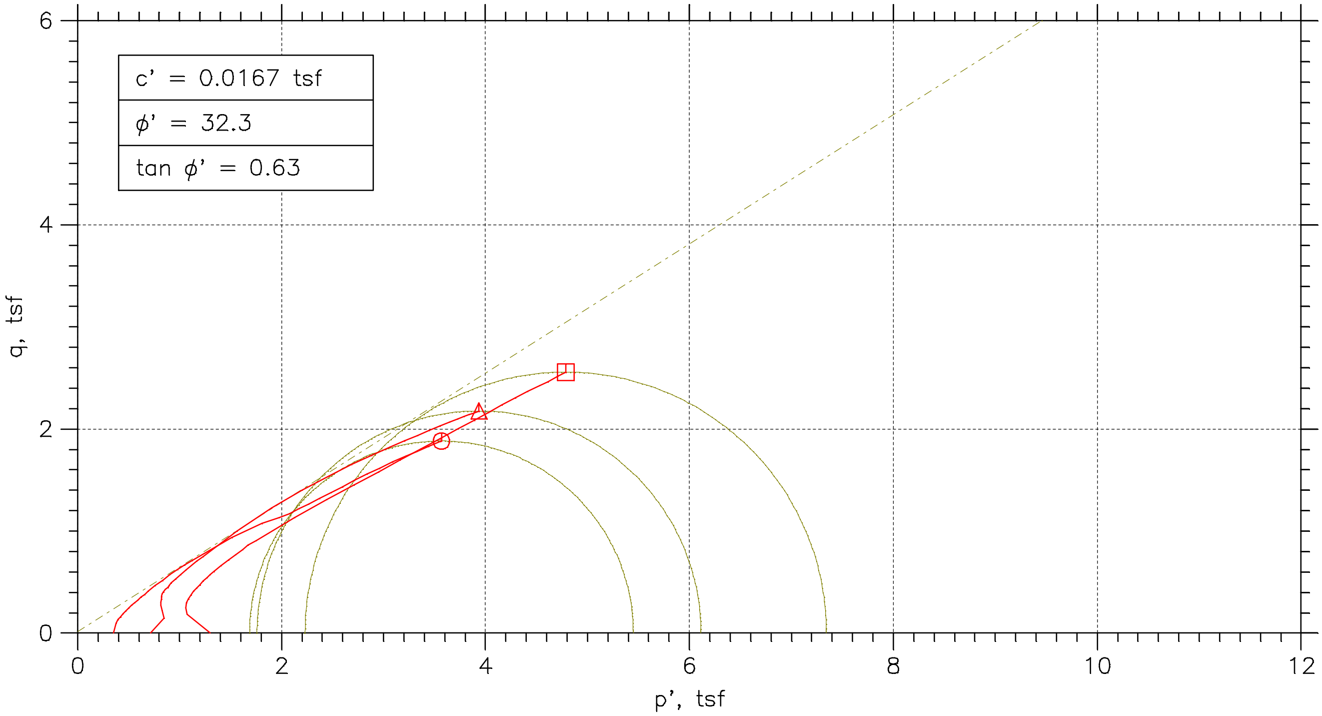
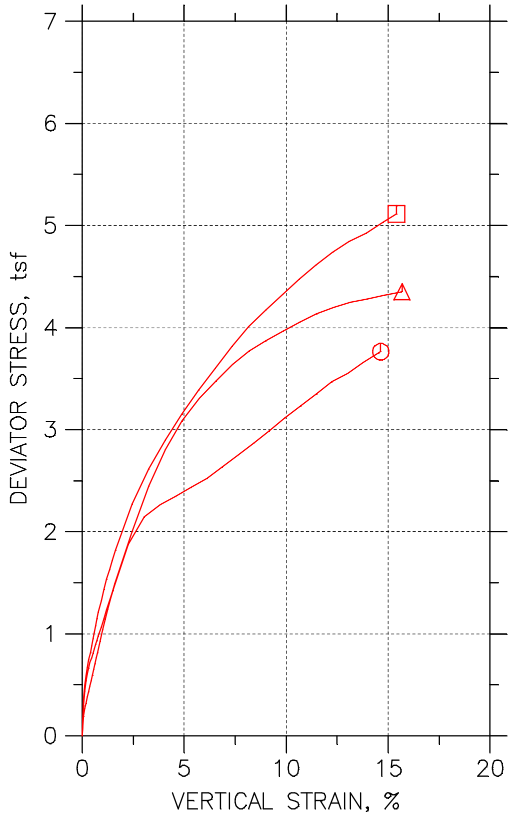
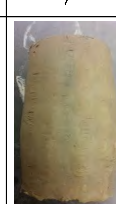




	Symbol	○	△	□	
	Test No.	5.0 PSI	10.0 PSI	20.0 PSI	
Initial	Diameter, in	2.813	2.7921	2.8256	
Initial	Height, in	6.0902	5.9878	6.0303	
Initial	Water Content, %	8.98	11.83	8.88	
Initial	Dry Density, pcf	128.2	127.1	126.	
Initial	Saturation, %	75.28	95.64	69.49	
Initial	Void Ratio	0.32442	0.33638	0.34747	
Before Shear	Water Content, %	13.14	12.04	11.49	
Before Shear	Dry Density, pcf	125.1	127.9	129.4	
Before Shear	Saturation, %	100.00	100.00	100.00	
Before Shear	Void Ratio	0.35748	0.32749	0.31248	
Before Shear	Back Press., tsf	5.0458	5.0445	5.1811	
	Minor Prin. Stress, tsf	0.35425	0.71546	1.2989	
	Max. Dev. Stress, tsf	3.764	4.3529	5.114	
	Time to Failure, min	1147.2	1143.8	1128.7	
	Strain Rate, %/min	0.02	0.02	0.02	
	B-Value	0.95	0.97	0.95	
	Estimated Specific Gravity	2.72	2.72	2.72	
	Liquid Limit	22	22	22	
	Plastic Limit	15	15	15	
	Plasticity Index	7	7	7	
	Failure Sketch				

Project: DYNERGY HENNEPIN

Location: HENNEPIN, IL

Project No.: MR155233

Boring No.: HEN-029 S-3

Sample Type: 3.0" ST

Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL

Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Tue, 22-DEC-2015 13:46:20

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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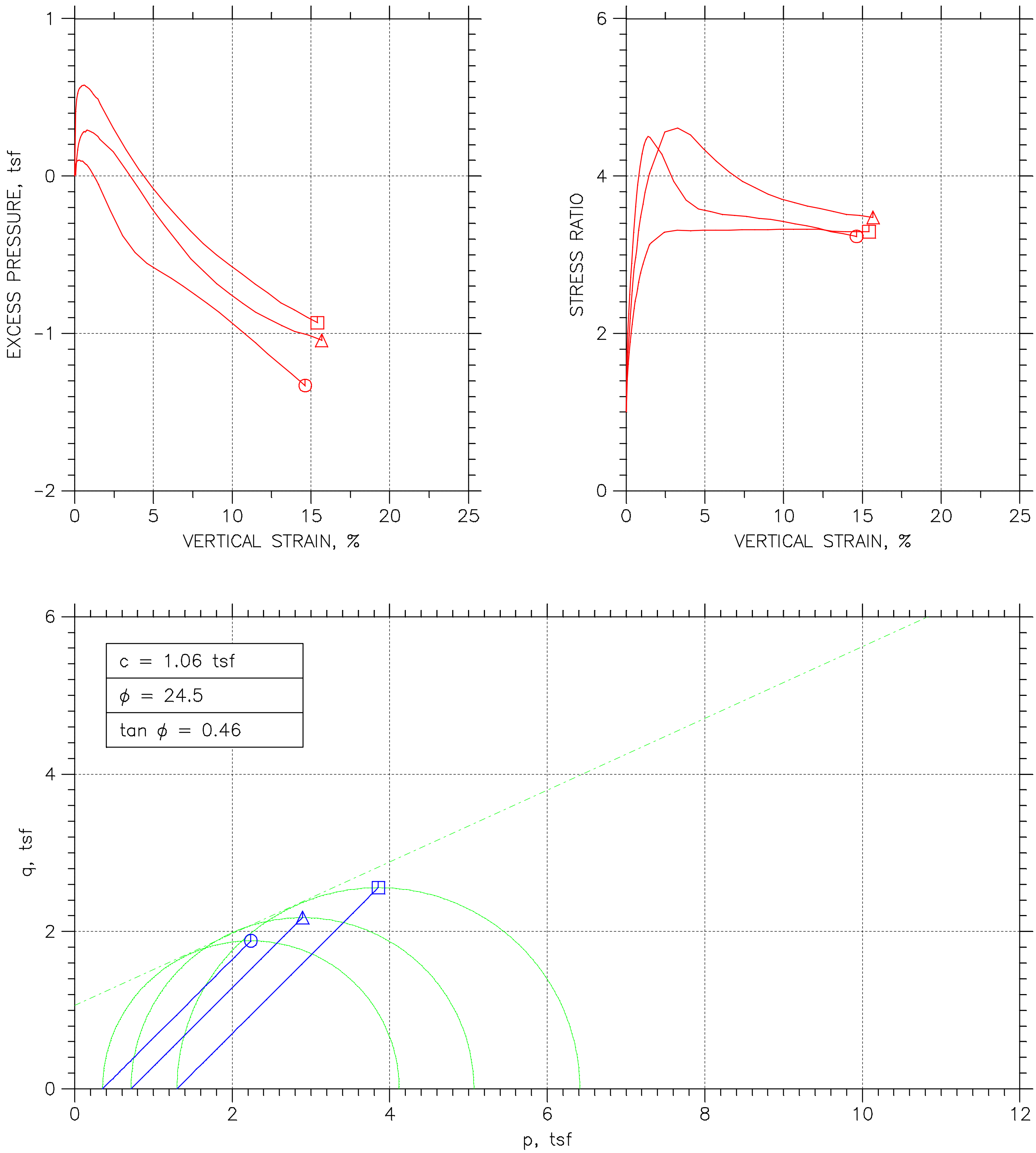

Project: DYNERGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
Boring No.: HEN-029 S-3	Tested By: BCM	Checked By: WPQ
Sample No.: S-3	Test Date: 12/17/15	Depth: 5.0'-7.0'
Test No.: HEN-029 S-3	Sample Type: 3.0" ST	Elevation: ----
Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL		
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.		

Tue, 22-DEC-2015 13:47:19

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-029 S-3
Sample No.: S-3
Test No.: 5.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/17/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 5.0'-7.0'
Elevation: ----

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Soil Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.09 in
Specimen Area: 6.21 in^2
Specimen Volume: 37.85 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 22

Plastic Limit: 15

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2148	0	0	5.0458	5.4	5.4
2	5.0035	0.055219	6.2182	17.005	0.1969	5.1201	5.4	5.5969
3	10.003	0.11893	6.2222	23.059	0.26683	5.1363	5.4	5.6668
4	15.003	0.17981	6.226	27.85	0.32207	5.1427	5.4	5.7221
5	20.003	0.24353	6.23	32.852	0.37967	5.1462	5.4	5.7797
6	25.003	0.30866	6.234	37.643	0.43475	5.1462	5.4	5.8348
7	30.003	0.37237	6.238	42.276	0.48795	5.1422	5.4	5.8879
8	35.003	0.43609	6.242	46.961	0.54168	5.1422	5.4	5.9417
9	40.003	0.49838	6.2459	51.752	0.59657	5.1392	5.4	5.9966
10	45.003	0.5621	6.2499	56.385	0.64956	5.1346	5.4	6.0496
11	50.003	0.6244	6.2538	61.386	0.70674	5.1294	5.4	6.1067
12	55.003	0.68811	6.2579	66.335	0.76322	5.123	5.4	6.1632
13	60.003	0.75041	6.2618	71.126	0.81783	5.1172	5.4	6.2178
14	70.003	0.87784	6.2698	80.918	0.92923	5.1027	5.4	6.3292
15	80.003	1.0067	6.278	90.553	1.0385	5.0835	5.4	6.4385
16	90.003	1.1341	6.2861	99.661	1.1415	5.0638	5.4	6.5415
17	100	1.2601	6.2941	108.72	1.2436	5.0411	5.4	6.6436
18	110	1.3904	6.3024	117.14	1.3382	5.0179	5.4	6.7382
19	120	1.5164	6.3105	124.88	1.4248	4.9917	5.4	6.8248
20	180	2.271	6.3592	165.63	1.8753	4.828	5.4	7.2753
21	240	3.037	6.4095	191.27	2.1486	4.6677	5.4	7.5486
22	300	3.8158	6.4613	203.48	2.2674	4.5591	5.4	7.6674
23	360	4.5789	6.513	212.11	2.3449	4.4923	5.4	7.7449
24	420	5.3421	6.5655	222.17	2.4364	4.4447	5.4	7.8364
25	480	6.1095	6.6192	231.96	2.5232	4.3959	5.4	7.9232
26	540	6.874	6.6735	244.18	2.6344	4.346	5.4	8.0344
27	600	7.6386	6.7288	257.13	2.7513	4.2926	5.4	8.1513
28	660	8.4116	6.7856	270.03	2.8652	4.2357	5.4	8.2652
29	720	9.1663	6.842	283.82	2.9867	4.1793	5.4	8.3867
30	780	9.9295	6.8999	298.25	3.1122	4.1172	5.4	8.5122
31	840	10.708	6.9601	312.3	3.2307	4.051	5.4	8.6307
32	900	11.471	7.0201	326.83	3.3521	3.986	5.4	8.7521
33	960	12.232	7.0809	340.94	3.4668	3.9169	5.4	8.8668
34	1020	13.009	7.1442	352.31	3.5507	3.8512	5.4	8.9507
35	1080	13.774	7.2075	366.11	3.6572	3.7891	5.4	9.0572
36	1140	14.538	7.272	379.11	3.7536	3.7217	5.4	9.1536
37	1147.2	14.632	7.28	380.59	3.764	3.7142	5.4	9.164

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-029 S-3
Sample No.: S-3
Test No.: 5.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/17/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 5.0'-7.0'
Elevation: ----

Soil Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.09 in
Specimen Area: 6.21 in^2
Specimen Volume: 37.85 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 22

Plastic Limit: 15

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	5.4	5.4	0	0.000	0.35425	0.35425	1.000	0.35425	0
2	0.06	5.5969	5.4	0.07433	0.378	0.47681	0.27992	1.703	0.37837	0.098449
3	0.12	5.6668	5.4	0.09059	0.340	0.53049	0.26366	2.012	0.39707	0.13342
4	0.18	5.7221	5.4	0.096978	0.301	0.57934	0.25727	2.252	0.4183	0.16104
5	0.24	5.7797	5.4	0.10046	0.265	0.63345	0.25378	2.496	0.44362	0.18983
6	0.31	5.8348	5.4	0.10046	0.231	0.68854	0.25378	2.713	0.47116	0.21738
7	0.37	5.8879	5.4	0.096397	0.198	0.7458	0.25785	2.892	0.50182	0.24397
8	0.44	5.9417	5.4	0.096397	0.178	0.79953	0.25785	3.101	0.52869	0.27084
9	0.50	5.9966	5.4	0.093494	0.157	0.85732	0.26075	3.288	0.55904	0.29829
10	0.56	6.0496	5.4	0.088848	0.137	0.91496	0.2654	3.447	0.59018	0.32478
11	0.62	6.1067	5.4	0.083622	0.118	0.97736	0.27062	3.611	0.62399	0.35337
12	0.69	6.1632	5.4	0.077234	0.101	1.0402	0.27701	3.755	0.65862	0.38161
13	0.75	6.2178	5.4	0.071427	0.087	1.1007	0.28282	3.892	0.69173	0.40892
14	0.88	6.3292	5.4	0.056909	0.061	1.2266	0.29734	4.125	0.76195	0.46462
15	1.01	6.4385	5.4	0.037746	0.036	1.355	0.3165	4.281	0.83576	0.51926
16	1.13	6.5415	5.4	0.018002	0.016	1.4777	0.33624	4.395	0.907	0.57075
17	1.26	6.6436	5.4	-0.0046456	-0.004	1.6025	0.35889	4.465	0.98071	0.62182
18	1.39	6.7382	5.4	-0.027874	-0.021	1.7203	0.38212	4.502	1.0512	0.66911
19	1.52	6.8248	5.4	-0.054006	-0.038	1.8331	0.40825	4.490	1.1207	0.71241
20	2.27	7.2753	5.4	-0.21776	-0.116	2.4473	0.57201	4.278	1.5096	0.93763
21	3.04	7.5486	5.4	-0.37804	-0.176	2.8809	0.73229	3.934	1.8066	1.0743
22	3.82	7.6674	5.4	-0.48663	-0.215	3.1083	0.84088	3.696	1.9746	1.1337
23	4.58	7.7449	5.4	-0.55341	-0.236	3.2525	0.90766	3.583	2.0801	1.1724
24	5.34	7.8364	5.4	-0.60103	-0.247	3.3917	0.95528	3.550	2.1735	1.2182
25	6.11	7.9232	5.4	-0.64981	-0.258	3.5272	1.0041	3.513	2.2656	1.2616
26	6.87	8.0344	5.4	-0.69975	-0.266	3.6884	1.054	3.499	2.3712	1.3172
27	7.64	8.1513	5.4	-0.75318	-0.274	3.8588	1.1074	3.484	2.4831	1.3757
28	8.41	8.2652	5.4	-0.81008	-0.283	4.0295	1.1643	3.461	2.5969	1.4326
29	9.17	8.3867	5.4	-0.86641	-0.290	4.2074	1.2207	3.447	2.714	1.4934
30	9.93	8.5122	5.4	-0.92855	-0.298	4.395	1.2828	3.426	2.8389	1.5561
31	10.71	8.6307	5.4	-0.99475	-0.308	4.5797	1.349	3.395	2.9643	1.6153
32	11.47	8.7521	5.4	-1.0598	-0.316	4.7661	1.414	3.371	3.0901	1.676
33	12.23	8.8668	5.4	-1.1289	-0.326	4.9499	1.4831	3.337	3.2165	1.7334
34	13.01	8.9507	5.4	-1.1945	-0.336	5.0994	1.5488	3.293	3.3241	1.7753
35	13.77	9.0572	5.4	-1.2566	-0.344	5.2681	1.6109	3.270	3.4395	1.8286
36	14.54	9.1536	5.4	-1.324	-0.353	5.4318	1.6783	3.237	3.555	1.8768
37	14.63	9.164	5.4	-1.3316	-0.354	5.4499	1.6858	3.233	3.5678	1.882

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-029 S-3
Sample No.: S-3
Test No.: 10.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/17/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 5.0'-7.0'
Elevation: ----

Terracon Consulting Engineers & Scientists

Soil Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.99 in
Specimen Area: 6.12 in^2
Specimen Volume: 36.66 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 22

Plastic Limit: 15

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.1229	0	0	5.0445	5.76	5.76
2	5.0033	0.057527	6.1265	25.039	0.29426	5.058	5.76	6.0543
3	10.003	0.12145	6.1304	37.584	0.44142	5.1518	5.76	6.2014
4	15.003	0.19176	6.1347	45.895	0.53865	5.2102	5.76	6.2986
5	20.003	0.25727	6.1387	52.089	0.61094	5.2487	5.76	6.3709
6	25.003	0.32599	6.143	57.012	0.66822	5.2731	5.76	6.4282
7	30.003	0.3931	6.1471	61.458	0.71985	5.2947	5.76	6.4799
8	35.003	0.46021	6.1512	65.375	0.76522	5.3111	5.76	6.5252
9	40.003	0.52573	6.1553	69.134	0.80868	5.321	5.76	6.5687
10	45.003	0.59444	6.1596	72.945	0.85267	5.3262	5.76	6.6127
11	50.003	0.66316	6.1638	76.651	0.89536	5.3239	5.76	6.6554
12	55.003	0.72867	6.1679	80.356	0.93803	5.3315	5.76	6.698
13	60.003	0.79898	6.1723	84.009	0.97997	5.3355	5.76	6.74
14	70.003	0.93481	6.1807	91.314	1.0637	5.3309	5.76	6.8237
15	80.003	1.0674	6.189	98.884	1.1504	5.3251	5.76	6.9104
16	90.003	1.2049	6.1976	106.24	1.2343	5.3186	5.76	6.9943
17	110	1.4781	6.2148	121.28	1.405	5.2971	5.76	7.165
18	120	1.6155	6.2235	129.06	1.4931	5.2784	5.76	7.2531
19	180	2.4465	6.2765	174.42	2.0009	5.1979	5.76	7.7609
20	240	3.2615	6.3294	215.08	2.4466	5.0819	5.76	8.2066
21	300	4.0812	6.3835	248.9	2.8074	4.9623	5.76	8.5674
22	360	4.909	6.439	275.85	3.0845	4.8381	5.76	8.8445
23	420	5.7319	6.4952	298.08	3.3042	4.7238	5.76	9.0642
24	480	6.5549	6.5524	316.61	3.479	4.6206	5.76	9.239
25	540	7.3826	6.611	334.34	3.6413	4.5173	5.76	9.4013
26	600	8.1976	6.6697	349.06	3.7681	4.4392	5.76	9.5281
27	660	9.0189	6.7299	362.08	3.8737	4.3628	5.76	9.6337
28	720	9.8547	6.7923	374.04	3.9649	4.2946	5.76	9.7249
29	780	10.668	6.8541	386.11	4.056	4.2374	5.76	9.816
30	840	11.485	6.9174	397.49	4.1373	4.1808	5.76	9.8973
31	900	12.324	6.9836	407.45	4.2007	4.1354	5.76	9.9607
32	960	13.15	7.05	415.97	4.2482	4.0945	5.76	10.008
33	1020	13.976	7.1177	423.01	4.279	4.0578	5.76	10.039
34	1080	14.808	7.1873	430.74	4.315	4.0345	5.76	10.075
35	1140	15.625	7.2568	438.47	4.3503	4.003	5.76	10.11
36	1143.8	15.678	7.2613	438.99	4.3529	4.0001	5.76	10.113

TRIAXIAL TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN-029 S-3
Sample No.: S-3
Test No.: 10.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/17/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 5.0'-7.0'
Elevation: ----

Soil Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.99 in
Specimen Area: 6.12 in^2
Specimen Volume: 36.66 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 22

Plastic Limit: 15

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	5.76	5.76	0	0.000	0.71546	0.71546	1.000	0.71546	0
2	0.06	6.0543	5.76	0.013413	0.046	0.99631	0.70205	1.419	0.84918	0.14713
3	0.12	6.2014	5.76	0.10731	0.243	1.0496	0.60815	1.726	0.82886	0.22071
4	0.19	6.2986	5.76	0.16562	0.307	1.0885	0.54984	1.980	0.81916	0.26932
5	0.26	6.3709	5.76	0.20411	0.334	1.1223	0.51135	2.195	0.81681	0.30547
6	0.33	6.4282	5.76	0.22861	0.342	1.1551	0.48685	2.373	0.82096	0.33411
7	0.39	6.4799	5.76	0.25019	0.348	1.1851	0.46527	2.547	0.8252	0.35993
8	0.46	6.5252	5.76	0.26651	0.348	1.2142	0.44895	2.704	0.83155	0.38261
9	0.53	6.5687	5.76	0.27643	0.342	1.2477	0.43903	2.842	0.84337	0.40434
10	0.59	6.6127	5.76	0.28168	0.330	1.2865	0.43378	2.966	0.86012	0.42633
11	0.66	6.6554	5.76	0.27935	0.312	1.3315	0.43612	3.053	0.8838	0.44768
12	0.73	6.698	5.76	0.28693	0.306	1.3666	0.42853	3.189	0.89755	0.46901
13	0.80	6.74	5.76	0.29101	0.297	1.4044	0.42445	3.309	0.91444	0.48999
14	0.93	6.8237	5.76	0.28634	0.269	1.4928	0.42912	3.479	0.96098	0.53186
15	1.07	6.9104	5.76	0.28051	0.244	1.5853	0.43495	3.645	1.0101	0.57518
16	1.20	6.9943	5.76	0.2741	0.222	1.6756	0.44136	3.796	1.0585	0.61713
17	1.48	7.165	5.76	0.25252	0.180	1.8679	0.46294	4.035	1.1654	0.7025
18	1.62	7.2531	5.76	0.23386	0.157	1.9747	0.4816	4.100	1.2281	0.74654
19	2.45	7.7609	5.76	0.15338	0.077	2.563	0.56208	4.560	1.5625	1.0004
20	3.26	8.2066	5.76	0.037324	0.015	3.1248	0.67814	4.608	1.9014	1.2233
21	4.08	8.5674	5.76	-0.082229	-0.029	3.6051	0.79769	4.519	2.2014	1.4037
22	4.91	8.8445	5.76	-0.20645	-0.067	4.0064	0.92191	4.346	2.4641	1.5422
23	5.73	9.0642	5.76	-0.32075	-0.097	4.3404	1.0362	4.189	2.6883	1.6521
24	6.55	9.239	5.76	-0.42397	-0.122	4.6184	1.1394	4.053	2.8789	1.7395
25	7.38	9.4013	5.76	-0.5272	-0.145	4.8839	1.2427	3.930	3.0633	1.8206
26	8.20	9.5281	5.76	-0.60534	-0.161	5.0889	1.3208	3.853	3.2049	1.8841
27	9.02	9.6337	5.76	-0.68174	-0.176	5.2709	1.3972	3.772	3.3341	1.9369
28	9.85	9.7249	5.76	-0.74997	-0.189	5.4304	1.4654	3.706	3.4479	1.9825
29	10.67	9.816	5.76	-0.80713	-0.199	5.5785	1.5226	3.664	3.5506	2.028
30	11.48	9.8973	5.76	-0.8637	-0.209	5.7165	1.5792	3.620	3.6478	2.0687
31	12.32	9.9607	5.76	-0.90918	-0.216	5.8254	1.6246	3.586	3.725	2.1004
32	13.15	10.008	5.76	-0.95001	-0.224	5.9137	1.6655	3.551	3.7896	2.1241
33	13.98	10.039	5.76	-0.98675	-0.231	5.9812	1.7022	3.514	3.8417	2.1395
34	14.81	10.075	5.76	-1.0101	-0.234	6.0405	1.7255	3.501	3.883	2.1575
35	15.62	10.11	5.76	-1.0416	-0.239	6.1074	1.757	3.476	3.9322	2.1752
36	15.68	10.113	5.76	-1.0445	-0.240	6.1128	1.7599	3.473	3.9364	2.1764

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Sample No.: S-3
Test No.: 20.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/17/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 5.0'-7.0'
Elevation: ----

Soil Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.03 in
Specimen Area: 6.27 in^2
Specimen Volume: 37.81 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 22

Plastic Limit: 15

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2706	0	0	5.1811	6.48	6.48
2	5.0002	0.061721	6.2745	31.946	0.36658	5.5924	6.48	6.8466
3	10	0.12796	6.2786	43.274	0.49624	5.6668	6.48	6.9762
4	15	0.19419	6.2828	51.605	0.59138	5.7058	6.48	7.0714
5	20	0.26043	6.287	58.557	0.67061	5.7267	6.48	7.1506
6	25	0.32817	6.2912	65.03	0.74424	5.7413	6.48	7.2242
7	30	0.39441	6.2954	71.383	0.8164	5.7511	6.48	7.2964
8	35	0.45914	6.2995	77.257	0.88301	5.7558	6.48	7.363
9	40	0.52538	6.3037	83.31	0.95156	5.7575	6.48	7.4316
10	45	0.59312	6.308	89.244	1.0186	5.7587	6.48	7.4986
11	50	0.66086	6.3123	94.878	1.0822	5.7558	6.48	7.5622
12	55	0.72861	6.3166	100.57	1.1464	5.7511	6.48	7.6264
13	60	0.79635	6.3209	106.15	1.2091	5.7477	6.48	7.6891
14	70	0.93334	6.3297	116.22	1.3219	5.7337	6.48	7.8019
15	80.001	1.0688	6.3383	126.22	1.4338	5.718	6.48	7.9138
16	90.001	1.2043	6.347	135.51	1.5373	5.6994	6.48	8.0173
17	100	1.3428	6.3559	144.26	1.6342	5.6796	6.48	8.1142
18	110	1.4798	6.3648	152.18	1.7215	5.6726	6.48	8.2015
19	120	1.6183	6.3737	160.81	1.8165	5.6371	6.48	8.2965
20	180	2.4372	6.4272	202.52	2.2687	5.4865	6.48	8.7487
21	240	3.2501	6.4812	235.37	2.6147	5.3475	6.48	9.0947
22	300	4.0781	6.5372	263.42	2.9013	5.2224	6.48	9.3813
23	360	4.8865	6.5927	289.19	3.1583	5.1119	6.48	9.6383
24	420	5.7054	6.65	313.16	3.3906	5.0119	6.48	9.8706
25	480	6.5349	6.709	335.88	3.6046	4.92	6.48	10.085
26	540	7.3478	6.7679	358.41	3.813	4.8328	6.48	10.293
27	600	8.1637	6.828	379.99	4.0069	4.7525	6.48	10.487
28	660	8.9992	6.8907	399.41	4.1734	4.6792	6.48	10.653
29	720	9.8151	6.953	417.75	4.3259	4.6164	6.48	10.806
30	780	10.631	7.0165	435.67	4.4706	4.5565	6.48	10.951
31	840	11.459	7.0821	453.83	4.6139	4.4954	6.48	11.094
32	900	12.269	7.1475	470.55	4.7401	4.4396	6.48	11.22
33	960	13.094	7.2154	485.54	4.8451	4.3744	6.48	11.325
34	1020	13.928	7.2853	498.42	4.9259	4.3314	6.48	11.406
35	1080	14.742	7.3549	513.89	5.0307	4.2854	6.48	11.511
36	1128.7	15.412	7.4131	526.53	5.114	4.2494	6.48	11.594

TRIAXIAL TEST

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Tested By: BCM
Test Date: 12/17/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 5.0'-7.0'
Elevation: ----

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Consulting Engineers & Scientists

Soil Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.03 in
Specimen Area: 6.27 in^2
Specimen Volume: 37.81 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 22

Plastic Limit: 15

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	6.48	6.48	0	0.000	1.2989	1.2989	1.000	1.2989	0
2	0.06	6.8466	6.48	0.41121	1.122	1.2542	0.88764	1.413	1.0709	0.18329
3	0.13	6.9762	6.48	0.48566	0.979	1.3094	0.81319	1.610	1.0613	0.24812
4	0.19	7.0714	6.48	0.52463	0.887	1.3656	0.77423	1.764	1.0699	0.29569
5	0.26	7.1506	6.48	0.54557	0.814	1.4239	0.75329	1.890	1.0886	0.33531
6	0.33	7.2242	6.48	0.56011	0.753	1.483	0.73875	2.007	1.1109	0.37212
7	0.39	7.2964	6.48	0.57	0.698	1.5453	0.72886	2.120	1.1371	0.4082
8	0.46	7.363	6.48	0.57465	0.651	1.6072	0.72421	2.219	1.1657	0.4415
9	0.53	7.4316	6.48	0.57639	0.606	1.674	0.72246	2.317	1.1982	0.47578
10	0.59	7.4986	6.48	0.57756	0.567	1.7399	0.7213	2.412	1.2306	0.50932
11	0.66	7.5622	6.48	0.57465	0.531	1.8064	0.72421	2.494	1.2653	0.5411
12	0.73	7.6264	6.48	0.57	0.497	1.8752	0.72886	2.573	1.302	0.57319
13	0.80	7.6891	6.48	0.56651	0.469	1.9414	0.73235	2.651	1.3369	0.60454
14	0.93	7.8019	6.48	0.55255	0.418	2.0683	0.74631	2.771	1.4073	0.66097
15	1.07	7.9138	6.48	0.53684	0.374	2.1959	0.76201	2.882	1.4789	0.71692
16	1.20	8.0173	6.48	0.51823	0.337	2.3179	0.78062	2.969	1.5493	0.76863
17	1.34	8.1142	6.48	0.49846	0.305	2.4346	0.8004	3.042	1.6175	0.81712
18	1.48	8.2015	6.48	0.49148	0.285	2.5288	0.80738	3.132	1.6681	0.86073
19	1.62	8.2965	6.48	0.456	0.251	2.6594	0.84286	3.155	1.7511	0.90827
20	2.44	8.7487	6.48	0.30535	0.135	3.2622	0.9935	3.284	2.1279	1.1344
21	3.25	9.0947	6.48	0.16635	0.064	3.7472	1.1325	3.309	2.4399	1.3073
22	4.08	9.3813	6.48	0.041296	0.014	4.1588	1.2576	3.307	2.7082	1.4506
23	4.89	9.6383	6.48	-0.069214	-0.022	4.5263	1.3681	3.309	2.9472	1.5791
24	5.71	9.8706	6.48	-0.16925	-0.050	4.8588	1.4681	3.310	3.1634	1.6953
25	6.53	10.085	6.48	-0.26115	-0.072	5.1646	1.56	3.311	3.3623	1.8023
26	7.35	10.293	6.48	-0.3484	-0.091	5.4602	1.6472	3.315	3.5537	1.9065
27	8.16	10.487	6.48	-0.42866	-0.107	5.7345	1.7275	3.319	3.731	2.0035
28	9.00	10.653	6.48	-0.50195	-0.120	5.9742	1.8008	3.318	3.8875	2.0867
29	9.82	10.806	6.48	-0.56476	-0.131	6.1895	1.8636	3.321	4.0266	2.1629
30	10.63	10.951	6.48	-0.62467	-0.140	6.3942	1.9235	3.324	4.1588	2.2353
31	11.46	11.094	6.48	-0.68574	-0.149	6.5985	1.9846	3.325	4.2915	2.3069
32	12.27	11.22	6.48	-0.74158	-0.156	6.7805	2.0404	3.323	4.4105	2.3701
33	13.09	11.325	6.48	-0.80672	-0.167	6.9506	2.1056	3.301	4.5281	2.4225
34	13.93	11.406	6.48	-0.84976	-0.173	7.0745	2.1486	3.293	4.6116	2.463
35	14.74	11.511	6.48	-0.89571	-0.178	7.2252	2.1946	3.292	4.7099	2.5153
36	15.41	11.594	6.48	-0.93177	-0.182	7.3446	2.2306	3.293	4.7876	2.557

Drained Direct Shear Tests
ASTM D 3080

DIRECT SHEAR TEST by ASTM D3080

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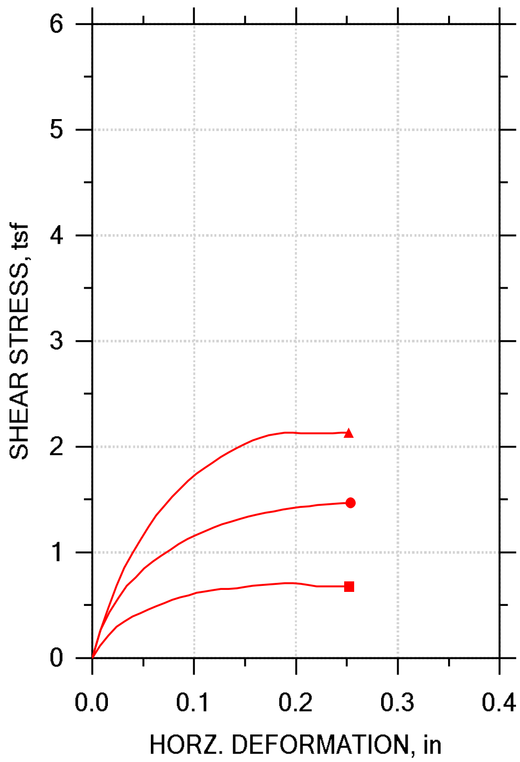

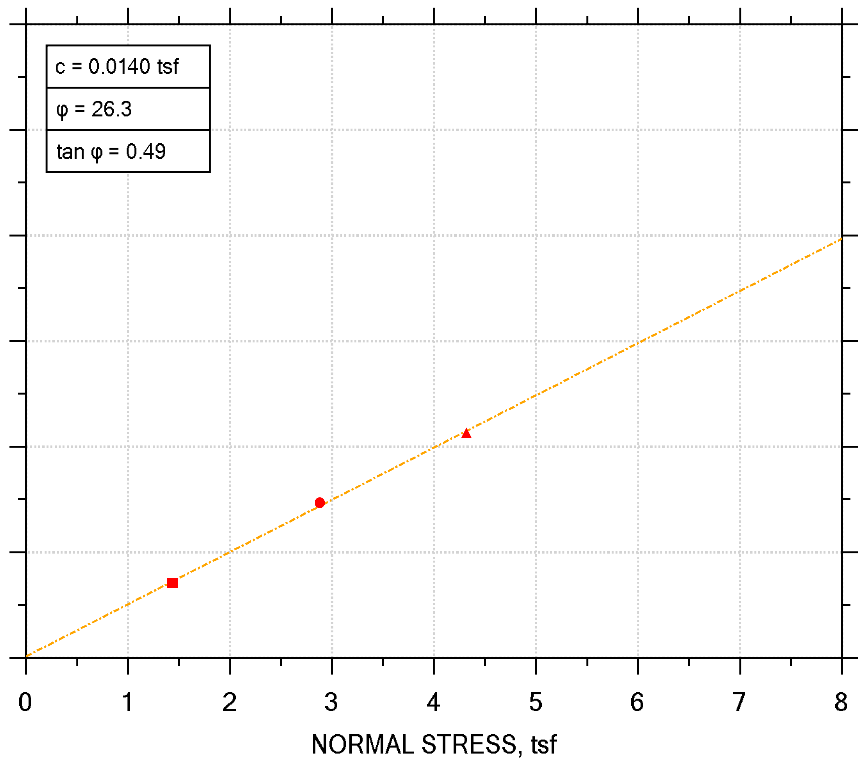

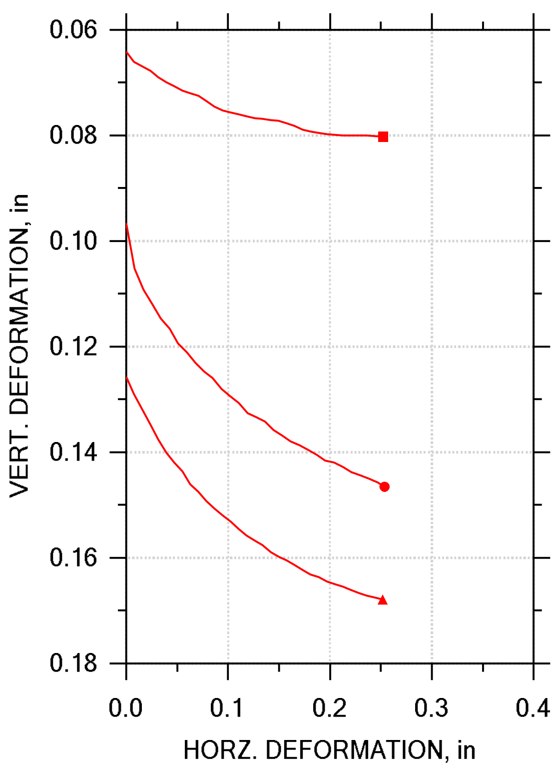

Symbol		■	●	▲	
Test No.		20.0 PSI	40.0 PSI	60.0 PSI	
Sample No.		S-10	S-10	S-10	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.5008	2.4941	2.4941	
	Area, in²	4.9118	4.8856	4.8856	
	Height, in	0.99488	0.99134	0.99134	
	Water Content, %	31.89	31.11	31.27	
	Dry Density, pcf	90.09	91.18	91.04	
	Saturation, %	98.03	98.12	98.32	
	Void Ratio	0.88489	0.8623	0.86515	
Consol. Height, in		0.9307	0.89469	0.86562	
Consol. Void Ratio		0.76329	0.68073	0.62862	
Final	Water Content, %	26.56	21.67	19.99	
	Dry Density, pcf	97.99	107.0	109.6	
	Saturation, %	98.57	100.41	98.99	
	Void Ratio	0.73289	0.58702	0.5493	
Normal Stress, tsf		1.4397	2.8796	4.3197	
Max. Shear Stress, tsf		0.7101	1.4695	2.1341	
Ult. Shear Stress, tsf		0.67742	1.4695	2.1332	
Time to Failure, min		3213.2	1360.9	976.75	
Disp. Rate, in/min		5.9055e-05	0.00020472	0.00020472	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		46	46	46	
Plastic Limit		21	21	21	
Plasticity Index		25	25	25	

Project: DYNEGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN-002 S-10
Sample Type: TRIMMED
Description: GRAY LEAN CLAY CL
Remarks:

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-002 S-10
Sample No.: S-10
Test No.: 20.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/22/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 35.0'-37.0'
Elevation: ----

Soil Description: GRAY LEAN CLAY CL
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	1.44	0.06418	0.000	0.0000	0.0000
2	131.60	1.44	0.06602	0.118	0.007867	0.007867
3	254.56	1.44	0.06694	0.209	0.01577	0.01577
4	403.13	1.44	0.06782	0.298	0.02364	0.02364
5	547.67	1.44	0.06897	0.348	0.03150	0.03150
6	674.90	1.44	0.06998	0.392	0.03937	0.03937
7	808.72	1.44	0.07065	0.423	0.04724	0.04724
8	938.15	1.44	0.07157	0.460	0.05514	0.05514
9	1062.33	1.44	0.07200	0.493	0.06300	0.06300
10	1186.07	1.44	0.07247	0.522	0.07087	0.07087
11	1319.95	1.44	0.07342	0.551	0.07874	0.07874
12	1456.77	1.44	0.07454	0.576	0.08660	0.08660
13	1592.98	1.44	0.07522	0.595	0.09451	0.09451
14	1735.33	1.44	0.07565	0.616	0.1024	0.1024
15	1877.85	1.44	0.07603	0.633	0.1102	0.1102
16	2020.47	1.44	0.07634	0.644	0.1181	0.1181
17	2150.55	1.44	0.07672	0.655	0.1260	0.1260
18	2262.37	1.44	0.07684	0.654	0.1339	0.1339
19	2385.54	1.44	0.07709	0.660	0.1417	0.1417
20	2525.44	1.44	0.07726	0.671	0.1496	0.1496
21	2675.94	1.44	0.07772	0.682	0.1575	0.1575
22	2805.55	1.44	0.07819	0.690	0.1653	0.1653
23	2942.54	1.44	0.07888	0.696	0.1732	0.1732
24	3076.86	1.44	0.07922	0.705	0.1811	0.1811
25	3213.20	1.44	0.07954	0.710	0.1890	0.1890
26	3343.01	1.44	0.07974	0.710	0.1968	0.1968
27	3473.34	1.44	0.07985	0.704	0.2047	0.2047
28	3608.85	1.44	0.07996	0.692	0.2126	0.2126
29	3746.25	1.44	0.07996	0.681	0.2205	0.2205
30	3883.52	1.44	0.08005	0.680	0.2283	0.2283
31	4012.40	1.44	0.08003	0.681	0.2362	0.2362
32	4135.33	1.44	0.08007	0.677	0.2441	0.2441
33	4281.23	1.44	0.08023	0.677	0.2520	0.2520

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-002 S-10
Sample No.: S-10
Test No.: 40.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/28/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 35.0'-37.0'
Elevation: ----

Soil Description: GRAY LEAN CLAY CL
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	2.88	0.09665	0.000	0.0000	0.0000
2	63.01	2.88	0.1053	0.266	0.008527	0.008527
3	113.06	2.88	0.1093	0.435	0.01702	0.01702
4	161.97	2.88	0.1120	0.572	0.02551	0.02551
5	207.04	2.88	0.1147	0.682	0.03400	0.03400
6	246.29	2.88	0.1166	0.766	0.04252	0.04252
7	290.78	2.88	0.1194	0.846	0.05101	0.05101
8	336.22	2.88	0.1211	0.914	0.05950	0.05950
9	381.75	2.88	0.1231	0.971	0.06799	0.06799
10	427.55	2.88	0.1247	1.02	0.07648	0.07648
11	476.78	2.88	0.1260	1.08	0.08505	0.08505
12	524.26	2.88	0.1281	1.12	0.09350	0.09350
13	568.33	2.88	0.1294	1.16	0.1020	0.1020
14	609.05	2.88	0.1306	1.20	0.1105	0.1105
15	655.39	2.88	0.1326	1.24	0.1190	0.1190
16	700.01	2.88	0.1334	1.27	0.1275	0.1275
17	744.02	2.88	0.1342	1.29	0.1360	0.1360
18	791.88	2.88	0.1358	1.32	0.1445	0.1445
19	840.22	2.88	0.1369	1.34	0.1530	0.1530
20	881.51	2.88	0.1380	1.36	0.1615	0.1615
21	924.69	2.88	0.1387	1.37	0.1700	0.1700
22	970.07	2.88	0.1395	1.39	0.1785	0.1785
23	1012.97	2.88	0.1404	1.40	0.1870	0.1870
24	1060.61	2.88	0.1416	1.42	0.1954	0.1954
25	1102.24	2.88	0.1419	1.43	0.2039	0.2039
26	1147.68	2.88	0.1428	1.44	0.2125	0.2125
27	1193.57	2.88	0.1438	1.45	0.2210	0.2210
28	1237.05	2.88	0.1444	1.46	0.2294	0.2294
29	1282.41	2.88	0.1449	1.46	0.2380	0.2380
30	1326.10	2.88	0.1457	1.47	0.2464	0.2464
31	1360.88	2.88	0.1465	1.47	0.2535	0.2535

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-002 S-10
Sample No.: S-10
Test No.: 60.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/29/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 35.0'-37.0'
Elevation: ----

Soil Description: GRAY LEAN CLAY CL
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	4.32	0.1257	0.000	0.0000	0.0000
2	36.45	4.32	0.1290	0.248	0.007867	0.007867
3	76.38	4.32	0.1319	0.473	0.01573	0.01573
4	117.56	4.32	0.1348	0.683	0.02360	0.02360
5	158.10	4.32	0.1376	0.854	0.03150	0.03150
6	195.04	4.32	0.1402	0.991	0.03937	0.03937
7	234.81	4.32	0.1419	1.12	0.04724	0.04724
8	276.54	4.32	0.1437	1.24	0.05510	0.05510
9	317.01	4.32	0.1460	1.35	0.06297	0.06297
10	354.77	4.32	0.1475	1.44	0.07087	0.07087
11	393.79	4.32	0.1492	1.53	0.07874	0.07874
12	432.98	4.32	0.1507	1.61	0.08660	0.08660
13	471.79	4.32	0.1519	1.68	0.09447	0.09447
14	510.07	4.32	0.1530	1.74	0.1023	0.1023
15	550.12	4.32	0.1546	1.80	0.1102	0.1102
16	586.12	4.32	0.1558	1.85	0.1181	0.1181
17	626.51	4.32	0.1567	1.90	0.1260	0.1260
18	667.00	4.32	0.1576	1.95	0.1338	0.1338
19	705.99	4.32	0.1589	1.99	0.1417	0.1417
20	740.73	4.32	0.1598	2.02	0.1496	0.1496
21	783.69	4.32	0.1604	2.06	0.1575	0.1575
22	822.45	4.32	0.1613	2.09	0.1654	0.1654
23	862.70	4.32	0.1624	2.11	0.1732	0.1732
24	899.50	4.32	0.1631	2.12	0.1811	0.1811
25	938.61	4.32	0.1637	2.13	0.1890	0.1890
26	976.75	4.32	0.1645	2.13	0.1968	0.1968
27	1016.13	4.32	0.1649	2.13	0.2047	0.2047
28	1052.08	4.32	0.1654	2.12	0.2126	0.2126
29	1090.23	4.32	0.1661	2.13	0.2204	0.2204
30	1128.98	4.32	0.1666	2.13	0.2283	0.2283
31	1166.56	4.32	0.1671	2.13	0.2362	0.2362
32	1203.36	4.32	0.1675	2.13	0.2441	0.2441
33	1242.33	4.32	0.1679	2.13	0.2519	0.2519

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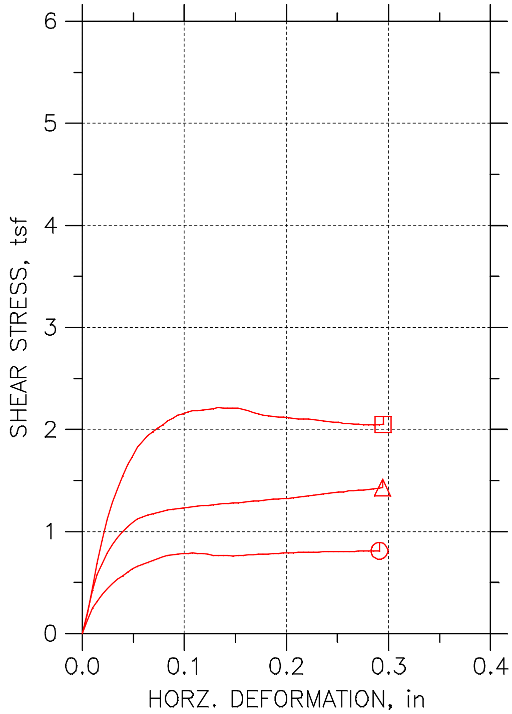
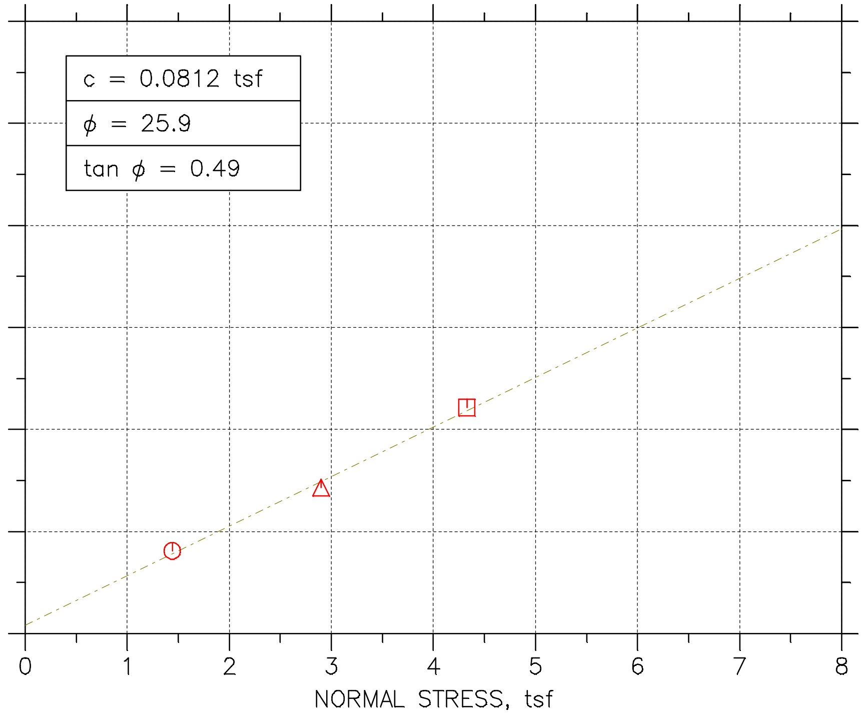
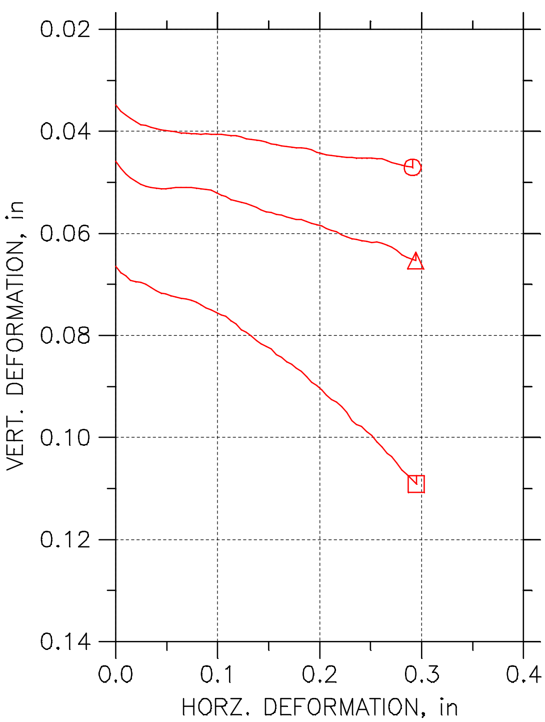
DIRECT SHEAR TEST REPORT







Symbol		○	△	□	
Test No.		20.0 PSI	40.0 PSI	60.0 PSI	
Sample No.		S-8	S-8	S-8	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.4961	2.4961	2.4965	
	Area, in^2	4.8933	4.8933	4.8948	
	Height, in	1.0122	1.0122	1.0039	
	Water Content, %	32.17	32.73	32.51	
	Dry Density, pcf	87.418	87.479	87.762	
	Saturation, %	92.85	94.60	94.59	
	Void Ratio	0.94243	0.94108	0.93482	
Consol. Height, in		0.97952	0.97134	0.94117	
Consol. Void Ratio		0.87971	0.86272	0.81385	
Final	Water Content, %	31.22	30.03	26.52	
	Dry Density, pcf	91.684	93.514	98.465	
	Saturation, %	99.66	100.12	99.56	
	Void Ratio	0.85205	0.81582	0.72452	
Normal Stress, tsf		1.4402	2.8996	4.3279	
Max. Shear Stress, tsf		0.8107	1.4297	2.2144	
Ult. Shear Stress, tsf		0.8107	1.4297	2.0494	
Time to Failure, min		1757.8	1807.9	847.22	
Disp. Rate, in/min		0.000173	0.000173	0.000173	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		45	45	45	
Plastic Limit		21	21	21	
Plasticity Index		24	24	24	

Project: DYNEGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN-003 S-8
Sample Type: 3" ST
Description: DARK GRAY LEAN CLAY
Remarks: TEST PERFORMED AS PER ASTM D 3080

Thu, 31-DEC-2015 10:00:11

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-003 S-8
Sample No.: S-8
Test No.: 20.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/30/15
Sample Type: 3" ST

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-27.5'
Elevation: ----

Soil Description: DARK GRAY LEAN CLAY
Remarks: TEST PERFORMED AS PER ASTM D 3080

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	1.439	0.03483	0	0
2	96.13	1.44	0.03603	0.1338	0.004953
3	131.38	1.439	0.03684	0.2532	0.00986
4	155.73	1.44	0.03749	0.3118	0.01477
5	187.84	1.44	0.03813	0.3833	0.01972
6	217.18	1.441	0.03869	0.4396	0.02463
7	243.52	1.44	0.0389	0.4875	0.02953
8	275.52	1.44	0.03916	0.5354	0.03449
9	300.06	1.439	0.0395	0.5673	0.03939
10	328.84	1.44	0.03976	0.6016	0.0443
11	357.41	1.44	0.03985	0.6312	0.04925
12	389.00	1.44	0.03993	0.6594	0.05416
13	412.41	1.44	0.0401	0.6799	0.05907
14	439.26	1.44	0.04036	0.6997	0.06402
15	469.45	1.44	0.0404	0.7187	0.06892
16	492.76	1.44	0.04049	0.7347	0.07383
17	525.42	1.44	0.04053	0.7521	0.07878
18	555.92	1.44	0.04058	0.7651	0.08369
19	584.60	1.44	0.04053	0.7734	0.0886
20	614.13	1.44	0.04062	0.7788	0.0935
21	638.65	1.44	0.04062	0.7826	0.09846
22	668.06	1.44	0.04066	0.7871	0.1034
23	694.56	1.44	0.04075	0.7886	0.1083
24	724.56	1.44	0.04083	0.7818	0.1132
25	753.15	1.44	0.04088	0.7833	0.1181
26	781.97	1.44	0.04105	0.7772	0.123
27	808.98	1.439	0.04143	0.7666	0.128
28	836.74	1.44	0.04161	0.7658	0.1329
29	867.05	1.439	0.04173	0.7628	0.1378
30	895.41	1.44	0.04186	0.7674	0.1428
31	924.95	1.44	0.04212	0.7605	0.1477
32	952.02	1.44	0.04246	0.7628	0.1526
33	982.73	1.44	0.04255	0.7674	0.1575
34	1008.92	1.44	0.04289	0.7704	0.1624
35	1040.42	1.44	0.04294	0.7742	0.1673
36	1068.99	1.439	0.04306	0.7772	0.1723
37	1097.71	1.44	0.04319	0.7795	0.1772
38	1125.56	1.44	0.04319	0.781	0.1821
39	1153.88	1.439	0.04332	0.7848	0.187
40	1182.79	1.44	0.04366	0.7871	0.192
41	1213.01	1.44	0.04409	0.7902	0.1969
42	1239.85	1.44	0.04435	0.7924	0.2018
43	1267.40	1.44	0.04457	0.7932	0.2067
44	1295.23	1.44	0.04478	0.7955	0.2116
45	1327.06	1.44	0.04491	0.7955	0.2165
46	1353.95	1.44	0.04499	0.7978	0.2215
47	1384.41	1.44	0.04517	0.7993	0.2264
48	1411.93	1.44	0.04517	0.7993	0.2313
49	1440.51	1.44	0.04525	0.8008	0.2363
50	1467.72	1.44	0.04529	0.8023	0.2412
51	1497.01	1.44	0.04525	0.8023	0.2461
52	1527.85	1.44	0.04529	0.8031	0.251
53	1553.35	1.44	0.04534	0.8039	0.2559
54	1581.68	1.44	0.04538	0.8054	0.2608
55	1611.88	1.44	0.04581	0.8061	0.2658
56	1640.02	1.44	0.04607	0.8069	0.2707
57	1670.18	1.44	0.04641	0.8084	0.2756
58	1699.23	1.44	0.04667	0.8077	0.2805
59	1723.65	1.44	0.04684	0.8077	0.2855
60	1753.88	1.44	0.04705	0.8107	0.2904
61	1757.84	1.44	0.0471	0.8107	0.291

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-003 S-8
Sample No.: S-8
Test No.: 40.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/30/15
Sample Type: 3" ST

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-27.5'
Elevation: ----

Soil Description: DARK GRAY LEAN CLAY
Remarks: TEST PERFORMED AS PER ASTM D 3080

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	2.897	0.04584	0	0
2	114.87	2.9	0.04725	0.2106	0.004953
3	145.95	2.9	0.04841	0.4274	0.00986
4	176.59	2.9	0.04916	0.58	0.01477
5	202.41	2.9	0.04974	0.6846	0.01972
6	232.48	2.9	0.0504	0.7905	0.02463
7	261.87	2.9	0.05081	0.8712	0.02953
8	290.11	2.9	0.05106	0.9393	0.03449
9	321.20	2.9	0.05114	0.9985	0.03939
10	352.66	2.9	0.05123	1.046	0.0443
11	382.71	2.9	0.05123	1.086	0.04925
12	414.39	2.9	0.05114	1.122	0.05416
13	438.31	2.9	0.05106	1.144	0.05907
14	468.23	2.897	0.05098	1.164	0.06402
15	494.07	2.9	0.05098	1.175	0.06892
16	525.08	2.9	0.05106	1.189	0.07383
17	555.16	2.9	0.05114	1.202	0.07878
18	584.30	2.9	0.05131	1.212	0.08369
19	613.31	2.9	0.05139	1.22	0.0886
20	638.98	2.9	0.05156	1.225	0.0935
21	665.57	2.9	0.05206	1.232	0.09846
22	698.58	2.9	0.05247	1.237	0.1034
23	723.48	2.9	0.0528	1.243	0.1083
24	754.38	2.9	0.05347	1.249	0.1132
25	779.70	2.9	0.05371	1.253	0.1181
26	807.48	2.9	0.05396	1.256	0.123
27	835.84	2.9	0.05421	1.261	0.128
28	866.30	2.9	0.05454	1.268	0.1329
29	897.54	2.9	0.05496	1.275	0.1378
30	923.22	2.9	0.05546	1.277	0.1428
31	948.87	2.897	0.05579	1.281	0.1477
32	977.74	2.9	0.05595	1.283	0.1526
33	1008.50	2.9	0.05628	1.287	0.1575
34	1036.20	2.9	0.05645	1.292	0.1624
35	1065.14	2.9	0.05678	1.299	0.1673
36	1090.22	2.9	0.05703	1.301	0.1723
37	1121.83	2.9	0.05728	1.307	0.1772
38	1150.05	2.9	0.05728	1.309	0.1821
39	1179.40	2.9	0.05769	1.315	0.187
40	1211.30	2.9	0.05802	1.32	0.192
41	1235.54	2.9	0.05836	1.321	0.1969
42	1267.50	2.9	0.05861	1.326	0.2018
43	1295.04	2.9	0.05902	1.333	0.2067
44	1325.43	2.9	0.05943	1.339	0.2116
45	1350.23	2.897	0.05968	1.345	0.2165
46	1376.84	2.9	0.06026	1.35	0.2215
47	1410.97	2.9	0.06068	1.355	0.2264
48	1438.72	2.902	0.06109	1.36	0.2313
49	1465.83	2.9	0.06117	1.368	0.2363
50	1495.50	2.9	0.06142	1.376	0.2412
51	1524.98	2.897	0.06159	1.378	0.2461
52	1553.26	2.9	0.06184	1.386	0.251
53	1581.27	2.9	0.06167	1.389	0.2559
54	1612.55	2.9	0.06192	1.397	0.2608
55	1641.33	2.9	0.06234	1.401	0.2658
56	1668.07	2.9	0.06275	1.406	0.2707
57	1694.82	2.897	0.06333	1.406	0.2756
58	1722.63	2.9	0.06416	1.411	0.2805
59	1752.47	2.9	0.06466	1.418	0.2855
60	1780.46	2.9	0.06507	1.425	0.2904
61	1807.89	2.9	0.06532	1.43	0.2941

DIRECT SHEAR TEST DATA

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Project: FERMILAB
Boring No.: HEN-003 S-8
Sample No.: S-8
Test No.: 60.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/30/15
Sample Type: 3" ST

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-27.5'
Elevation: ----

Soil Description: DARK GRAY LEAN CLAY
Remarks: TEST PERFORMED AS PER ASTM D 3080

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	4.327	0.06641	0	0
2	86.54	4.328	0.06774	0.1957	0.004953
3	113.71	4.328	0.06836	0.4534	0.00986
4	146.70	4.328	0.06918	0.6917	0.01477
5	178.06	4.328	0.0695	0.9147	0.01972
6	210.27	4.327	0.06956	1.123	0.02463
7	240.13	4.329	0.06994	1.287	0.02953
8	268.05	4.328	0.07057	1.421	0.03449
9	298.27	4.328	0.07126	1.546	0.03939
10	328.20	4.329	0.0717	1.656	0.0443
11	354.47	4.328	0.07189	1.735	0.04925
12	388.91	4.328	0.0722	1.825	0.05416
13	415.00	4.328	0.07245	1.883	0.05907
14	444.61	4.329	0.07277	1.938	0.06402
15	472.16	4.328	0.07289	1.98	0.06892
16	499.33	4.328	0.07314	2.013	0.07383
17	533.88	4.328	0.07352	2.048	0.07878
18	565.33	4.328	0.07402	2.082	0.08369
19	592.80	4.328	0.07459	2.109	0.0886
20	623.55	4.328	0.07497	2.139	0.0935
21	648.04	4.328	0.07553	2.155	0.09846
22	676.07	4.328	0.07604	2.172	0.1034
23	703.78	4.328	0.07629	2.181	0.1083
24	734.95	4.328	0.07711	2.187	0.1132
25	764.15	4.328	0.0778	2.191	0.1181
26	793.49	4.327	0.07887	2.194	0.123
27	819.91	4.328	0.07943	2.204	0.128
28	847.22	4.328	0.08019	2.214	0.1329
29	876.38	4.328	0.08101	2.207	0.1378
30	904.29	4.327	0.0817	2.211	0.1428
31	933.31	4.328	0.0822	2.209	0.1477
32	960.71	4.328	0.0827	2.207	0.1526
33	989.71	4.328	0.08371	2.198	0.1575
34	1016.16	4.328	0.08421	2.184	0.1624
35	1046.73	4.328	0.08509	2.167	0.1673
36	1075.11	4.328	0.0856	2.149	0.1723
37	1100.97	4.327	0.08641	2.139	0.1772
38	1129.39	4.328	0.08698	2.135	0.1821
39	1159.96	4.328	0.08805	2.128	0.187
40	1187.52	4.328	0.08918	2.123	0.192
41	1218.23	4.328	0.08981	2.12	0.1969
42	1245.98	4.328	0.09069	2.115	0.2018
43	1274.07	4.328	0.0917	2.11	0.2067
44	1302.20	4.327	0.09258	2.103	0.2116
45	1333.73	4.327	0.09302	2.104	0.2165
46	1360.22	4.327	0.09396	2.103	0.2215
47	1391.01	4.327	0.09503	2.098	0.2264
48	1419.79	4.328	0.09667	2.09	0.2313
49	1447.73	4.328	0.09742	2.086	0.2363
50	1475.92	4.327	0.0978	2.08	0.2412
51	1504.97	4.329	0.09887	2.07	0.2461
52	1534.21	4.327	0.09962	2.068	0.251
53	1561.65	4.328	0.1008	2.061	0.2559
54	1590.39	4.328	0.1018	2.057	0.2608
55	1620.96	4.328	0.1031	2.054	0.2658
56	1648.88	4.328	0.1038	2.054	0.2707
57	1679.49	4.327	0.105	2.048	0.2756
58	1708.47	4.327	0.1064	2.045	0.2805
59	1733.25	4.328	0.1072	2.045	0.2855
60	1763.44	4.328	0.1082	2.045	0.2904
61	1786.77	4.328	0.1091	2.049	0.2947

DIRECT SHEAR TEST by ASTM D3080

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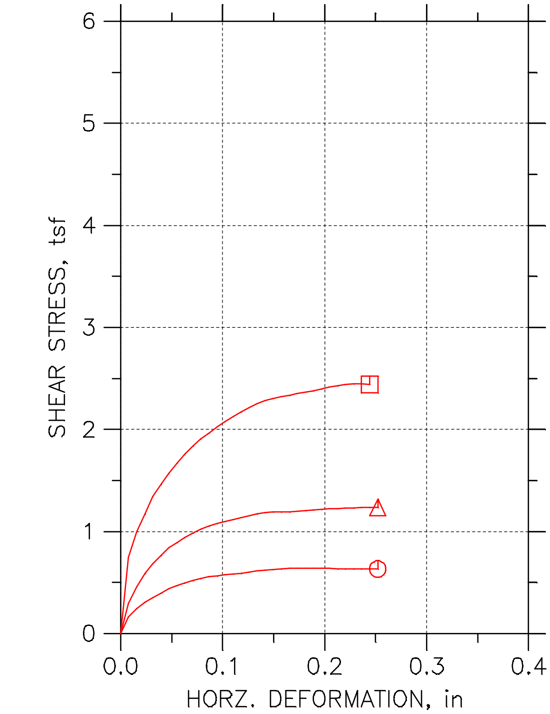

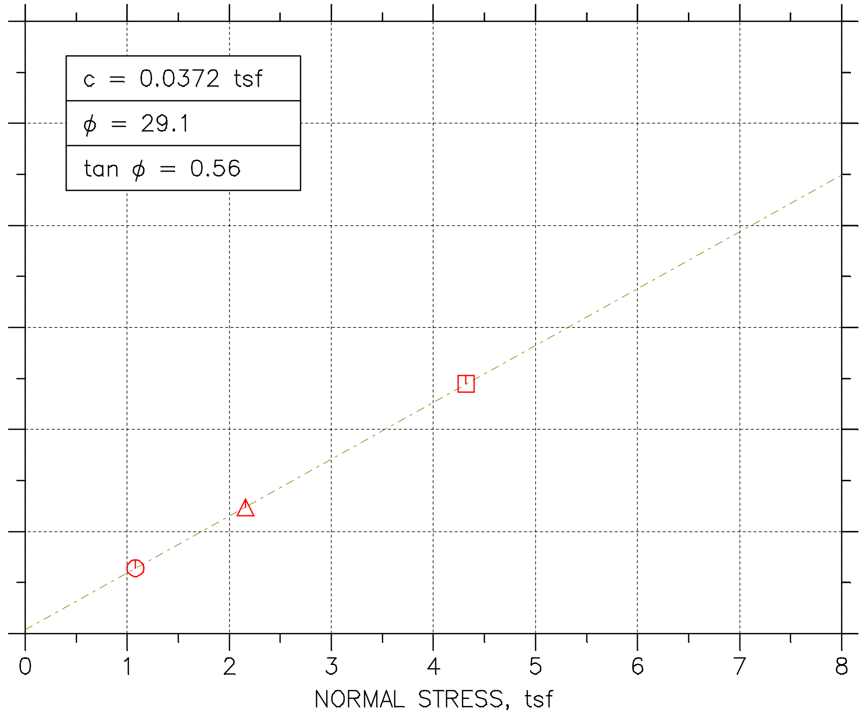

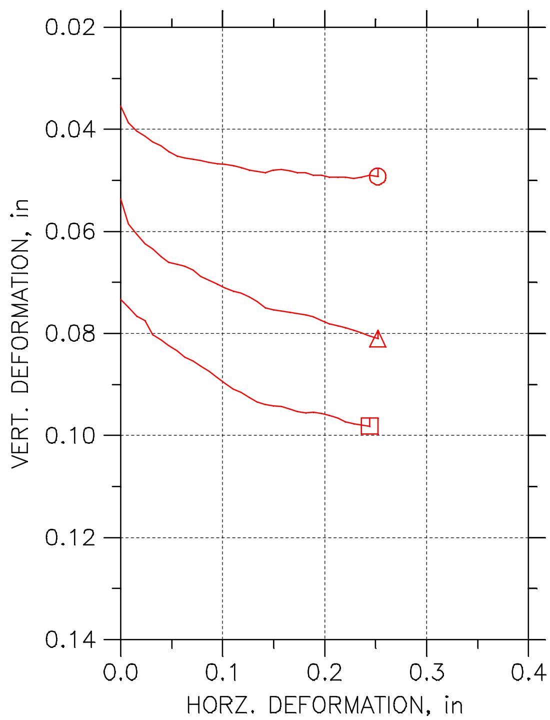

Symbol		○	△	□	
Test No.		15 PSI	30 PSI	60 PSI	
Sample No.		S-7	S-7	S-7	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.5709	2.4937	2.4854	
	Area, in^2	5.191	4.884	4.8517	
	Height, in	0.99843	0.98228	0.9622	
	Water Content, %	29.74	29.77	29.48	
	Dry Density, pcf	82.742	90.834	92.776	
	Saturation, %	76.89	93.13	96.59	
	Void Ratio	1.0522	0.86938	0.83025	
Consol. Height, in		0.963	0.93324	0.89292	
Consol. Void Ratio		0.9794	0.77604	0.69847	
Final	Water Content, %	34.40	26.34	23.67	
	Dry Density, pcf	87.034	98.998	103.32	
	Saturation, %	98.39	100.17	100.04	
	Void Ratio	0.95102	0.71522	0.64355	
Normal Stress, tsf		1.0798	2.1597	4.3201	
Max. Shear Stress, tsf		0.64126	1.2376	2.446	
Ult. Shear Stress, tsf		0.63334	1.2376	2.4421	
Time to Failure, min		895.63	1225.4	1252	
Disp. Rate, in/min		0.000207	0.000207	0.000207	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		45	45	45	
Plastic Limit		23	23	23	
Plasticity Index		22	22	22	

Project: DYNEGY HENNEPIN	
Location: HENNEPIN, IL	
Project No.: MR155233	
Boring No.: HEN-004 S7	
Sample Type: 3.0'' ST	
Description: VERY DARK GRAY LEAN CLAY CL- ORGANICS NOTED	
Remarks: TEST PERFORMED AS PER ASTM D3080.	

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DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-004 S7
Sample No.: S-7
Test No.: 15 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/6/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 20.0'-22.0'
Elevation: ----

Soil Description: VERY DARK GRAY LEAN CLAY CL- ORGANICS NOTED
Remarks: TEST PERFORMED AS PER ASTM D3080.

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	1.079	0.03543	0	0
2	52.87	1.08	0.03877	0.1643	0.007876
3	92.18	1.08	0.04041	0.2425	0.01575
4	132.36	1.079	0.04135	0.3092	0.02363
5	171.72	1.08	0.04249	0.3538	0.0315
6	207.28	1.08	0.04325	0.3968	0.03938
7	247.73	1.08	0.04438	0.4399	0.04725
8	286.40	1.08	0.04526	0.472	0.05513
9	322.72	1.08	0.04558	0.4953	0.06301
10	362.86	1.08	0.04583	0.5181	0.07088
11	402.61	1.08	0.04615	0.5388	0.07876
12	441.62	1.08	0.04646	0.5562	0.08663
13	477.07	1.08	0.04671	0.568	0.09451
14	515.28	1.08	0.0469	0.5774	0.1024
15	554.10	1.08	0.04709	0.5853	0.1103
16	589.91	1.08	0.04747	0.5933	0.1181
17	631.34	1.08	0.04797	0.6051	0.126
18	664.33	1.08	0.04829	0.6145	0.1339
19	703.46	1.08	0.04848	0.6234	0.1418
20	745.35	1.08	0.04804	0.6289	0.1496
21	783.16	1.08	0.04791	0.6328	0.1575
22	820.22	1.08	0.04816	0.6373	0.1654
23	858.73	1.08	0.04854	0.6393	0.1733
24	895.63	1.08	0.04848	0.6413	0.1811
25	935.53	1.08	0.04898	0.6403	0.189
26	971.85	1.079	0.04905	0.6393	0.1969
27	1012.19	1.08	0.04936	0.6373	0.2048
28	1048.66	1.081	0.04942	0.6363	0.2126
29	1085.79	1.08	0.04942	0.6348	0.2205
30	1123.47	1.08	0.04961	0.6328	0.2284
31	1162.13	1.08	0.04942	0.6333	0.2362
32	1199.13	1.079	0.04905	0.6324	0.2441
33	1236.88	1.08	0.04923	0.6333	0.252

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-004 S7
Sample No.: S-7
Test No.: 30 PSI

Location: HENNEPIN, IL
Tested By: HP
Test Date: 12/6/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: BCM
Depth: 20.0'-22.0'
Elevation: ----

Soil Description: VERY DARK GRAY LEAN CLAY CL- ORGANICS NOTED
Remarks: TEST PERFORMED AS PER ASTM D3080.

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	2.158	0.05365	0	0
2	44.38	2.16	0.05856	0.2976	0.007876
3	84.25	2.16	0.06058	0.4585	0.01575
4	125.18	2.159	0.06241	0.5878	0.02363
5	162.47	2.16	0.06348	0.6841	0.0315
6	197.93	2.16	0.06493	0.7629	0.03938
7	240.57	2.16	0.06613	0.8389	0.04725
8	274.16	2.16	0.06644	0.8908	0.05513
9	313.67	2.159	0.06689	0.942	0.06301
10	351.00	2.16	0.06764	0.9844	0.07088
11	389.72	2.159	0.06878	1.023	0.07876
12	427.42	2.159	0.06953	1.056	0.08663
13	466.41	2.159	0.07029	1.082	0.09451
14	502.85	2.16	0.07111	1.102	0.1024
15	538.11	2.16	0.07168	1.119	0.1103
16	576.81	2.16	0.07212	1.138	0.1181
17	619.31	2.16	0.07287	1.157	0.126
18	652.41	2.159	0.07376	1.171	0.1339
19	693.77	2.159	0.07496	1.184	0.1418
20	731.23	2.16	0.0754	1.19	0.1496
21	767.99	2.16	0.07565	1.19	0.1575
22	806.68	2.16	0.0759	1.192	0.1654
23	843.01	2.16	0.07609	1.196	0.1733
24	882.66	2.16	0.07634	1.203	0.1811
25	918.72	2.16	0.07672	1.211	0.189
26	955.92	2.16	0.07748	1.218	0.1969
27	995.76	2.16	0.07817	1.221	0.2048
28	1033.70	2.16	0.07849	1.226	0.2126
29	1073.13	2.16	0.07893	1.229	0.2205
30	1108.90	2.16	0.07937	1.231	0.2284
31	1147.19	2.16	0.07987	1.234	0.2362
32	1185.23	2.16	0.0805	1.236	0.2441
33	1225.37	2.16	0.08101	1.238	0.252

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-004 S7
Sample No.: S-7
Test No.: 60 PSI

Location: HENNEPIN, IL
Tested By: HP
Test Date: 12/6/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: BCM
Depth: 20.0'-22.0'
Elevation: ----

Soil Description: VERY DARK GRAY LEAN CLAY CL- ORGANICS NOTED
Remarks: TEST PERFORMED AS PER ASTM D3080.

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	4.319	0.07332	0	0
2	141.08	4.319	0.07483	0.744	0.007876
3	182.59	4.319	0.07659	1.001	0.01575
4	219.18	4.318	0.07754	1.176	0.02363
5	259.25	4.318	0.08025	1.34	0.0315
6	297.64	4.319	0.08126	1.465	0.03938
7	335.60	4.319	0.08233	1.571	0.04725
8	374.97	4.319	0.08334	1.67	0.05513
9	411.17	4.319	0.08466	1.754	0.06301
10	453.03	4.319	0.08536	1.841	0.07088
11	491.17	4.319	0.08637	1.907	0.07876
12	528.00	4.319	0.08744	1.966	0.08663
13	567.37	4.319	0.08863	2.025	0.09451
14	604.60	4.319	0.08977	2.075	0.1024
15	643.89	4.319	0.0909	2.128	0.1103
16	680.77	4.319	0.0916	2.174	0.1181
17	717.15	4.319	0.09261	2.214	0.126
18	754.96	4.318	0.09349	2.254	0.1339
19	791.57	4.319	0.09393	2.282	0.1418
20	831.59	4.319	0.09425	2.306	0.1496
21	873.07	4.319	0.09437	2.323	0.1575
22	908.73	4.318	0.09488	2.335	0.1654
23	946.00	4.319	0.09538	2.351	0.1733
24	984.76	4.319	0.09557	2.366	0.1811
25	1022.43	4.319	0.09544	2.377	0.189
26	1061.30	4.319	0.0957	2.395	0.1969
27	1100.41	4.319	0.09607	2.414	0.2048
28	1137.14	4.319	0.09658	2.428	0.2126
29	1175.39	4.319	0.09733	2.443	0.2205
30	1213.75	4.319	0.09771	2.446	0.2284
31	1251.96	4.32	0.0979	2.446	0.2362
32	1288.97	4.319	0.09815	2.442	0.2441

DIRECT SHEAR TEST by ASTM D3080

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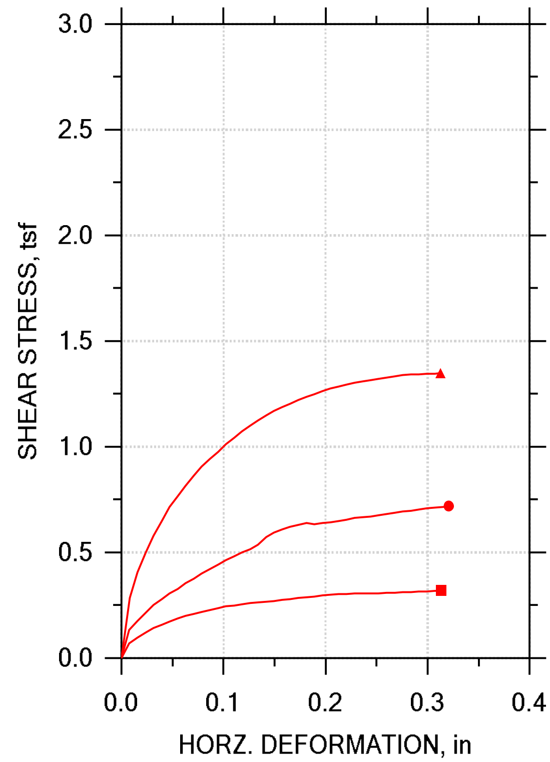
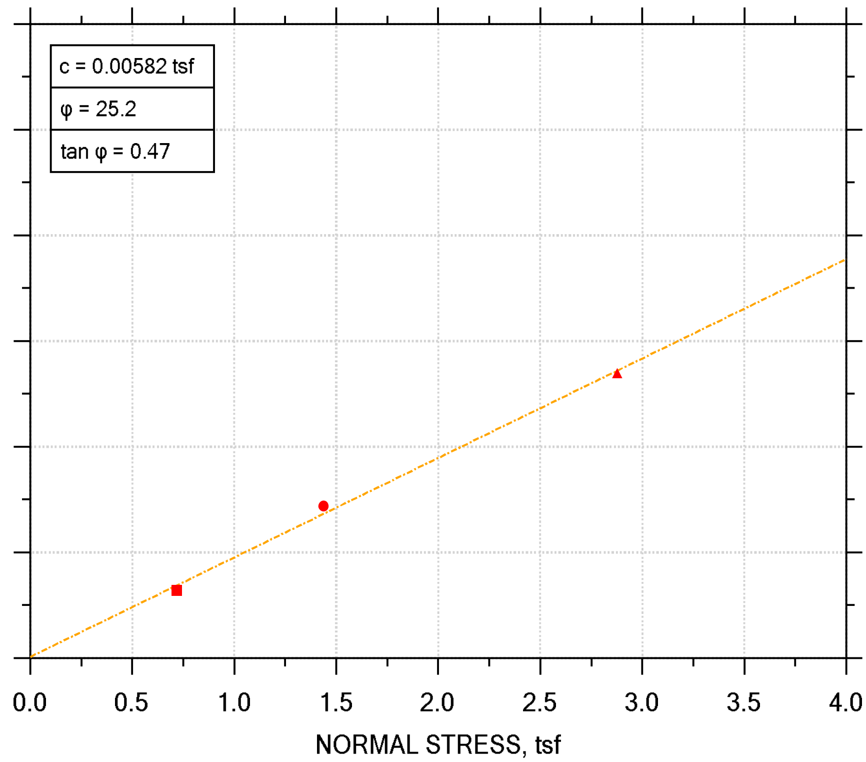
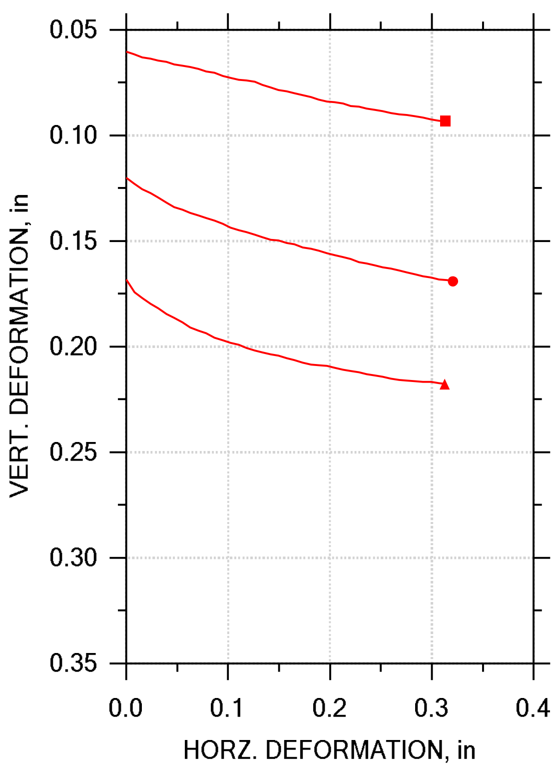






Symbol		■	●	▲	
Test No.		10 PSI	20 PSI	40 PSI	
Sample No.		S-4	S-4	S-4	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.4823	2.4862	2.4819	
	Area, in²	4.8394	4.8548	4.8379	
	Height, in	1.002	0.98622	1.0028	
	Water Content, %	53.29	53.23	53.48	
	Dry Density, pcf	68.32	67.84	67.67	
	Saturation, %	98.07	96.80	96.84	
	Void Ratio	1.4671	1.4847	1.4909	
Consol. Height, in		0.94176	0.86607	0.83469	
Consol. Void Ratio		1.3189	1.182	1.0734	
Final	Water Content, %	45.63	39.25	34.99	
	Dry Density, pcf	75.33	81.87	86.43	
	Saturation, %	99.55	100.09	99.42	
	Void Ratio	1.2376	1.0587	0.9502	
Normal Stress, tsf		0.71768	1.4381	2.8781	
Max. Shear Stress, tsf		0.3191	0.71924	1.348	
Ult. Shear Stress, tsf		0.3191	0.71924	1.348	
Time to Failure, min		80.5	80.604	81.975	
Disp. Rate, in/min		0.0039961	0.0039961	0.0039961	
Estimated Specific Gravity		2.70	2.70	2.70	
Liquid Limit		43	43	43	
Plastic Limit		24	24	24	
Plasticity Index		19	19	19	

Project: DYNEGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN-005 S4
Sample Type: 3.0" ST
Description: DARK GRAY LEAN CLAY WITH SAND AND FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080.

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
Boring No.: HEN-005 S4	Tested By: HP	Checked By: BCM
Sample No.: S-4	Test Date: 12/30/15	Depth: 12.5'-14.5'
Test No.: 10 PSI	Sample Type: 3.0" ST	Elevation: ----

Soil Description: DARK GRAY LEAN CLAY WITH SAND AND FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080.

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	0.718	0.06020	0.000	0.0000	0.0000
2	4.00	0.718	0.06153	0.0683	0.007876	0.007876
3	6.06	0.717	0.06310	0.0981	0.01575	0.01575
4	8.07	0.718	0.06380	0.121	0.02363	0.02363
5	10.15	0.718	0.06449	0.141	0.03150	0.03150
6	11.97	0.718	0.06531	0.157	0.03938	0.03938
7	13.94	0.718	0.06632	0.173	0.04725	0.04725
8	15.92	0.718	0.06689	0.187	0.05513	0.05513
9	17.78	0.717	0.06764	0.199	0.06301	0.06301
10	19.76	0.718	0.06859	0.209	0.07088	0.07088
11	21.79	0.718	0.06985	0.219	0.07876	0.07876
12	23.83	0.718	0.07042	0.228	0.08663	0.08663
13	25.79	0.718	0.07168	0.237	0.09451	0.09451
14	27.77	0.717	0.07281	0.244	0.1024	0.1024
15	29.83	0.718	0.07357	0.250	0.1103	0.1103
16	31.69	0.718	0.07395	0.255	0.1182	0.1182
17	33.69	0.718	0.07451	0.259	0.1260	0.1260
18	35.65	0.717	0.07596	0.264	0.1339	0.1339
19	37.72	0.717	0.07729	0.267	0.1418	0.1418
20	39.63	0.718	0.07842	0.271	0.1496	0.1496
21	41.54	0.718	0.07905	0.275	0.1575	0.1575
22	43.63	0.718	0.07987	0.279	0.1654	0.1654
23	45.58	0.717	0.08094	0.284	0.1733	0.1733
24	47.50	0.718	0.08189	0.288	0.1811	0.1811
25	49.57	0.718	0.08315	0.292	0.1890	0.1890
26	51.56	0.718	0.08391	0.296	0.1969	0.1969
27	53.48	0.718	0.08435	0.299	0.2048	0.2048
28	55.29	0.718	0.08485	0.302	0.2126	0.2126
29	57.40	0.718	0.08592	0.304	0.2205	0.2205
30	59.23	0.718	0.08649	0.305	0.2284	0.2284
31	61.35	0.718	0.08725	0.306	0.2362	0.2362
32	63.17	0.718	0.08788	0.307	0.2441	0.2441
33	65.13	0.718	0.08838	0.307	0.2520	0.2520
34	67.13	0.718	0.08933	0.308	0.2599	0.2599
35	69.22	0.718	0.09002	0.309	0.2677	0.2677
36	71.18	0.718	0.09046	0.311	0.2756	0.2756
37	73.11	0.718	0.09097	0.313	0.2835	0.2835
38	75.10	0.718	0.09153	0.315	0.2914	0.2914
39	77.07	0.718	0.09242	0.317	0.2992	0.2992
40	78.86	0.718	0.09298	0.318	0.3071	0.3071
41	80.50	0.718	0.09324	0.319	0.3129	0.3129

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-005 S4
Sample No.: S-4
Test No.: 20 PSI

Location: HENNEPIN, IL
Tested By: HP
Test Date: 12/30/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: BCM
Depth: 12.5'-14.5'
Elevation: ----

Soil Description: DARK GRAY LEAN CLAY WITH SAND AND FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080.

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	1.43	0.1202	0.000	0.0000	0.0000
2	2.29	1.43	0.1228	0.133	0.007876	0.007876
3	4.23	1.43	0.1253	0.176	0.01575	0.01575
4	6.22	1.44	0.1272	0.215	0.02363	0.02363
5	8.28	1.44	0.1295	0.250	0.03150	0.03150
6	10.27	1.44	0.1319	0.279	0.03938	0.03938
7	12.30	1.44	0.1338	0.306	0.04725	0.04725
8	14.12	1.44	0.1352	0.329	0.05513	0.05513
9	16.11	1.44	0.1365	0.354	0.06301	0.06301
10	18.07	1.44	0.1380	0.377	0.07088	0.07088
11	19.97	1.44	0.1391	0.399	0.07876	0.07876
12	21.95	1.44	0.1404	0.421	0.08663	0.08663
13	23.99	1.44	0.1420	0.443	0.09451	0.09451
14	26.02	1.44	0.1436	0.463	0.1024	0.1024
15	27.95	1.44	0.1449	0.482	0.1103	0.1103
16	29.93	1.44	0.1457	0.499	0.1181	0.1181
17	31.99	1.44	0.1471	0.514	0.1260	0.1260
18	33.87	1.44	0.1482	0.535	0.1339	0.1339
19	35.86	1.44	0.1493	0.574	0.1418	0.1418
20	37.86	1.44	0.1498	0.594	0.1496	0.1496
21	39.90	1.44	0.1510	0.610	0.1575	0.1575
22	41.78	1.44	0.1517	0.620	0.1654	0.1654
23	43.73	1.44	0.1530	0.630	0.1733	0.1733
24	45.75	1.44	0.1538	0.638	0.1811	0.1811
25	47.75	1.44	0.1545	0.633	0.1890	0.1890
26	49.63	1.44	0.1559	0.638	0.1969	0.1969
27	51.74	1.44	0.1567	0.644	0.2048	0.2048
28	53.71	1.44	0.1577	0.650	0.2126	0.2126
29	55.61	1.44	0.1585	0.656	0.2205	0.2205
30	57.47	1.44	0.1599	0.662	0.2284	0.2284
31	59.60	1.44	0.1606	0.667	0.2362	0.2362
32	61.41	1.44	0.1615	0.670	0.2441	0.2441
33	63.52	1.44	0.1625	0.677	0.2520	0.2520
34	65.33	1.44	0.1631	0.683	0.2599	0.2599
35	67.28	1.44	0.1640	0.688	0.2677	0.2677
36	69.30	1.44	0.1649	0.693	0.2756	0.2756
37	71.37	1.44	0.1657	0.698	0.2835	0.2835
38	73.34	1.44	0.1666	0.703	0.2914	0.2914
39	75.29	1.44	0.1674	0.708	0.2993	0.2993
40	77.30	1.44	0.1682	0.711	0.3071	0.3071
41	79.27	1.44	0.1686	0.715	0.3150	0.3150
42	80.60	1.44	0.1691	0.719	0.3205	0.3205

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-005 S4
Sample No.: S-4
Test No.: 40 PSI

Location: HENNEPIN, IL
Tested By: HP
Test Date: 12/30/15
Sample Type: 3.0" ST

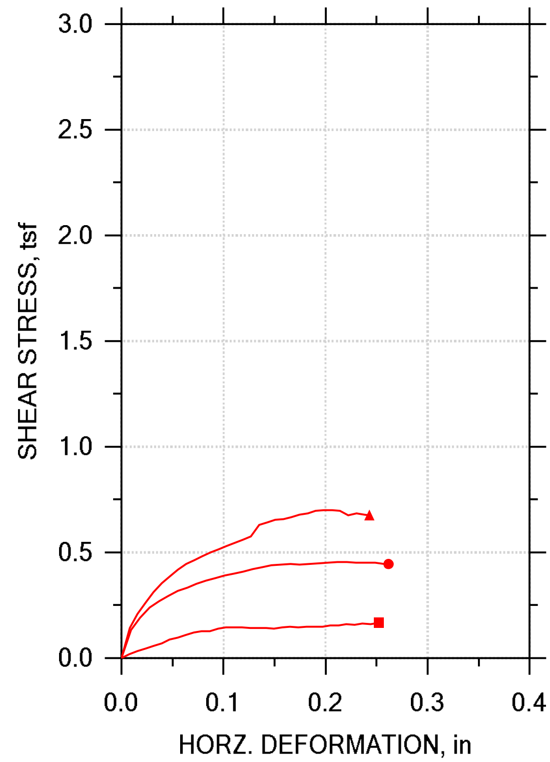
Project No.: MR155233
Checked By: BCM
Depth: 12.5'-14.5'
Elevation: ----

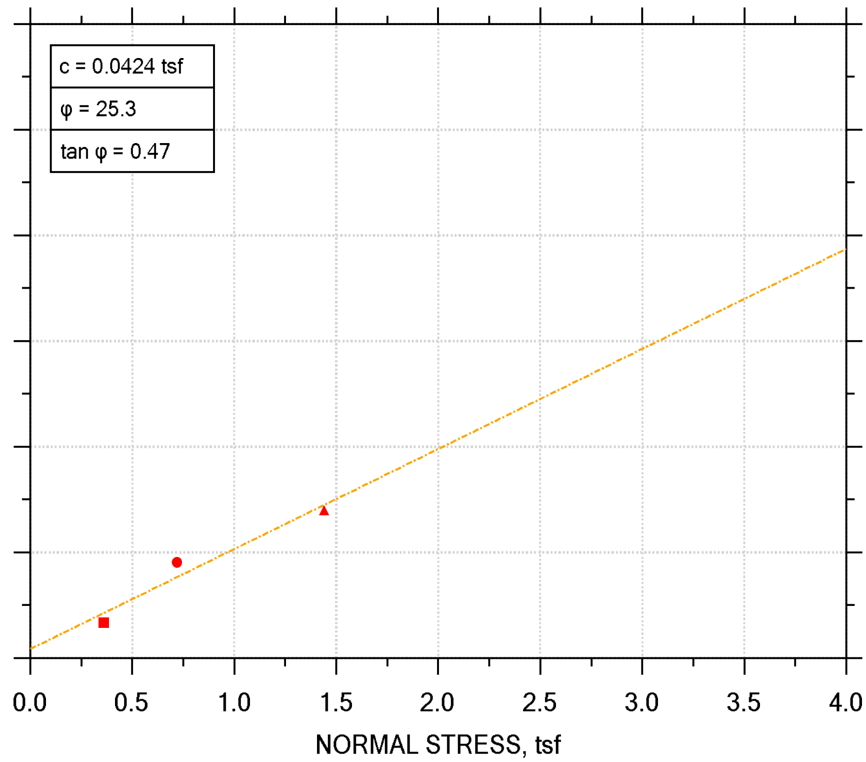
Soil Description: DARK GRAY LEAN CLAY WITH SAND AND FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080.

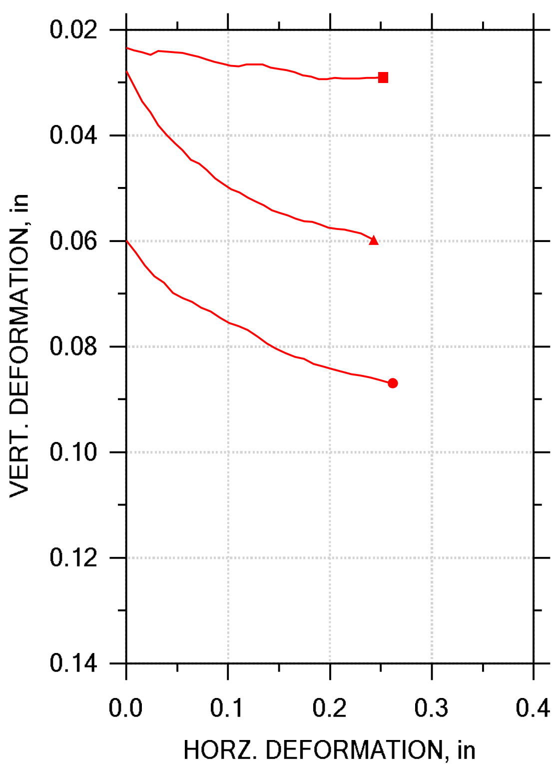
Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	2.88	0.1681	0.000	0.0000	0.0000
2	5.35	2.87	0.1742	0.285	0.007923	0.007923
3	7.35	2.87	0.1768	0.407	0.01575	0.01575
4	9.37	2.88	0.1797	0.499	0.02363	0.02363
5	11.37	2.88	0.1819	0.577	0.03150	0.03150
6	13.39	2.88	0.1845	0.648	0.03938	0.03938
7	15.49	2.88	0.1865	0.714	0.04725	0.04725
8	17.43	2.88	0.1886	0.766	0.05513	0.05513
9	19.35	2.88	0.1908	0.815	0.06301	0.06301
10	21.38	2.88	0.1925	0.863	0.07088	0.07088
11	23.40	2.88	0.1937	0.905	0.07876	0.07876
12	25.34	2.88	0.1957	0.943	0.08663	0.08663
13	27.19	2.88	0.1971	0.976	0.09451	0.09451
14	29.19	2.88	0.1981	1.01	0.1024	0.1024
15	31.08	2.88	0.1992	1.04	0.1103	0.1103
16	33.09	2.88	0.2007	1.07	0.1181	0.1181
17	35.10	2.88	0.2018	1.10	0.1260	0.1260
18	37.22	2.88	0.2029	1.12	0.1339	0.1339
19	39.11	2.88	0.2037	1.15	0.1418	0.1418
20	41.16	2.88	0.2044	1.17	0.1496	0.1496
21	43.03	2.88	0.2054	1.19	0.1575	0.1575
22	45.09	2.88	0.2064	1.20	0.1654	0.1654
23	47.11	2.88	0.2077	1.22	0.1733	0.1733
24	49.03	2.88	0.2085	1.24	0.1811	0.1811
25	51.03	2.88	0.2089	1.25	0.1890	0.1890
26	52.98	2.88	0.2092	1.26	0.1969	0.1969
27	54.99	2.88	0.2100	1.28	0.2048	0.2048
28	56.80	2.88	0.2108	1.29	0.2126	0.2126
29	58.83	2.88	0.2116	1.29	0.2205	0.2205
30	60.98	2.88	0.2122	1.30	0.2284	0.2284
31	62.85	2.88	0.2131	1.31	0.2362	0.2362
32	64.77	2.88	0.2137	1.32	0.2441	0.2441
33	66.81	2.88	0.2144	1.32	0.2520	0.2520
34	68.70	2.88	0.2153	1.33	0.2599	0.2599
35	70.65	2.88	0.2157	1.33	0.2677	0.2677
36	72.65	2.88	0.2161	1.34	0.2756	0.2756
37	74.82	2.88	0.2164	1.34	0.2835	0.2835
38	76.70	2.88	0.2165	1.34	0.2914	0.2914
39	78.62	2.88	0.2167	1.35	0.2992	0.2992
40	80.39	2.88	0.2172	1.35	0.3071	0.3071
41	81.97	2.88	0.2177	1.35	0.3126	0.3126

DIRECT SHEAR TEST by ASTM D3080







Symbol		■	●	▲	
Test No.		5.0 PSI	10.0 PSI	20.0 PSI	
Sample No.		S-4	S-4	S-4	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.5744	2.5728	2.5728	
	Area, in²	5.2053	5.1989	5.1989	
	Height, in	0.99685	0.99134	0.99134	
	Water Content, %	43.92	43.72	43.94	
	Dry Density, pcf	68.44	68.81	69.02	
	Saturation, %	81.69	82.05	82.92	
	Void Ratio	1.4355	1.4225	1.415	
Consol. Height, in		0.97344	0.93151	0.9636	
Consol. Void Ratio		1.3783	1.2763	1.3474	
Final	Water Content, %	49.94	45.37	46.75	
	Dry Density, pcf	70.49	75.42	73.45	
	Saturation, %	97.71	100.11	98.33	
	Void Ratio	1.3647	1.2101	1.2694	
Normal Stress, tsf		0.3602	0.71979	1.4396	
Max. Shear Stress, tsf		0.16591	0.45364	0.70049	
Ult. Shear Stress, tsf		0.16591	0.44507	0.67713	
Time to Failure, min		4266.5	1139.6	1013.5	
Disp. Rate, in/min		5.9055e-05	0.00020472	0.00020472	
Estimated Specific Gravity		2.67	2.67	2.67	
Liquid Limit		NP	NP	NP	
Plastic Limit		NP	NP	NP	
Plasticity Index		NP	NP	NP	

Project: DYNEGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN-008 S4
Sample Type: 3.0" ST
Description: FLY ASH / LEAN CLAY WITH SAND MIX SAMPLE TAKEN FROM THE FLY ASH STRATA
Remarks: TEST PERFORMED AS PER ASTM D3080.

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-008 S4
Sample No.: S-4
Test No.: 5.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/146/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 35.0'-37.0'
Elevation: ----

Soil Description: FLY ASH / LEAN CLAY WITH SAND MIX SAMPLE TAKEN FROM THE FLY ASH STRATA
Remarks: TEST PERFORMED AS PER ASTM D3080.

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	0.359	0.02341	0.000	0.0000	0.0000
2	130.95	0.359	0.02385	0.0182	0.007876	0.007876
3	252.94	0.359	0.02424	0.0338	0.01575	0.01575
4	379.00	0.360	0.02471	0.0446	0.02363	0.02363
5	526.83	0.359	0.02406	0.0578	0.03150	0.03150
6	657.29	0.359	0.02411	0.0702	0.03938	0.03938
7	817.53	0.359	0.02428	0.0875	0.04725	0.04725
8	933.21	0.359	0.02437	0.0982	0.05513	0.05513
9	1068.43	0.359	0.02476	0.110	0.06301	0.06301
10	1213.40	0.359	0.02510	0.121	0.07088	0.07088
11	1339.35	0.359	0.02558	0.128	0.07876	0.07876
12	1469.39	0.359	0.02601	0.127	0.08663	0.08663
13	1605.55	0.359	0.02645	0.139	0.09451	0.09451
14	1727.16	0.359	0.02679	0.146	0.1024	0.1024
15	1864.59	0.359	0.02697	0.144	0.1103	0.1103
16	1999.57	0.359	0.02649	0.144	0.1181	0.1181
17	2145.44	0.359	0.02653	0.141	0.1260	0.1260
18	2273.92	0.359	0.02658	0.142	0.1339	0.1339
19	2405.83	0.359	0.02710	0.143	0.1418	0.1418
20	2539.29	0.359	0.02740	0.140	0.1496	0.1496
21	2670.74	0.359	0.02762	0.146	0.1575	0.1575
22	2795.67	0.359	0.02796	0.147	0.1654	0.1654
23	2917.16	0.359	0.02857	0.146	0.1733	0.1733
24	3055.69	0.359	0.02887	0.149	0.1811	0.1811
25	3181.49	0.359	0.02931	0.149	0.1890	0.1890
26	3308.15	0.359	0.02939	0.149	0.1968	0.1968
27	3445.58	0.359	0.02909	0.155	0.2047	0.2047
28	3579.69	0.359	0.02922	0.155	0.2126	0.2126
29	3731.12	0.359	0.02918	0.159	0.2205	0.2205
30	3860.05	0.359	0.02922	0.157	0.2284	0.2284
31	3999.46	0.359	0.02909	0.164	0.2362	0.2362
32	4141.08	0.359	0.02905	0.162	0.2441	0.2441
33	4266.47	0.360	0.02900	0.166	0.2520	0.2520

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-008 S4
Sample No.: S-4
Test No.: 10.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/28/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 35.0'-37.0'
Elevation: ----

Soil Description: FLY ASH / LEAN CLAY WITH SAND MIX SAMPLE TAKEN FROM THE FLY ASH STRATA
Remarks: TEST PERFORMED AS PER ASTM D3080.

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	0.719	0.05983	0.000	0.0000	0.0000
2	158.45	0.719	0.06222	0.132	0.009199	0.009199
3	205.56	0.720	0.06455	0.191	0.01840	0.01840
4	254.95	0.720	0.06663	0.238	0.02760	0.02760
5	299.15	0.719	0.06783	0.270	0.03679	0.03679
6	341.39	0.720	0.06979	0.295	0.04599	0.04599
7	391.35	0.720	0.07073	0.319	0.05519	0.05519
8	431.04	0.720	0.07155	0.335	0.06439	0.06439
9	476.57	0.720	0.07262	0.352	0.07359	0.07359
10	520.20	0.720	0.07332	0.365	0.08279	0.08279
11	563.92	0.720	0.07458	0.379	0.09199	0.09199
12	606.27	0.720	0.07546	0.390	0.1012	0.1012
13	652.13	0.720	0.07615	0.400	0.1104	0.1104
14	695.38	0.720	0.07691	0.410	0.1196	0.1196
15	736.80	0.719	0.07811	0.423	0.1288	0.1288
16	782.53	0.720	0.07937	0.431	0.1380	0.1380
17	831.29	0.720	0.08038	0.440	0.1472	0.1472
18	870.18	0.720	0.08120	0.443	0.1564	0.1564
19	918.37	0.720	0.08189	0.444	0.1656	0.1656
20	962.28	0.720	0.08233	0.443	0.1748	0.1748
21	1005.17	0.720	0.08328	0.446	0.1840	0.1840
22	1050.60	0.720	0.08378	0.450	0.1932	0.1932
23	1091.31	0.720	0.08429	0.453	0.2024	0.2024
24	1139.63	0.720	0.08479	0.454	0.2116	0.2116
25	1181.83	0.720	0.08517	0.453	0.2208	0.2208
26	1225.69	0.719	0.08542	0.452	0.2300	0.2300
27	1272.35	0.720	0.08580	0.451	0.2392	0.2392
28	1316.66	0.720	0.08630	0.450	0.2483	0.2483
29	1362.97	0.720	0.08674	0.445	0.2575	0.2575
30	1382.74	0.720	0.08693	0.445	0.2614	0.2614

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN-008 S4
Tested By: BCM
Checked By: WPQ
Sample No.: S-4
Test Date: 12/29/15
Depth: 35.0'-37.0'
Test No.: 20.0 PSI
Sample Type: 3.0" ST
Elevation: ----

Soil Description: FLY ASH / LEAN CLAY WITH SAND MIX SAMPLE TAKEN FROM THE FLY ASH STRATA
Remarks: TEST PERFORMED AS PER ASTM D3080.

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	1.44	0.02774	0.000	0.0000	0.0000
2	84.76	1.44	0.03083	0.143	0.007935	0.007935
3	122.53	1.44	0.03360	0.209	0.01587	0.01587
4	160.70	1.44	0.03562	0.264	0.02381	0.02381
5	200.90	1.44	0.03808	0.314	0.03174	0.03174
6	240.99	1.44	0.03990	0.354	0.03968	0.03968
7	279.87	1.44	0.04142	0.388	0.04761	0.04761
8	319.42	1.44	0.04274	0.418	0.05555	0.05555
9	357.55	1.44	0.04457	0.444	0.06348	0.06348
10	393.06	1.44	0.04533	0.464	0.07142	0.07142
11	433.53	1.44	0.04652	0.482	0.07935	0.07935
12	471.68	1.44	0.04816	0.499	0.08729	0.08729
13	508.29	1.44	0.04917	0.515	0.09522	0.09522
14	548.55	1.44	0.05018	0.531	0.1032	0.1032
15	588.53	1.44	0.05075	0.545	0.1111	0.1111
16	627.66	1.44	0.05176	0.559	0.1190	0.1190
17	663.82	1.44	0.05245	0.575	0.1270	0.1270
18	703.53	1.44	0.05321	0.630	0.1349	0.1349
19	742.80	1.44	0.05415	0.641	0.1428	0.1428
20	779.75	1.44	0.05472	0.655	0.1508	0.1508
21	821.94	1.44	0.05510	0.657	0.1587	0.1587
22	855.16	1.44	0.05579	0.666	0.1666	0.1666
23	894.84	1.44	0.05630	0.680	0.1746	0.1746
24	937.49	1.44	0.05636	0.685	0.1825	0.1825
25	975.40	1.44	0.05686	0.698	0.1904	0.1904
26	1013.53	1.44	0.05743	0.700	0.1984	0.1984
27	1052.23	1.44	0.05775	0.700	0.2063	0.2063
28	1089.85	1.44	0.05787	0.698	0.2142	0.2142
29	1130.18	1.44	0.05819	0.676	0.2221	0.2221
30	1166.99	1.44	0.05856	0.684	0.2301	0.2301
31	1208.40	1.44	0.05926	0.680	0.2380	0.2380
32	1235.66	1.44	0.05976	0.677	0.2431	0.2431

DIRECT SHEAR TEST by ASTM D3080

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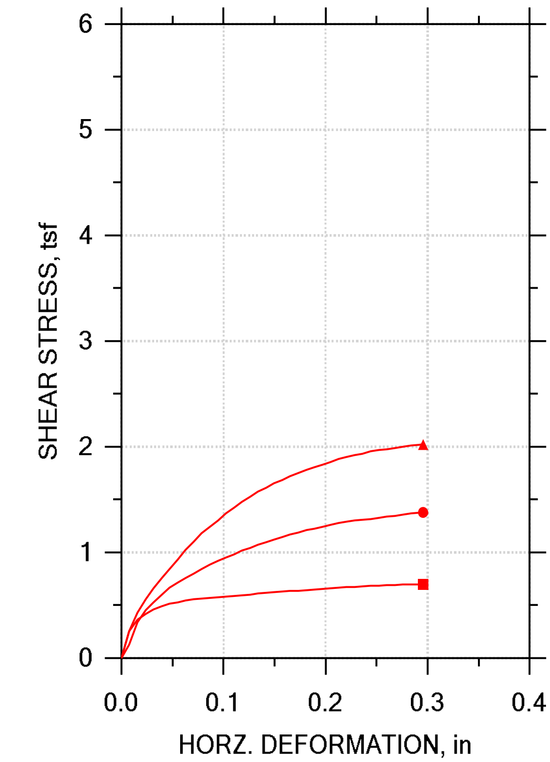

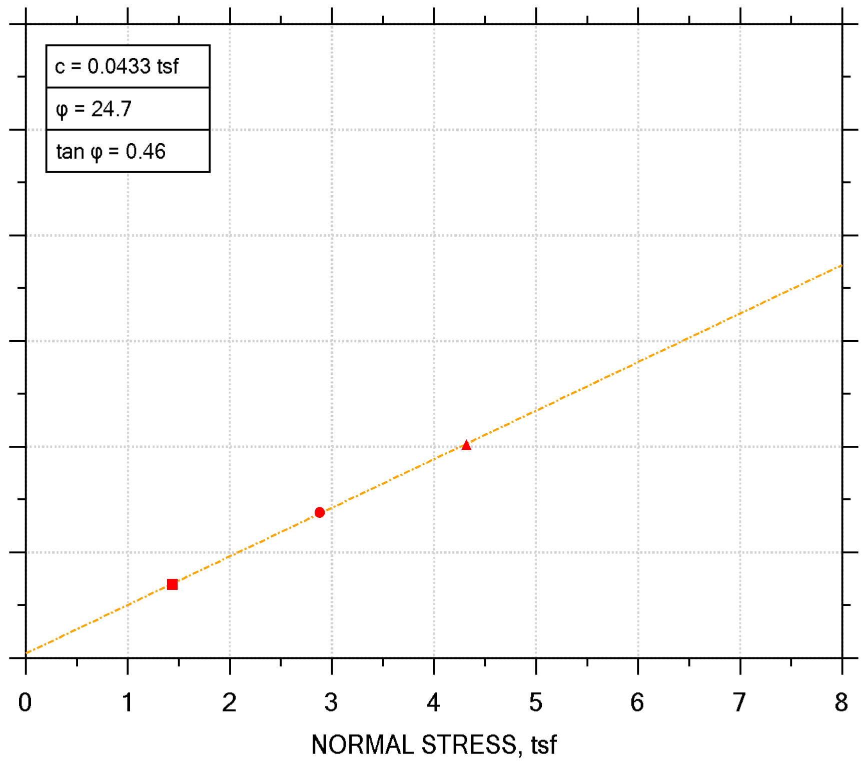

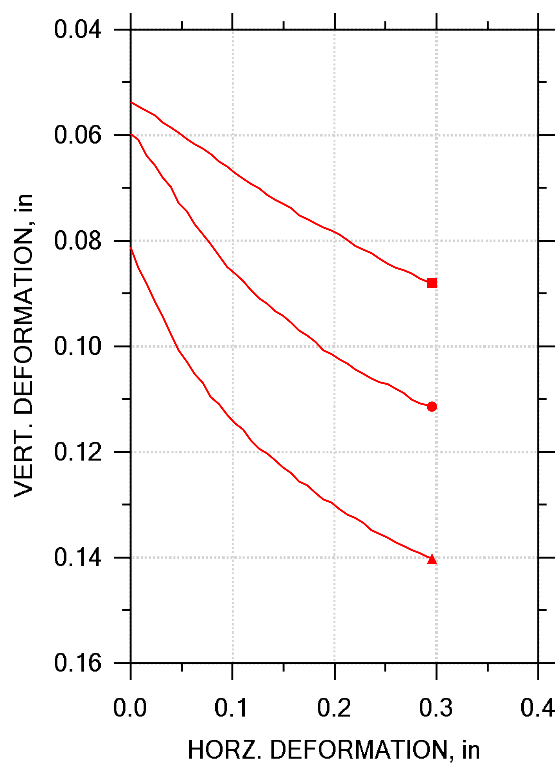

Symbol		■	●	▲
Test No.		20.0 PSI	40.0 PSI	60.0 PSI
Sample No.		S-9	S-9	S-9
Shape		Circular	Circular	Circular
Initial	Dimension, in	2.498	2.4992	2.5059
	Area, in²	4.901	4.9056	4.932
	Height, in	0.99213	0.99961	0.99291
	Water Content, %	26.32	26.88	27.01
	Dry Density, pcf	99.41	98.96	97.46
	Saturation, %	101.09	102.13	98.98
	Void Ratio	0.70807	0.71592	0.74226
Consol. Height, in		0.93839	0.93984	0.91168
Consol. Void Ratio		0.61555	0.61332	0.59971
Final	Water Content, %	20.28	18.96	17.91
	Dry Density, pcf	109.1	111.4	113.5
	Saturation, %	99.11	98.29	98.16
	Void Ratio	0.55655	0.52466	0.49629
Normal Stress, tsf		1.4387	2.8784	4.3182
Max. Shear Stress, tsf		0.69878	1.3783	2.0224
Ult. Shear Stress, tsf		0.69878	1.3783	2.0224
Time to Failure, min		74.891	75.103	74.824
Disp. Rate, in/min		0.0039823	0.0039823	0.0039823
Estimated Specific Gravity		2.72	2.72	2.72
Liquid Limit		30	30	30
Plastic Limit		15	15	15
Plasticity Index		15	15	15

Project: DYNEGY HENNEPIN	
Location: HENNEPIN, IL	
Project No.: MR155233	
Boring No.: HEN-012 S-9	
Sample Type: TRIMMED	
Description: BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND CL	
Remarks:	

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-012 S-9
Sample No.: S-9
Test No.: 20.0 PSI

Location: HENNEPIN, IL
Tested By: HP
Test Date: 12/30/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: BCM
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND CL
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	1.44	0.05374	0.000	0.0000	0.0000
2	2.36	1.44	0.05449	0.255	0.007902	0.007902
3	4.41	1.44	0.05541	0.361	0.01580	0.01580
4	6.20	1.44	0.05620	0.419	0.02364	0.02364
5	8.36	1.44	0.05759	0.461	0.03154	0.03154
6	10.28	1.44	0.05849	0.491	0.03940	0.03940
7	12.21	1.44	0.05946	0.514	0.04727	0.04727
8	14.37	1.44	0.06072	0.530	0.05514	0.05514
9	16.51	1.44	0.06170	0.545	0.06300	0.06300
10	18.51	1.44	0.06253	0.557	0.07087	0.07087
11	20.48	1.44	0.06368	0.563	0.07884	0.07884
12	22.37	1.44	0.06492	0.571	0.08664	0.08664
13	24.20	1.44	0.06593	0.574	0.09451	0.09451
14	26.24	1.44	0.06710	0.580	0.1024	0.1024
15	28.30	1.44	0.06820	0.586	0.1102	0.1102
16	30.30	1.44	0.06917	0.594	0.1181	0.1181
17	32.31	1.44	0.07004	0.603	0.1260	0.1260
18	34.44	1.44	0.07130	0.612	0.1339	0.1339
19	36.46	1.44	0.07221	0.620	0.1417	0.1417
20	38.12	1.44	0.07295	0.626	0.1497	0.1497
21	40.00	1.44	0.07385	0.630	0.1575	0.1575
22	42.18	1.44	0.07515	0.634	0.1654	0.1654
23	44.09	1.44	0.07589	0.638	0.1732	0.1732
24	46.27	1.44	0.07673	0.645	0.1811	0.1811
25	48.21	1.44	0.07745	0.650	0.1890	0.1890
26	50.13	1.44	0.07809	0.656	0.1969	0.1969
27	52.19	1.44	0.07879	0.662	0.2048	0.2048
28	54.02	1.44	0.07987	0.668	0.2126	0.2126
29	55.82	1.44	0.08097	0.671	0.2205	0.2205
30	57.85	1.44	0.08169	0.675	0.2283	0.2283
31	59.94	1.44	0.08230	0.678	0.2362	0.2362
32	61.95	1.44	0.08334	0.682	0.2441	0.2441
33	64.02	1.44	0.08442	0.687	0.2520	0.2520
34	65.84	1.44	0.08511	0.689	0.2598	0.2598
35	68.00	1.44	0.08554	0.692	0.2678	0.2678
36	69.87	1.44	0.08624	0.695	0.2757	0.2757
37	71.73	1.44	0.08714	0.696	0.2835	0.2835
38	73.67	1.44	0.08770	0.697	0.2914	0.2914
39	74.89	1.44	0.08801	0.699	0.2959	0.2959

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-012 S-9
Sample No.: S-9
Test No.: 40.0 PSI

Location: HENNEPIN, IL
Tested By: HP
Test Date: 12/30/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: BCM
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND CL
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	2.88	0.05977	0.000	0.0000	0.0000
2	2.06	2.88	0.06089	0.127	0.007902	0.007902
3	4.31	2.88	0.06384	0.341	0.01577	0.01577
4	6.41	2.88	0.06564	0.452	0.02364	0.02364
5	8.28	2.88	0.06802	0.530	0.03150	0.03150
6	10.21	2.88	0.06982	0.600	0.03947	0.03947
7	12.15	2.88	0.07283	0.663	0.04727	0.04727
8	14.13	2.88	0.07441	0.714	0.05514	0.05514
9	16.14	2.88	0.07686	0.757	0.06300	0.06300
10	18.27	2.88	0.07875	0.799	0.07087	0.07087
11	20.38	2.88	0.08055	0.841	0.07877	0.07877
12	22.34	2.88	0.08280	0.882	0.08664	0.08664
13	24.49	2.88	0.08496	0.920	0.09451	0.09451
14	26.26	2.88	0.08615	0.954	0.1024	0.1024
15	28.11	2.88	0.08759	0.985	0.1102	0.1102
16	30.15	2.88	0.08930	1.02	0.1181	0.1181
17	32.26	2.88	0.09089	1.04	0.1260	0.1260
18	34.35	2.88	0.09193	1.07	0.1339	0.1339
19	36.34	2.88	0.09330	1.10	0.1417	0.1417
20	38.37	2.88	0.09418	1.12	0.1496	0.1496
21	40.32	2.88	0.09548	1.15	0.1575	0.1575
22	42.32	2.88	0.09696	1.17	0.1654	0.1654
23	44.13	2.88	0.09798	1.19	0.1732	0.1732
24	46.14	2.88	0.09912	1.21	0.1811	0.1811
25	48.23	2.88	0.1007	1.23	0.1890	0.1890
26	50.29	2.88	0.1015	1.24	0.1969	0.1969
27	52.22	2.88	0.1025	1.26	0.2047	0.2047
28	54.25	2.88	0.1032	1.28	0.2126	0.2126
29	56.19	2.88	0.1044	1.29	0.2205	0.2205
30	58.34	2.88	0.1053	1.30	0.2283	0.2283
31	59.96	2.88	0.1060	1.31	0.2362	0.2362
32	61.98	2.88	0.1068	1.32	0.2441	0.2441
33	64.03	2.88	0.1072	1.33	0.2520	0.2520
34	66.11	2.88	0.1080	1.34	0.2598	0.2598
35	68.11	2.88	0.1089	1.35	0.2678	0.2678
36	70.11	2.88	0.1101	1.36	0.2757	0.2757
37	72.14	2.88	0.1108	1.37	0.2835	0.2835
38	74.07	2.88	0.1112	1.38	0.2914	0.2914
39	75.10	2.88	0.1114	1.38	0.2953	0.2953

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-012 S-9
Sample No.: S-9
Test No.: 60.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/29/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND CL
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	4.31	0.08124	0.000	0.0000	0.0000
2	2.11	4.31	0.08504	0.255	0.007902	0.007902
3	3.99	4.31	0.08810	0.430	0.01587	0.01587
4	5.99	4.31	0.09148	0.557	0.02364	0.02364
5	8.00	4.31	0.09436	0.659	0.03150	0.03150
6	10.07	4.31	0.09768	0.755	0.03944	0.03944
7	12.06	4.32	0.1007	0.842	0.04727	0.04727
8	14.23	4.32	0.1029	0.931	0.05514	0.05514
9	16.27	4.32	0.1053	1.02	0.06300	0.06300
10	18.25	4.32	0.1070	1.10	0.07087	0.07087
11	20.40	4.32	0.1095	1.18	0.07877	0.07877
12	22.17	4.32	0.1109	1.24	0.08664	0.08664
13	24.09	4.32	0.1130	1.30	0.09451	0.09451
14	26.17	4.32	0.1145	1.37	0.1024	0.1024
15	28.27	4.32	0.1158	1.42	0.1103	0.1103
16	30.44	4.32	0.1178	1.48	0.1181	0.1181
17	32.30	4.32	0.1194	1.53	0.1260	0.1260
18	34.32	4.32	0.1202	1.58	0.1339	0.1339
19	36.24	4.32	0.1216	1.61	0.1417	0.1417
20	38.28	4.32	0.1229	1.66	0.1496	0.1496
21	40.11	4.32	0.1240	1.69	0.1575	0.1575
22	42.17	4.32	0.1256	1.72	0.1654	0.1654
23	44.24	4.32	0.1263	1.75	0.1732	0.1732
24	46.21	4.32	0.1278	1.78	0.1811	0.1811
25	48.15	4.32	0.1289	1.81	0.1890	0.1890
26	50.11	4.32	0.1296	1.83	0.1969	0.1969
27	52.12	4.32	0.1308	1.86	0.2047	0.2047
28	54.28	4.32	0.1319	1.89	0.2126	0.2126
29	55.96	4.32	0.1325	1.90	0.2205	0.2205
30	57.96	4.32	0.1335	1.92	0.2283	0.2283
31	60.01	4.32	0.1348	1.94	0.2362	0.2362
32	62.07	4.32	0.1355	1.96	0.2441	0.2441
33	64.02	4.32	0.1362	1.97	0.2520	0.2520
34	65.98	4.32	0.1370	1.98	0.2598	0.2598
35	68.04	4.32	0.1379	1.99	0.2678	0.2678
36	70.01	4.32	0.1386	2.00	0.2756	0.2756
37	72.03	4.32	0.1392	2.01	0.2835	0.2835
38	73.88	4.32	0.1399	2.02	0.2914	0.2914
39	74.82	4.32	0.1402	2.02	0.2953	0.2953

DIRECT SHEAR TEST by ASTM D3080

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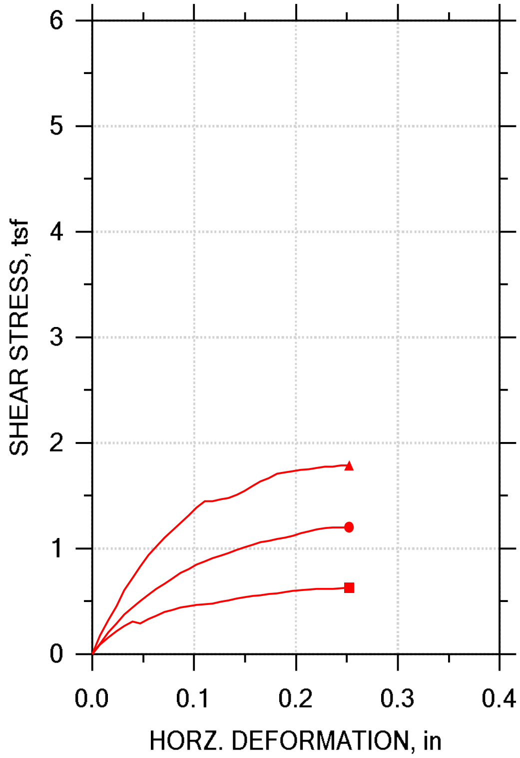
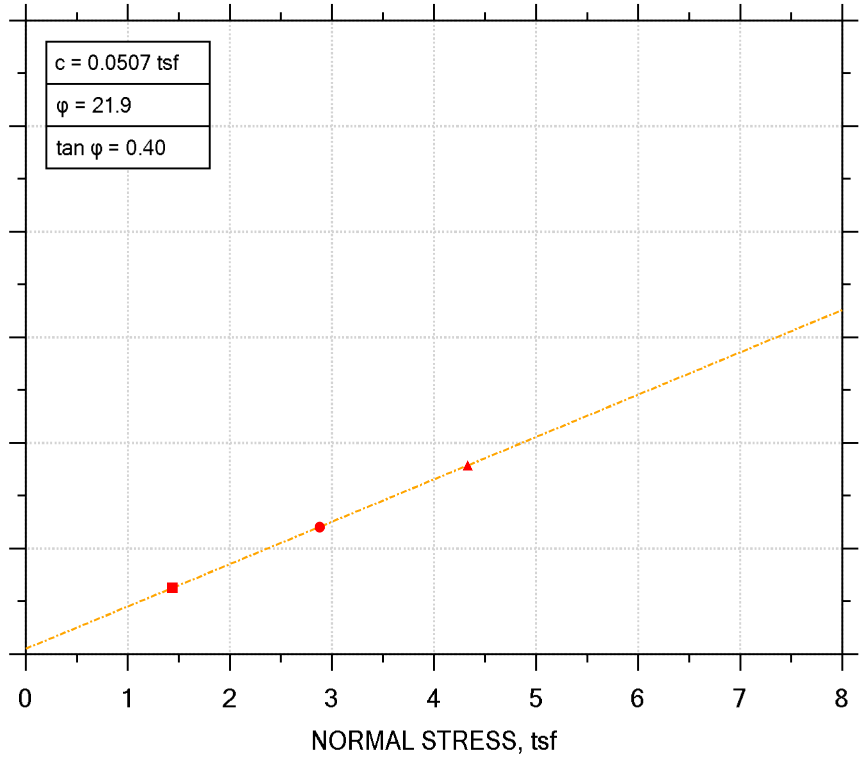
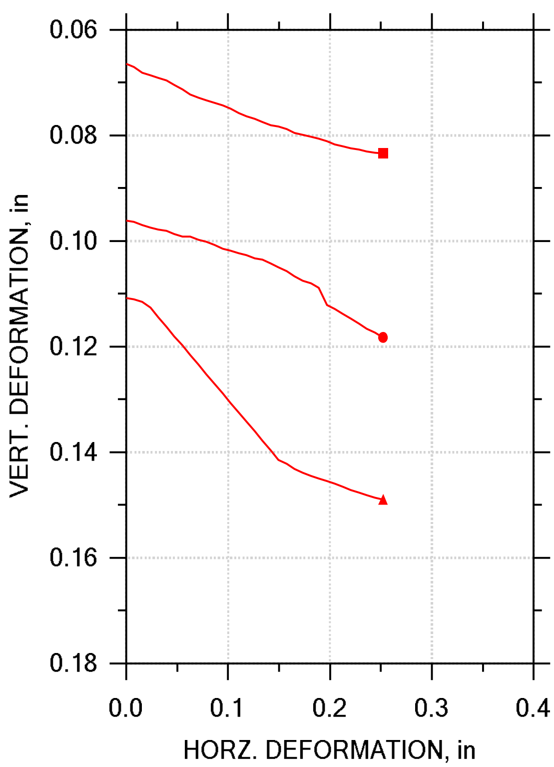






Symbol		■	●	▲	
Test No.		20.0 PSI	40.0 PSI	60.0 PSI	
Sample No.		S-10	S-10	S-10	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.5004	2.4969	2.4925	
Initial	Area, in²	4.9103	4.8964	4.8794	
Initial	Height, in	0.98937	0.99173	0.9937	
Initial	Water Content, %	63.41	63.89	63.12	
Initial	Dry Density, pcf	59.35	58.29	59.56	
Initial	Saturation, %	92.67	90.85	92.76	
Initial	Void Ratio	1.8612	1.9129	1.8508	
Consol. Height, in		0.92292	0.89565	0.88288	
Consol. Void Ratio		1.669	1.6307	1.5329	
Final	Water Content, %	59.75	57.69	52.17	
Final	Dry Density, pcf	64.81	66.19	70.06	
Final	Saturation, %	100.32	100.23	99.68	
Final	Void Ratio	1.62	1.5655	1.4235	
Normal Stress, tsf		1.4387	2.8788	4.328	
Max. Shear Stress, tsf		0.62916	1.2024	1.788	
Ult. Shear Stress, tsf		0.62916	1.2019	1.788	
Time to Failure, min		63.266	61.596	63.531	
Disp. Rate, in/min		0.004	0.004	0.004	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		70	70	70	
Plastic Limit		38	38	38	
Plasticity Index		32	32	32	

Project: DYNEGY HENNEPIN

Location: HENNEPIN, IL

Project No.: MR155233

Boring No.: HEN-014 S-10

Sample Type: TRIMMED

Description: VERY DARK BROWNISH GRAY ORGANIC SILT MH

Remarks:

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-014 S-10
Sample No.: S-10
Test No.: 20.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 35.0'-37.0'
Elevation: ----

Soil Description: VERY DARK BROWNISH GRAY ORGANIC SILT MH
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	1.44	0.06645	0.000	0.0000	0.0000
2	1.99	1.44	0.06706	0.0884	0.007867	0.007867
3	3.95	1.44	0.06811	0.159	0.01577	0.01577
4	5.72	1.44	0.06858	0.215	0.02364	0.02364
5	7.78	1.44	0.06906	0.268	0.03150	0.03150
6	9.71	1.44	0.06958	0.306	0.03937	0.03937
7	11.55	1.44	0.07038	0.293	0.04724	0.04724
8	13.80	1.44	0.07126	0.333	0.05514	0.05514
9	15.82	1.44	0.07223	0.366	0.06300	0.06300
10	17.89	1.44	0.07286	0.397	0.07087	0.07087
11	19.81	1.44	0.07329	0.420	0.07874	0.07874
12	21.66	1.44	0.07380	0.443	0.08664	0.08664
13	23.47	1.44	0.07425	0.455	0.09451	0.09451
14	25.50	1.44	0.07490	0.466	0.1024	0.1024
15	27.62	1.44	0.07571	0.470	0.1103	0.1103
16	29.65	1.44	0.07641	0.477	0.1181	0.1181
17	31.63	1.44	0.07682	0.494	0.1260	0.1260
18	33.73	1.44	0.07749	0.511	0.1339	0.1339
19	35.77	1.44	0.07807	0.528	0.1418	0.1418
20	37.40	1.44	0.07832	0.541	0.1496	0.1496
21	39.24	1.44	0.07877	0.552	0.1575	0.1575
22	41.37	1.44	0.07947	0.560	0.1654	0.1654
23	43.43	1.44	0.07990	0.569	0.1732	0.1732
24	45.55	1.44	0.08028	0.575	0.1811	0.1811
25	47.50	1.44	0.08061	0.586	0.1890	0.1890
26	49.45	1.44	0.08111	0.597	0.1968	0.1968
27	51.42	1.44	0.08169	0.605	0.2047	0.2047
28	53.26	1.44	0.08205	0.612	0.2126	0.2126
29	55.04	1.44	0.08241	0.617	0.2205	0.2205
30	57.01	1.44	0.08271	0.619	0.2283	0.2283
31	59.20	1.44	0.08306	0.620	0.2362	0.2362
32	61.20	1.44	0.08324	0.626	0.2441	0.2441
33	63.27	1.44	0.08342	0.629	0.2520	0.2520

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-014 S-10
Sample No.: S-10
Test No.: 40.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 35.0'-37.0'
Elevation: ----

Soil Description: VERY DARK BROWNISH GRAY ORGANIC SILT MH
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	2.88	0.09608	0.000	0.0000	0.0000
2	2.14	2.88	0.09638	0.0973	0.007867	0.007867
3	4.46	2.88	0.09696	0.206	0.01577	0.01577
4	6.38	2.88	0.09744	0.291	0.02364	0.02364
5	8.47	2.88	0.09783	0.374	0.03150	0.03150
6	10.24	2.88	0.09812	0.442	0.03937	0.03937
7	12.06	2.88	0.09869	0.505	0.04724	0.04724
8	14.09	2.88	0.09913	0.564	0.05517	0.05517
9	16.18	2.88	0.09922	0.616	0.06300	0.06300
10	18.35	2.88	0.09981	0.664	0.07087	0.07087
11	20.32	2.88	0.1001	0.716	0.07874	0.07874
12	22.33	2.88	0.1008	0.768	0.08660	0.08660
13	24.20	2.88	0.1014	0.807	0.09451	0.09451
14	26.17	2.88	0.1018	0.850	0.1024	0.1024
15	27.99	2.88	0.1023	0.881	0.1102	0.1102
16	29.96	2.88	0.1027	0.908	0.1181	0.1181
17	32.02	2.88	0.1033	0.934	0.1260	0.1260
18	34.18	2.88	0.1035	0.958	0.1339	0.1339
19	36.19	2.88	0.1043	0.988	0.1417	0.1417
20	38.09	2.88	0.1050	1.01	0.1496	0.1496
21	40.08	2.88	0.1058	1.04	0.1575	0.1575
22	42.07	2.88	0.1066	1.06	0.1653	0.1653
23	43.72	2.88	0.1075	1.07	0.1732	0.1732
24	45.68	2.88	0.1080	1.09	0.1811	0.1811
25	47.72	2.88	0.1088	1.10	0.1890	0.1890
26	49.91	2.88	0.1121	1.12	0.1969	0.1969
27	51.97	2.88	0.1128	1.14	0.2047	0.2047
28	53.89	2.88	0.1138	1.16	0.2126	0.2126
29	55.91	2.88	0.1147	1.18	0.2205	0.2205
30	57.81	2.88	0.1156	1.20	0.2283	0.2283
31	59.72	2.88	0.1166	1.20	0.2362	0.2362
32	61.60	2.88	0.1174	1.20	0.2441	0.2441
33	63.64	2.88	0.1183	1.20	0.2520	0.2520

DIRECT SHEAR TEST DATA

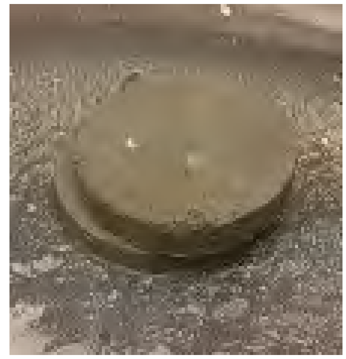
Project: DYNEGY HENNEPIN
Boring No.: HEN-014 S-10
Sample No.: S-10
Test No.: 60.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 35.0'-37.0'
Elevation: ----

Soil Description: VERY DARK BROWNISH GRAY ORGANIC SILT MH
Remarks:

Step: 1 of 1



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	4.32	0.1108	0.000	0.0000	0.0000
2	1.96	4.32	0.1110	0.174	0.007867	0.007867
3	3.96	4.32	0.1115	0.324	0.01577	0.01577
4	6.07	4.32	0.1126	0.454	0.02364	0.02364
5	8.38	4.32	0.1144	0.603	0.03150	0.03150
6	10.29	4.33	0.1162	0.722	0.03937	0.03937
7	12.37	4.32	0.1180	0.833	0.04724	0.04724
8	14.20	4.32	0.1198	0.936	0.05514	0.05514
9	15.96	4.33	0.1216	1.02	0.06304	0.06304
10	17.98	4.33	0.1234	1.10	0.07087	0.07087
11	20.04	4.33	0.1252	1.17	0.07874	0.07874
12	22.18	4.33	0.1270	1.24	0.08660	0.08660
13	24.18	4.33	0.1288	1.31	0.09451	0.09451
14	26.19	4.33	0.1307	1.39	0.1024	0.1024
15	28.05	4.33	0.1325	1.45	0.1102	0.1102
16	30.04	4.33	0.1342	1.45	0.1181	0.1181
17	31.83	4.33	0.1361	1.47	0.1260	0.1260
18	33.83	4.33	0.1378	1.48	0.1339	0.1339
19	35.92	4.33	0.1396	1.51	0.1417	0.1417
20	37.97	4.33	0.1414	1.54	0.1496	0.1496
21	39.90	4.33	0.1421	1.59	0.1575	0.1575
22	41.91	4.33	0.1432	1.64	0.1653	0.1653
23	43.88	4.33	0.1439	1.67	0.1732	0.1732
24	45.98	4.33	0.1445	1.71	0.1811	0.1811
25	47.55	4.33	0.1449	1.72	0.1890	0.1890
26	49.50	4.33	0.1454	1.73	0.1968	0.1968
27	51.56	4.33	0.1460	1.74	0.2047	0.2047
28	53.71	4.33	0.1466	1.75	0.2126	0.2126
29	55.70	4.33	0.1472	1.76	0.2205	0.2205
30	57.68	4.33	0.1476	1.77	0.2283	0.2283
31	59.68	4.33	0.1481	1.78	0.2362	0.2362
32	61.60	4.33	0.1487	1.79	0.2441	0.2441
33	63.53	4.33	0.1489	1.79	0.2520	0.2520

DIRECT SHEAR TEST by ASTM D3080

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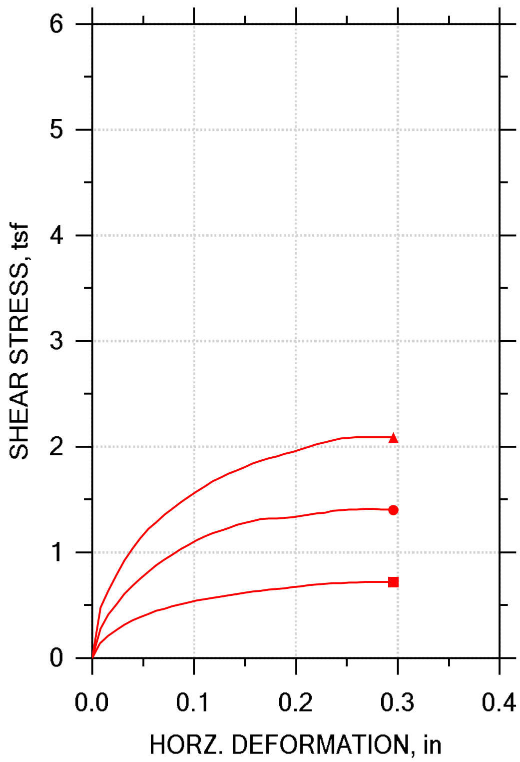

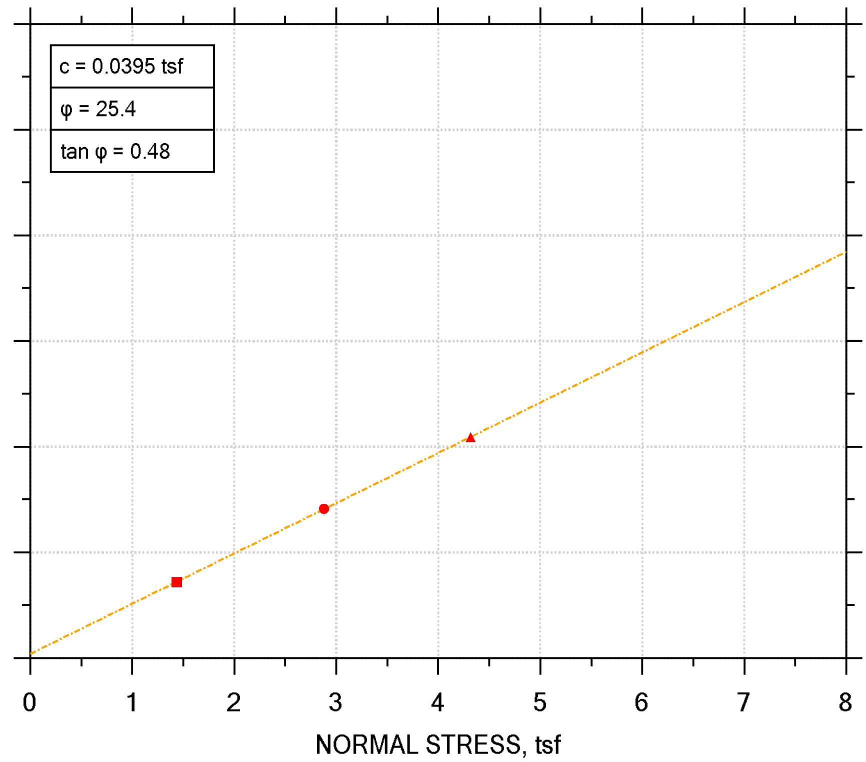

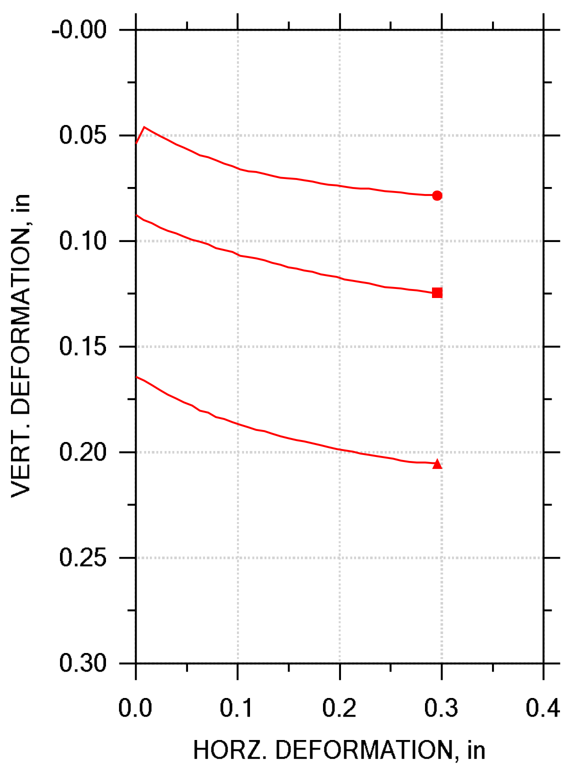

Symbol		■	●	▲	
Test No.		20.0 PSI	40.0 PSI	60.0 PSI	
Sample No.		S-9	S-10	S-10	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.4988	2.4925	2.4949	
	Area, in²	4.9041	4.8794	4.8887	
	Height, in	0.99685	0.9937	0.99921	
	Water Content, %	50.74	50.66	50.36	
	Dry Density, pcf	63.80	64.49	64.25	
	Saturation, %	83.06	84.38	83.37	
	Void Ratio	1.6615	1.6331	1.6429	
Consol. Height, in		0.90913	0.93973	0.83483	
Consol. Void Ratio		1.4273	1.4901	1.2081	
Final	Water Content, %	47.61	52.20	40.38	
	Dry Density, pcf	72.91	70.02	80.86	
	Saturation, %	97.45	99.63	99.86	
	Void Ratio	1.3288	1.4251	1.0999	
Normal Stress, tsf		1.4387	2.8787	4.3188	
Max. Shear Stress, tsf		0.72169	1.4131	2.0916	
Ult. Shear Stress, tsf		0.72113	1.4013	2.0888	
Time to Failure, min		73.304	70.325	72.709	
Disp. Rate, in/min		0.004	0.004	0.004	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		60	60	60	
Plastic Limit		35	35	35	
Plasticity Index		25	25	25	

Project: DYNEGY HENNEPIN	
Location: HENNEPIN, IL	
Project No.: MR155233	
Boring No.: HEN-017 S-9	
Sample Type: TRIMMED	
Description: DARK BROWNISH GRAY ORGANIC CLAY WITH SAND OL- SAND SEAMS AND SHELL NOTED	
Remarks:	

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-017 S-9
Sample No.: S-9
Test No.: 20.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: DARK BROWNISH GRAY ORGANIC CLAY WITH SAND OL- SAND SEAMS AND SHELL NOTED
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	1.44	0.08772	0.000	0.0000	0.0000
2	2.20	1.44	0.08988	0.137	0.007902	0.007902
3	4.24	1.44	0.09150	0.210	0.01577	0.01577
4	6.12	1.44	0.09370	0.266	0.02374	0.02374
5	8.04	1.44	0.09516	0.314	0.03150	0.03150
6	10.02	1.44	0.09638	0.355	0.03940	0.03940
7	11.96	1.44	0.09802	0.391	0.04727	0.04727
8	13.90	1.44	0.09928	0.419	0.05517	0.05517
9	16.08	1.44	0.1002	0.446	0.06300	0.06300
10	18.20	1.44	0.1016	0.468	0.07091	0.07091
11	20.21	1.44	0.1033	0.491	0.07877	0.07877
12	22.29	1.44	0.1041	0.511	0.08664	0.08664
13	24.05	1.44	0.1051	0.528	0.09451	0.09451
14	25.85	1.44	0.1068	0.544	0.1024	0.1024
15	27.87	1.44	0.1076	0.557	0.1102	0.1102
16	29.97	1.44	0.1082	0.569	0.1182	0.1182
17	32.12	1.44	0.1092	0.582	0.1260	0.1260
18	34.05	1.44	0.1103	0.593	0.1339	0.1339
19	36.06	1.44	0.1112	0.606	0.1417	0.1417
20	38.04	1.44	0.1126	0.617	0.1496	0.1496
21	39.95	1.44	0.1131	0.628	0.1575	0.1575
22	41.73	1.44	0.1139	0.637	0.1654	0.1654
23	43.68	1.44	0.1147	0.646	0.1732	0.1732
24	45.76	1.44	0.1158	0.655	0.1811	0.1811
25	47.81	1.44	0.1163	0.663	0.1890	0.1890
26	49.83	1.44	0.1171	0.672	0.1969	0.1969
27	51.86	1.44	0.1181	0.681	0.2047	0.2047
28	53.73	1.44	0.1188	0.688	0.2126	0.2126
29	55.82	1.44	0.1195	0.698	0.2205	0.2205
30	57.41	1.44	0.1200	0.702	0.2283	0.2283
31	59.37	1.44	0.1210	0.707	0.2362	0.2362
32	61.47	1.44	0.1219	0.710	0.2441	0.2441
33	63.59	1.44	0.1222	0.713	0.2520	0.2520
34	65.57	1.44	0.1224	0.717	0.2598	0.2598
35	67.56	1.44	0.1230	0.718	0.2678	0.2678
36	69.58	1.44	0.1235	0.720	0.2756	0.2756
37	71.39	1.44	0.1240	0.721	0.2835	0.2835
38	73.30	1.44	0.1245	0.722	0.2914	0.2914
39	74.33	1.44	0.1246	0.721	0.2958	0.2958

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN	Location: HENNEPIN, IL	Project No.: MR155233
Boring No.: HEN-014 S-10	Tested By: BCM	Checked By: WPQ
Sample No.: S-10	Test Date: 12/13/15	Depth: 35.0'-37.0'
Test No.: 40.0 PSI	Sample Type: TRIMMED	Elevation: ----

Soil Description: DARK BROWNISH GRAY ORGANIC CLAY WITH SAND OL- SAND SEAMS AND SHELL NOTED
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	2.88	0.05397	0.000	0.0000	0.0000
2	2.48	2.88	0.04592	0.281	0.007936	0.007936
3	4.74	2.88	0.04821	0.415	0.01577	0.01577
4	6.92	2.88	0.05017	0.508	0.02364	0.02364
5	9.08	2.88	0.05215	0.604	0.03154	0.03154
6	11.02	2.88	0.05413	0.684	0.03940	0.03940
7	12.91	2.88	0.05577	0.754	0.04727	0.04727
8	14.79	2.88	0.05759	0.819	0.05514	0.05514
9	16.83	2.88	0.05936	0.881	0.06300	0.06300
10	18.90	2.88	0.06031	0.936	0.07091	0.07091
11	20.98	2.88	0.06175	0.984	0.07881	0.07881
12	22.90	2.88	0.06337	1.03	0.08664	0.08664
13	24.97	2.88	0.06458	1.08	0.09451	0.09451
14	27.05	2.88	0.06620	1.12	0.1024	0.1024
15	28.75	2.88	0.06688	1.15	0.1102	0.1102
16	30.65	2.88	0.06735	1.18	0.1181	0.1181
17	32.80	2.88	0.06820	1.21	0.1260	0.1260
18	34.81	2.88	0.06915	1.23	0.1339	0.1339
19	36.91	2.88	0.07005	1.26	0.1417	0.1417
20	38.79	2.88	0.07031	1.28	0.1496	0.1496
21	40.72	2.88	0.07061	1.30	0.1575	0.1575
22	42.75	2.88	0.07131	1.31	0.1654	0.1654
23	44.66	2.88	0.07191	1.32	0.1733	0.1733
24	46.49	2.88	0.07265	1.32	0.1811	0.1811
25	48.46	2.88	0.07326	1.33	0.1890	0.1890
26	50.53	2.88	0.07373	1.34	0.1969	0.1969
27	52.55	2.88	0.07427	1.35	0.2047	0.2047
28	54.57	2.88	0.07474	1.36	0.2126	0.2126
29	56.40	2.88	0.07513	1.37	0.2205	0.2205
30	58.54	2.88	0.07531	1.38	0.2283	0.2283
31	60.49	2.88	0.07567	1.39	0.2362	0.2362
32	62.38	2.88	0.07632	1.40	0.2441	0.2441
33	64.23	2.88	0.07663	1.40	0.2520	0.2520
34	66.35	2.88	0.07711	1.41	0.2598	0.2598
35	68.36	2.88	0.07753	1.41	0.2678	0.2678
36	70.32	2.88	0.07787	1.41	0.2756	0.2756
37	72.11	2.88	0.07805	1.41	0.2835	0.2835
38	74.02	2.88	0.07830	1.41	0.2914	0.2914
39	75.19	2.88	0.07850	1.40	0.2954	0.2954

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-014 S-10
Sample No.: S-10
Test No.: 60.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 35.0'-37.0'
Elevation: ----

Soil Description: DARK BROWNISH GRAY ORGANIC CLAY WITH SAND OL- SAND SEAMS AND SHELL NOTED
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	4.32	0.1644	0.000	0.0000	0.0000
2	2.87	4.32	0.1661	0.476	0.007936	0.007936
3	5.02	4.32	0.1683	0.638	0.01580	0.01580
4	7.32	4.32	0.1706	0.785	0.02364	0.02364
5	9.43	4.32	0.1726	0.920	0.03150	0.03150
6	11.41	4.32	0.1746	1.04	0.03944	0.03944
7	13.32	4.32	0.1764	1.13	0.04727	0.04727
8	15.31	4.32	0.1780	1.23	0.05514	0.05514
9	17.28	4.32	0.1802	1.29	0.06304	0.06304
10	19.26	4.32	0.1812	1.36	0.07087	0.07087
11	21.42	4.32	0.1833	1.41	0.07877	0.07877
12	23.30	4.32	0.1844	1.47	0.08664	0.08664
13	25.32	4.32	0.1857	1.53	0.09454	0.09454
14	27.14	4.32	0.1869	1.58	0.1024	0.1024
15	29.28	4.32	0.1881	1.63	0.1102	0.1102
16	31.25	4.32	0.1893	1.67	0.1181	0.1181
17	33.23	4.32	0.1901	1.71	0.1260	0.1260
18	35.24	4.32	0.1913	1.75	0.1339	0.1339
19	37.22	4.32	0.1924	1.78	0.1417	0.1417
20	39.18	4.32	0.1934	1.81	0.1496	0.1496
21	41.14	4.32	0.1942	1.84	0.1575	0.1575
22	43.17	4.32	0.1948	1.87	0.1654	0.1654
23	45.13	4.32	0.1957	1.89	0.1732	0.1732
24	47.14	4.32	0.1966	1.91	0.1811	0.1811
25	49.12	4.32	0.1976	1.93	0.1890	0.1890
26	51.15	4.32	0.1984	1.95	0.1969	0.1969
27	53.20	4.32	0.1991	1.98	0.2048	0.2048
28	55.12	4.32	0.1997	2.00	0.2126	0.2126
29	56.93	4.32	0.2007	2.02	0.2205	0.2205
30	58.94	4.32	0.2012	2.04	0.2283	0.2283
31	61.01	4.32	0.2019	2.06	0.2362	0.2362
32	63.11	4.32	0.2025	2.08	0.2441	0.2441
33	64.90	4.32	0.2031	2.09	0.2520	0.2520
34	66.86	4.32	0.2039	2.09	0.2598	0.2598
35	68.95	4.32	0.2046	2.09	0.2678	0.2678
36	70.84	4.32	0.2048	2.09	0.2756	0.2756
37	72.71	4.32	0.2050	2.09	0.2835	0.2835
38	74.61	4.32	0.2052	2.09	0.2914	0.2914
39	75.80	4.32	0.2053	2.09	0.2956	0.2956

DIRECT SHEAR TEST by ASTM D3080

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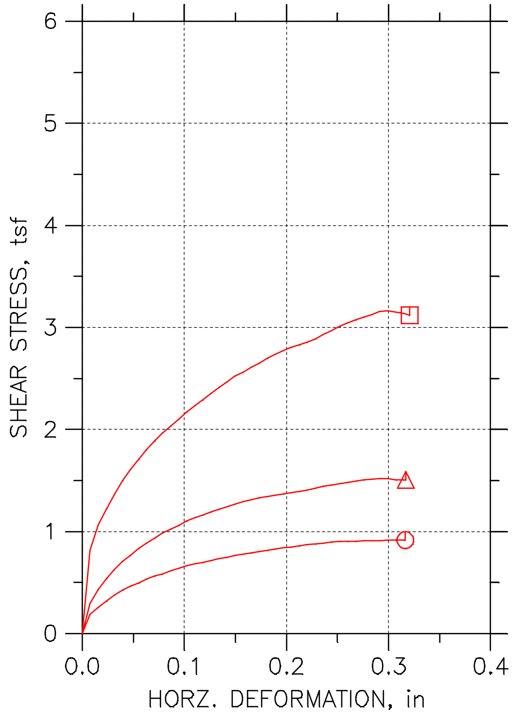

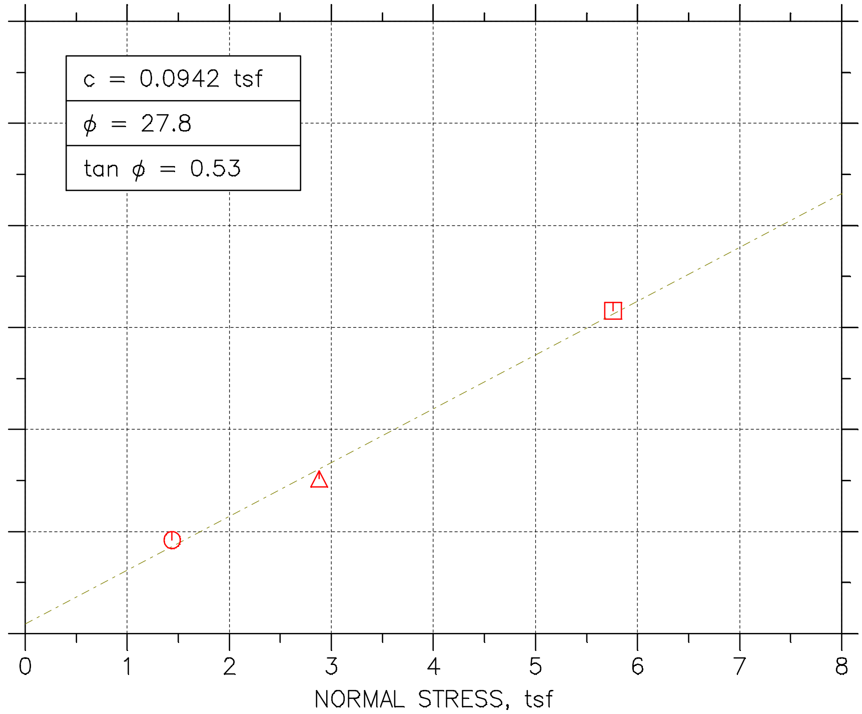

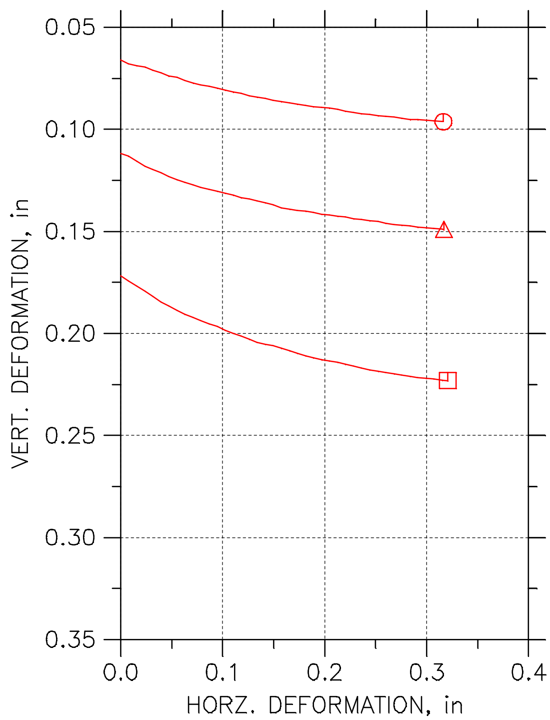

Symbol		○	△	□	
Test No.		20 PSI	40 PSI	80 PSI	
Sample No.		S-11	S-11	S-11	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.5783	2.574	2.5764	
	Area, in^2	5.2212	5.2037	5.2133	
	Height, in	0.99882	0.99055	0.99331	
	Water Content, %	40.96	40.97	40.38	
	Dry Density, pcf	71.698	72.342	72.172	
	Saturation, %	81.42	82.71	81.20	
	Void Ratio	1.3683	1.3472	1.3528	
Consol. Height, in		0.93345	0.88036	0.82222	
Consol. Void Ratio		1.2133	1.0861	0.94751	
Final	Water Content, %	42.12	36.41	30.26	
	Dry Density, pcf	79.345	85.159	93.078	
	Saturation, %	100.49	99.64	99.85	
	Void Ratio	1.1401	0.99396	0.82432	
Normal Stress, tsf		1.4387	2.8788	5.7589	
Max. Shear Stress, tsf		0.91675	1.517	3.1636	
Ult. Shear Stress, tsf		0.91675	1.5068	3.1176	
Time to Failure, min		80.291	75.783	79.062	
Disp. Rate, in/min		0.004	0.004	0.004	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		27	27	27	
Plastic Limit		20	20	20	
Plasticity Index		7	7	7	

Project: DYNEGY HENNEPIN

Location: HENNEPIN, IL

Project No.: MR155233

Boring No.: HEN-018 S11

Sample Type: 3.0'' ST

Description: DARK BROWN AND GRAY ORGANIC CLAY WITH SAND OL - SAND SEAMS AND SHELL NOTED

Remarks: TEST PERFORMED AS PER ASTM D3080.

Wed, 23-DEC-2015 11:01:23

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-018 S11
Sample No.: S-11
Test No.: 20 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 40.0'-42.0'
Elevation: ----

Soil Description: DARK BROWN AND GRAY ORGANIC CLAY WITH SAND OL - SAND SEAMS AND SHELL NOTED
Remarks: TEST PERFORMED AS PER ASTM D3080.

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	1.439	0.066	0	0
2	2.61	1.437	0.06783	0.1909	0.007876
3	4.60	1.438	0.06884	0.2576	0.01575
4	6.53	1.436	0.06966	0.3184	0.02363
5	8.61	1.436	0.07117	0.3765	0.0315
6	10.63	1.436	0.07243	0.4272	0.03938
7	12.62	1.437	0.07376	0.4666	0.04725
8	14.54	1.437	0.07464	0.4992	0.05513
9	16.54	1.439	0.07622	0.5322	0.06301
10	18.52	1.439	0.07748	0.5621	0.07088
11	20.46	1.438	0.07823	0.5861	0.07876
12	22.45	1.438	0.07893	0.6149	0.08663
13	24.59	1.438	0.07994	0.64	0.09451
14	26.43	1.439	0.08075	0.6634	0.1024
15	28.43	1.439	0.0817	0.6837	0.1103
16	30.42	1.437	0.08227	0.6986	0.1181
17	32.47	1.438	0.08353	0.7173	0.126
18	34.56	1.438	0.08435	0.7354	0.1339
19	36.52	1.438	0.08492	0.7498	0.1418
20	38.29	1.438	0.08567	0.7674	0.1496
21	40.39	1.438	0.0863	0.7808	0.1575
22	42.43	1.438	0.087	0.793	0.1654
23	44.32	1.439	0.08769	0.8048	0.1733
24	46.47	1.438	0.08826	0.8186	0.1811
25	48.52	1.438	0.08901	0.8293	0.189
26	50.45	1.439	0.08927	0.8394	0.1969
27	52.21	1.439	0.08952	0.8495	0.2048
28	54.25	1.439	0.09034	0.857	0.2126
29	56.31	1.438	0.09116	0.8719	0.2205
30	58.23	1.439	0.09185	0.8805	0.2284
31	60.23	1.439	0.09242	0.8863	0.2362
32	62.18	1.439	0.0928	0.8991	0.2441
33	64.11	1.439	0.09336	0.9013	0.252
34	66.08	1.439	0.0938	0.9055	0.2599
35	68.01	1.439	0.09412	0.9061	0.2677
36	70.08	1.438	0.09462	0.9087	0.2756
37	71.98	1.439	0.09513	0.9125	0.2835
38	74.07	1.439	0.09538	0.9103	0.2914
39	76.00	1.439	0.0957	0.9141	0.2992
40	77.97	1.439	0.09595	0.9135	0.3071
41	79.91	1.439	0.0962	0.9162	0.315
42	80.29	1.439	0.09626	0.9167	0.3163

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-018 S11
Sample No.: S-11
Test No.: 40 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 40.0'-42.0'
Elevation: ----

Soil Description: DARK BROWN AND GRAY ORGANIC CLAY WITH SAND OL - SAND SEAMS AND SHELL NOTED
Remarks: TEST PERFORMED AS PER ASTM D3080.

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	2.88	0.1118	0	0
2	2.24	2.874	0.1132	0.2943	0.007876
3	4.45	2.877	0.1156	0.4329	0.01575
4	6.47	2.879	0.1181	0.5399	0.02363
5	8.39	2.879	0.1197	0.625	0.0315
6	10.46	2.878	0.1212	0.7069	0.03938
7	12.43	2.878	0.1232	0.7647	0.04725
8	14.48	2.877	0.1248	0.8326	0.05513
9	16.38	2.877	0.126	0.8856	0.06301
10	18.29	2.879	0.1272	0.9343	0.07088
11	20.31	2.878	0.1284	0.9867	0.07876
12	22.28	2.877	0.1295	1.025	0.08663
13	24.27	2.878	0.1303	1.061	0.09451
14	26.47	2.879	0.1313	1.103	0.1024
15	28.29	2.878	0.1323	1.135	0.1103
16	30.33	2.878	0.1334	1.164	0.1181
17	32.24	2.878	0.1343	1.19	0.126
18	34.28	2.878	0.1352	1.218	0.1339
19	36.38	2.878	0.1362	1.245	0.1418
20	38.30	2.878	0.137	1.267	0.1496
21	40.17	2.879	0.1384	1.291	0.1575
22	42.16	2.877	0.1391	1.312	0.1654
23	44.26	2.879	0.1396	1.332	0.1733
24	46.14	2.879	0.14	1.343	0.1811
25	48.19	2.879	0.1408	1.355	0.189
26	50.33	2.879	0.1415	1.368	0.1969
27	52.21	2.879	0.142	1.382	0.2048
28	54.03	2.879	0.1425	1.394	0.2126
29	56.02	2.878	0.143	1.407	0.2205
30	58.15	2.879	0.1439	1.426	0.2284
31	60.05	2.879	0.1441	1.441	0.2362
32	62.00	2.879	0.1447	1.454	0.2441
33	64.00	2.879	0.1452	1.468	0.252
34	65.90	2.879	0.1461	1.481	0.2599
35	67.88	2.878	0.1467	1.493	0.2677
36	69.83	2.879	0.1471	1.504	0.2756
37	71.65	2.879	0.1475	1.512	0.2835
38	73.83	2.879	0.1481	1.516	0.2914
39	75.78	2.879	0.1484	1.517	0.2992
40	77.73	2.879	0.1486	1.508	0.3071
41	79.68	2.879	0.149	1.506	0.315
42	80.15	2.879	0.1491	1.507	0.317

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-018 S11
Sample No.: S-11
Test No.: 80 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 40.0'-42.0'
Elevation: ----

Soil Description: DARK BROWN AND GRAY ORGANIC CLAY WITH SAND OL - SAND SEAMS AND SHELL NOTED
Remarks: TEST PERFORMED AS PER ASTM D3080.

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	5.76	0.1718	0	0
2	5.76	5.758	0.1742	0.814	0.007876
3	7.82	5.758	0.1767	1.067	0.01575
4	9.78	5.755	0.1792	1.227	0.02363
5	11.79	5.756	0.1819	1.362	0.0315
6	13.84	5.757	0.1845	1.498	0.03938
7	15.81	5.754	0.1865	1.604	0.04725
8	17.73	5.754	0.1887	1.704	0.05518
9	19.75	5.759	0.1906	1.799	0.06301
10	21.92	5.757	0.1921	1.888	0.07088
11	23.73	5.757	0.1936	1.961	0.07876
12	25.77	5.758	0.1953	2.033	0.08663
13	27.88	5.759	0.1966	2.103	0.09451
14	29.82	5.758	0.1983	2.17	0.1024
15	31.77	5.756	0.2	2.236	0.1103
16	33.65	5.758	0.2012	2.29	0.1181
17	35.80	5.757	0.2029	2.354	0.126
18	37.75	5.759	0.2044	2.412	0.1339
19	39.72	5.756	0.2053	2.465	0.1418
20	41.79	5.757	0.2059	2.522	0.1496
21	43.76	5.757	0.2073	2.563	0.1575
22	45.75	5.757	0.2084	2.611	0.1654
23	47.50	5.759	0.2097	2.651	0.1733
24	49.59	5.759	0.211	2.697	0.1811
25	51.43	5.758	0.2118	2.737	0.189
26	53.61	5.758	0.2128	2.776	0.1969
27	55.44	5.759	0.2134	2.805	0.2048
28	57.33	5.759	0.2141	2.829	0.2126
29	59.33	5.758	0.215	2.856	0.2205
30	61.41	5.758	0.216	2.89	0.2284
31	63.37	5.759	0.2169	2.929	0.2362
32	65.33	5.759	0.2179	2.969	0.2441
33	67.37	5.758	0.2184	3.009	0.252
34	69.38	5.759	0.2192	3.047	0.2599
35	71.19	5.759	0.2197	3.075	0.2677
36	73.46	5.759	0.2205	3.1	0.2756
37	75.20	5.758	0.2211	3.128	0.2835
38	77.32	5.757	0.2218	3.156	0.2914
39	79.06	5.759	0.222	3.164	0.2992
40	81.22	5.759	0.2224	3.151	0.3071
41	83.02	5.759	0.2228	3.139	0.315
42	84.64	5.759	0.2231	3.118	0.3208

DIRECT SHEAR TEST by ASTM D3080

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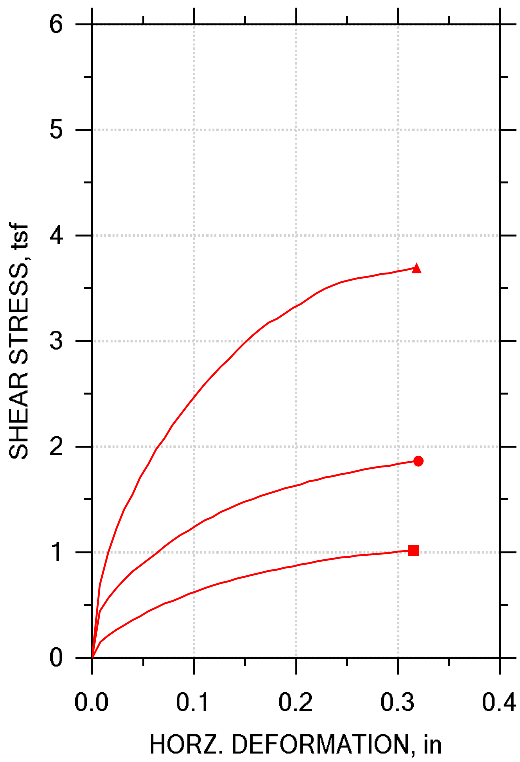

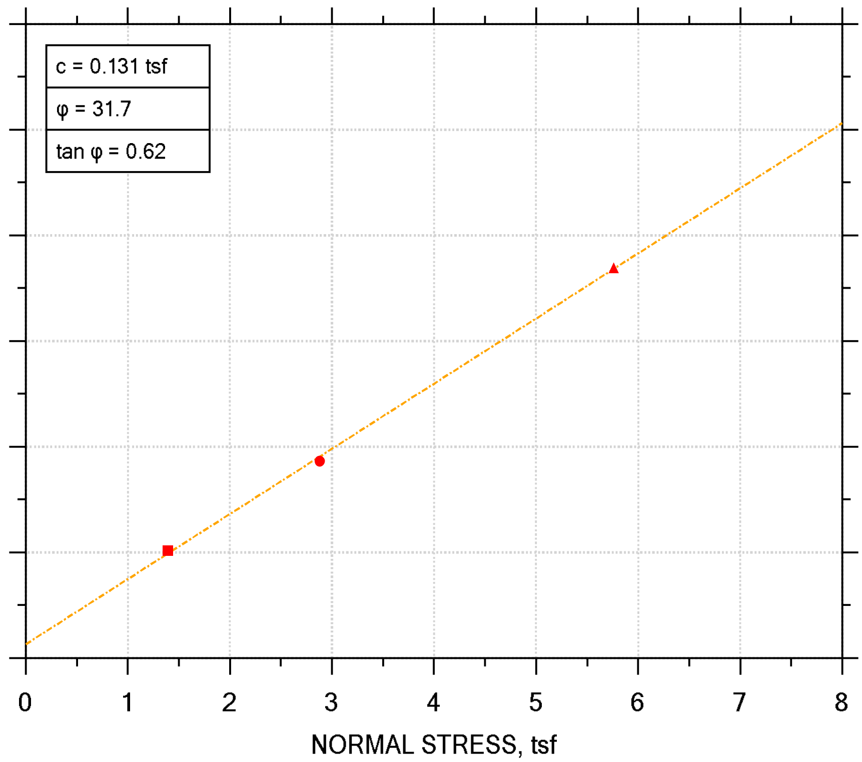

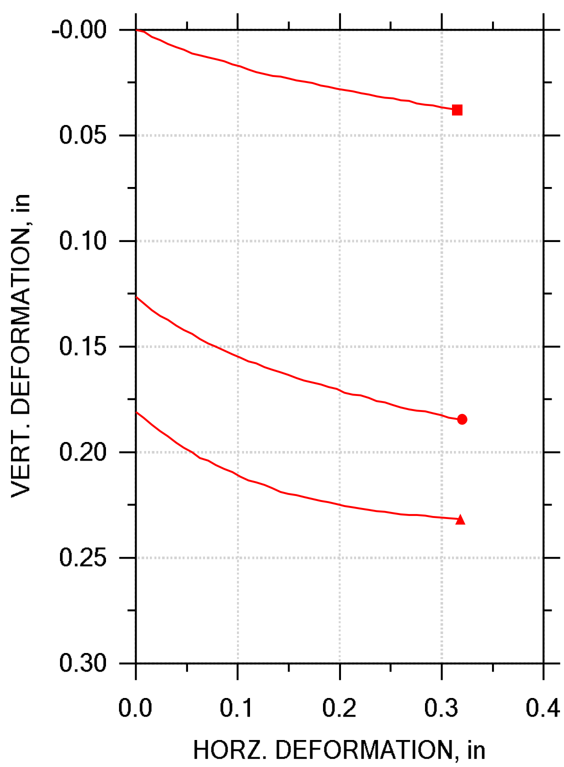

	Symbol	■	●	▲
	Test No.	20 PSI	40 PSI	80 PSI
	Sample No.	S-7	S-7	S-7
	Shape	Circular	Circular	Circular
Initial	Dimension, in	2.5748	2.576	2.5783
Initial	Area, in²	5.2069	5.2117	5.2212
Initial	Height, in	0.99449	0.99252	0.99488
Initial	Water Content, %	44.55	44.66	44.88
Initial	Dry Density, pcf	67.26	67.42	67.10
Initial	Saturation, %	80.27	80.78	80.53
Initial	Void Ratio	1.4873	1.4816	1.4935
	Consol. Height, in	0.99449	0.86625	0.81402
	Consol. Void Ratio	1.4873	1.1659	1.0402
Final	Water Content, %	50.59	40.33	34.75
Final	Dry Density, pcf	69.94	82.81	87.47
Final	Saturation, %	97.38	105.92	102.03
Final	Void Ratio	1.3922	1.0204	0.91268
	Normal Stress, tsf	1.3947	2.8789	5.7584
	Max. Shear Stress, tsf	1.0185	1.8642	3.695
	Ult. Shear Stress, tsf	1.0185	1.8642	3.695
	Time to Failure, min	79.017	81.05	81.167
	Disp. Rate, in/min	0.004	0.004	0.004
	Estimated Specific Gravity	2.68	2.68	2.68
	Liquid Limit	34	34	34
	Plastic Limit	28	28	26
	Plasticity Index	6	6	8

Project: DYNEGY HENNEPIN

Location: HENNEPIN, IL

Project No.: MR155233

Boring No.: HEN-019 S-7

Sample Type: TRIMMED

Description: VERY DARK GRAY ORGANIC SILT WITH SAND OL SHELLS NOTED

Remarks: TEST PERFORMED AS PER ASTM D3080.

DIRECT SHEAR TEST DATA

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Consulting Engineers & Scientists

Project: DYNEGY HENNEPIN
Boring No.: HEN-019 S-7
Sample No.: S-7
Test No.: 20 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/146/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-27.0'
Elevation: ----

Soil Description: VERY DARK GRAY ORGANIC SILT WITH SAND OL SHELLS NOTED
Remarks: TEST PERFORMED AS PER ASTM D3080.

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	1.40	0.0000	0.000	0.0000	0.0000
2	2.24	1.40	0.001009	0.150	0.008016	0.008016
3	4.21	1.39	0.003278	0.211	0.01589	0.01589
4	6.13	1.39	0.004728	0.264	0.02377	0.02377
5	8.15	1.39	0.006556	0.309	0.03164	0.03164
6	10.27	1.39	0.008132	0.356	0.03952	0.03952
7	12.08	1.39	0.009456	0.397	0.04740	0.04740
8	14.17	1.40	0.01122	0.442	0.05527	0.05527
9	16.22	1.39	0.01204	0.480	0.06315	0.06315
10	18.14	1.40	0.01292	0.512	0.07102	0.07102
11	20.08	1.39	0.01399	0.542	0.07890	0.07890
12	21.96	1.39	0.01488	0.567	0.08677	0.08677
13	24.13	1.39	0.01645	0.604	0.09465	0.09465
14	26.03	1.40	0.01734	0.632	0.1025	0.1025
15	27.97	1.40	0.01885	0.658	0.1104	0.1104
16	30.04	1.39	0.01992	0.683	0.1183	0.1183
17	32.00	1.39	0.02093	0.707	0.1262	0.1262
18	34.07	1.40	0.02169	0.730	0.1340	0.1340
19	35.81	1.39	0.02219	0.749	0.1419	0.1419
20	37.86	1.39	0.02307	0.767	0.1498	0.1498
21	39.69	1.39	0.02389	0.785	0.1577	0.1577
22	41.87	1.39	0.02465	0.806	0.1655	0.1655
23	43.68	1.39	0.02515	0.821	0.1734	0.1734
24	45.61	1.40	0.02622	0.838	0.1813	0.1813
25	47.58	1.39	0.02711	0.853	0.1892	0.1892
26	49.70	1.40	0.02774	0.869	0.1970	0.1970
27	51.63	1.39	0.02843	0.883	0.2049	0.2049
28	53.53	1.39	0.02912	0.898	0.2127	0.2127
29	55.49	1.39	0.03001	0.913	0.2206	0.2206
30	57.46	1.40	0.03076	0.927	0.2285	0.2285
31	59.32	1.40	0.03152	0.939	0.2364	0.2364
32	61.60	1.39	0.03221	0.952	0.2442	0.2442
33	63.33	1.40	0.03247	0.960	0.2521	0.2521
34	65.38	1.40	0.03322	0.970	0.2600	0.2600
35	67.15	1.40	0.03379	0.977	0.2679	0.2679
36	69.28	1.39	0.03486	0.983	0.2757	0.2757
37	71.08	1.40	0.03537	0.989	0.2836	0.2836
38	73.09	1.40	0.03587	0.994	0.2915	0.2915
39	75.11	1.39	0.03656	1.00	0.2994	0.2994
40	76.98	1.39	0.03713	1.01	0.3072	0.3072
41	79.02	1.39	0.03801	1.02	0.3151	0.3151

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-019 S-7
Sample No.: S-7
Test No.: 40 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/146/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-27.0'
Elevation: ----

Soil Description: VERY DARK GRAY ORGANIC SILT WITH SAND OL SHELLS NOTED
Remarks: TEST PERFORMED AS PER ASTM D3080.

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	2.88	0.1263	0.000	0.0000	0.0000
2	2.71	2.88	0.1295	0.442	0.007876	0.007876
3	4.72	2.87	0.1327	0.566	0.01575	0.01575
4	6.72	2.87	0.1353	0.662	0.02363	0.02363
5	8.56	2.88	0.1374	0.742	0.03150	0.03150
6	10.61	2.88	0.1401	0.819	0.03938	0.03938
7	12.63	2.88	0.1420	0.871	0.04730	0.04730
8	14.64	2.88	0.1440	0.936	0.05513	0.05513
9	16.63	2.87	0.1464	0.990	0.06301	0.06301
10	18.60	2.88	0.1484	1.05	0.07088	0.07088
11	20.62	2.88	0.1499	1.11	0.07876	0.07876
12	22.64	2.88	0.1518	1.16	0.08663	0.08663
13	24.58	2.88	0.1536	1.21	0.09451	0.09451
14	26.52	2.88	0.1553	1.25	0.1024	0.1024
15	28.53	2.88	0.1568	1.30	0.1103	0.1103
16	30.56	2.88	0.1579	1.34	0.1181	0.1181
17	32.49	2.88	0.1596	1.38	0.1260	0.1260
18	34.47	2.88	0.1611	1.41	0.1339	0.1339
19	36.51	2.88	0.1621	1.45	0.1418	0.1418
20	38.44	2.88	0.1633	1.48	0.1496	0.1496
21	40.29	2.88	0.1647	1.50	0.1575	0.1575
22	42.52	2.88	0.1661	1.53	0.1654	0.1654
23	44.32	2.88	0.1671	1.56	0.1733	0.1733
24	46.34	2.88	0.1679	1.58	0.1811	0.1811
25	48.43	2.88	0.1690	1.60	0.1890	0.1890
26	50.30	2.88	0.1701	1.63	0.1969	0.1969
27	52.25	2.88	0.1718	1.64	0.2048	0.2048
28	54.26	2.88	0.1727	1.67	0.2126	0.2126
29	56.18	2.88	0.1732	1.68	0.2205	0.2205
30	58.19	2.88	0.1742	1.71	0.2284	0.2284
31	60.23	2.88	0.1757	1.72	0.2362	0.2362
32	62.17	2.88	0.1765	1.74	0.2441	0.2441
33	63.89	2.88	0.1776	1.75	0.2520	0.2520
34	66.05	2.88	0.1787	1.77	0.2599	0.2599
35	68.20	2.88	0.1798	1.79	0.2677	0.2677
36	69.90	2.88	0.1802	1.80	0.2756	0.2756
37	71.94	2.88	0.1807	1.81	0.2835	0.2835
38	73.80	2.88	0.1814	1.82	0.2914	0.2914
39	76.05	2.88	0.1826	1.84	0.2992	0.2992
40	77.78	2.88	0.1836	1.85	0.3071	0.3071
41	79.97	2.88	0.1842	1.86	0.3150	0.3150
42	81.05	2.88	0.1845	1.86	0.3199	0.3199

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-019 S-7
Sample No.: S-7
Test No.: 80 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/146/15
Sample Type: TRIMMED

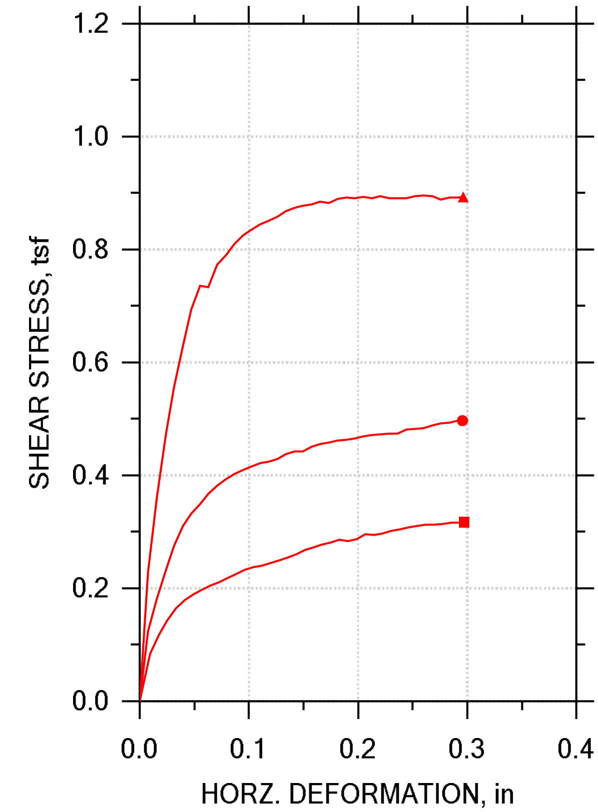
Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-27.0'
Elevation: ----

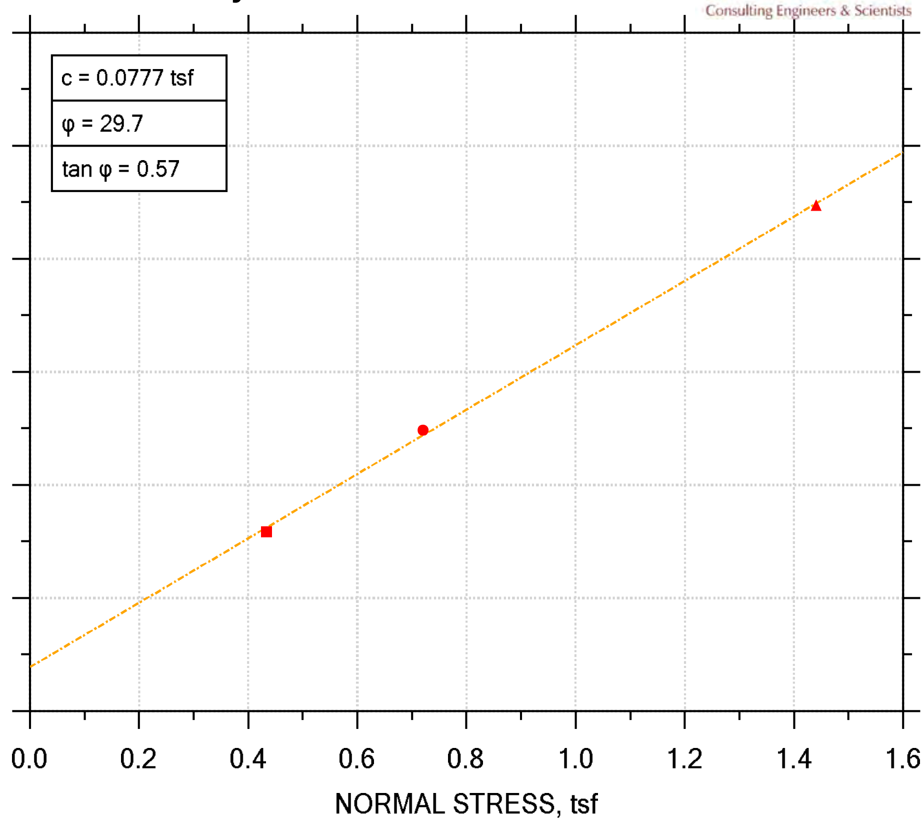
Soil Description: VERY DARK GRAY ORGANIC SILT WITH SAND OL SHELLS NOTED
Remarks: TEST PERFORMED AS PER ASTM D3080.

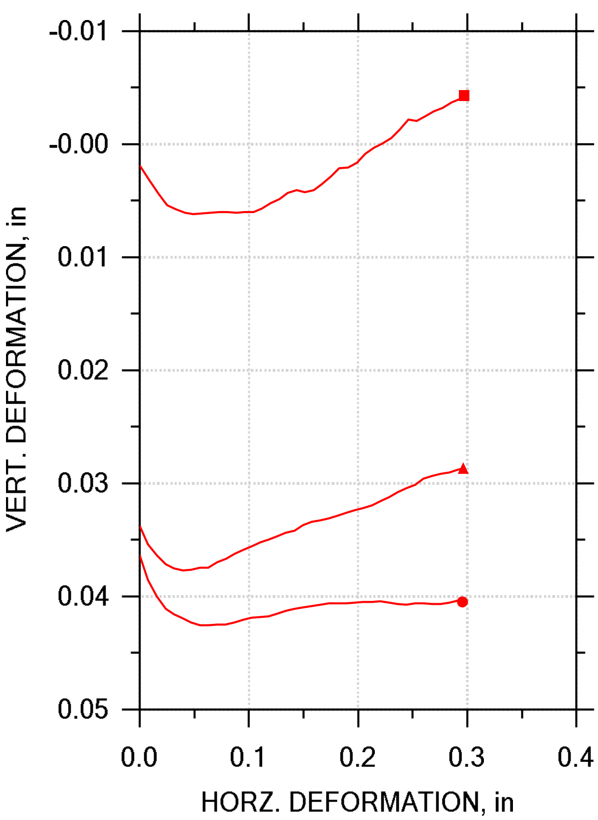
Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	5.76	0.1809	0.000	0.0000	0.0000
2	2.41	5.76	0.1838	0.693	0.007876	0.007876
3	4.56	5.76	0.1870	0.997	0.01575	0.01575
4	6.61	5.76	0.1899	1.23	0.02363	0.02363
5	8.66	5.76	0.1925	1.41	0.03150	0.03150
6	10.62	5.76	0.1954	1.55	0.03938	0.03938
7	12.67	5.75	0.1979	1.71	0.04725	0.04725
8	14.51	5.75	0.1999	1.84	0.05513	0.05513
9	16.84	5.76	0.2026	1.98	0.06301	0.06301
10	18.58	5.76	0.2041	2.08	0.07088	0.07088
11	20.61	5.76	0.2060	2.20	0.07876	0.07876
12	22.73	5.76	0.2080	2.30	0.08663	0.08663
13	24.64	5.76	0.2093	2.41	0.09451	0.09451
14	26.56	5.76	0.2116	2.50	0.1024	0.1024
15	28.75	5.76	0.2133	2.59	0.1103	0.1103
16	30.58	5.76	0.2143	2.67	0.1181	0.1181
17	32.68	5.76	0.2153	2.75	0.1260	0.1260
18	34.61	5.76	0.2171	2.83	0.1339	0.1339
19	36.73	5.76	0.2189	2.91	0.1418	0.1418
20	38.64	5.76	0.2196	2.98	0.1496	0.1496
21	40.62	5.76	0.2203	3.05	0.1575	0.1575
22	42.63	5.76	0.2213	3.11	0.1654	0.1654
23	44.66	5.76	0.2222	3.17	0.1733	0.1733
24	46.52	5.76	0.2229	3.21	0.1811	0.1811
25	48.51	5.76	0.2236	3.26	0.1890	0.1890
26	50.66	5.76	0.2246	3.32	0.1969	0.1969
27	52.51	5.76	0.2254	3.35	0.2048	0.2048
28	54.78	5.76	0.2261	3.41	0.2126	0.2126
29	56.49	5.76	0.2268	3.45	0.2205	0.2205
30	58.44	5.76	0.2273	3.50	0.2284	0.2284
31	60.62	5.76	0.2279	3.53	0.2362	0.2362
32	62.60	5.76	0.2283	3.55	0.2441	0.2441
33	64.58	5.76	0.2288	3.58	0.2520	0.2520
34	66.59	5.76	0.2295	3.59	0.2599	0.2599
35	68.47	5.76	0.2297	3.61	0.2677	0.2677
36	70.58	5.76	0.2298	3.62	0.2756	0.2756
37	72.44	5.76	0.2302	3.64	0.2835	0.2835
38	74.36	5.76	0.2306	3.65	0.2914	0.2914
39	76.49	5.76	0.2308	3.66	0.2992	0.2992
40	78.50	5.76	0.2312	3.67	0.3071	0.3071
41	80.37	5.76	0.2316	3.69	0.3150	0.3150
42	81.17	5.76	0.2317	3.70	0.3180	0.3180

DIRECT SHEAR TEST by ASTM D3080







		■	●	▲	
Symbol		■	●	▲	
Test No.		5.0 PSI	10.0 PSI	20.0 PSI	
Sample No.		S-5	S-5	S-5	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.4835	2.4835	2.4874	
	Area, in²	4.844	4.844	4.8594	
	Height, in	0.98504	0.98504	0.99016	
	Water Content, %	13.68	12.08	13.15	
	Dry Density, pcf	115.5	116.2	119.6	
	Saturation, %	79.15	71.31	85.21	
	Void Ratio	0.47011	0.46082	0.41964	
Consol. Height, in		0.98315	0.94868	0.95639	
Consol. Void Ratio		0.46729	0.4069	0.37123	
Final	Water Content, %	17.58	15.01	14.23	
	Dry Density, pcf	115.0	121.2	123.2	
	Saturation, %	100.38	101.90	102.21	
	Void Ratio	0.47651	0.40079	0.37856	
Normal Stress, tsf		0.4329	0.71995	1.4404	
Max. Shear Stress, tsf		0.31754	0.49691	0.89517	
Ult. Shear Stress, tsf		0.31754	0.49691	0.89342	
Time to Failure, min		70.449	70.931	63.315	
Disp. Rate, in/min		0.0041764	0.0041764	0.0041764	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		30	30	30	
Plastic Limit		17	17	17	
Plasticity Index		13	13	13	

Project: DYNERGY HENNEPIN	
Location: HENNEPIN, IL	
Project No.: MR155233	
Boring No.: HEN-020 S-5	
Sample Type: TRIMMED	
Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL	

Project: DYNERGY HENNEPIN
Boring No.: HEN-020 S-5
Sample No.: S-5
Test No.: 5.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 9.5'-11.5'
Elevation: ----

Soil Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	0.432	0.001891	0.000	0.0000	0.0000
2	2.06	0.431	0.003260	0.0842	0.009677	0.009677
3	3.96	0.431	0.004430	0.118	0.01754	0.01754
4	5.72	0.430	0.005385	0.143	0.02541	0.02541
5	7.48	0.432	0.005763	0.164	0.03328	0.03328
6	9.24	0.432	0.006051	0.180	0.04118	0.04118
7	11.16	0.432	0.006177	0.189	0.04905	0.04905
8	13.18	0.432	0.006141	0.198	0.05691	0.05691
9	15.12	0.432	0.006069	0.204	0.06481	0.06481
10	17.19	0.432	0.006015	0.211	0.07265	0.07265
11	19.08	0.432	0.006015	0.218	0.08055	0.08055
12	20.84	0.432	0.006051	0.225	0.08845	0.08845
13	22.43	0.432	0.006015	0.232	0.09628	0.09628
14	24.24	0.432	0.005979	0.237	0.1041	0.1041
15	26.28	0.433	0.005691	0.240	0.1120	0.1120
16	28.23	0.433	0.005222	0.245	0.1199	0.1199
17	30.17	0.432	0.004880	0.249	0.1278	0.1278
18	32.38	0.432	0.004286	0.255	0.1357	0.1357
19	34.18	0.432	0.004034	0.261	0.1435	0.1435
20	35.99	0.432	0.004268	0.268	0.1514	0.1514
21	37.60	0.433	0.004070	0.273	0.1593	0.1593
22	39.35	0.432	0.003494	0.277	0.1672	0.1672
23	41.44	0.432	0.002827	0.281	0.1750	0.1750
24	43.46	0.432	0.002143	0.286	0.1829	0.1829
25	45.45	0.432	0.002035	0.284	0.1908	0.1908
26	47.34	0.432	0.001621	0.287	0.1987	0.1987
27	49.26	0.432	0.0008464	0.296	0.2065	0.2065
28	50.99	0.432	0.0002881	0.295	0.2145	0.2145
29	52.78	0.432	-7.203e-05	0.297	0.2223	0.2223
30	54.50	0.433	-0.0005403	0.301	0.2301	0.2301
31	56.44	0.433	-0.001261	0.305	0.2380	0.2380
32	58.49	0.431	-0.002197	0.307	0.2459	0.2459
33	60.44	0.432	-0.002089	0.310	0.2538	0.2538
34	62.35	0.433	-0.002467	0.313	0.2616	0.2616
35	64.33	0.433	-0.002935	0.313	0.2695	0.2695
36	65.99	0.432	-0.003206	0.314	0.2774	0.2774
37	67.90	0.433	-0.003692	0.316	0.2853	0.2853
38	69.45	0.433	-0.004016	0.317	0.2932	0.2932
39	70.45	0.433	-0.004286	0.318	0.2972	0.2972

Project: DYNERGY HENNEPIN
Boring No.: HEN-020 S-5
Sample No.: S-5
Test No.: 10.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 9.5'-11.5'
Elevation: ----

Soil Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	0.720	0.03636	0.000	0.0000	0.0000
2	2.62	0.719	0.03857	0.124	0.007902	0.007902
3	4.55	0.720	0.04001	0.181	0.01577	0.01577
4	6.74	0.719	0.04108	0.232	0.02364	0.02364
5	8.83	0.719	0.04156	0.275	0.03150	0.03150
6	10.79	0.720	0.04192	0.310	0.03940	0.03940
7	12.32	0.719	0.04232	0.332	0.04727	0.04727
8	14.21	0.720	0.04254	0.349	0.05514	0.05514
9	15.98	0.720	0.04257	0.367	0.06300	0.06300
10	18.03	0.720	0.04246	0.382	0.07091	0.07091
11	19.96	0.720	0.04248	0.392	0.07877	0.07877
12	21.84	0.720	0.04228	0.402	0.08664	0.08664
13	23.80	0.720	0.04207	0.410	0.09454	0.09454
14	25.80	0.720	0.04189	0.415	0.1024	0.1024
15	27.44	0.720	0.04183	0.421	0.1102	0.1102
16	29.16	0.720	0.04174	0.424	0.1181	0.1181
17	31.06	0.720	0.04155	0.428	0.1260	0.1260
18	33.15	0.721	0.04128	0.438	0.1339	0.1339
19	35.08	0.720	0.04110	0.442	0.1418	0.1418
20	37.03	0.720	0.04099	0.442	0.1496	0.1496
21	38.86	0.720	0.04086	0.451	0.1575	0.1575
22	40.95	0.720	0.04074	0.456	0.1654	0.1654
23	42.69	0.720	0.04061	0.458	0.1732	0.1732
24	44.32	0.720	0.04059	0.462	0.1811	0.1811
25	46.09	0.720	0.04063	0.463	0.1890	0.1890
26	48.19	0.720	0.04056	0.466	0.1969	0.1969
27	50.25	0.720	0.04047	0.469	0.2047	0.2047
28	52.21	0.720	0.04047	0.472	0.2126	0.2126
29	54.11	0.719	0.04045	0.473	0.2205	0.2205
30	55.96	0.720	0.04052	0.474	0.2283	0.2283
31	57.73	0.720	0.04066	0.474	0.2363	0.2363
32	59.49	0.720	0.04075	0.481	0.2441	0.2441
33	61.13	0.720	0.04063	0.483	0.2520	0.2520
34	63.17	0.720	0.04063	0.484	0.2599	0.2599
35	65.27	0.720	0.04068	0.489	0.2678	0.2678
36	67.26	0.720	0.04065	0.492	0.2756	0.2756
37	69.25	0.720	0.04054	0.494	0.2835	0.2835
38	70.93	0.720	0.04038	0.497	0.2914	0.2914
39	71.92	0.720	0.04048	0.497	0.2955	0.2955

Project: DYNERGY HENNEPIN
Boring No.: HEN=020 S-5
Sample No.: S-5
Test No.: 20.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 9.5'-11.5'
Elevation: ----

Soil Description: BROWN LEAN CLAY WITH SAND AND GRAVEL CL
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	1.44	0.03377	0.000	0.0000	0.0000
2	2.66	1.44	0.03542	0.228	0.007902	0.007902
3	4.70	1.44	0.03638	0.361	0.01577	0.01577
4	6.57	1.44	0.03717	0.472	0.02364	0.02364
5	8.27	1.44	0.03751	0.556	0.03154	0.03154
6	10.21	1.44	0.03773	0.628	0.03940	0.03940
7	12.14	1.44	0.03766	0.693	0.04731	0.04731
8	13.96	1.44	0.03746	0.736	0.05514	0.05514
9	15.73	1.44	0.03746	0.734	0.06300	0.06300
10	17.91	1.44	0.03695	0.774	0.07087	0.07087
11	19.88	1.44	0.03667	0.790	0.07881	0.07881
12	21.69	1.44	0.03625	0.810	0.08664	0.08664
13	23.58	1.44	0.03587	0.825	0.09454	0.09454
14	25.36	1.44	0.03555	0.835	0.1024	0.1024
15	27.29	1.44	0.03524	0.845	0.1102	0.1102
16	28.99	1.44	0.03497	0.851	0.1182	0.1182
17	31.07	1.44	0.03468	0.858	0.1260	0.1260
18	33.08	1.44	0.03438	0.868	0.1339	0.1339
19	34.88	1.44	0.03418	0.873	0.1417	0.1417
20	36.71	1.44	0.03369	0.877	0.1496	0.1496
21	38.55	1.44	0.03341	0.880	0.1575	0.1575
22	40.35	1.44	0.03326	0.885	0.1654	0.1654
23	42.34	1.44	0.03306	0.883	0.1732	0.1732
24	44.20	1.44	0.03285	0.890	0.1811	0.1811
25	46.28	1.44	0.03260	0.892	0.1890	0.1890
26	48.11	1.44	0.03236	0.891	0.1969	0.1969
27	50.08	1.44	0.03216	0.894	0.2047	0.2047
28	51.90	1.44	0.03191	0.891	0.2126	0.2126
29	53.75	1.44	0.03159	0.894	0.2205	0.2205
30	55.52	1.44	0.03123	0.891	0.2283	0.2283
31	57.38	1.44	0.03078	0.891	0.2362	0.2362
32	59.35	1.44	0.03045	0.891	0.2441	0.2441
33	61.35	1.44	0.03011	0.894	0.2520	0.2520
34	63.31	1.44	0.02955	0.895	0.2599	0.2599
35	65.06	1.44	0.02932	0.894	0.2678	0.2678
36	66.95	1.44	0.02917	0.889	0.2756	0.2756
37	68.86	1.44	0.02901	0.892	0.2835	0.2835
38	70.72	1.44	0.02880	0.892	0.2914	0.2914
39	71.60	1.44	0.02865	0.893	0.2960	0.2960

DIRECT SHEAR TEST by ASTM D3080

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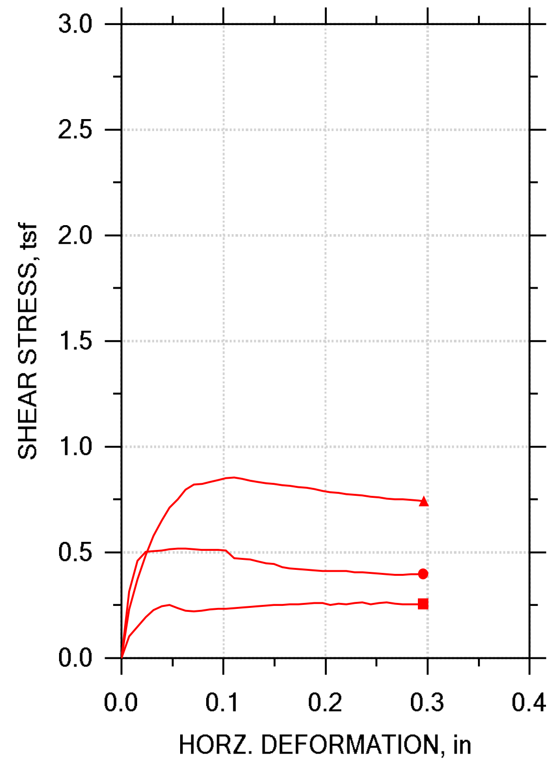

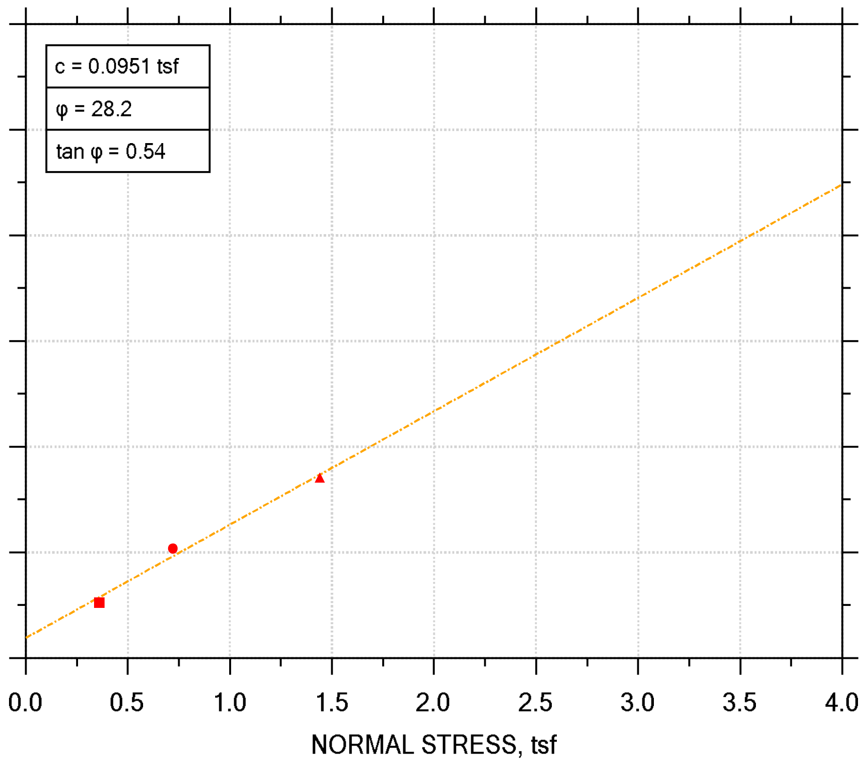

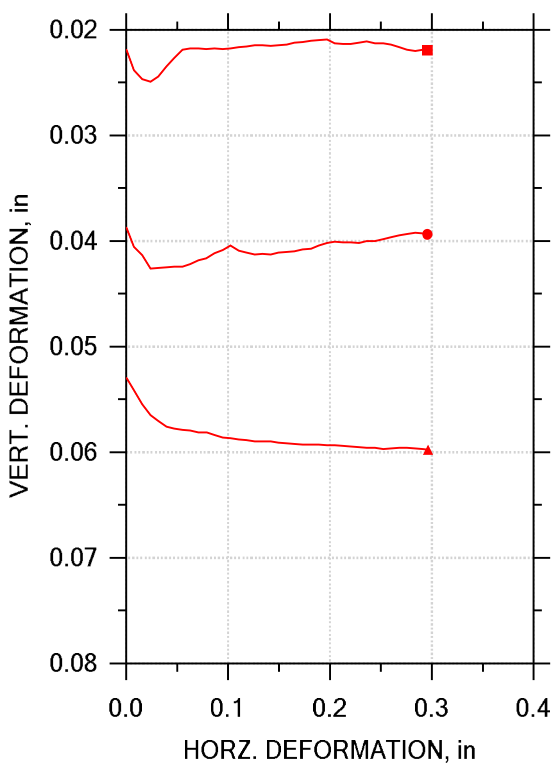

Symbol		■	●	▲	
Test No.		5.0 PSI	10 PSI	20 PSI	
Sample No.		S-4	S-4	S-4	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.4878	2.4917	2.4929	
	Area, in²	4.8609	4.8763	4.8809	
	Height, in	0.99252	0.99409	0.99567	
	Water Content, %	34.29	34.23	32.70	
	Dry Density, pcf	74.65	74.24	73.55	
	Saturation, %	85.41	84.30	78.99	
	Void Ratio	0.92338	0.93397	0.95221	
Consol. Height, in		0.97073	0.95541	0.94274	
Consol. Void Ratio		0.88115	0.85871	0.84844	
Final	Water Content, %	37.77	37.64	36.21	
	Dry Density, pcf	76.34	77.30	78.25	
	Saturation, %	98.62	100.97	99.73	
	Void Ratio	0.88087	0.8574	0.83505	
Normal Stress, tsf		0.35988	0.72024	1.4391	
Max. Shear Stress, tsf		0.26345	0.51869	0.85481	
Ult. Shear Stress, tsf		0.25625	0.39908	0.74345	
Time to Failure, min		58.762	15.262	25.728	
Disp. Rate, in/min		0.0044283	0.0044283	0.0044283	
Estimated Specific Gravity		2.30	2.30	2.30	
Liquid Limit		NP	NP	NP	
Plastic Limit		NP	NP	NP	
Plasticity Index		NP	NP	NP	

Project: DYNEGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN-022 S-4
Sample Type: TRIMMED
Description: VERY DARK GRAY VARVED FLY ASH WITH SAND - SAND SEAMS NOTED
Remarks:

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-022 S-4
Sample No.: S-4
Test No.: 5.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 7.5'-9.0'
Elevation: ----

Soil Description: VERY DARK GRAY VARVED FLY ASH WITH SAND - SAND SEAMS NOTED
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	0.360	0.02179	0.000	0.0000	0.0000
2	1.82	0.358	0.02383	0.102	0.007902	0.007902
3	3.38	0.360	0.02467	0.149	0.01577	0.01577
4	5.29	0.360	0.02492	0.195	0.02364	0.02364
5	6.98	0.361	0.02444	0.227	0.03150	0.03150
6	8.88	0.360	0.02348	0.245	0.03940	0.03940
7	10.59	0.360	0.02265	0.251	0.04727	0.04727
8	12.59	0.360	0.02186	0.237	0.05514	0.05514
9	14.44	0.359	0.02177	0.224	0.06300	0.06300
10	16.23	0.360	0.02177	0.222	0.07087	0.07087
11	17.90	0.360	0.02181	0.226	0.07877	0.07877
12	19.57	0.360	0.02177	0.229	0.08664	0.08664
13	21.32	0.360	0.02179	0.232	0.09454	0.09454
14	23.06	0.360	0.02175	0.234	0.1024	0.1024
15	24.91	0.360	0.02165	0.237	0.1102	0.1102
16	26.82	0.360	0.02159	0.239	0.1182	0.1182
17	28.76	0.360	0.02148	0.242	0.1260	0.1260
18	30.35	0.360	0.02145	0.244	0.1339	0.1339
19	31.96	0.361	0.02154	0.248	0.1417	0.1417
20	33.58	0.360	0.02145	0.250	0.1496	0.1496
21	35.60	0.360	0.02139	0.252	0.1575	0.1575
22	37.49	0.360	0.02121	0.253	0.1654	0.1654
23	39.23	0.360	0.02114	0.255	0.1732	0.1732
24	41.08	0.360	0.02105	0.258	0.1811	0.1811
25	42.93	0.360	0.02094	0.260	0.1890	0.1890
26	44.61	0.360	0.02093	0.261	0.1969	0.1969
27	46.36	0.360	0.02130	0.252	0.2047	0.2047
28	47.82	0.360	0.02136	0.257	0.2126	0.2126
29	49.66	0.360	0.02132	0.255	0.2205	0.2205
30	51.62	0.360	0.02120	0.259	0.2283	0.2283
31	53.54	0.360	0.02111	0.263	0.2362	0.2362
32	55.38	0.360	0.02129	0.255	0.2441	0.2441
33	57.05	0.360	0.02130	0.260	0.2520	0.2520
34	58.76	0.360	0.02139	0.263	0.2599	0.2599
35	60.45	0.360	0.02165	0.259	0.2678	0.2678
36	62.07	0.360	0.02188	0.256	0.2756	0.2756
37	63.81	0.360	0.02202	0.254	0.2835	0.2835
38	65.75	0.360	0.02190	0.255	0.2914	0.2914
39	66.77	0.359	0.02193	0.256	0.2956	0.2956

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-022 S-4
Sample No.: S-4
Test No.: 10 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 7.5'-9.0'
Elevation: ----

Soil Description: VERY DARK GRAY VARVED FLY ASH WITH SAND - SAND SEAMS NOTED
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	0.719	0.03869	0.000	0.0000	0.0000
2	2.62	0.719	0.04054	0.316	0.007902	0.007902
3	4.32	0.719	0.04135	0.461	0.01577	0.01577
4	6.40	0.719	0.04260	0.502	0.02364	0.02364
5	8.11	0.720	0.04257	0.505	0.03150	0.03150
6	9.82	0.720	0.04247	0.510	0.03940	0.03940
7	11.45	0.720	0.04240	0.516	0.04727	0.04727
8	13.23	0.720	0.04243	0.518	0.05514	0.05514
9	15.26	0.720	0.04220	0.519	0.06300	0.06300
10	16.97	0.720	0.04182	0.515	0.07087	0.07087
11	18.82	0.720	0.04162	0.512	0.07877	0.07877
12	20.59	0.720	0.04118	0.513	0.08664	0.08664
13	22.44	0.720	0.04088	0.511	0.09451	0.09451
14	24.17	0.720	0.04044	0.509	0.1024	0.1024
15	25.70	0.719	0.04091	0.474	0.1102	0.1102
16	27.41	0.720	0.04112	0.471	0.1181	0.1181
17	29.20	0.720	0.04125	0.466	0.1260	0.1260
18	31.17	0.720	0.04122	0.457	0.1339	0.1339
19	32.93	0.720	0.04125	0.450	0.1417	0.1417
20	34.76	0.720	0.04108	0.446	0.1497	0.1497
21	36.49	0.720	0.04101	0.429	0.1575	0.1575
22	38.19	0.720	0.04098	0.425	0.1654	0.1654
23	39.89	0.720	0.04081	0.421	0.1732	0.1732
24	41.41	0.720	0.04071	0.418	0.1811	0.1811
25	43.24	0.720	0.04041	0.415	0.1890	0.1890
26	45.33	0.720	0.04020	0.413	0.1969	0.1969
27	47.18	0.720	0.04004	0.413	0.2047	0.2047
28	48.98	0.720	0.04014	0.413	0.2126	0.2126
29	50.59	0.720	0.04014	0.411	0.2205	0.2205
30	52.50	0.720	0.04017	0.406	0.2283	0.2283
31	54.10	0.720	0.04000	0.405	0.2362	0.2362
32	55.71	0.720	0.04000	0.404	0.2441	0.2441
33	57.50	0.720	0.03983	0.401	0.2520	0.2520
34	59.41	0.720	0.03966	0.398	0.2598	0.2598
35	61.36	0.720	0.03943	0.395	0.2678	0.2678
36	63.21	0.720	0.03933	0.394	0.2756	0.2756
37	64.91	0.719	0.03919	0.396	0.2835	0.2835
38	66.55	0.720	0.03929	0.398	0.2914	0.2914
39	67.46	0.720	0.03936	0.399	0.2955	0.2955

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-022 S-4
Sample No.: S-4
Test No.: 20 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 7.5'-9.0'
Elevation: ----

Soil Description: VERY DARK GRAY VARVED FLY ASH WITH SAND - SAND SEAMS NOTED
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	1.44	0.05293	0.000	0.0000	0.0000
2	2.34	1.44	0.05415	0.230	0.007902	0.007902
3	4.34	1.44	0.05548	0.372	0.01577	0.01577
4	6.32	1.44	0.05646	0.488	0.02364	0.02364
5	8.15	1.44	0.05703	0.579	0.03161	0.03161
6	9.79	1.44	0.05757	0.653	0.03940	0.03940
7	11.59	1.44	0.05779	0.712	0.04727	0.04727
8	13.24	1.44	0.05790	0.753	0.05524	0.05524
9	15.17	1.44	0.05797	0.798	0.06300	0.06300
10	17.06	1.44	0.05811	0.821	0.07087	0.07087
11	18.69	1.44	0.05811	0.824	0.07884	0.07884
12	20.66	1.44	0.05837	0.834	0.08664	0.08664
13	22.39	1.44	0.05858	0.842	0.09451	0.09451
14	24.07	1.44	0.05865	0.851	0.1024	0.1024
15	25.73	1.44	0.05880	0.855	0.1102	0.1102
16	27.50	1.44	0.05887	0.850	0.1181	0.1181
17	29.48	1.44	0.05896	0.838	0.1260	0.1260
18	31.22	1.44	0.05896	0.833	0.1339	0.1339
19	33.08	1.44	0.05900	0.829	0.1418	0.1418
20	34.82	1.44	0.05907	0.824	0.1496	0.1496
21	36.71	1.44	0.05914	0.818	0.1575	0.1575
22	38.43	1.44	0.05919	0.814	0.1654	0.1654
23	40.07	1.44	0.05925	0.809	0.1732	0.1732
24	41.68	1.44	0.05930	0.806	0.1811	0.1811
25	43.49	1.44	0.05928	0.800	0.1890	0.1890
26	45.57	1.44	0.05936	0.792	0.1969	0.1969
27	47.30	1.44	0.05936	0.786	0.2047	0.2047
28	49.13	1.44	0.05937	0.781	0.2126	0.2126
29	50.86	1.44	0.05945	0.777	0.2205	0.2205
30	52.57	1.44	0.05952	0.773	0.2283	0.2283
31	54.32	1.44	0.05955	0.769	0.2362	0.2362
32	55.87	1.44	0.05955	0.765	0.2441	0.2441
33	57.62	1.44	0.05968	0.761	0.2520	0.2520
34	59.71	1.44	0.05961	0.755	0.2598	0.2598
35	61.58	1.44	0.05959	0.752	0.2678	0.2678
36	63.36	1.44	0.05959	0.750	0.2757	0.2757
37	64.97	1.44	0.05961	0.748	0.2835	0.2835
38	66.90	1.44	0.05972	0.746	0.2914	0.2914
39	67.87	1.44	0.05975	0.743	0.2961	0.2961

DIRECT SHEAR TEST by ASTM D3080

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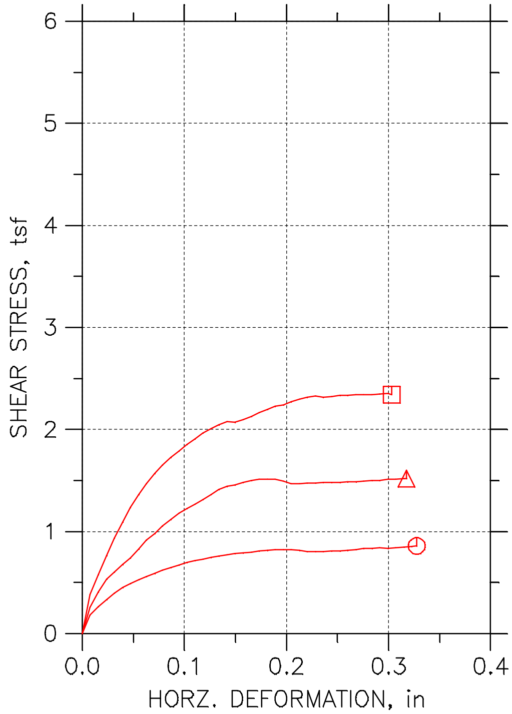

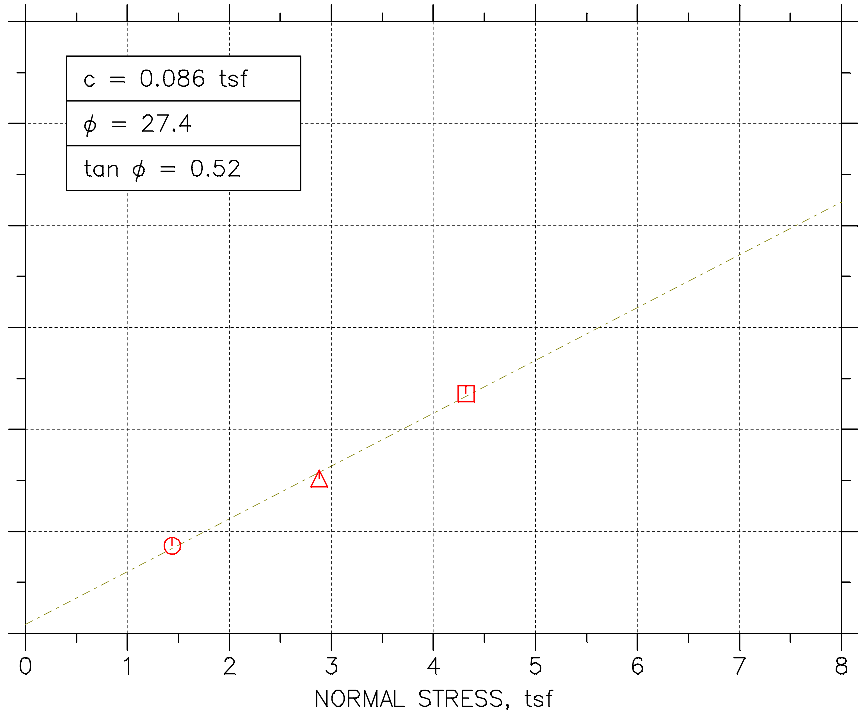

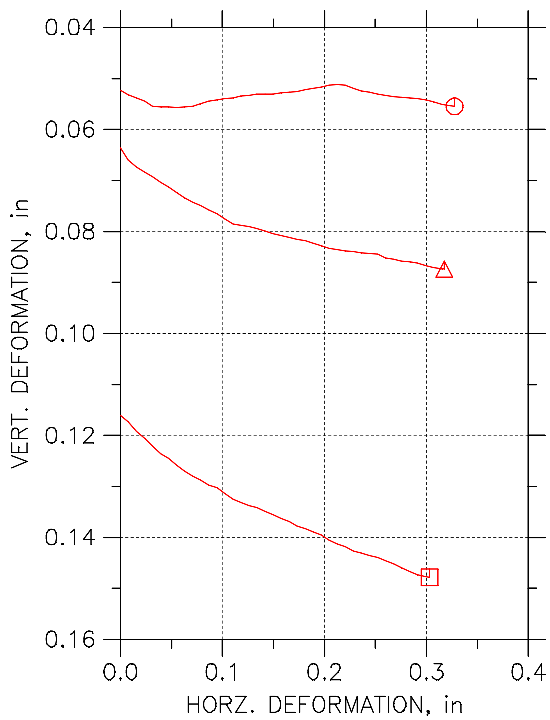

Symbol		○	△	□	
Test No.		20 PSI	40 PSI	60 PSI	
Sample No.		S-9	S-9	S-9	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.5803	2.5787	2.578	
	Area, in^2	5.2292	5.2228	5.2196	
	Height, in	0.99646	0.99882	1.0004	
	Water Content, %	27.10	27.49	27.75	
	Dry Density, pcf	82.685	82.862	81.487	
	Saturation, %	84.62	86.28	83.76	
	Void Ratio	0.73653	0.73281	0.76205	
Consol. Height, in		0.9488	0.93496	0.88478	
Consol. Void Ratio		0.65348	0.62203	0.55841	
Final	Water Content, %	27.69	24.38	21.54	
	Dry Density, pcf	87.559	90.805	95.616	
	Saturation, %	99.53	96.47	98.75	
	Void Ratio	0.63985	0.58123	0.50167	
Normal Stress, tsf		1.4387	2.8787	4.3188	
Max. Shear Stress, tsf		0.85913	1.5203	2.3505	
Ult. Shear Stress, tsf		0.85913	1.5203	2.3401	
Time to Failure, min		82.679	84.196	80.075	

Project: DYNEGY HENNEPIN	Disp. Rate, in/min	0.004	0.004	0.004	
Location: HENNEPIN, IL	Estimated Specific Gravity	2.30	2.30	2.30	
Project No.: MR155233	Liquid Limit	---	---	---	
Boring No.: HEN-023 S1	Plastic Limit	---	---	---	
Sample Type: 3.0'' ST	Plasticity Index	---	---	---	

Description: VERY DARK GRAY FLY ASH WITH SAND AND GRAVEL

Remarks: TEST PERFORMED AS PER ASTM D3080.

Wed, 23-DEC-2015 12:06:11

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-023 S1
Sample No.: S-9
Test No.: 20 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/146/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 27.0'-29.0'
Elevation: ----

Soil Description: VERY DARK GRAY FLY ASH WITH SAND AND GRAVEL
Remarks: TEST PERFORMED AS PER ASTM D3080.

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	1.437	0.05232	0	0
2	2.57	1.439	0.05321	0.1845	0.007876
3	4.37	1.439	0.05384	0.262	0.01575
4	6.49	1.438	0.05447	0.3348	0.02363
5	8.64	1.439	0.05541	0.3987	0.0315
6	10.60	1.439	0.05554	0.4493	0.03938
7	12.60	1.439	0.0556	0.4929	0.04725
8	14.66	1.44	0.05566	0.5295	0.05513
9	16.62	1.44	0.05554	0.5601	0.06301
10	18.58	1.441	0.05541	0.5898	0.07088
11	20.52	1.44	0.05497	0.6213	0.07876
12	22.48	1.44	0.0544	0.6477	0.08663
13	24.33	1.44	0.05415	0.6723	0.09451
14	26.65	1.44	0.0539	0.6982	0.1024
15	28.33	1.44	0.05377	0.7149	0.1103
16	30.29	1.44	0.05346	0.7312	0.1181
17	32.44	1.44	0.05327	0.7446	0.126
18	34.34	1.44	0.05308	0.7604	0.1339
19	36.25	1.44	0.05302	0.7747	0.1418
20	38.33	1.44	0.05302	0.7854	0.1496
21	40.21	1.44	0.05276	0.7919	0.1576
22	42.27	1.44	0.05264	0.7998	0.1654
23	44.18	1.44	0.05251	0.81	0.1733
24	46.26	1.44	0.0522	0.8174	0.1811
25	48.13	1.44	0.05195	0.8211	0.189
26	50.09	1.439	0.05169	0.823	0.1969
27	52.06	1.439	0.05138	0.8202	0.2048
28	54.03	1.439	0.05125	0.8179	0.2126
29	55.86	1.439	0.05131	0.8049	0.2205
30	57.76	1.438	0.05195	0.8021	0.2284
31	59.91	1.438	0.05239	0.8021	0.2362
32	61.73	1.439	0.05264	0.81	0.2441
33	63.96	1.439	0.05302	0.8086	0.252
34	65.73	1.439	0.05327	0.8174	0.2599
35	67.59	1.439	0.05352	0.8225	0.2677
36	69.70	1.439	0.05371	0.8327	0.2756
37	71.64	1.439	0.05384	0.8364	0.2835
38	73.60	1.439	0.05396	0.8392	0.2914
39	75.59	1.439	0.05415	0.8373	0.2992
40	77.45	1.439	0.05453	0.8383	0.3071
41	79.47	1.439	0.05503	0.8462	0.315
42	81.41	1.439	0.05529	0.8526	0.3229
43	82.68	1.439	0.05548	0.8591	0.3275

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-023 S1
Sample No.: S-9
Test No.: 40 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/146/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 27.0'-29.0'
Elevation: ----

Soil Description: VERY DARK GRAY FLY ASH WITH SAND AND GRAVEL
Remarks: TEST PERFORMED AS PER ASTM D3080.

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	2.879	0.06367	0	0
2	5.50	2.879	0.066	0.2558	0.007876
3	7.58	2.876	0.06739	0.4071	0.01575
4	9.71	2.879	0.0684	0.5366	0.02363
5	11.73	2.878	0.06928	0.6049	0.0315
6	13.68	2.878	0.07042	0.6796	0.03938
7	15.64	2.877	0.0713	0.7404	0.04725
8	17.61	2.877	0.07243	0.8268	0.05513
9	19.78	2.878	0.07344	0.914	0.06301
10	21.88	2.878	0.07432	0.9795	0.07088
11	23.89	2.878	0.07496	1.051	0.07876
12	25.89	2.879	0.07584	1.118	0.08663
13	27.97	2.876	0.07659	1.179	0.09451
14	29.98	2.879	0.0776	1.222	0.1024
15	31.97	2.878	0.07855	1.269	0.1103
16	34.06	2.878	0.0788	1.313	0.1181
17	36.03	2.878	0.07905	1.361	0.126
18	38.01	2.879	0.07943	1.411	0.1339
19	40.08	2.878	0.07987	1.443	0.1418
20	42.02	2.878	0.08038	1.453	0.1496
21	43.98	2.878	0.08082	1.483	0.1575
22	45.99	2.879	0.08113	1.499	0.1654
23	48.06	2.879	0.08157	1.516	0.1733
24	49.93	2.879	0.08183	1.51	0.1811
25	51.88	2.879	0.08233	1.512	0.189
26	54.00	2.879	0.08284	1.492	0.1969
27	55.79	2.879	0.08328	1.472	0.2048
28	57.64	2.879	0.08353	1.466	0.2126
29	59.87	2.879	0.08378	1.473	0.2205
30	61.83	2.878	0.08397	1.477	0.2284
31	63.72	2.879	0.08416	1.481	0.2362
32	65.75	2.879	0.08429	1.479	0.2441
33	67.56	2.879	0.08441	1.482	0.252
34	69.63	2.879	0.08523	1.486	0.2599
35	71.57	2.879	0.08548	1.49	0.2677
36	73.66	2.879	0.0858	1.494	0.2756
37	75.62	2.879	0.08599	1.499	0.2835
38	77.53	2.879	0.08624	1.502	0.2914
39	79.64	2.879	0.08668	1.51	0.2992
40	81.55	2.879	0.08712	1.514	0.3072
41	83.43	2.879	0.08737	1.518	0.315
42	84.20	2.879	0.08737	1.52	0.3176

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-023 S1
Sample No.: S-9
Test No.: 60 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/146/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 27.0'-29.0'
Elevation: ----

Soil Description: VERY DARK GRAY FLY ASH WITH SAND AND GRAVEL
Remarks: TEST PERFORMED AS PER ASTM D3080.

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	4.319	0.1161	0	0
2	6.63	4.317	0.1173	0.3858	0.007876
3	8.64	4.317	0.1192	0.5763	0.01575
4	10.67	4.319	0.1206	0.7651	0.02363
5	12.61	4.319	0.1221	0.938	0.0315
6	14.65	4.316	0.1236	1.092	0.03938
7	16.80	4.318	0.1244	1.238	0.04725
8	18.85	4.319	0.1259	1.362	0.05513
9	20.70	4.319	0.127	1.466	0.06301
10	22.72	4.317	0.128	1.566	0.07088
11	24.69	4.318	0.1288	1.652	0.07876
12	26.74	4.319	0.1297	1.728	0.08663
13	28.73	4.318	0.1303	1.792	0.09451
14	30.64	4.318	0.1314	1.849	0.1024
15	32.69	4.318	0.1325	1.908	0.1103
16	34.81	4.318	0.1331	1.962	0.1181
17	36.79	4.319	0.1337	2.006	0.126
18	38.68	4.317	0.1342	2.046	0.1339
19	40.54	4.318	0.1348	2.078	0.1418
20	42.61	4.319	0.1355	2.073	0.1496
21	44.59	4.317	0.1363	2.095	0.1575
22	46.53	4.318	0.1369	2.126	0.1654
23	48.62	4.318	0.1377	2.162	0.1733
24	50.61	4.318	0.1382	2.198	0.1811
25	52.53	4.319	0.1389	2.227	0.189
26	54.34	4.318	0.1395	2.24	0.1969
27	56.45	4.319	0.1406	2.273	0.2048
28	58.39	4.318	0.1413	2.297	0.2126
29	60.26	4.318	0.1418	2.315	0.2205
30	62.40	4.318	0.1427	2.325	0.2284
31	64.27	4.318	0.1431	2.315	0.2362
32	66.19	4.318	0.1435	2.324	0.2441
33	68.09	4.319	0.1439	2.334	0.252
34	70.02	4.319	0.1446	2.335	0.2599
35	72.17	4.318	0.1452	2.338	0.2677
36	74.03	4.318	0.1459	2.342	0.2756
37	76.23	4.318	0.1466	2.343	0.2835
38	78.15	4.319	0.1473	2.348	0.2914
39	80.07	4.319	0.1476	2.35	0.2992
40	81.07	4.318	0.1478	2.34	0.3032

DIRECT SHEAR TEST by ASTM D3080

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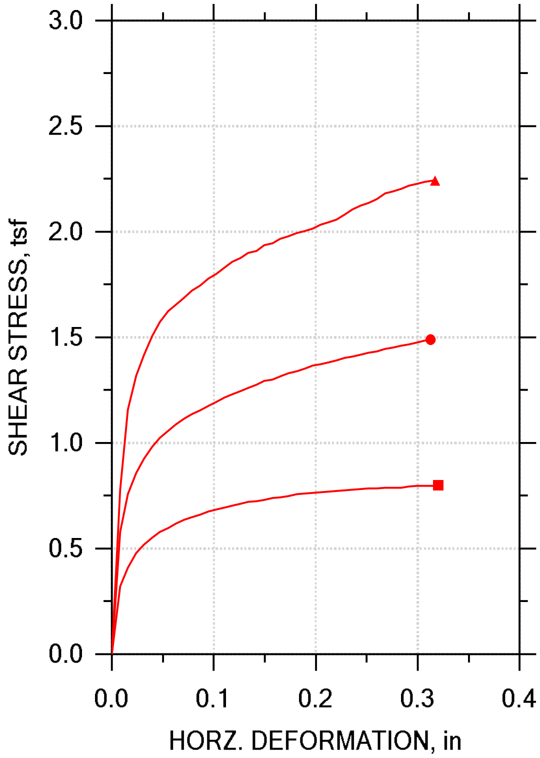

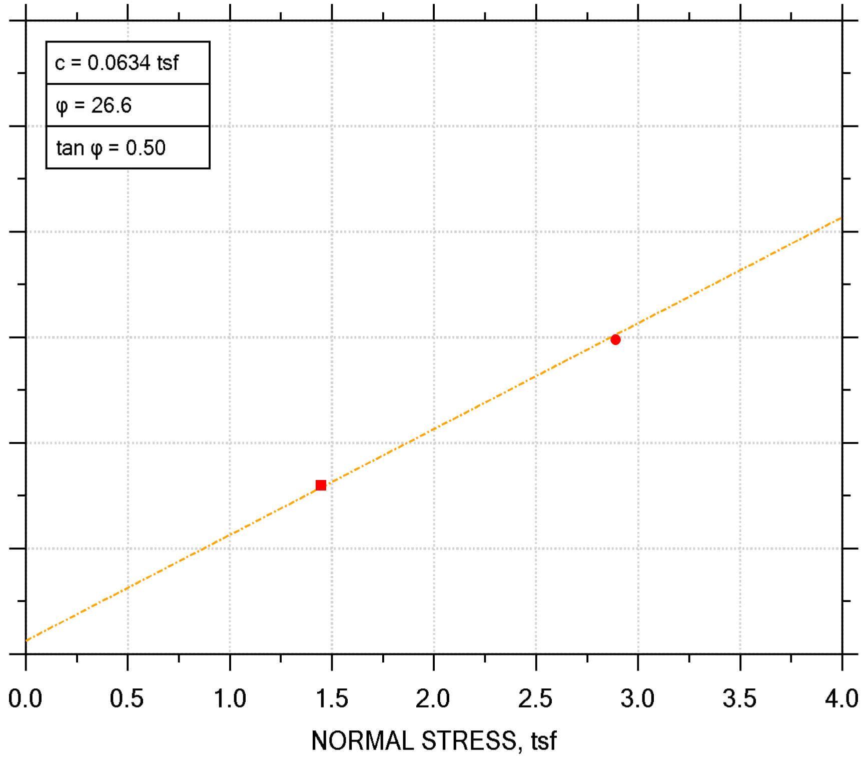

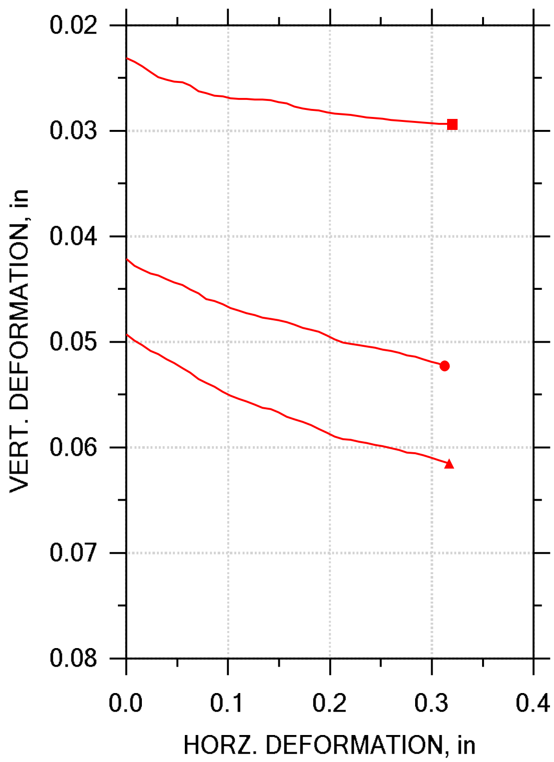

Symbol		■	●	▲	
Test No.		20.0 PSI	40.0 PSI	60.0 PSI	
Sample No.		S-9	S-9	S-9	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.4996	2.4996	2.5035	
	Area, in²	4.9072	4.9072	4.9227	
	Height, in	1.0012	1.0043	1.0063	
	Water Content, %	48.30	48.74	48.73	
	Dry Density, pcf	73.27	74.93	74.29	
	Saturation, %	103.35	108.66	106.94	
	Void Ratio	1.2152	1.1662	1.1848	
Consol. Height, in		0.97808	0.96221	0.95704	
Consol. Void Ratio		1.1641	1.0754	1.0779	
Final	Water Content, %	43.69	39.99	40.37	
	Dry Density, pcf	75.49	79.04	79.13	
	Saturation, %	98.76	98.70	99.84	
	Void Ratio	1.1502	1.0534	1.0513	
Normal Stress, tsf		1.4455	2.8899	4.3244	
Max. Shear Stress, tsf		0.7992	1.4892	2.2422	
Ult. Shear Stress, tsf		0.7992	1.4892	2.2422	
Time to Failure, min		78.896	78.246	79.775	
Disp. Rate, in/min		0.004	0.004	0.004	
Estimated Specific Gravity		2.60	2.60	2.60	
Liquid Limit		58	58	58	
Plastic Limit		23	23	23	
Plasticity Index		35	35	35	

Project: DYNEGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN-024 S-9
Sample Type: 3" ST
Description: DARK GRAY ORGANIC CLAY WITH SAND OH
Remarks: TEST PERFORMED AS PER ASTM D3080

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-024 S-9
Sample No.: S-9
Test No.: 20.0 PSI

Location: HENNEPIN, IL
Tested By: WPQ
Test Date: 12/16/15
Sample Type: 3" ST

Project No.: MR155233
Checked By: BCM
Depth: 26.5'-28.5'
Elevation: ----

Soil Description: DARK GRAY ORGANIC CLAY WITH SAND OH
Remarks: TEST PERFORMED AS PER ASTM D3080

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	1.45	0.02310	0.000	0.0000	0.0000
2	2.83	1.44	0.02346	0.322	0.007916	0.007916
3	4.68	1.44	0.02391	0.410	0.01578	0.01578
4	6.60	1.44	0.02445	0.478	0.02365	0.02365
5	8.62	1.44	0.02490	0.519	0.03152	0.03152
6	10.54	1.44	0.02516	0.550	0.03939	0.03939
7	12.47	1.44	0.02535	0.577	0.04726	0.04726
8	14.35	1.44	0.02542	0.598	0.05512	0.05512
9	16.24	1.44	0.02568	0.617	0.06299	0.06299
10	18.42	1.44	0.02622	0.636	0.07091	0.07091
11	20.09	1.44	0.02645	0.648	0.07878	0.07878
12	21.99	1.44	0.02667	0.661	0.08665	0.08665
13	24.07	1.44	0.02674	0.674	0.09451	0.09451
14	25.98	1.44	0.02690	0.685	0.1024	0.1024
15	27.86	1.44	0.02696	0.695	0.1102	0.1102
16	29.65	1.44	0.02699	0.703	0.1181	0.1181
17	31.66	1.44	0.02703	0.712	0.1260	0.1260
18	33.60	1.44	0.02706	0.720	0.1339	0.1339
19	35.46	1.44	0.02709	0.725	0.1418	0.1418
20	37.49	1.44	0.02728	0.732	0.1496	0.1496
21	39.55	1.44	0.02741	0.738	0.1575	0.1575
22	41.43	1.44	0.02770	0.744	0.1654	0.1654
23	43.16	1.44	0.02790	0.750	0.1732	0.1732
24	45.07	1.45	0.02799	0.756	0.1811	0.1811
25	47.14	1.44	0.02809	0.761	0.1890	0.1890
26	48.89	1.44	0.02825	0.765	0.1969	0.1969
27	50.73	1.44	0.02835	0.767	0.2048	0.2048
28	52.81	1.45	0.02844	0.770	0.2126	0.2126
29	54.81	1.44	0.02847	0.774	0.2205	0.2205
30	56.58	1.44	0.02864	0.775	0.2284	0.2284
31	58.54	1.45	0.02870	0.779	0.2362	0.2362
32	60.26	1.45	0.02876	0.782	0.2441	0.2441
33	62.26	1.45	0.02886	0.784	0.2520	0.2520
34	64.13	1.45	0.02896	0.786	0.2599	0.2599
35	66.07	1.45	0.02905	0.787	0.2678	0.2678
36	68.20	1.44	0.02912	0.788	0.2756	0.2756
37	69.92	1.45	0.02918	0.787	0.2835	0.2835
38	71.92	1.45	0.02921	0.792	0.2914	0.2914
39	73.61	1.44	0.02928	0.796	0.2992	0.2992
40	75.77	1.44	0.02931	0.798	0.3071	0.3071
41	77.51	1.44	0.02934	0.797	0.3150	0.3150
42	78.90	1.45	0.02938	0.799	0.3202	0.3202

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-024 S-9
Sample No.: S-9
Test No.: 40.0 PSI

Location: HENNEPIN, IL
Tested By: WPQ
Test Date: 12/16/15
Sample Type: 3" ST

Project No.: MR155233
Checked By: BCM
Depth: 26.5'-28.5'
Elevation: ----

Soil Description: DARK GRAY ORGANIC CLAY WITH SAND OH
Remarks: TEST PERFORMED AS PER ASTM D3080

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	2.89	0.04212	0.000	0.0000	0.0000
2	4.33	2.89	0.04276	0.579	0.007916	0.007916
3	6.24	2.89	0.04315	0.759	0.01578	0.01578
4	8.26	2.89	0.04350	0.856	0.02365	0.02365
5	10.18	2.89	0.04373	0.923	0.03152	0.03152
6	12.02	2.89	0.04405	0.981	0.03939	0.03939
7	13.99	2.89	0.04434	1.02	0.04726	0.04726
8	15.82	2.89	0.04463	1.06	0.05512	0.05512
9	17.65	2.89	0.04504	1.09	0.06299	0.06299
10	19.62	2.89	0.04540	1.11	0.07091	0.07091
11	21.62	2.89	0.04591	1.14	0.07878	0.07878
12	23.51	2.89	0.04614	1.15	0.08665	0.08665
13	25.43	2.89	0.04640	1.18	0.09451	0.09451
14	27.27	2.89	0.04678	1.20	0.1024	0.1024
15	29.24	2.89	0.04704	1.22	0.1102	0.1102
16	31.09	2.89	0.04730	1.23	0.1181	0.1181
17	33.03	2.89	0.04746	1.25	0.1260	0.1260
18	35.12	2.89	0.04768	1.26	0.1339	0.1339
19	36.86	2.89	0.04784	1.28	0.1418	0.1418
20	38.90	2.89	0.04794	1.30	0.1496	0.1496
21	40.73	2.89	0.04813	1.30	0.1575	0.1575
22	42.66	2.89	0.04839	1.32	0.1654	0.1654
23	44.59	2.89	0.04868	1.33	0.1732	0.1732
24	46.52	2.89	0.04887	1.34	0.1811	0.1811
25	48.24	2.89	0.04903	1.35	0.1890	0.1890
26	50.32	2.89	0.04942	1.37	0.1969	0.1969
27	52.25	2.89	0.04974	1.37	0.2048	0.2048
28	54.15	2.89	0.05006	1.38	0.2126	0.2126
29	56.03	2.89	0.05019	1.39	0.2205	0.2205
30	58.01	2.89	0.05029	1.40	0.2284	0.2284
31	59.88	2.89	0.05042	1.41	0.2362	0.2362
32	61.69	2.89	0.05055	1.42	0.2441	0.2441
33	63.69	2.89	0.05071	1.43	0.2520	0.2520
34	65.33	2.89	0.05087	1.43	0.2599	0.2599
35	67.31	2.89	0.05106	1.44	0.2678	0.2678
36	69.14	2.89	0.05129	1.45	0.2756	0.2756
37	71.13	2.89	0.05138	1.46	0.2835	0.2835
38	73.21	2.89	0.05164	1.47	0.2914	0.2914
39	75.04	2.89	0.05187	1.48	0.2992	0.2992
40	76.93	2.89	0.05209	1.49	0.3071	0.3071
41	78.25	2.89	0.05228	1.49	0.3125	0.3125

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-024 S-9
Sample No.: S-9
Test No.: 60.0 PSI

Location: HENNEPIN, IL
Tested By: WPQ
Test Date: 12/16/15
Sample Type: 3" ST

Project No.: MR155233
Checked By: BCM
Depth: 26.5'-28.5'
Elevation: ----

Soil Description: DARK GRAY ORGANIC CLAY WITH SAND OH
Remarks: TEST PERFORMED AS PER ASTM D3080

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	4.32	0.04926	0.000	0.0000	0.0000
2	4.54	4.32	0.04986	0.778	0.007916	0.007916
3	6.59	4.32	0.05030	1.16	0.01578	0.01578
4	8.54	4.32	0.05082	1.32	0.02365	0.02365
5	10.51	4.32	0.05114	1.42	0.03152	0.03152
6	12.34	4.32	0.05162	1.51	0.03939	0.03939
7	14.31	4.32	0.05202	1.57	0.04726	0.04726
8	16.21	4.32	0.05250	1.62	0.05512	0.05512
9	17.95	4.32	0.05290	1.66	0.06299	0.06299
10	19.92	4.32	0.05351	1.69	0.07091	0.07091
11	22.00	4.32	0.05391	1.72	0.07878	0.07878
12	23.87	4.32	0.05423	1.74	0.08665	0.08665
13	25.83	4.32	0.05471	1.78	0.09451	0.09451
14	27.73	4.32	0.05511	1.80	0.1024	0.1024
15	29.76	4.32	0.05539	1.83	0.1102	0.1102
16	31.70	4.32	0.05567	1.86	0.1181	0.1181
17	33.58	4.32	0.05595	1.88	0.1260	0.1260
18	35.51	4.32	0.05623	1.90	0.1339	0.1339
19	37.34	4.32	0.05639	1.91	0.1418	0.1418
20	39.30	4.32	0.05667	1.94	0.1496	0.1496
21	41.16	4.32	0.05707	1.95	0.1575	0.1575
22	43.16	4.32	0.05735	1.97	0.1654	0.1654
23	44.97	4.32	0.05755	1.98	0.1732	0.1732
24	46.86	4.32	0.05787	2.00	0.1811	0.1811
25	48.65	4.32	0.05827	2.00	0.1890	0.1890
26	50.79	4.32	0.05863	2.02	0.1969	0.1969
27	52.65	4.32	0.05899	2.03	0.2048	0.2048
28	54.53	4.32	0.05919	2.04	0.2126	0.2126
29	56.53	4.32	0.05927	2.06	0.2205	0.2205
30	58.38	4.32	0.05943	2.08	0.2284	0.2284
31	60.24	4.32	0.05959	2.11	0.2362	0.2362
32	62.16	4.32	0.05975	2.12	0.2441	0.2441
33	64.08	4.32	0.05987	2.14	0.2520	0.2520
34	65.85	4.32	0.06007	2.16	0.2599	0.2599
35	67.89	4.32	0.06023	2.18	0.2678	0.2678
36	69.71	4.32	0.06047	2.19	0.2756	0.2756
37	71.73	4.32	0.06055	2.20	0.2835	0.2835
38	73.61	4.32	0.06071	2.22	0.2914	0.2914
39	75.62	4.32	0.06095	2.23	0.2992	0.2992
40	77.34	4.32	0.06119	2.24	0.3071	0.3071
41	79.25	4.32	0.06148	2.24	0.3150	0.3150
42	79.77	4.32	0.06152	2.24	0.3167	0.3167

DIRECT SHEAR TEST by ASTM D3080

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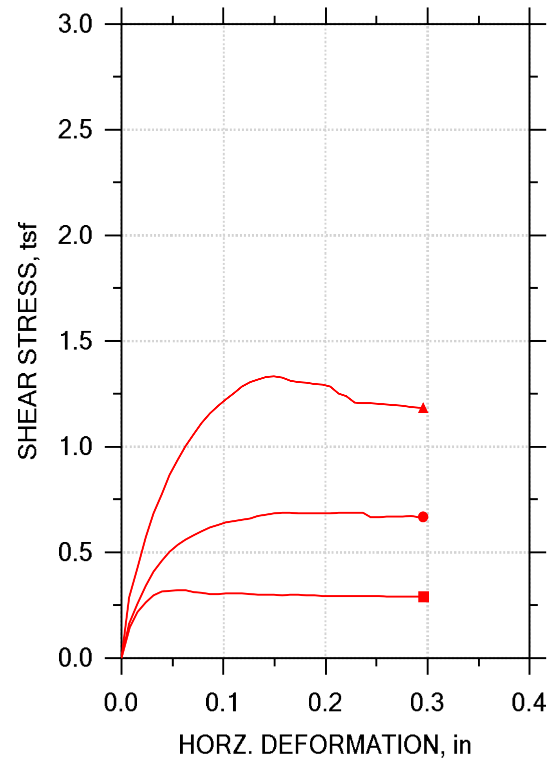

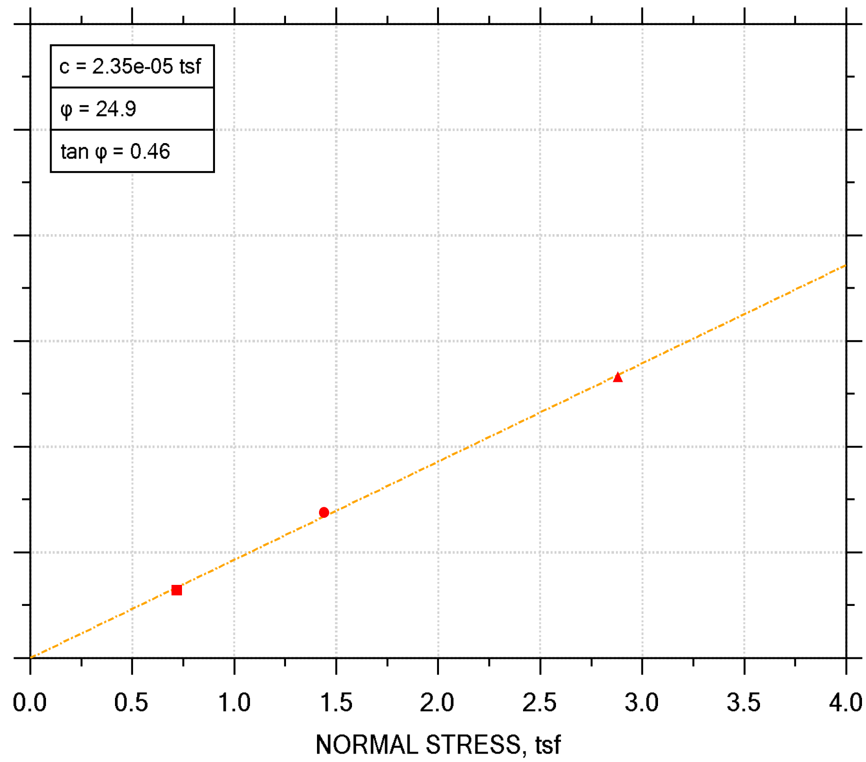

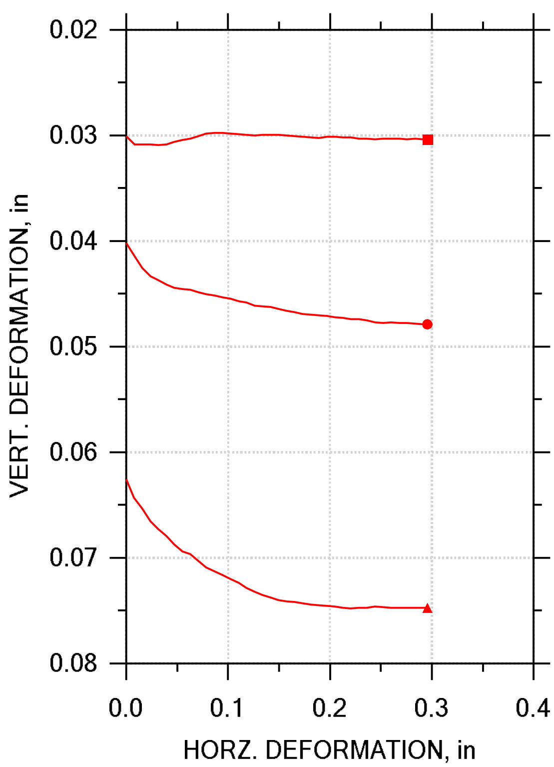

	Symbol	■	●	▲	
	Test No.	10 PSI	20 PSI	40 PSI	
	Sample No.	S-6	S-6	S-6	
	Shape	Circular	Circular	Circular	
Initial	Dimension, in	2.4969	2.4957	2.502	
Initial	Area, in²	4.8964	4.8917	4.9165	
Initial	Height, in	1.0035	0.99685	0.99685	
Initial	Water Content, %	31.49	31.84	31.90	
Initial	Dry Density, pcf	74.23	74.44	73.95	
Initial	Saturation, %	77.52	78.85	77.93	
Initial	Void Ratio	0.93443	0.92878	0.94155	
	Consol. Height, in	0.97345	0.95666	0.93431	
	Consol. Void Ratio	0.87642	0.851	0.81974	
Final	Water Content, %	37.75	35.63	34.57	
Final	Dry Density, pcf	76.55	78.20	79.95	
Final	Saturation, %	99.14	98.01	99.89	
Final	Void Ratio	0.87576	0.83613	0.79599	
	Normal Stress, tsf	0.72004	1.4392	2.8793	
	Max. Shear Stress, tsf	0.32137	0.68923	1.332	
	Ult. Shear Stress, tsf	0.28956	0.66847	1.1862	
	Time to Failure, min	13.317	52.872	34.55	
	Disp. Rate, in/min	0.0044283	0.0044283	0.0044283	
	Estimated Specific Gravity	2.30	2.30	2.30	
	Liquid Limit	NP	NP	NP	
	Plastic Limit	NP	NP	NP	
	Plasticity Index	NP	NP	NP	

Project: DYNEGY HENNEPIN

Location: HENNEPIN, IL

Project No.: MR155233

Boring No.: HEN-025 S-6

Sample Type: TRIMMED

Description: VERY DARK GRAY FLY ASH WITH SAND

Remarks:

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-025 S-6
Sample No.: S-6
Test No.: 10 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 11.5'-13.5'
Elevation: ----

Soil Description: VERY DARK GRAY FLY ASH WITH SAND
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	0.719	0.03009	0.000	0.0000	0.0000
2	2.49	0.719	0.03083	0.147	0.007971	0.007971
3	4.56	0.720	0.03083	0.219	0.01577	0.01577
4	6.40	0.720	0.03083	0.264	0.02364	0.02364
5	8.22	0.720	0.03090	0.298	0.03154	0.03154
6	9.89	0.720	0.03087	0.314	0.03944	0.03944
7	11.62	0.720	0.03061	0.319	0.04727	0.04727
8	13.32	0.720	0.03045	0.321	0.05514	0.05514
9	15.05	0.720	0.03029	0.320	0.06300	0.06300
10	16.89	0.720	0.03007	0.312	0.07087	0.07087
11	18.73	0.720	0.02984	0.310	0.07877	0.07877
12	20.76	0.719	0.02975	0.303	0.08664	0.08664
13	22.51	0.719	0.02979	0.304	0.09451	0.09451
14	24.15	0.720	0.02982	0.306	0.1024	0.1024
15	25.71	0.720	0.02986	0.306	0.1102	0.1102
16	27.59	0.720	0.02993	0.305	0.1181	0.1181
17	29.28	0.720	0.02998	0.302	0.1260	0.1260
18	31.01	0.720	0.02993	0.300	0.1339	0.1339
19	32.97	0.719	0.02995	0.300	0.1417	0.1417
20	34.86	0.720	0.02995	0.298	0.1496	0.1496
21	36.70	0.720	0.03000	0.298	0.1575	0.1575
22	38.37	0.720	0.03007	0.298	0.1654	0.1654
23	40.03	0.720	0.03011	0.298	0.1732	0.1732
24	41.67	0.720	0.03018	0.298	0.1811	0.1811
25	43.57	0.720	0.03022	0.296	0.1890	0.1890
26	45.47	0.720	0.03015	0.294	0.1969	0.1969
27	47.27	0.720	0.03015	0.294	0.2047	0.2047
28	49.05	0.720	0.03016	0.294	0.2126	0.2126
29	50.95	0.720	0.03018	0.294	0.2205	0.2205
30	52.72	0.720	0.03029	0.293	0.2283	0.2283
31	54.18	0.719	0.03033	0.294	0.2362	0.2362
32	55.82	0.720	0.03034	0.294	0.2441	0.2441
33	57.83	0.720	0.03029	0.294	0.2520	0.2520
34	59.65	0.720	0.03031	0.291	0.2598	0.2598
35	61.60	0.720	0.03031	0.291	0.2678	0.2678
36	63.38	0.720	0.03036	0.290	0.2756	0.2756
37	65.11	0.720	0.03031	0.290	0.2835	0.2835
38	66.87	0.720	0.03038	0.290	0.2914	0.2914
39	67.77	0.720	0.03043	0.290	0.2959	0.2959

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-025 S-6
Sample No.: S-6
Test No.: 20 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 11.5'-13.5'
Elevation: ----

Soil Description: VERY DARK GRAY FLY ASH WITH SAND
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	1.44	0.04020	0.000	0.0000	0.0000
2	2.45	1.44	0.04135	0.162	0.007902	0.007902
3	4.38	1.44	0.04254	0.259	0.01577	0.01577
4	6.37	1.44	0.04333	0.343	0.02364	0.02364
5	8.17	1.44	0.04372	0.410	0.03154	0.03154
6	9.94	1.44	0.04414	0.461	0.03940	0.03940
7	11.65	1.44	0.04441	0.502	0.04731	0.04731
8	13.41	1.44	0.04452	0.537	0.05517	0.05517
9	15.14	1.44	0.04459	0.560	0.06300	0.06300
10	16.90	1.44	0.04482	0.582	0.07087	0.07087
11	18.84	1.44	0.04502	0.600	0.07877	0.07877
12	20.84	1.44	0.04513	0.618	0.08664	0.08664
13	22.56	1.44	0.04531	0.632	0.09451	0.09451
14	24.41	1.44	0.04544	0.643	0.1024	0.1024
15	26.03	1.44	0.04572	0.649	0.1102	0.1102
16	27.61	1.44	0.04585	0.654	0.1182	0.1182
17	29.43	1.44	0.04612	0.662	0.1260	0.1260
18	31.34	1.44	0.04617	0.671	0.1339	0.1339
19	33.28	1.44	0.04623	0.679	0.1417	0.1417
20	35.06	1.44	0.04643	0.684	0.1496	0.1496
21	36.88	1.44	0.04661	0.687	0.1575	0.1575
22	38.57	1.44	0.04675	0.687	0.1654	0.1654
23	40.34	1.44	0.04691	0.685	0.1732	0.1732
24	41.97	1.44	0.04697	0.684	0.1811	0.1811
25	43.74	1.44	0.04704	0.683	0.1890	0.1890
26	45.60	1.44	0.04711	0.684	0.1969	0.1969
27	47.52	1.44	0.04720	0.686	0.2048	0.2048
28	49.31	1.44	0.04725	0.687	0.2126	0.2126
29	51.07	1.44	0.04738	0.688	0.2205	0.2205
30	52.87	1.44	0.04738	0.689	0.2283	0.2283
31	54.66	1.44	0.04749	0.689	0.2363	0.2363
32	56.02	1.44	0.04772	0.667	0.2441	0.2441
33	57.82	1.44	0.04774	0.668	0.2520	0.2520
34	59.66	1.44	0.04770	0.669	0.2598	0.2598
35	61.64	1.44	0.04774	0.669	0.2678	0.2678
36	63.57	1.44	0.04776	0.669	0.2756	0.2756
37	65.29	1.44	0.04781	0.671	0.2835	0.2835
38	67.10	1.44	0.04787	0.666	0.2914	0.2914
39	67.98	1.44	0.04788	0.668	0.2953	0.2953

DIRECT SHEAR TEST DATA

Project: DYNEGY HENNEPIN
Boring No.: HEN-025 S-6
Sample No.: S-6
Test No.: 40 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 11.5'-13.5'
Elevation: ----

Soil Description: VERY DARK GRAY FLY ASH WITH SAND
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	2.88	0.06254	0.000	0.0000	0.0000
2	2.06	2.88	0.06431	0.288	0.007902	0.007902
3	3.73	2.88	0.06535	0.427	0.01577	0.01577
4	5.68	2.88	0.06656	0.572	0.02364	0.02364
5	7.41	2.88	0.06726	0.683	0.03150	0.03150
6	9.18	2.88	0.06796	0.775	0.03940	0.03940
7	11.28	2.88	0.06874	0.867	0.04731	0.04731
8	13.15	2.88	0.06937	0.941	0.05514	0.05514
9	14.96	2.88	0.06966	1.00	0.06300	0.06300
10	16.75	2.88	0.07029	1.06	0.07087	0.07087
11	18.48	2.88	0.07094	1.11	0.07877	0.07877
12	20.21	2.88	0.07126	1.16	0.08664	0.08664
13	22.02	2.88	0.07162	1.19	0.09451	0.09451
14	23.89	2.88	0.07200	1.22	0.1024	0.1024
15	25.71	2.88	0.07238	1.26	0.1103	0.1103
16	27.46	2.88	0.07284	1.28	0.1182	0.1182
17	29.34	2.88	0.07322	1.31	0.1260	0.1260
18	31.19	2.88	0.07355	1.32	0.1339	0.1339
19	32.76	2.88	0.07378	1.33	0.1417	0.1417
20	34.55	2.88	0.07400	1.33	0.1496	0.1496
21	36.46	2.88	0.07414	1.33	0.1575	0.1575
22	38.17	2.88	0.07421	1.31	0.1654	0.1654
23	40.09	2.88	0.07432	1.31	0.1732	0.1732
24	41.83	2.88	0.07443	1.30	0.1811	0.1811
25	43.52	2.88	0.07448	1.30	0.1890	0.1890
26	45.41	2.88	0.07454	1.29	0.1969	0.1969
27	47.13	2.88	0.07463	1.29	0.2047	0.2047
28	48.78	2.88	0.07475	1.25	0.2126	0.2126
29	50.52	2.88	0.07479	1.24	0.2205	0.2205
30	52.37	2.88	0.07472	1.21	0.2283	0.2283
31	54.21	2.88	0.07472	1.21	0.2363	0.2363
32	56.04	2.88	0.07463	1.21	0.2441	0.2441
33	57.71	2.88	0.07466	1.20	0.2520	0.2520
34	59.65	2.88	0.07472	1.20	0.2599	0.2599
35	61.38	2.88	0.07472	1.20	0.2678	0.2678
36	63.12	2.88	0.07470	1.19	0.2756	0.2756
37	64.78	2.88	0.07470	1.19	0.2835	0.2835
38	66.67	2.88	0.07472	1.19	0.2914	0.2914
39	67.75	2.88	0.07474	1.19	0.2958	0.2958

DIRECT SHEAR TEST by ASTM D3080

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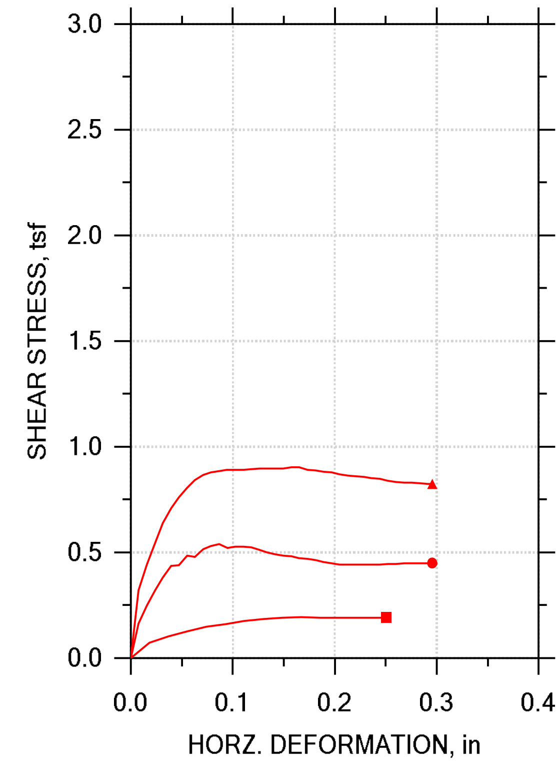

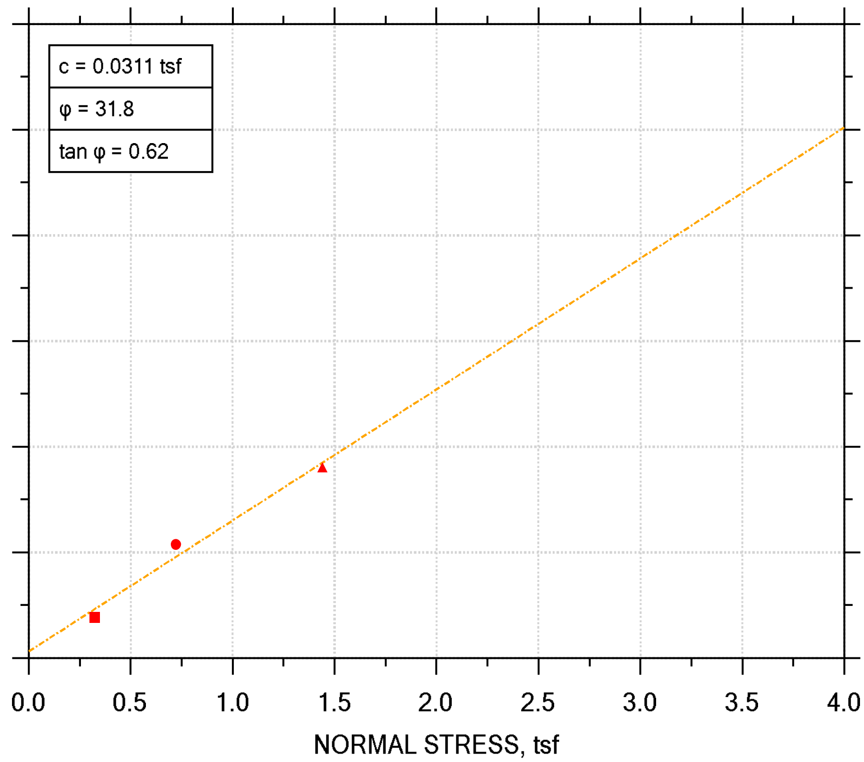

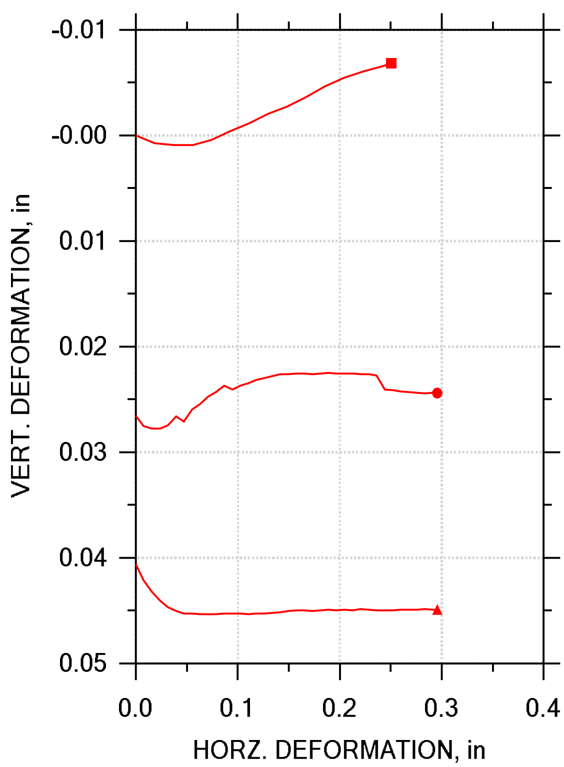

Symbol		■	●	▲	
Test No.		5.0 PSI	10.0 PSI	20.0 PSI	
Sample No.		S-5	S-5	S-5	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.4913	2.4941	2.4976	
	Area, in²	4.8748	4.8856	4.8995	
	Height, in	0.9878	0.99094	0.99252	
	Water Content, %	16.30	16.70	16.83	
	Dry Density, pcf	112.2	111.3	110.7	
	Saturation, %	86.28	86.36	85.72	
	Void Ratio	0.51397	0.52594	0.53408	
Consol. Height, in		0.9878	0.9644	0.95193	
Consol. Void Ratio		0.51397	0.48506	0.47134	
Final	Water Content, %	19.67	18.05	17.75	
	Dry Density, pcf	111.4	114.1	115.9	
	Saturation, %	102.01	100.52	103.90	
	Void Ratio	0.52446	0.48839	0.46469	
Normal Stress, tsf		0.32343	0.72072	1.4396	
Max. Shear Stress, tsf		0.19271	0.53843	0.90226	
Ult. Shear Stress, tsf		0.19231	0.44946	0.82371	
Time to Failure, min		39.855	23.081	41.061	
Disp. Rate, in/min		0.047244	0.004	0.004	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		31	31	31	
Plastic Limit		17	17	17	
Plasticity Index		14	14	14	

Project: DYNEGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN-029 S-5
Sample Type: TRIMMED
Description: DARK BROWN AND GRAY SLIGHTLY ORGANIC CLAY CL SAND POCKETS NOTED
Remarks:

Project: DYNEGY HENNEPIN
Boring No.: HEN-029 S-5
Sample No.: S-5
Test No.: 5.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: ----

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Soil Description: DARK BROWN AND GRAY SLIGHTLY ORGANIC CLAY CL SAND POCKETS NOTED
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	0.323	0.0000	0.000202	0.0000	0.0000
2	5.49	0.322	0.0007383	0.0717	0.01854	0.01854
3	10.36	0.323	0.0009004	0.104	0.03709	0.03709
4	15.03	0.323	0.0009004	0.128	0.05563	0.05563
5	19.38	0.323	0.0004142	0.147	0.07418	0.07418
6	23.15	0.323	-0.0003962	0.161	0.09280	0.09280
7	27.26	0.323	-0.001135	0.175	0.1113	0.1113
8	31.47	0.323	-0.002053	0.186	0.1299	0.1299
9	35.85	0.324	-0.002755	0.191	0.1484	0.1484
10	39.85	0.323	-0.003638	0.193	0.1670	0.1670
11	44.32	0.323	-0.004646	0.192	0.1856	0.1856
12	48.69	0.323	-0.005475	0.192	0.2041	0.2041
13	53.17	0.323	-0.006051	0.192	0.2228	0.2228
14	57.05	0.323	-0.006537	0.192	0.2413	0.2413
15	60.08	0.322	-0.006843	0.192	0.2506	0.2506

Project: DYNEGY HENNEPIN
Boring No.: HEN-029 S-5
Sample No.: S-5
Test No.: 10.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: ----

Soil Description: DARK BROWN AND GRAY SLIGHTLY ORGANIC CLAY CL SAND POCKETS NOTED
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	0.719	0.02654	0.000	0.0000	0.0000
2	2.71	0.719	0.02752	0.165	0.007902	0.007902
3	4.89	0.719	0.02777	0.248	0.01580	0.01580
4	7.16	0.720	0.02779	0.321	0.02364	0.02364
5	9.14	0.721	0.02746	0.382	0.03150	0.03150
6	11.21	0.721	0.02662	0.436	0.03940	0.03940
7	12.99	0.722	0.02710	0.441	0.04727	0.04727
8	14.76	0.722	0.02597	0.484	0.05517	0.05517
9	16.83	0.722	0.02543	0.479	0.06300	0.06300
10	18.94	0.722	0.02471	0.516	0.07087	0.07087
11	21.09	0.721	0.02433	0.529	0.07877	0.07877
12	23.08	0.721	0.02372	0.538	0.08664	0.08664
13	25.09	0.720	0.02404	0.521	0.09451	0.09451
14	26.95	0.721	0.02370	0.527	0.1024	0.1024
15	28.84	0.720	0.02343	0.528	0.1102	0.1102
16	30.60	0.720	0.02318	0.523	0.1182	0.1182
17	32.68	0.720	0.02294	0.512	0.1260	0.1260
18	34.69	0.720	0.02280	0.499	0.1339	0.1339
19	36.76	0.720	0.02262	0.491	0.1417	0.1417
20	38.80	0.720	0.02258	0.485	0.1496	0.1496
21	40.72	0.720	0.02256	0.482	0.1575	0.1575
22	42.71	0.720	0.02253	0.474	0.1654	0.1654
23	44.65	0.720	0.02258	0.468	0.1732	0.1732
24	46.29	0.720	0.02255	0.463	0.1811	0.1811
25	48.27	0.720	0.02249	0.455	0.1890	0.1890
26	50.29	0.720	0.02255	0.448	0.1969	0.1969
27	52.42	0.720	0.02253	0.444	0.2047	0.2047
28	54.59	0.720	0.02253	0.441	0.2126	0.2126
29	56.45	0.720	0.02260	0.441	0.2205	0.2205
30	58.41	0.720	0.02264	0.441	0.2283	0.2283
31	60.25	0.720	0.02271	0.443	0.2362	0.2362
32	62.14	0.719	0.02408	0.443	0.2441	0.2441
33	64.05	0.720	0.02410	0.444	0.2520	0.2520
34	66.14	0.720	0.02424	0.447	0.2598	0.2598
35	68.26	0.719	0.02431	0.448	0.2678	0.2678
36	70.36	0.719	0.02438	0.449	0.2756	0.2756
37	72.12	0.719	0.02442	0.449	0.2835	0.2835
38	74.01	0.719	0.02437	0.449	0.2914	0.2914
39	75.01	0.719	0.02438	0.449	0.2953	0.2953

Project: DYNEGY HENNEPIN
Boring No.: HEN-029 S-5
Sample No.: S-5
Test No.: 20.0 PSI

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/13/15
Sample Type: TRIMMED

Project No.: MR155233
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: ----

Terracon Consulting Engineers & Scientists

Soil Description: DARK BROWN AND GRAY SLIGHTLY ORGANIC CLAY CL SAND POCKETS NOTED
Remarks:

Step: 1 of 1

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in	Cumulative Displacement in
1	0.00	1.44	0.04059	0.000	0.0000	0.0000
2	2.82	1.44	0.04214	0.321	0.007867	0.007867
3	4.83	1.44	0.04324	0.444	0.01573	0.01573
4	7.10	1.44	0.04405	0.546	0.02360	0.02360
5	9.38	1.44	0.04470	0.641	0.03147	0.03147
6	11.33	1.44	0.04504	0.710	0.03937	0.03937
7	13.35	1.44	0.04526	0.759	0.04724	0.04724
8	15.20	1.44	0.04529	0.807	0.05510	0.05510
9	17.03	1.44	0.04533	0.841	0.06297	0.06297
10	19.00	1.44	0.04531	0.865	0.07087	0.07087
11	21.09	1.44	0.04531	0.877	0.07877	0.07877
12	23.26	1.44	0.04527	0.883	0.08660	0.08660
13	25.19	1.44	0.04529	0.890	0.09447	0.09447
14	27.24	1.44	0.04527	0.891	0.1023	0.1023
15	29.09	1.44	0.04533	0.890	0.1102	0.1102
16	30.98	1.44	0.04529	0.893	0.1181	0.1181
17	32.82	1.44	0.04526	0.896	0.1260	0.1260
18	34.93	1.44	0.04524	0.896	0.1338	0.1338
19	36.84	1.44	0.04513	0.895	0.1417	0.1417
20	39.05	1.44	0.04500	0.896	0.1496	0.1496
21	41.06	1.44	0.04499	0.902	0.1575	0.1575
22	42.87	1.44	0.04495	0.902	0.1653	0.1653
23	44.87	1.44	0.04502	0.889	0.1732	0.1732
24	46.86	1.44	0.04497	0.888	0.1811	0.1811
25	48.59	1.44	0.04493	0.883	0.1889	0.1889
26	50.54	1.44	0.04499	0.877	0.1968	0.1968
27	52.49	1.44	0.04493	0.869	0.2047	0.2047
28	54.68	1.44	0.04497	0.865	0.2126	0.2126
29	56.76	1.44	0.04488	0.862	0.2204	0.2204
30	58.63	1.44	0.04493	0.858	0.2283	0.2283
31	60.64	1.44	0.04497	0.850	0.2362	0.2362
32	62.54	1.44	0.04497	0.847	0.2441	0.2441
33	64.42	1.44	0.04499	0.840	0.2519	0.2519
34	66.26	1.44	0.04493	0.834	0.2598	0.2598
35	68.32	1.44	0.04493	0.831	0.2677	0.2677
36	70.44	1.44	0.04493	0.830	0.2756	0.2756
37	72.48	1.44	0.04488	0.828	0.2834	0.2834
38	74.27	1.44	0.04490	0.825	0.2913	0.2913
39	75.29	1.44	0.04490	0.824	0.2955	0.2955

Hydraulic Conductivity Tests
ASTM D 5084

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

Terracon
Consulting Engineers & Scientists

Laboratory Services Group 750 Corporate Woods Parkway Vernon Hills, Illinois 60061 Phone:(847) 793-0306 Fax:(847) 793-0309

TERRACON PROJECT NO.:	**MR155233**	**12/21/2015**
PROJECT NAME:	**DYNERGY - HENNEPIN SITE**	
CLIENT:	**AECOM**	
LOCATION :	**HENNEPIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	HEN-B010
SAMPLE NO.	S-5
DEPTH:	10.0'-11.5'
CLASSIFICATION	VERY DARK GRAY FLY ASH WITH SAND AND GRAVEL

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	86.6	93.3
WATER CONTENT (%)	26.5	23.2
DIAMETER (cm)	7.215	6.956
LENGTH (cm)	4.527	4.521
HYDRAULIC GRADIENT (MAXIMUM)	20.83	
PERCENT SATURATION	99.5	
HYDRAULIC CONDUCTIVITY k (cm/sec)	1.16E-05	

SAMPLE PHOTO

(Percent saturation calculation is based on final measurements and an estimated specific gravity.)

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

Laboratory Services Group 750 Corporate Woods Parkway Vernon Hills, Illinois 60061 Phone:(847) 793-0306 Fax:(847) 793-0309

TERRACON PROJECT NO.:	**MR155233**	**12/21/2015**
PROJECT NAME:	**DYNERGY - HENNEPIN SITE**	
CLIENT:	**AECOM**	
LOCATION :	**HENNEPIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	HEN-B017
SAMPLE NO.	S-3
DEPTH:	5.0'-7.0'
CLASSIFICATION	VERY DARK GRAY LEAN CLAY WITH SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	76.0	82.8
WATER CONTENT (%)	36.7	38.2
DIAMETER (cm)	6.929	6.692
LENGTH (cm)	7.541	7.425

SAMPLE PHOTO

HYDRAULIC GRADIENT (MAXIMUM)	26.49
PERCENT SATURATION	99.3
HYDRAULIC CONDUCTIVITY k (cm/sec)	6.79E-07

(Percent saturation calculation is based on final measurements and an estimated specific gravity.)

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

Laboratory Services Group 750 Corporate Woods Parkway Vernon Hills, Illinois 60061 Phone:(847) 793-0306 Fax:(847) 793-0309

TERRACON PROJECT NO.:	**MR155233**	**12/21/2015**
PROJECT NAME:	**DYNERGY - HENNEPIN SITE**	
CLIENT:	**AECOM**	
LOCATION :	**HENNEPIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	HEN-B023
SAMPLE NO.	S-9
DEPTH:	27.0'-29.0'
CLASSIFICATION	VERY DARK GRAY FLY ASH WITH SAND AND GRAVEL

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	81.8	83.2
WATER CONTENT (%)	28.3	31.5
DIAMETER (cm)	7.154	7.063
LENGTH (cm)	5.432	5.479
HYDRAULIC GRADIENT (MAXIMUM)	17.36	
PERCENT SATURATION	100.4	
HYDRAULIC CONDUCTIVITY k (cm/sec)	1.00E-05	

SAMPLE PHOTO

(Percent saturation calculation is based on final measurements and an estimated specific gravity.)

Deaired water was used as the liquid permeant.

Unconfined Compression Tests
ASTM D 2166

UNCONFINED COMPRESSION TEST
ASTM D2166

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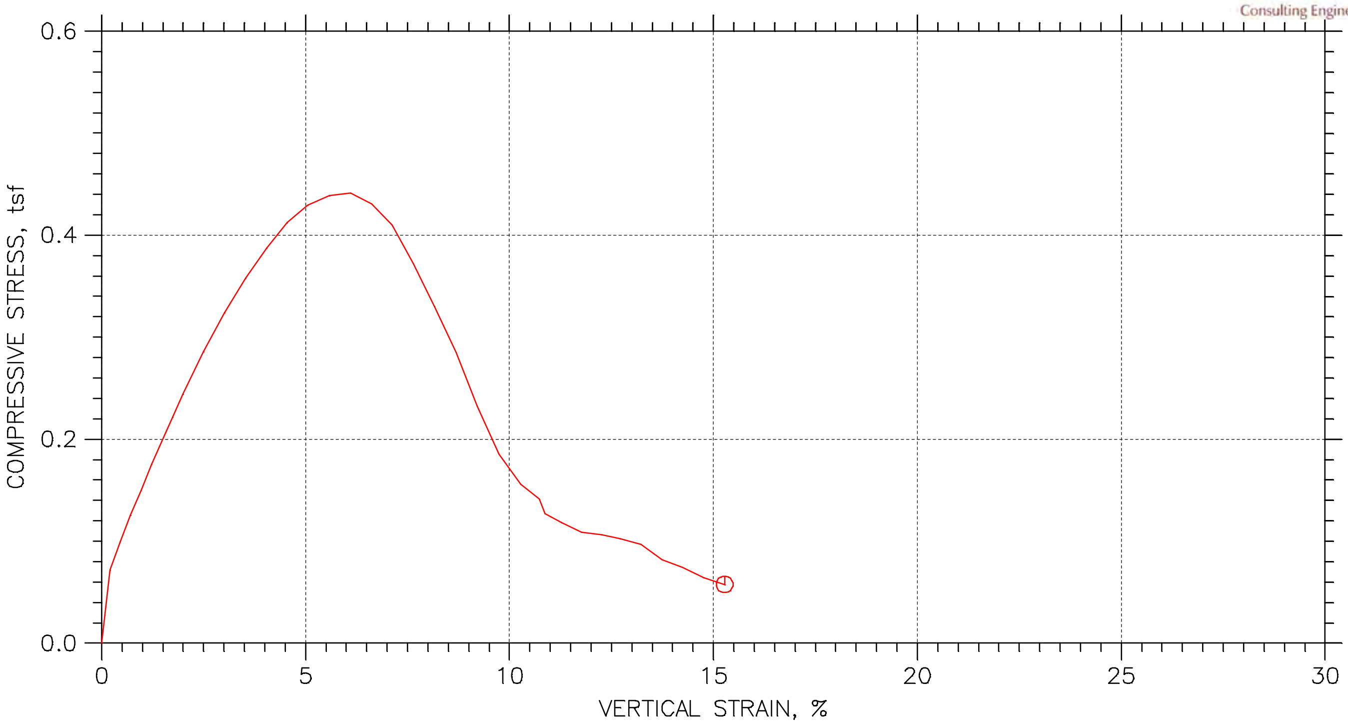


Symbol		⏀			
Test No.		HENB001S4			
Initial	Diameter, in	2.865			
	Height, in	6.0992			
	Water Content, %	17.60			
	Dry Density, pcf	108.4			
	Saturation, %	84.55			
	Void Ratio	0.56618			
Unconfined Compressive Strength, tsf		0.44114			
Undrained Shear Strength, tsf		0.22057			
Time to Failure, min		6.0041			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		21			
Plastic Limit		14			
Plasticity Index		7			
Failure Sketch					

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HENB001 S-4
Sample Type: 3.0'' ST
Description: BROWN AND GRAY LEAN CLAY WITH SAND CL SAND SEAMS NOTED
Remarks: TEST PERFORMED AS PER ASTM D2166.

Tue, 22-DEC-2015 14:04:16

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HENB001 S-4
Sample No.: ST-4
Test No.: HENB001S4

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/14/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 7.5'-9.5'
Elevation: -----

Soil Description: BROWN AND GRAY LEAN CLAY WITH SAND CL SAND SEAMS NOTED
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 6.10 in
Specimen Area: 6.45 in^2
Specimen Volume: 39.32 in^3

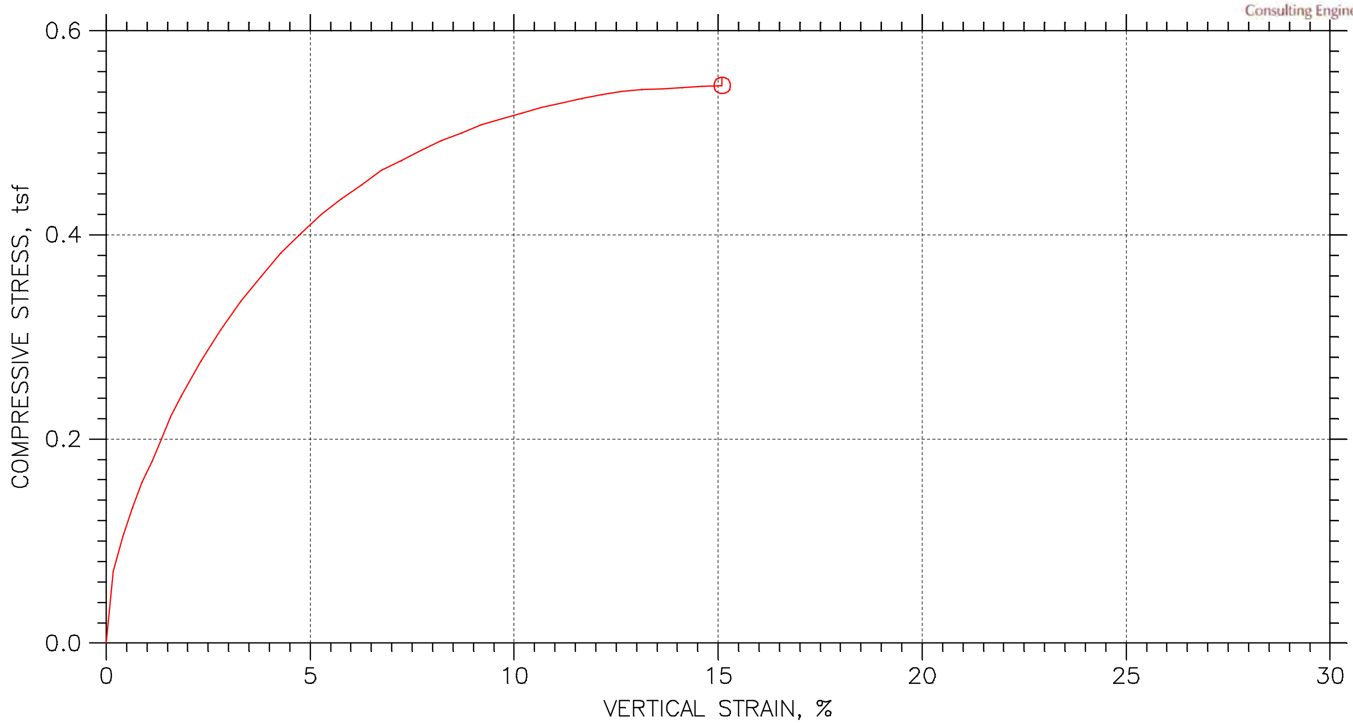
Liquid Limit: 21
Plastic Limit: 14
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.4465	0	0
2	0.25412	0.012269	0.20115	6.4512	6.4595	0.071907	0.035954
3	0.50388	0.027674	0.45373	8.9163	6.4759	0.099133	0.049566
4	0.75412	0.043356	0.71085	11.329	6.4927	0.12563	0.062816
5	1.0041	0.05913	0.96947	13.584	6.5097	0.15025	0.075125
6	1.2541	0.074997	1.2296	15.892	6.5268	0.17531	0.087656
7	1.5041	0.090402	1.4822	17.99	6.5435	0.19795	0.098974
8	1.7541	0.1059	1.7363	20.193	6.5605	0.22161	0.11081
9	2.0041	0.1214	1.9904	22.291	6.5775	0.24401	0.122
10	2.5041	0.15221	2.4955	26.225	6.6115	0.28559	0.14279
11	3.0041	0.18348	3.0082	29.896	6.6465	0.32386	0.16193
12	3.5041	0.2153	3.53	33.2	6.6824	0.35772	0.17886
13	4.0041	0.24667	4.0443	36.137	6.7183	0.38729	0.19364
14	4.5041	0.27739	4.5479	38.707	6.7537	0.41265	0.20633
15	5.0041	0.30847	5.0576	40.491	6.79	0.42936	0.21468
16	5.5041	0.3403	5.5794	41.592	6.8275	0.43861	0.21931
17	6.0041	0.37212	6.1012	42.064	6.8654	0.44114	0.22057
18	6.5042	0.40349	6.6154	41.277	6.9032	0.43052	0.21526
19	7.0042	0.43439	7.1221	39.547	6.9409	0.41023	0.20511
20	7.5042	0.46603	7.6409	36.085	6.9799	0.37223	0.18612
21	8.0042	0.49776	8.1611	32.204	7.0194	0.33032	0.16516
22	8.5042	0.52996	8.689	27.955	7.06	0.2851	0.14255
23	9.0042	0.5616	9.2077	22.92	7.1003	0.23242	0.11621
24	9.5042	0.59398	9.7386	18.357	7.1421	0.18506	0.09253
25	10.004	0.62673	10.276	15.577	7.1848	0.1561	0.078051
26	10.504	0.65486	10.737	14.161	7.222	0.14118	0.070591
27	11.004	0.66279	10.867	12.745	7.2325	0.12688	0.063439
28	11.5	0.6877	11.275	11.906	7.2658	0.11798	0.058991
29	12	0.71722	11.759	11.014	7.3056	0.10855	0.054275
30	12.5	0.74775	12.26	10.857	7.3473	0.10639	0.053196
31	13	0.77515	12.709	10.542	7.3851	0.10278	0.05139
32	13.5	0.80652	13.223	9.9653	7.4289	0.096583	0.048291
33	14	0.83816	13.742	8.4968	7.4736	0.081857	0.040929
34	14.5	0.86897	14.247	7.7625	7.5176	0.074345	0.037173
35	15	0.89996	14.755	6.7659	7.5624	0.064417	0.032208
36	15.5	0.93169	15.276	6.0841	7.6088	0.057572	0.028786

UNCONFINED COMPRESSION TEST
ASTM D2166

Terracon
Consulting Engineers & Scientists



Symbol		⏀			
Test No.		HEN001S7			
Initial	Diameter, in	2.8047			
	Height, in	6.0043			
	Water Content, %	37.23			
	Dry Density, pcf	81.96			
	Saturation, %	94.48			
	Void Ratio	1.0718			
Unconfined Compressive Strength, tsf		0.54628			
Undrained Shear Strength, tsf		0.27314			
Time to Failure, min		15.5			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		38			
Plastic Limit		22			
Plasticity Index		16			
Failure Sketch					

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN001 S7
Sample Type: 3.0'' ST
Description: DARK GRAY ORGANIC LEAN CLAY OL SHELL NOTED
Remarks: TEST PERFORMED AS PER ASTM D2166. 410

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN001 S7
Sample No.: ST-7
Test No.: HEN001S7

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/15/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 20.0'-22.0'
Elevation: ----

Soil Description: DARK GRAY ORGANIC LEAN CLAY OL SHELL NOTED
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 6.00 in
Specimen Area: 6.18 in^2
Specimen Volume: 37.10 in^3

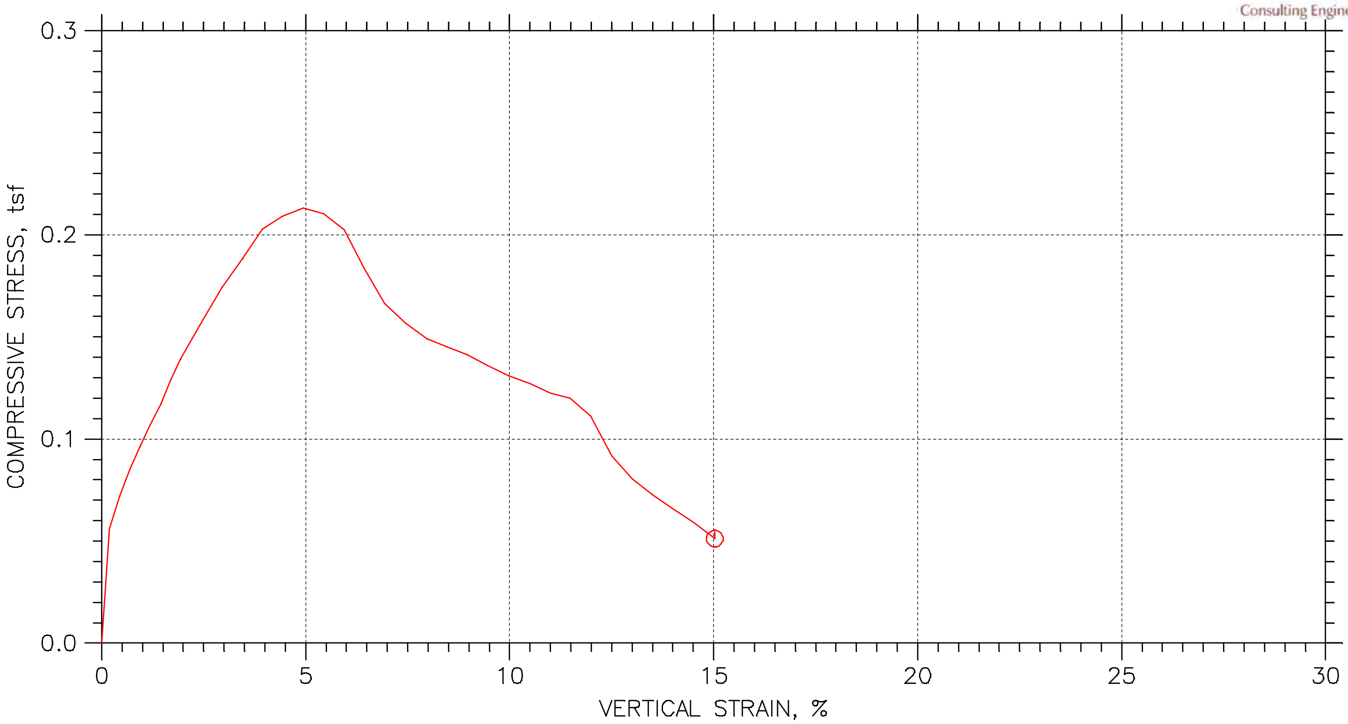
Liquid Limit: 38
Plastic Limit: 22
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.1783	0	0
2	0.25003	0.010322	0.1719	6.0347	6.189	0.070205	0.035102
3	0.50003	0.024571	0.40922	8.9991	6.2037	0.10444	0.052221
4	0.75003	0.038638	0.6435	11.434	6.2183	0.13239	0.066196
5	1	0.05307	0.88386	13.657	6.2334	0.15775	0.078876
6	1.25	0.067593	1.1257	15.51	6.2487	0.17871	0.089357
7	1.5	0.082299	1.3707	17.469	6.2642	0.20078	0.10039
8	1.75	0.095361	1.5882	19.374	6.278	0.2222	0.1111
9	2.0001	0.11007	1.8331	21.121	6.2937	0.24163	0.12081
10	2.5	0.13957	2.3245	24.297	6.3254	0.27657	0.13829
11	3	0.16862	2.8083	27.103	6.3568	0.30698	0.15349
12	3.5	0.19803	3.2981	29.697	6.389	0.33466	0.16733
13	4.0001	0.22781	3.7941	32.026	6.422	0.35906	0.17953
14	4.5	0.25759	4.29	34.302	6.4552	0.3826	0.1913
15	5.0001	0.28709	4.7814	36.208	6.4886	0.40178	0.20089
16	5.5001	0.31623	5.2666	38.061	6.5218	0.42019	0.21009
17	6.0001	0.34582	5.7595	39.596	6.5559	0.43486	0.21743
18	6.5001	0.3756	6.2555	41.078	6.5906	0.44876	0.22438
19	7.0001	0.40519	6.7484	42.613	6.6254	0.46309	0.23154
20	7.5001	0.43415	7.2306	43.725	6.6599	0.47271	0.23636
21	8.0001	0.46329	7.7159	44.889	6.6949	0.48276	0.24138
22	8.5001	0.49288	8.2088	46.001	6.7308	0.49207	0.24604
23	9.0001	0.52266	8.7047	46.954	6.7674	0.49955	0.24978
24	9.5001	0.55226	9.1976	48.013	6.8041	0.50806	0.25403
25	10	0.5813	9.6814	48.807	6.8406	0.51371	0.25686
26	10.5	0.6109	10.174	49.601	6.8781	0.51922	0.25961
27	11	0.64067	10.67	50.395	6.9163	0.52462	0.26231
28	11.5	0.67054	11.168	51.136	6.955	0.52937	0.26468
29	12	0.69996	11.658	51.824	6.9936	0.53353	0.26677
30	12.5	0.729	12.141	52.459	7.0321	0.53712	0.26856
31	13	0.7586	12.634	53.094	7.0718	0.54057	0.27029
32	13.5	0.78856	13.133	53.571	7.1124	0.54231	0.27115
33	14	0.81824	13.628	53.941	7.1531	0.54295	0.27147
34	14.5	0.84766	14.117	54.365	7.1939	0.54411	0.27205
35	15	0.8767	14.601	54.841	7.2347	0.54579	0.27289
36	15.5	0.90648	15.097	55.212	7.2769	0.54628	0.27314

UNCONFINED COMPRESSION TEST
ASTM D2166

Terracon
Consulting Engineers & Scientists



Symbol		⦶			
Test No.		HENB003S5			
Initial	Diameter, in	2.8394			
	Height, in	6.2583			
	Water Content, %	38.47			
	Dry Density, pcf	68.88			
	Saturation, %	72.73			
	Void Ratio	1.4017			
Unconfined Compressive Strength, tsf		0.21317			
Undrained Shear Strength, tsf		0.10659			
Time to Failure, min		5.0039			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.65			
Liquid Limit		---			
Plastic Limit		---			
Plasticity Index		---			
Failure Sketch					

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HENB003 S-5
Sample Type: 3.0" ST
Description: BLACK ORGANIC CLAY WITH SAND OL WOOD NOTED
Remarks: TEST PERFORMED AS PER ASTM D2166. 412

Tue, 22-DEC-2015 14:24:30

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HENB003 S-5
Sample No.: ST-5
Test No.: HENB003S5

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/14/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: -----

Soil Description: BLACK ORGANIC CLAY WITH SAND OL WOOD NOTED
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 6.26 in
Specimen Area: 6.33 in^2
Specimen Volume: 39.63 in^3

Liquid Limit: ---
Plastic Limit: ---
Estimated Specific Gravity: 2.65

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.3319	0	0
2	0.25412	0.011992	0.19162	4.9302	6.3441	0.055954	0.027977
3	0.50387	0.027951	0.44662	6.3463	6.3603	0.071842	0.035921
4	0.75387	0.043725	0.69868	7.5527	6.3764	0.085281	0.042641
5	1.0039	0.059407	0.94926	8.5492	6.3926	0.09629	0.048145
6	1.2539	0.074812	1.1954	9.5457	6.4085	0.10725	0.053623
7	1.5039	0.090125	1.4401	10.437	6.4244	0.11697	0.058487
8	1.7539	0.10562	1.6877	11.539	6.4406	0.12899	0.064497
9	2.0039	0.12121	1.9368	12.483	6.457	0.13919	0.069597
10	2.5039	0.15258	2.438	14.109	6.4901	0.15652	0.07826
11	3.0039	0.1844	2.9465	15.787	6.5241	0.17423	0.087113
12	3.5039	0.21567	3.4462	17.151	6.5579	0.1883	0.094151
13	4.0039	0.24621	3.9341	18.567	6.5912	0.20282	0.10141
14	4.5039	0.27729	4.4309	19.249	6.6255	0.20918	0.10459
15	5.0039	0.30903	4.9379	19.721	6.6608	0.21317	0.10659
16	5.5039	0.34085	5.4464	19.564	6.6966	0.21034	0.10517
17	6.0039	0.37194	5.9432	18.934	6.732	0.2025	0.10125
18	6.5039	0.40284	6.437	17.256	6.7675	0.18358	0.091792
19	7.0039	0.4343	6.9396	15.735	6.8041	0.1665	0.083252
20	7.5039	0.46659	7.4555	14.896	6.842	0.15675	0.078375
21	8.0039	0.49887	7.9714	14.266	6.8804	0.14929	0.074645
22	8.5039	0.52987	8.4667	13.951	6.9176	0.14521	0.072605
23	9.0039	0.56068	8.959	13.637	6.955	0.14117	0.070586
24	9.5039	0.59223	9.4631	13.217	6.9937	0.13607	0.068035
25	10.004	0.62451	9.979	12.798	7.0338	0.131	0.0655
26	10.504	0.65661	10.492	12.483	7.0741	0.12705	0.063525
27	11.004	0.68779	10.99	12.116	7.1137	0.12263	0.061314
28	11.504	0.71879	11.485	11.906	7.1535	0.11983	0.059917
29	12.004	0.75034	11.99	11.119	7.1945	0.11128	0.055639
30	12.504	0.78244	12.502	9.231	7.2367	0.091843	0.045921
31	13.004	0.81417	13.01	8.1296	7.2788	0.080416	0.040208
32	13.504	0.84517	13.505	7.3953	7.3205	0.072736	0.036368
33	14.004	0.87635	14.003	6.7135	7.3629	0.065649	0.032825
34	14.504	0.90817	14.512	6.0841	7.4067	0.059143	0.029571
35	15.004	0.94037	15.026	5.2974	7.4516	0.051185	0.025593

UNCONFINED COMPRESSION TEST
ASTM D2166

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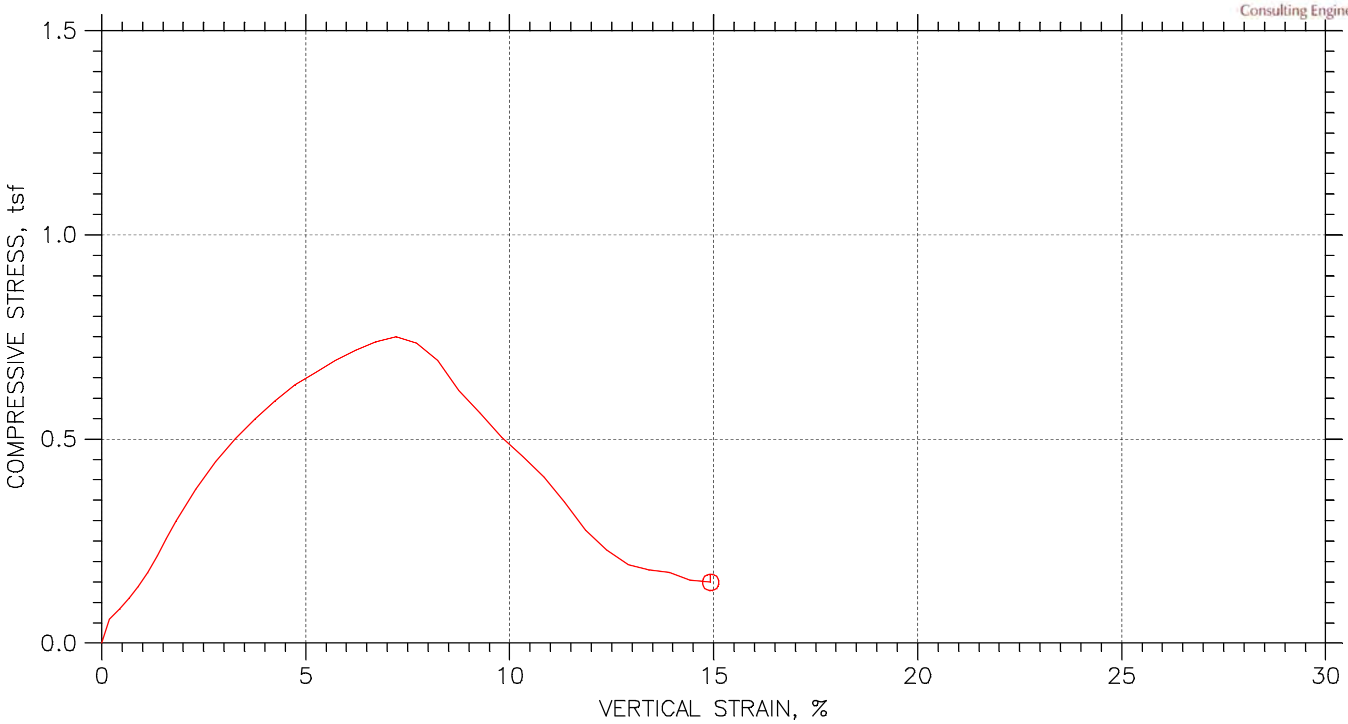

Symbol		○			
Test No.		HEN004S5			
Initial	Diameter, in	2.8673			
	Height, in	6.2728			
	Water Content, %	36.84			
	Dry Density, pcf	84.04			
	Saturation, %	98.19			
	Void Ratio	1.0205			
Unconfined Compressive Strength, tsf		0.75034			
Undrained Shear Strength, tsf		0.37517			
Time to Failure, min		7.5002			
Strain Rate, %/min		1.52			
Estimated Specific Gravity		2.72			
Liquid Limit		NP			
Plastic Limit		NP			
Plasticity Index		NP			
Failure Sketch					

Project: DYNERGY HENNEPIN,	
Location: HENNEPIN, IL	
Project No.: MR155233	
Boring No.: HEN-004 S5	
Sample Type: 3" ST	
Description: BROWN BLACK AND GRAY SANDY SILT WITH GRAVEL	
Remarks: TEST PERFORMED AS PER ASTM D 2166.	414

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN,
Boring No.: HEN-004 S5
Sample No.: S-5
Test No.: HEN004S5

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/16/15
Sample Type: 3" ST

Project No.: MR155233
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: -----

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Soil Description: BROWN BLACK AND GRAY SANDY SILT WITH GRAVEL
Remarks: TEST PERFORMED AS PER ASTM D 2166.

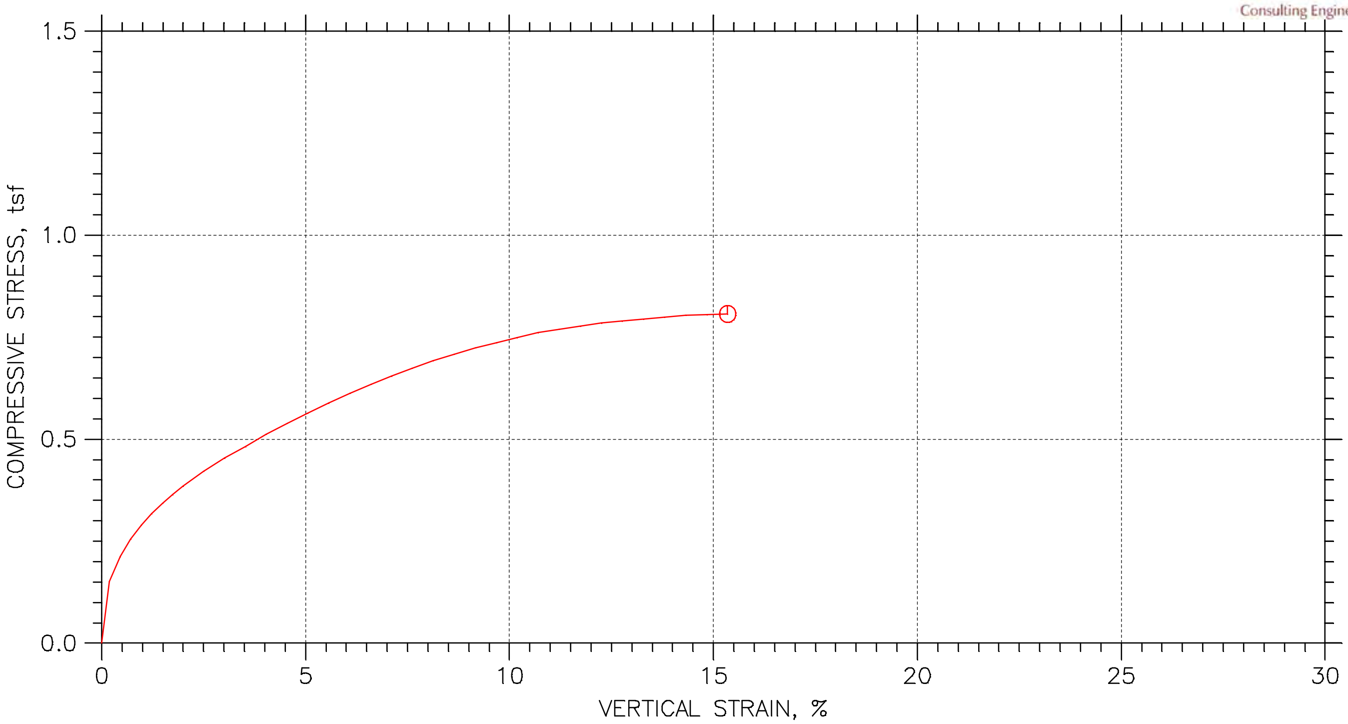
Specimen Height: 6.27 in
Specimen Area: 6.46 in^2
Specimen Volume: 40.50 in^3

Liquid Limit: NP
Plastic Limit: NP
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.4572	0	0
2	0.25028	0.012177	0.19412	5.2238	6.4697	0.058134	0.029067
3	0.50028	0.027213	0.43382	7.5583	6.4853	0.083913	0.041956
4	0.75028	0.042065	0.67058	9.9187	6.5008	0.10986	0.054928
5	1.0003	0.05664	0.90294	12.595	6.516	0.13917	0.069586
6	1.2503	0.07103	1.1323	15.755	6.5311	0.17369	0.086843
7	1.5003	0.085328	1.3603	19.418	6.5462	0.21358	0.10679
8	1.7503	0.099811	1.5912	23.365	6.5616	0.25638	0.12819
9	2.0003	0.11439	1.8235	27.325	6.5771	0.29913	0.14956
10	2.5002	0.14446	2.3029	34.567	6.6094	0.37656	0.18828
11	3.0002	0.17527	2.7941	40.945	6.6428	0.4438	0.2219
12	3.5002	0.2059	3.2823	46.44	6.6763	0.50083	0.25041
13	4.0002	0.23634	3.7676	51.238	6.71	0.5498	0.2749
14	4.5002	0.26669	4.2514	55.585	6.7439	0.59344	0.29672
15	5.0002	0.29768	4.7456	59.525	6.7789	0.63223	0.31612
16	5.5002	0.32877	5.2411	62.756	6.8143	0.66308	0.33154
17	6.0002	0.35967	5.7338	65.903	6.8499	0.69271	0.34636
18	6.5002	0.39048	6.225	68.625	6.8858	0.71756	0.35878
19	7.0002	0.4212	6.7147	70.966	6.922	0.73816	0.36908
20	7.5002	0.45266	7.2161	72.527	6.9594	0.75034	0.37517
21	8.0002	0.48439	7.722	71.456	6.9975	0.73524	0.36762
22	8.5002	0.5164	8.2323	67.599	7.0364	0.69171	0.34585
23	9.0002	0.54878	8.7485	60.738	7.0762	0.618	0.309
24	9.5002	0.58153	9.2705	55.746	7.117	0.56396	0.28198
25	10	0.61492	9.8029	50.193	7.159	0.50481	0.25241
26	10.5	0.64785	10.328	45.66	7.2009	0.45654	0.22827
27	11	0.67986	10.838	40.855	7.2421	0.40618	0.20309
28	11.5	0.71141	11.341	34.915	7.2832	0.34517	0.17258
29	12	0.7437	11.856	28.086	7.3257	0.27604	0.13802
30	12.5	0.77681	12.384	23.378	7.3698	0.22839	0.1142
31	13	0.81021	12.916	19.773	7.4149	0.192	0.095999
32	13.5	0.84139	13.413	18.548	7.4575	0.17907	0.089536
33	14	0.87256	13.91	17.974	7.5005	0.17253	0.086267
34	14.5	0.9043	14.416	16.213	7.5449	0.15472	0.07736
35	15	0.93612	14.923	15.704	7.5898	0.14897	0.074485

UNCONFINED COMPRESSION TEST
ASTM D2166



Symbol					
Test No.		HEN004S9			
Initial	Diameter, in	2.7551			
	Height, in	6.0059			
	Water Content, %	33.62			
	Dry Density, pcf	85.2			
	Saturation, %	92.10			
	Void Ratio	0.99292			
Unconfined Compressive Strength, tsf		0.80682			
Undrained Shear Strength, tsf		0.40341			
Time to Failure, min		15.004			
Strain Rate, %/min		1.14			
Estimated Specific Gravity		2.72			
Liquid Limit		43			
Plastic Limit		22			
Plasticity Index		21			
Failure Sketch					

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN004 S-9
Sample Type: 3.0'' ST
Description: BROWN AND GRAY LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D2166. 416

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN004 S-9
Sample No.: ST-9
Test No.: HEN004S9

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/15/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: BROWN AND GRAY LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D2166.

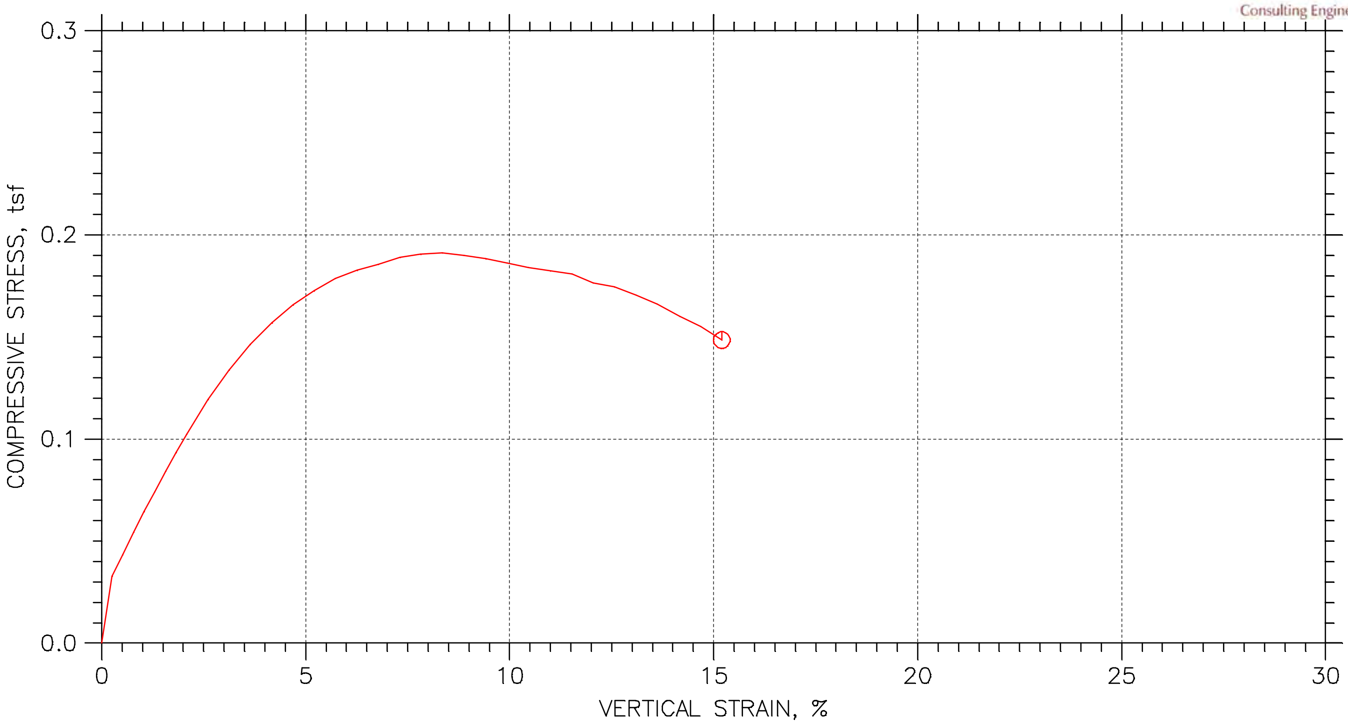
Specimen Height: 6.01 in
Specimen Area: 5.96 in^2
Specimen Volume: 35.81 in^3

Liquid Limit: 43
Plastic Limit: 22
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	5.9617	0	0
2	0.25398	0.01157	0.19265	12.53	5.9732	0.15103	0.075517
3	0.50398	0.027058	0.45052	17.637	5.9887	0.21204	0.10602
4	0.75398	0.04291	0.71446	21.269	6.0046	0.25504	0.12752
5	1.004	0.058397	0.97233	24.165	6.0202	0.289	0.1445
6	1.254	0.073885	1.2302	26.639	6.036	0.31777	0.15888
7	1.504	0.089281	1.4866	28.798	6.0517	0.34262	0.17131
8	1.754	0.10477	1.7444	30.746	6.0675	0.36484	0.18242
9	2.004	0.11989	1.9962	32.483	6.0831	0.38447	0.19224
10	2.504	0.15005	2.4983	35.695	6.1145	0.42032	0.21016
11	3.004	0.18093	3.0126	38.696	6.1469	0.45325	0.22663
12	3.504	0.21163	3.5238	41.433	6.1795	0.48276	0.24138
13	4.004	0.24252	4.038	44.118	6.2126	0.5113	0.25565
14	4.504	0.27322	4.5492	46.698	6.2458	0.53832	0.26916
15	5.004	0.30374	5.0573	49.172	6.2793	0.56382	0.28191
16	5.504	0.33453	5.57	51.647	6.3134	0.589	0.2945
17	6.004	0.36542	6.0843	53.963	6.3479	0.61207	0.30603
18	6.504	0.3963	6.5985	56.174	6.3829	0.63366	0.31683
19	7.004	0.42691	7.1082	58.333	6.4179	0.65441	0.32721
20	7.504	0.45734	7.6148	60.386	6.4531	0.67375	0.33688
21	8.004	0.48831	8.1306	62.334	6.4893	0.69161	0.3458
22	8.504	0.51938	8.6478	64.124	6.5261	0.70746	0.35373
23	9.004	0.55045	9.1651	65.914	6.5632	0.72309	0.36155
24	9.504	0.58088	9.6717	67.546	6.6	0.73686	0.36843
25	10.004	0.6114	10.18	69.02	6.6374	0.74871	0.37435
26	10.504	0.64246	10.697	70.547	6.6758	0.76086	0.38043
27	11.004	0.67362	11.216	71.758	6.7148	0.76943	0.38471
28	11.504	0.70478	11.735	72.969	6.7543	0.77784	0.38892
29	12.004	0.73557	12.247	74.022	6.7938	0.78448	0.39224
30	12.504	0.76636	12.76	74.917	6.8337	0.78932	0.39466
31	13.004	0.79761	13.28	75.917	6.8747	0.79509	0.39755
32	13.504	0.82886	13.801	76.707	6.9162	0.79854	0.39927
33	14.004	0.86002	14.32	77.602	6.9581	0.803	0.4015
34	14.504	0.8909	14.834	78.339	7.0001	0.80576	0.40288
35	15.004	0.92178	15.348	78.918	7.0426	0.80682	0.40341

UNCONFINED COMPRESSION TEST
ASTM D2166



Symbol	⦶			
Test No.	HENB005S2			
Initial: Diameter, in	2.8366			
Initial: Height, in	6.0217			
Initial: Water Content, %	59.63			
Initial: Dry Density, pcf	60.38			
Initial: Saturation, %	91.85			
Initial: Void Ratio	1.688			
Unconfined Compressive Strength, tsf	0.19114			
Undrained Shear Strength, tsf	0.095571			
Time to Failure, min	8.0034			
Strain Rate, %/min	1			
Estimated Specific Gravity	2.60			
Liquid Limit	---			
Plastic Limit	---			
Plasticity Index	---			
Failure Sketch				

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HENB005 S-2
Sample Type: 3.0" ST
Description: BLACK TO VERY DARK GRAY ORGANIC CLAY OL
Remarks: TEST PERFORMED AS PER ASTM D2166. 418

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HENB005 S-2
Sample No.: ST-2
Test No.: HENB005S2

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/14/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 7.5'-9.5'
Elevation: -----

Soil Description: BLACK TO VERY DARK GRAY ORGANIC CLAY OL
Remarks: TEST PERFORMED AS PER ASTM D2166.

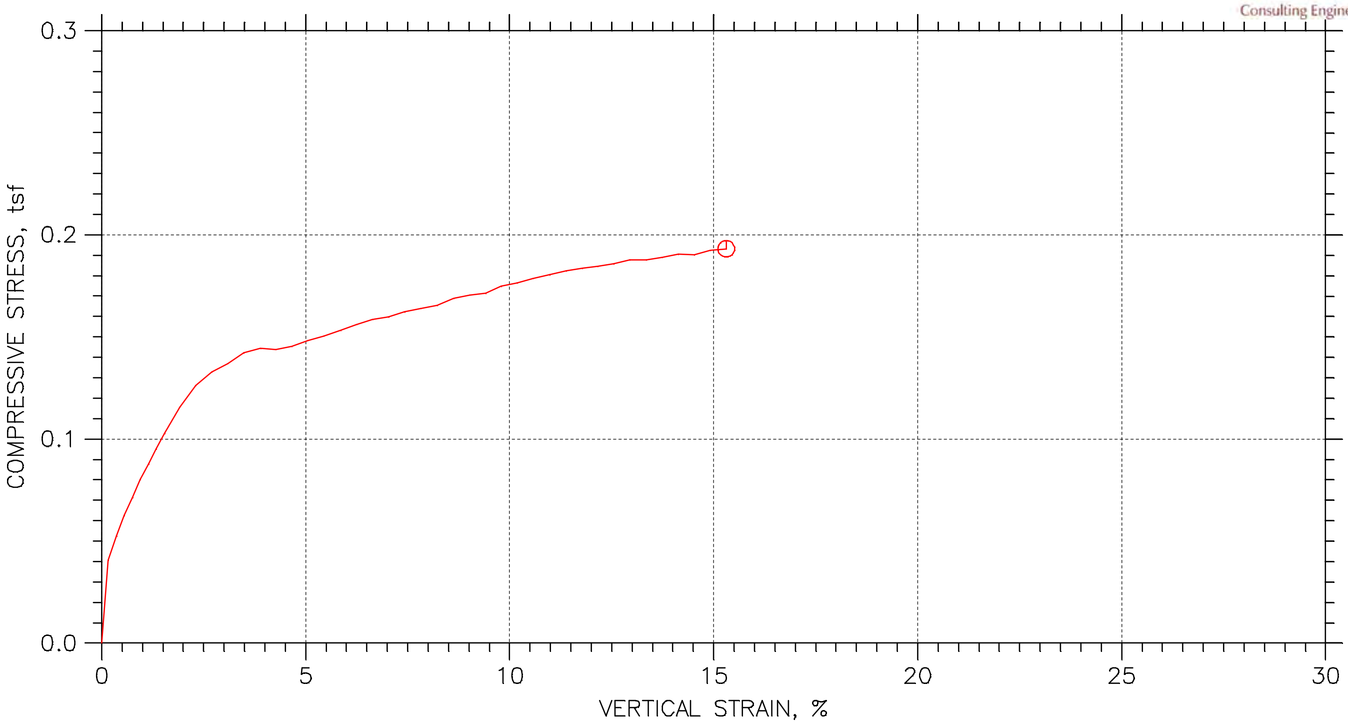
Specimen Height: 6.02 in
Specimen Area: 6.32 in^2
Specimen Volume: 38.05 in^3

Liquid Limit: ---
Plastic Limit: ---
Estimated Specific Gravity: 2.60

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.3196	0	0
2	0.25025	0.015497	0.25736	2.8847	6.3359	0.032781	0.016391
3	0.50417	0.031272	0.51932	3.8288	6.3526	0.043395	0.021698
4	0.75417	0.046861	0.77822	4.8253	6.3692	0.054548	0.027274
5	1	0.062267	1.034	5.717	6.3856	0.06446	0.03223
6	1.2539	0.078318	1.3006	6.6086	6.4029	0.074313	0.037157
7	1.5037	0.094092	1.5626	7.5002	6.4199	0.084116	0.042058
8	1.7534	0.10977	1.823	8.3394	6.437	0.09328	0.04664
9	2.0034	0.12555	2.0849	9.1786	6.4542	0.10239	0.051196
10	2.5034	0.15673	2.6027	10.752	6.4885	0.11931	0.059656
11	3.0034	0.18791	3.1205	12.116	6.5232	0.13373	0.066864
12	3.5034	0.21946	3.6444	13.322	6.5586	0.14625	0.073124
13	4.0034	0.25119	4.1714	14.371	6.5947	0.1569	0.078451
14	4.5034	0.28264	4.6938	15.263	6.6309	0.16573	0.082864
15	5.0034	0.31373	5.2101	15.997	6.667	0.17276	0.08638
16	5.5034	0.3451	5.7309	16.626	6.7038	0.17857	0.089285
17	6.0034	0.37674	6.2564	17.098	6.7414	0.18262	0.091308
18	6.5034	0.40847	6.7833	17.466	6.7795	0.18549	0.092744
19	7.0034	0.43983	7.3042	17.885	6.8176	0.18888	0.094442
20	7.5034	0.47092	7.8205	18.147	6.8558	0.19059	0.095293
21	8.0034	0.50256	8.3459	18.305	6.8951	0.19114	0.095571
22	8.5034	0.53494	8.8836	18.305	6.9358	0.19002	0.095011
23	9.0034	0.56713	9.4183	18.252	6.9767	0.18836	0.094182
24	9.5034	0.59878	9.9437	18.147	7.0174	0.1862	0.093098
25	10.003	0.63023	10.466	18.042	7.0583	0.18405	0.092023
26	10.503	0.66187	10.992	17.99	7.1	0.18243	0.091217
27	11.003	0.69416	11.528	17.938	7.143	0.18081	0.090403
28	11.503	0.7258	12.053	17.623	7.1857	0.17658	0.08829
29	12.003	0.75707	12.572	17.518	7.2284	0.17449	0.087246
30	12.503	0.78853	13.095	17.203	7.2719	0.17033	0.085167
31	13.003	0.82035	13.623	16.889	7.3163	0.1662	0.0831
32	13.503	0.85255	14.158	16.364	7.3619	0.16004	0.080021
33	14.003	0.8841	14.682	15.945	7.4071	0.15499	0.077493
34	14.503	0.91518	15.198	15.368	7.4522	0.14847	0.074237

UNCONFINED COMPRESSION TEST
ASTM D2166



Symbol		⦶			
Test No.		HENB012S7			
Initial	Diameter, in	2.8343			
	Height, in	6.0142			
	Water Content, %	38.30			
	Dry Density, pcf	73.56			
	Saturation, %	79.62			
	Void Ratio	1.3083			
Unconfined Compressive Strength, tsf		0.19314			
Undrained Shear Strength, tsf		0.09657			
Time to Failure, min		19.5			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		---			
Plastic Limit		---			
Plasticity Index		---			
Failure Sketch					

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HENB012 S-7
Sample Type: 3.0'' ST
Description: VERY DARK GRAY LEAN CLAY CL ORGANICS NOTED
Remarks: TEST PERFORMED AS PER ASTM D2166. 420

Tue, 22-DEC-2015 14:45:08

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HENB012 S-7
Sample No.: S-7
Test No.: HENB012S7

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/14/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 20.0'-22.0'
Elevation: -----

Soil Description: VERY DARK GRAY LEAN CLAY CL ORGANICS NOTED
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 6.01 in
Specimen Area: 6.31 in^2
Specimen Volume: 37.94 in^3

Liquid Limit: ---
Plastic Limit: ---
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.3091	0	0
2	0.25005	0.0095937	0.15952	3.5665	6.3192	0.040637	0.020318
3	0.50007	0.021309	0.35431	4.6155	6.3315	0.052486	0.026243
4	0.75007	0.033117	0.55064	5.5072	6.344	0.062502	0.031251
5	1.0001	0.045017	0.74851	6.2939	6.3567	0.071289	0.035644
6	1.2501	0.056824	0.94484	7.0806	6.3693	0.080041	0.040021
7	1.5001	0.068724	1.1427	7.7625	6.382	0.087574	0.043787
8	1.7501	0.080532	1.339	8.4443	6.3947	0.095077	0.047538
9	2.0001	0.092247	1.5338	9.1261	6.4074	0.10255	0.051276
10	2.5001	0.1154	1.9188	10.332	6.4325	0.11565	0.057826
11	3.0001	0.13865	2.3053	11.329	6.458	0.12631	0.063154
12	3.5001	0.16208	2.6949	11.958	6.4838	0.13279	0.066396
13	4.0001	0.18579	3.0891	12.378	6.5102	0.1369	0.068448
14	4.5001	0.20977	3.4879	12.902	6.5371	0.14211	0.071054
15	5.0001	0.23366	3.8852	13.165	6.5641	0.1444	0.0722
16	5.5001	0.257	4.2732	13.165	6.5907	0.14382	0.071909
17	6.0001	0.28025	4.6598	13.375	6.6174	0.14552	0.07276
18	6.5001	0.30377	5.0509	13.689	6.6447	0.14833	0.074166
19	7.0001	0.32748	5.4451	13.951	6.6724	0.15055	0.075273
20	7.5001	0.35165	5.8469	14.266	6.7009	0.15329	0.076644
21	8.0001	0.37591	6.2503	14.581	6.7297	0.156	0.077999
22	8.5001	0.39952	6.643	14.896	6.758	0.1587	0.079349
23	9.0001	0.42277	7.0295	15.053	6.7861	0.15971	0.079855
24	9.5001	0.44611	7.4176	15.368	6.8146	0.16237	0.081184
25	10	0.46991	7.8133	15.577	6.8438	0.16388	0.08194
26	10.5	0.49417	8.2167	15.787	6.8739	0.16536	0.082681
27	11	0.51861	8.6232	16.207	6.9045	0.169	0.084502
28	11.5	0.54278	9.025	16.417	6.935	0.17044	0.08522
29	12	0.56594	9.41	16.574	6.9644	0.17134	0.085672
30	12.5	0.589	9.7935	16.994	6.9941	0.17494	0.08747
31	13	0.61252	10.185	17.203	7.0245	0.17633	0.088165
32	13.5	0.63632	10.58	17.518	7.0556	0.17877	0.089383
33	14	0.66058	10.984	17.78	7.0876	0.18062	0.090311
34	14.5	0.68466	11.384	18.042	7.1196	0.18246	0.091231
35	15	0.70827	11.777	18.252	7.1513	0.18377	0.091883
36	15.5	0.73133	12.16	18.41	7.1825	0.18455	0.092273
37	16	0.75467	12.548	18.619	7.2144	0.18582	0.092912
38	16.5	0.77847	12.944	18.882	7.2472	0.18759	0.093794
39	17	0.80264	13.346	18.987	7.2808	0.18776	0.09388
40	17.5	0.82681	13.748	19.196	7.3147	0.18895	0.094477
41	18	0.85043	14.14	19.459	7.3481	0.19066	0.095332
42	18.5	0.87367	14.527	19.511	7.3814	0.19032	0.095158
43	19	0.89701	14.915	19.826	7.415	0.19251	0.096254
44	19.5	0.92063	15.308	19.983	7.4494	0.19314	0.09657

UNCONFINED COMPRESSION TEST
ASTM D2166

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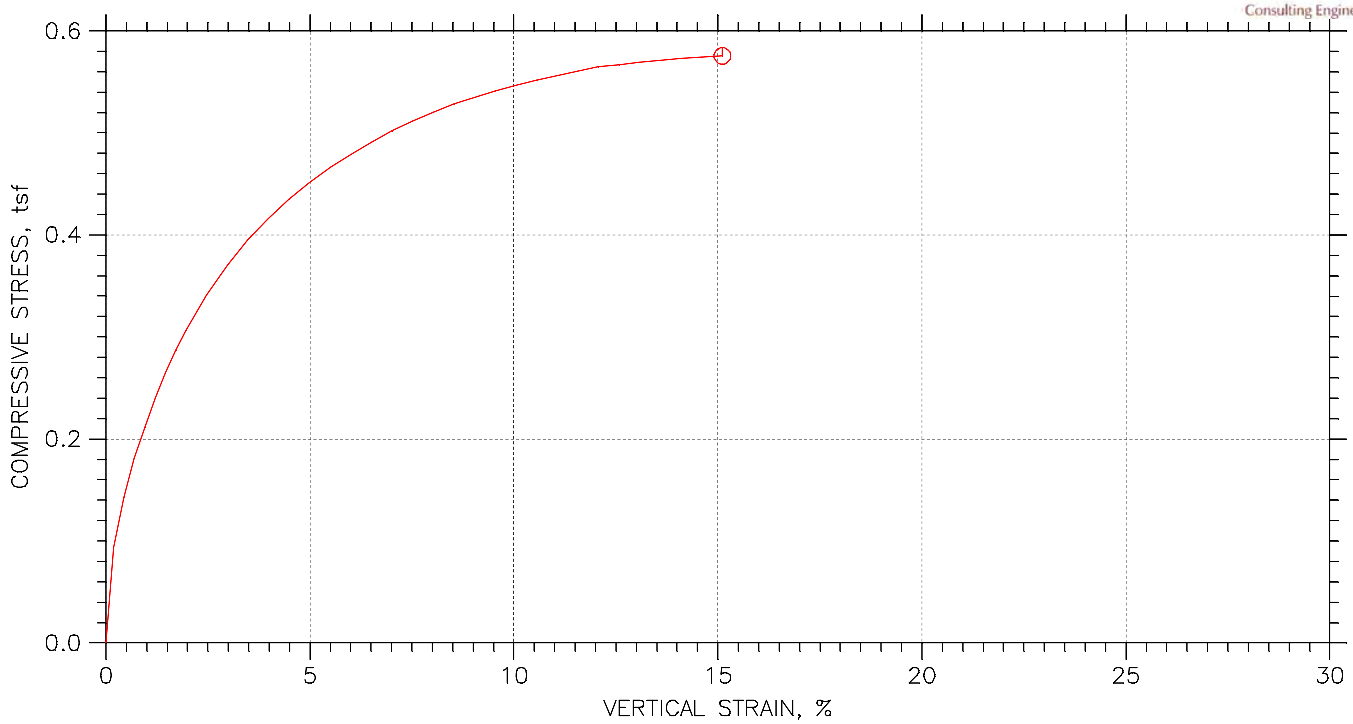

Symbol		⦶			
Test No.		HEN014S8			
Initial	Diameter, in	2.8339			
	Height, in	6.0764			
	Water Content, %	32.54			
	Dry Density, pcf	89.48			
	Saturation, %	98.61			
	Void Ratio	0.89757			
Unconfined Compressive Strength, tsf		0.57547			
Undrained Shear Strength, tsf		0.28774			
Time to Failure, min		15			
Strain Rate, %/min		1.14			
Estimated Specific Gravity		2.72			
Liquid Limit		43			
Plastic Limit		20			
Plasticity Index		23			
Failure Sketch					

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN014 S-8
Sample Type: 3.0'' ST
Description: BROWN AND GRAY LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D2166.

Tue, 22-DEC-2015 14:47:46

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN014 S-8
Sample No.: ST-8
Test No.: HEN014S8

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/15/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-27.0'
Elevation: ----

Soil Description: BROWN AND GRAY LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 6.08 in
Specimen Area: 6.31 in^2
Specimen Volume: 38.33 in^3

Liquid Limit: 43
Plastic Limit: 20
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.3073	0	0
2	0.25018	0.011388	0.18741	8.2129	6.3192	0.093577	0.046789
3	0.50018	0.026876	0.44229	12.53	6.3354	0.1424	0.0712
4	0.75018	0.042363	0.69718	15.952	6.3516	0.18083	0.090414
5	1.0002	0.057942	0.95356	18.742	6.3681	0.21191	0.10595
6	1.2502	0.073429	1.2084	21.269	6.3845	0.23986	0.11993
7	1.5002	0.088644	1.4588	23.533	6.4007	0.26472	0.13236
8	1.7502	0.10395	1.7107	25.586	6.4171	0.28708	0.14354
9	2.0002	0.11925	1.9626	27.376	6.4336	0.30638	0.15319
10	2.5002	0.15014	2.4709	30.641	6.4671	0.34113	0.17056
11	3.0002	0.18102	2.9791	33.431	6.501	0.37025	0.18513
12	3.5002	0.21209	3.4904	35.905	6.5355	0.39556	0.19778
13	4.0002	0.24243	3.9897	37.958	6.5694	0.41602	0.20801
14	4.5002	0.27285	4.4904	39.906	6.6039	0.43509	0.21754
15	5.0002	0.30347	4.9942	41.644	6.6389	0.45163	0.22582
16	5.5002	0.33417	5.4995	43.223	6.6744	0.46627	0.23314
17	6.0002	0.36487	6.0047	44.645	6.7103	0.47903	0.23951
18	6.5002	0.39566	6.5115	46.013	6.7466	0.49105	0.24553
19	7.0002	0.42627	7.0152	47.33	6.7832	0.50238	0.25119
20	7.5002	0.45707	7.522	48.435	6.8204	0.51131	0.25566
21	8.0002	0.48786	8.0288	49.541	6.8579	0.52012	0.26006
22	8.5002	0.51865	8.5355	50.594	6.8959	0.52825	0.26412
23	9.0002	0.54935	9.0408	51.489	6.9343	0.53462	0.26731
24	9.5002	0.57969	9.5401	52.384	6.9725	0.54093	0.27046
25	10	0.61058	10.048	53.226	7.0119	0.54654	0.27327
26	10.5	0.64128	10.554	54.068	7.0515	0.55207	0.27603
27	11	0.67189	11.057	54.806	7.0915	0.55644	0.27822
28	11.5	0.7025	11.561	55.543	7.1319	0.56073	0.28037
29	12	0.73311	12.065	56.28	7.1727	0.56494	0.28247
30	12.5	0.76408	12.575	56.806	7.2145	0.56692	0.28346
31	13	0.79506	13.084	57.385	7.2569	0.56936	0.28468
32	13.5	0.82603	13.594	57.912	7.2997	0.57121	0.2856
33	14	0.85665	14.098	58.438	7.3425	0.57304	0.28652
34	14.5	0.88717	14.6	58.912	7.3857	0.57431	0.28716
35	15	0.91814	15.11	59.386	7.43	0.57547	0.28774

UNCONFINED COMPRESSION TEST
ASTM D2166

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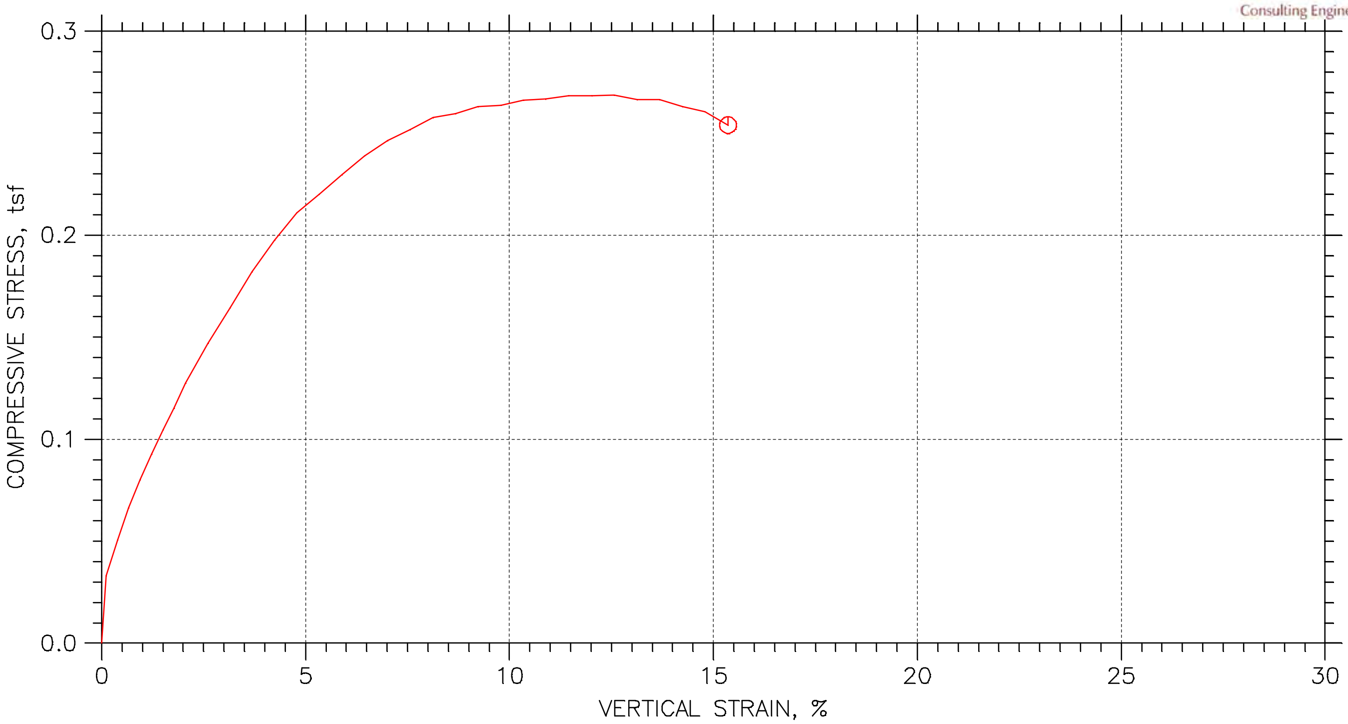


Symbol		○			
Test No.		HENB015S4			
Initial	Diameter, in	2.7992			
	Height, in	5.6701			
	Water Content, %	131.90			
	Dry Density, pcf	50.83			
	Saturation, %	155.02			
	Void Ratio	2.2547			
Unconfined Compressive Strength, tsf		0.26878			
Undrained Shear Strength, tsf		0.13439			
Time to Failure, min		11.5			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.65			
Liquid Limit		48			
Plastic Limit		25			
Plasticity Index		23			
Failure Sketch					

Project: DYNERGY HENNEPIN	
Location: HENNEPIN, IL	
Project No.: MR155233	
Boring No.: HENB015 S-4	
Sample Type: 3.0'' ST	
Description: BLACK AND DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL OL	
Remarks: TEST PERFORMED AS PER ASTM D2166.	424

Tue, 22-DEC-2015 14:50:01

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HENB015 S-4
Sample No.: ST-4
Test No.: HENB015S4

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/14/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 7.5'-9.5'
Elevation: -----

Soil Description: BLACK AND DARK GRAY ORGANIC CLAY WITH SAND AND GRAVEL OL
Remarks: TEST PERFORMED AS PER ASTM D2166.

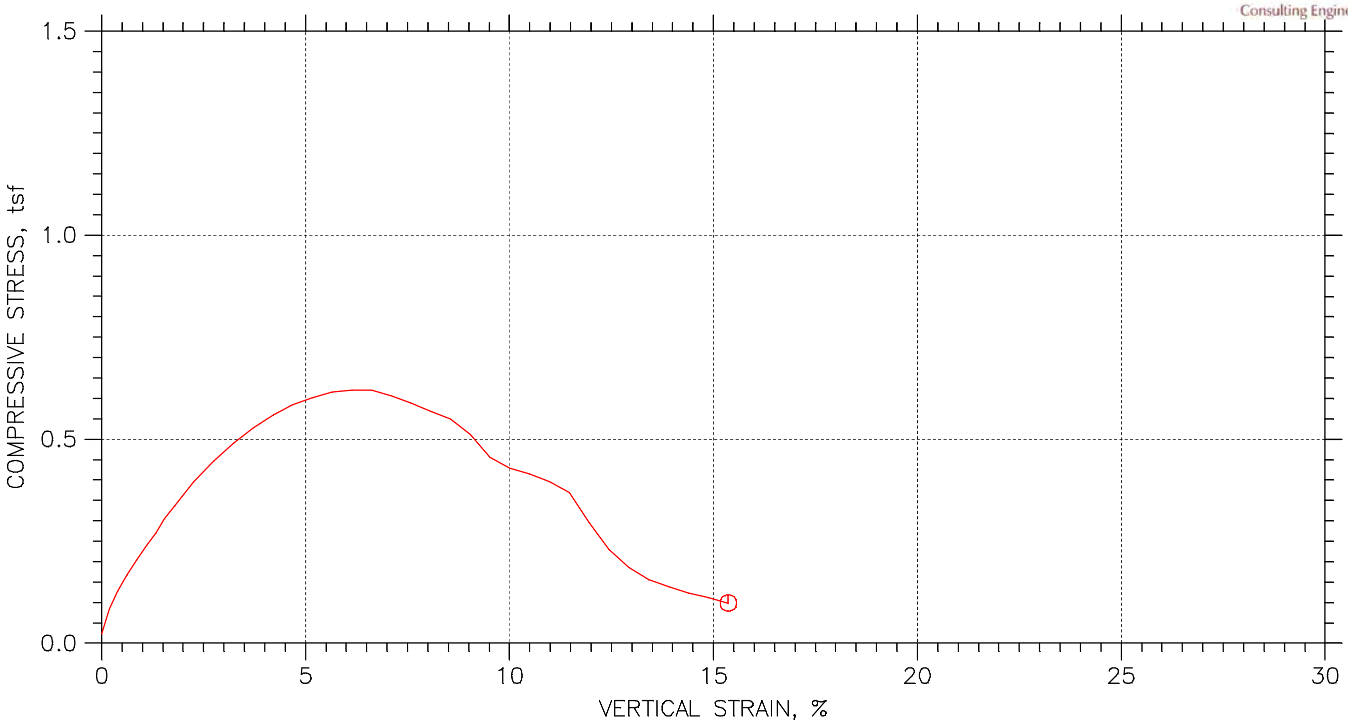
Specimen Height: 5.67 in
Specimen Area: 6.15 in^2
Specimen Volume: 34.89 in^3

Liquid Limit: 48
Plastic Limit: 25
Estimated Specific Gravity: 2.65

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.1541	0	0
2	0.25005	0.006365	0.11226	2.8323	6.161	0.033099	0.016549
3	0.50005	0.022047	0.38883	4.3533	6.1781	0.050734	0.025367
4	0.75005	0.037821	0.66703	5.717	6.1954	0.06644	0.03322
5	1.0001	0.053503	0.94361	6.9233	6.2127	0.080235	0.040118
6	1.2501	0.069278	1.2218	8.0247	6.2302	0.092739	0.046369
7	1.5001	0.085144	1.5016	9.0737	6.2479	0.10456	0.052282
8	1.7501	0.10073	1.7766	10.018	6.2654	0.11512	0.057561
9	2.0001	0.11623	2.0499	11.119	6.2829	0.12742	0.063712
10	2.5001	0.14741	2.5998	12.902	6.3183	0.14703	0.073515
11	3.0001	0.17841	3.1464	14.528	6.354	0.16463	0.082314
12	3.5001	0.20912	3.6882	16.154	6.3897	0.18203	0.091014
13	4.0001	0.2404	4.2397	17.623	6.4265	0.19744	0.09872
14	4.5001	0.27158	4.7896	18.934	6.4636	0.21091	0.10546
15	5.0001	0.30285	5.3411	19.878	6.5013	0.22015	0.11007
16	5.5001	0.3343	5.8959	20.875	6.5396	0.22983	0.11491
17	6.0001	0.36567	6.4491	21.819	6.5783	0.23881	0.1194
18	6.5001	0.39722	7.0055	22.658	6.6177	0.24652	0.12326
19	7.0001	0.42886	7.5635	23.287	6.6576	0.25185	0.12592
20	7.5001	0.4604	8.1199	23.969	6.6979	0.25766	0.12883
21	8.0001	0.49186	8.6747	24.284	6.7386	0.25947	0.12973
22	8.5001	0.52323	9.2278	24.756	6.7797	0.26291	0.13145
23	9.0001	0.55468	9.7826	24.966	6.8214	0.26352	0.13176
24	9.5001	0.58605	10.336	25.385	6.8634	0.2663	0.13315
25	10	0.61769	10.894	25.595	6.9064	0.26683	0.13342
26	10.5	0.64942	11.453	25.91	6.9501	0.26842	0.13421
27	11	0.68124	12.015	26.067	6.9944	0.26833	0.13417
28	11.5	0.71279	12.571	26.277	7.0389	0.26878	0.13439
29	12	0.74416	13.124	26.225	7.0837	0.26655	0.13327
30	12.5	0.7758	13.682	26.382	7.1295	0.26643	0.13321
31	13	0.80744	14.24	26.225	7.1759	0.26312	0.13156
32	13.5	0.83917	14.8	26.12	7.2231	0.26036	0.13018
33	14	0.87081	15.358	25.648	7.2707	0.25398	0.12699

UNCONFINED COMPRESSION TEST
ASTM D2166



Symbol		⏀			
Test No.		HEN015S8			
Initial	Diameter, in	2.8402			
	Height, in	6.0898			
	Water Content, %	148.86			
	Dry Density, pcf	39.26			
	Saturation, %	121.79			
	Void Ratio	3.3248			
Unconfined Compressive Strength, tsf		0.62021			
Undrained Shear Strength, tsf		0.31011			
Time to Failure, min		7.0003			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		74			
Plastic Limit		37			
Plasticity Index		37			
Failure Sketch					

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN015 S8
Sample Type: 3.0'' ST
Description: BLACK ORGANIC SILT WITH SAND OH
Remarks: TEST PERFORMED AS PER ASTM D2166.

Tue, 22-DEC-2015 14:52:19

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN015 S8
Sample No.: S-8
Test No.: HEN015S8

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/15/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-27.0'
Elevation: ----

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Soil Description: BLACK ORGANIC SILT WITH SAND OH
Remarks: TEST PERFORMED AS PER ASTM D2166.

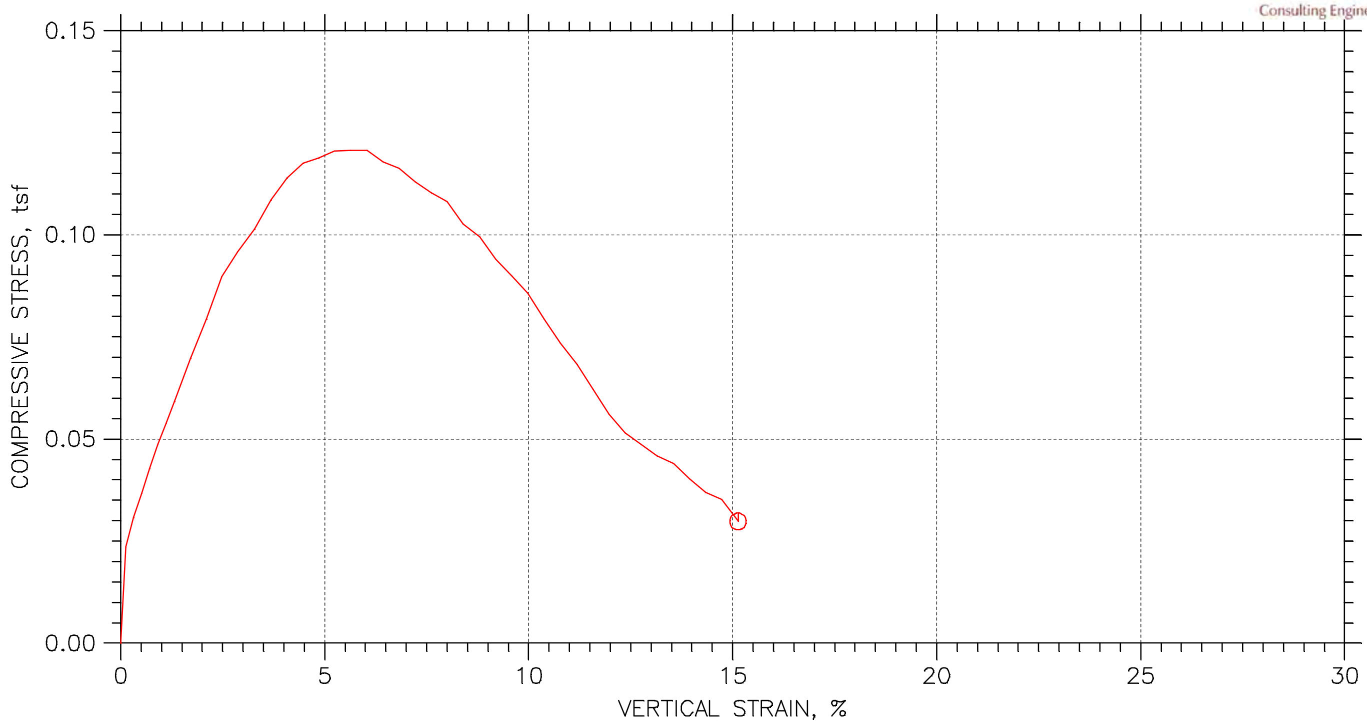
Specimen Height: 6.09 in
Specimen Area: 6.34 in^2
Specimen Volume: 38.58 in^3

Liquid Limit: 74
Plastic Limit: 37
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	1.9586	6.3354	0.022259	0.01113
2	0.25022	0.011144	0.18299	7.358	6.347	0.083469	0.041734
3	0.50022	0.024023	0.39448	11.328	6.3605	0.12823	0.064117
4	0.75023	0.037907	0.62247	14.928	6.3751	0.16859	0.084297
5	1.0002	0.052156	0.85646	18.21	6.3901	0.20518	0.10259
6	1.2502	0.06668	1.0949	21.227	6.4055	0.2386	0.1193
7	1.5002	0.081021	1.3304	24.139	6.4208	0.27068	0.13534
8	1.7502	0.093991	1.5434	27.262	6.4347	0.30504	0.15252
9	2.0002	0.1087	1.7849	30.173	6.4505	0.33679	0.16839
10	2.5002	0.13793	2.2649	35.679	6.4822	0.39629	0.19815
11	3.0002	0.16725	2.7464	40.337	6.5143	0.44583	0.22291
12	3.5002	0.19684	3.2324	44.625	6.547	0.49075	0.24538
13	4.0002	0.22625	3.7153	48.224	6.5799	0.52769	0.26385
14	4.5002	0.25585	4.2013	51.295	6.6133	0.55846	0.27923
15	5.0002	0.28517	4.6828	53.941	6.6467	0.58432	0.29216
16	5.5002	0.31467	5.1673	55.847	6.6806	0.60189	0.30094
17	6.0002	0.34409	5.6502	57.329	6.7148	0.61472	0.30736
18	6.5003	0.37359	6.1347	58.123	6.7495	0.62003	0.31002
19	7.0003	0.403	6.6177	58.441	6.7844	0.62021	0.31011
20	7.5003	0.43241	7.1007	57.382	6.8197	0.60583	0.30291
21	8.0003	0.46183	7.5836	56.112	6.8553	0.58933	0.29467
22	8.5003	0.49115	8.0651	54.471	6.8912	0.56912	0.28456
23	9.0003	0.52065	8.5496	52.883	6.9277	0.54961	0.27481
24	9.5003	0.55025	9.0356	49.548	6.9647	0.51222	0.25611
25	10	0.57993	9.5231	44.36	7.0022	0.45613	0.22806
26	10.5	0.60953	10.009	41.925	7.0401	0.42878	0.21439
27	11	0.63885	10.491	40.707	7.0779	0.4141	0.20705
28	11.5	0.66863	10.979	39.066	7.1168	0.39523	0.19762
29	12	0.69804	11.462	36.631	7.1556	0.36859	0.18429
30	12.5	0.72763	11.948	29.538	7.1951	0.29558	0.14779
31	13	0.75741	12.437	23.08	7.2353	0.22967	0.11484
32	13.5	0.78728	12.928	18.686	7.2761	0.18491	0.092455
33	14	0.81706	13.417	15.828	7.3171	0.15574	0.077872
34	14.5	0.84656	13.901	14.134	7.3583	0.1383	0.069149
35	15	0.87634	14.39	12.705	7.4003	0.12361	0.061803
36	15.5	0.90602	14.878	11.646	7.4427	0.11266	0.05633
37	16	0.93562	15.364	10.217	7.4855	0.09827	0.049135

UNCONFINED COMPRESSION TEST
ASTM D2166



Symbol		⦶			
Test No.		HENB017S3			
Initial	Diameter, in	2.8169			
	Height, in	5.9768			
	Water Content, %	36.89			
	Dry Density, pcf	81.7			
	Saturation, %	93.06			
	Void Ratio	1.0783			
Unconfined Compressive Strength, tsf		0.1207			
Undrained Shear Strength, tsf		0.060351			
Time to Failure, min		8.004			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		39			
Plastic Limit		21			
Plasticity Index		18			
Failure Sketch					

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HENB017 S-3
Sample Type: 3.0" ST
Description: VERY DARK GRAY LEAN CLAY WITH SAND
Remarks: TEST PERFORMED AS PER ASTM D2166. 428

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UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HENB017 S-3
Sample No.: ST-3
Test No.: HENB017S3

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/14/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 5.0'-7.0'
Elevation: -----

Soil Description: VERY DARK GRAY LEAN CLAY WITH SAND
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 5.98 in
Specimen Area: 6.23 in^2
Specimen Volume: 37.25 in^3

Liquid Limit: 39
Plastic Limit: 21
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.2322	0	0
2	0.50395	0.0072875	0.12193	2.0455	6.2398	0.023603	0.011801
3	0.75395	0.019095	0.31949	2.6749	6.2522	0.030804	0.015402
4	1.004	0.030903	0.51705	3.1994	6.2646	0.036771	0.018386
5	1.254	0.04271	0.71461	3.7239	6.2771	0.042714	0.021357
6	1.504	0.054702	0.91525	4.2484	6.2898	0.048632	0.024316
7	1.754	0.066695	1.1159	4.7204	6.3025	0.053926	0.026963
8	2.004	0.078687	1.3165	5.1925	6.3153	0.059198	0.029599
9	2.504	0.10221	1.7101	6.1365	6.3406	0.069682	0.034841
10	3.004	0.12546	2.0991	7.0282	6.3658	0.079491	0.039746
11	3.504	0.14861	2.4865	7.9723	6.3911	0.089813	0.044906
12	4.004	0.17204	2.8785	8.5492	6.4169	0.095925	0.047963
13	4.504	0.19584	3.2767	9.0737	6.4433	0.10139	0.050696
14	5.004	0.22001	3.6811	9.7555	6.4704	0.10856	0.054278
15	5.504	0.24399	4.0824	10.28	6.4975	0.11392	0.056958
16	6.004	0.26724	4.4713	10.647	6.5239	0.11751	0.058753
17	6.504	0.29021	4.8556	10.805	6.5503	0.11876	0.059381
18	7.004	0.31336	5.243	11.014	6.577	0.12058	0.060288
19	7.504	0.33689	5.6366	11.067	6.6045	0.12065	0.060323
20	8.004	0.36087	6.0379	11.119	6.6327	0.1207	0.060351
21	8.504	0.38476	6.4376	10.909	6.661	0.11792	0.058961
22	9.004	0.40819	6.8297	10.805	6.689	0.1163	0.058149
23	9.504	0.43135	7.2171	10.542	6.717	0.113	0.056502
24	10.004	0.45459	7.606	10.332	6.7452	0.11029	0.055145
25	10.504	0.47802	7.998	10.175	6.774	0.10815	0.054075
26	11.004	0.50192	8.3978	9.7031	6.8036	0.10268	0.051342
27	11.504	0.5259	8.7991	9.4408	6.8335	0.099472	0.049736
28	12.004	0.54979	9.1988	8.9688	6.8636	0.094084	0.047042
29	12.504	0.57341	9.5939	8.6017	6.8936	0.08984	0.04492
30	13.004	0.59675	9.9844	8.2345	6.9235	0.085634	0.042817
31	13.504	0.62036	10.38	7.6576	6.954	0.079285	0.039642
32	14.004	0.64416	10.778	7.1331	6.985	0.073526	0.036763
33	14.504	0.66805	11.177	6.661	7.0165	0.068353	0.034176
34	15.004	0.69194	11.577	6.0841	7.0482	0.062151	0.031076
35	15.504	0.71547	11.971	5.5072	7.0797	0.056007	0.028004
36	16.004	0.73871	12.36	5.0876	7.1111	0.051511	0.025756
37	16.504	0.76224	12.753	4.8253	7.1432	0.048637	0.024318
38	17.004	0.78594	13.15	4.5631	7.1758	0.045784	0.022892
39	17.504	0.80984	13.55	4.4057	7.209	0.044002	0.022001
40	18.004	0.83373	13.949	4.0386	7.2425	0.040149	0.020074
41	18.504	0.85734	14.345	3.7239	7.2759	0.03685	0.018425
42	19.004	0.88077	14.737	3.5665	7.3094	0.035132	0.017566
43	19.504	0.90448	15.133	3.042	7.3435	0.029826	0.014913

UNCONFINED COMPRESSION TEST
ASTM D2166

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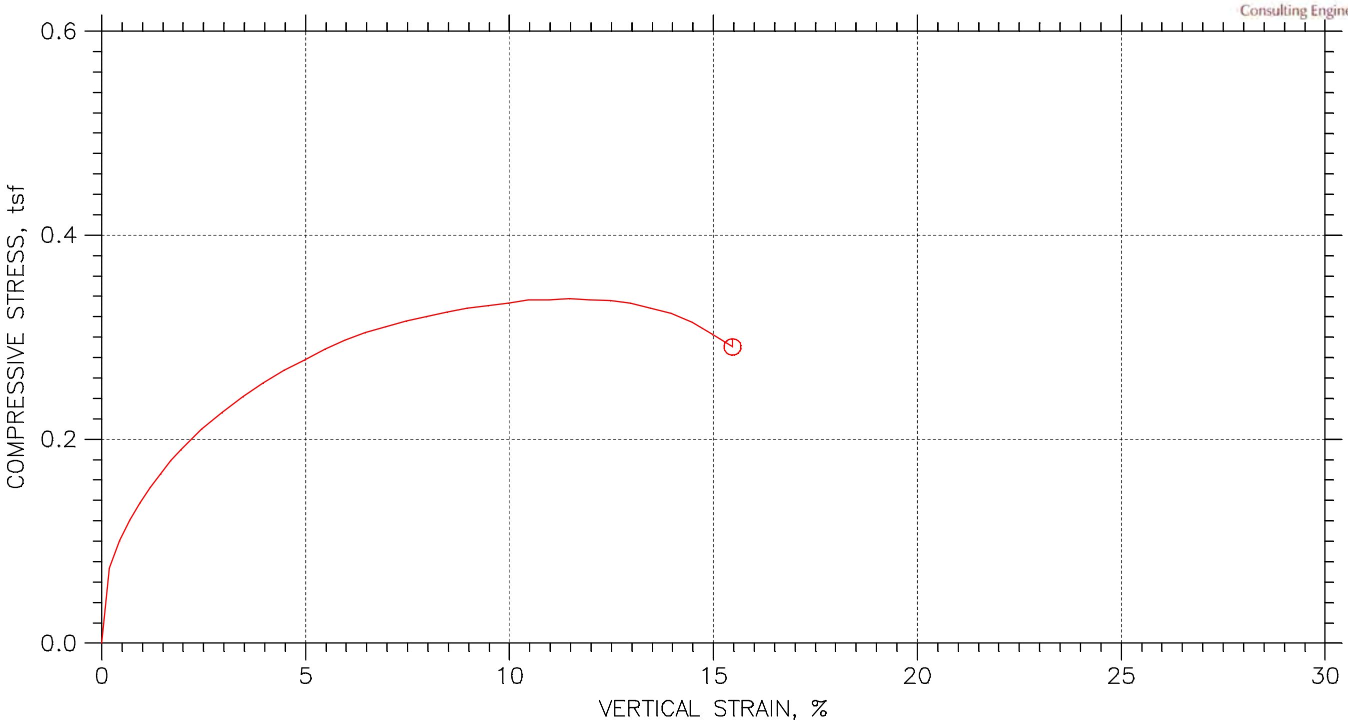


Symbol		○			
Test No.		HEN017S6			
Initial	Diameter, in	2.7764			
	Height, in	6.1713			
	Water Content, %	34.15			
	Dry Density, pcf	88.			
	Saturation, %	99.92			
	Void Ratio	0.9296			
Unconfined Compressive Strength, tsf		0.33759			
Undrained Shear Strength, tsf		0.16879			
Time to Failure, min		11.504			
Strain Rate, %/min		1.14			
Estimated Specific Gravity		2.72			
Liquid Limit		45			
Plastic Limit		24			
Plasticity Index		21			
Failure Sketch					

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN017 S-6
Sample Type: 3.0'' ST
Description: BROWN AND GRAY LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D2166. 430

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN017 S-6
Sample No.: ST-6
Test No.: HEN017S6

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/15/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

Soil Description: BROWN AND GRAY LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D2166.

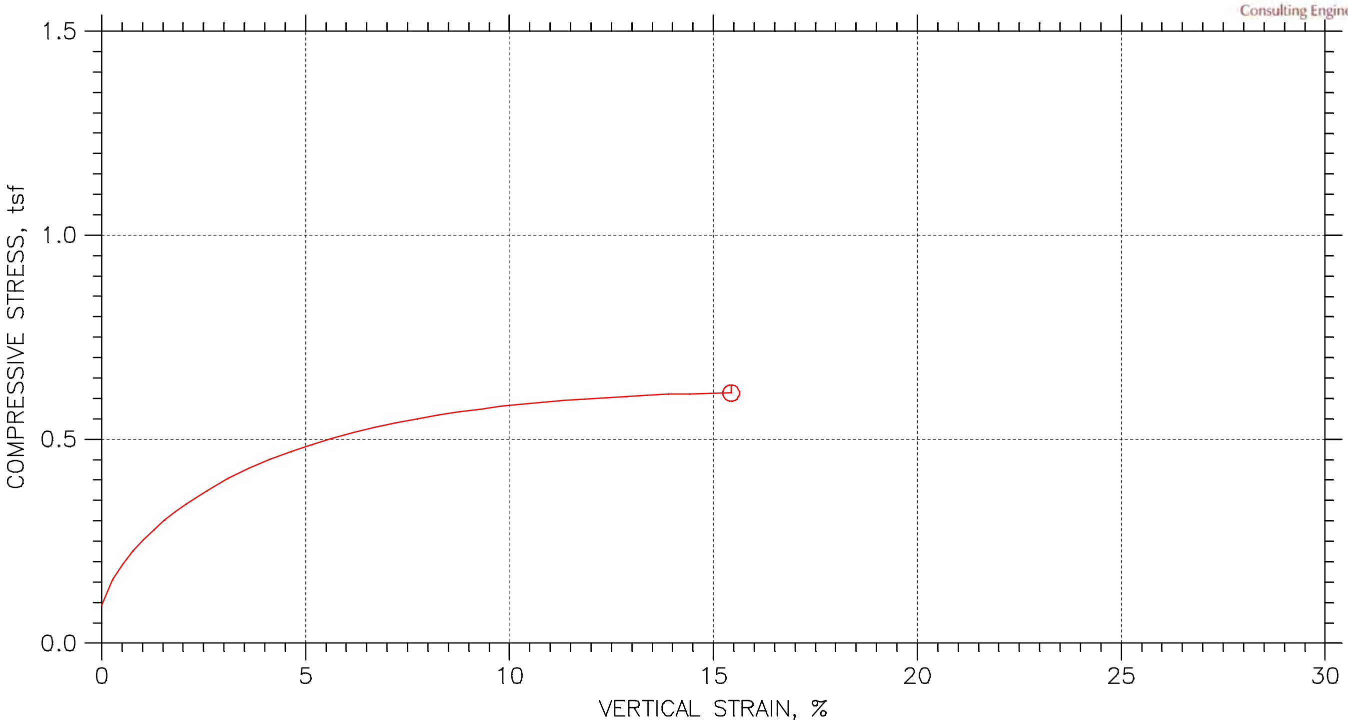
Specimen Height: 6.17 in
Specimen Area: 6.05 in^2
Specimen Volume: 37.36 in^3

Liquid Limit: 45
Plastic Limit: 24
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.0541	0	0
2	0.25403	0.011661	0.18896	6.2123	6.0655	0.073743	0.036871
3	0.50403	0.02724	0.4414	8.4762	6.0809	0.10036	0.05018
4	0.75403	0.042636	0.69089	10.214	6.0962	0.12063	0.060314
5	1.004	0.057942	0.9389	11.688	6.1114	0.13769	0.068847
6	1.254	0.073429	1.1899	13.004	6.127	0.15281	0.076406
7	1.504	0.088735	1.4379	14.162	6.1424	0.16601	0.083003
8	1.754	0.10431	1.6903	15.32	6.1582	0.17912	0.089561
9	2.004	0.11998	1.9442	16.268	6.1741	0.18971	0.094855
10	2.504	0.15123	2.4506	18.058	6.2062	0.2095	0.10475
11	3.004	0.18248	2.9569	19.585	6.2385	0.22603	0.11302
12	3.504	0.21355	3.4603	21.059	6.2711	0.24178	0.12089
13	4.004	0.24443	3.9608	22.322	6.3037	0.25496	0.12748
14	4.5041	0.27559	4.4657	23.533	6.3371	0.26738	0.13369
15	5.0041	0.30665	4.9691	24.534	6.3706	0.27727	0.13864
16	5.5041	0.33754	5.4695	25.639	6.4044	0.28824	0.14412
17	6.0041	0.36815	5.9655	26.534	6.4381	0.29674	0.14837
18	6.5041	0.39903	6.466	27.376	6.4726	0.30453	0.15227
19	7.0041	0.43019	6.9709	28.061	6.5077	0.31046	0.15523
20	7.5041	0.46107	7.4713	28.693	6.5429	0.31574	0.15787
21	8.0041	0.49187	7.9703	29.272	6.5784	0.32038	0.16019
22	8.5041	0.52248	8.4663	29.798	6.614	0.32438	0.16219
23	9.0041	0.55327	8.9653	30.325	6.6503	0.32831	0.16416
24	9.5041	0.58443	9.4702	30.746	6.6874	0.33103	0.16551
25	10.004	0.6154	9.9721	31.167	6.7247	0.3337	0.16685
26	10.504	0.64592	10.467	31.588	6.7618	0.33635	0.16818
27	11.004	0.67663	10.964	31.799	6.7996	0.33671	0.16836
28	11.504	0.7076	11.466	32.062	6.8381	0.33759	0.16879
29	12.004	0.73876	11.971	32.167	6.8773	0.33676	0.16838
30	12.504	0.76955	12.47	32.273	6.9166	0.33595	0.16798
31	13.004	0.79998	12.963	32.22	6.9557	0.33351	0.16676
32	13.504	0.83086	13.463	31.904	6.996	0.32835	0.16417
33	14.004	0.86202	13.968	31.588	7.037	0.3232	0.1616
34	14.504	0.89336	14.476	30.956	7.0788	0.31486	0.15743
35	15.004	0.92406	14.974	29.956	7.1202	0.30292	0.15146
36	15.504	0.95449	15.467	28.903	7.1618	0.29058	0.14529

UNCONFINED COMPRESSION TEST
ASTM D2166



Symbol	⦶			
Test No.	HEN018S8			
Initial: Diameter, in	2.8083			
Initial: Height, in	6.0094			
Initial: Water Content, %	31.88			
Initial: Dry Density, pcf	90.04			
Initial: Saturation, %	97.88			
Initial: Void Ratio	0.8859			
Unconfined Compressive Strength, tsf	0.61328			
Undrained Shear Strength, tsf	0.30664			
Time to Failure, min	15.004			
Strain Rate, %/min	1.14			
Estimated Specific Gravity	2.72			
Liquid Limit	43			
Plastic Limit	22			
Plasticity Index	21			
Failure Sketch				

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN018 S-8
Sample Type: 3.0" ST
Description: DARK BROWNISH GRAY LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D2166. 432

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN018 S-8
Sample No.: ST-8
Test No.: HEN018S8

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/15/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-27.0'
Elevation: ----

Soil Description: DARK BROWNISH GRAY LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 6.01 in
Specimen Area: 6.19 in^2
Specimen Volume: 37.22 in^3

Liquid Limit: 43
Plastic Limit: 22
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	7.9497	6.1939	0.092409	0.046205
2	0.25402	0.015943	0.2653	13.478	6.2104	0.15625	0.078126
3	0.50403	0.031431	0.52302	16.794	6.2265	0.1942	0.097101
4	0.75403	0.046554	0.77468	19.585	6.2423	0.22589	0.11295
5	1.004	0.061768	1.0279	22.059	6.2583	0.25379	0.12689
6	1.254	0.077165	1.2841	24.27	6.2745	0.2785	0.13925
7	1.504	0.092743	1.5433	26.376	6.291	0.30187	0.15094
8	1.754	0.10841	1.804	28.219	6.3077	0.32211	0.16105
9	2.004	0.12408	2.0648	30.009	6.3245	0.34163	0.17081
10	2.504	0.15524	2.5833	33.062	6.3582	0.3744	0.1872
11	3.004	0.18594	3.0942	35.8	6.3917	0.40327	0.20164
12	3.504	0.21664	3.6051	38.274	6.4256	0.42887	0.21444
13	4.004	0.24807	4.1281	40.38	6.4606	0.45001	0.22501
14	4.504	0.27923	4.6465	42.328	6.4958	0.46917	0.23459
15	5.004	0.30993	5.1574	44.171	6.5308	0.48697	0.24349
16	5.5041	0.34027	5.6623	45.803	6.5657	0.50228	0.25114
17	6.0041	0.37116	6.1762	47.33	6.6017	0.51619	0.2581
18	6.5041	0.40268	6.7007	48.751	6.6388	0.52872	0.26436
19	7.0041	0.43402	7.2222	50.067	6.6761	0.53996	0.26998
20	7.5041	0.46435	7.7271	51.278	6.7126	0.55001	0.27501
21	8.0041	0.4946	8.2304	52.436	6.7494	0.55937	0.27968
22	8.5041	0.52539	8.7428	53.489	6.7873	0.56741	0.28371
23	9.0041	0.55701	9.2688	54.384	6.8267	0.57358	0.28679
24	9.5041	0.58825	9.7888	55.332	6.866	0.58023	0.29012
25	10.004	0.61887	10.298	56.122	6.905	0.58519	0.2926
26	10.504	0.64939	10.806	56.964	6.9443	0.59061	0.29531
27	11.004	0.68063	11.326	57.701	6.9851	0.59477	0.29738
28	11.504	0.71206	11.849	58.333	7.0265	0.59773	0.29887
29	12.004	0.74286	12.361	59.07	7.0676	0.60177	0.30088
30	12.504	0.77301	12.863	59.702	7.1083	0.60472	0.30236
31	13.004	0.80362	13.373	60.333	7.1501	0.60755	0.30377
32	13.504	0.83496	13.894	60.965	7.1934	0.61021	0.30511
33	14.004	0.86658	14.42	61.439	7.2376	0.6112	0.3056
34	14.504	0.89719	14.93	61.966	7.281	0.61277	0.30638
35	15.004	0.92743	15.433	62.387	7.3243	0.61328	0.30664

UNCONFINED COMPRESSION TEST
ASTM D2166

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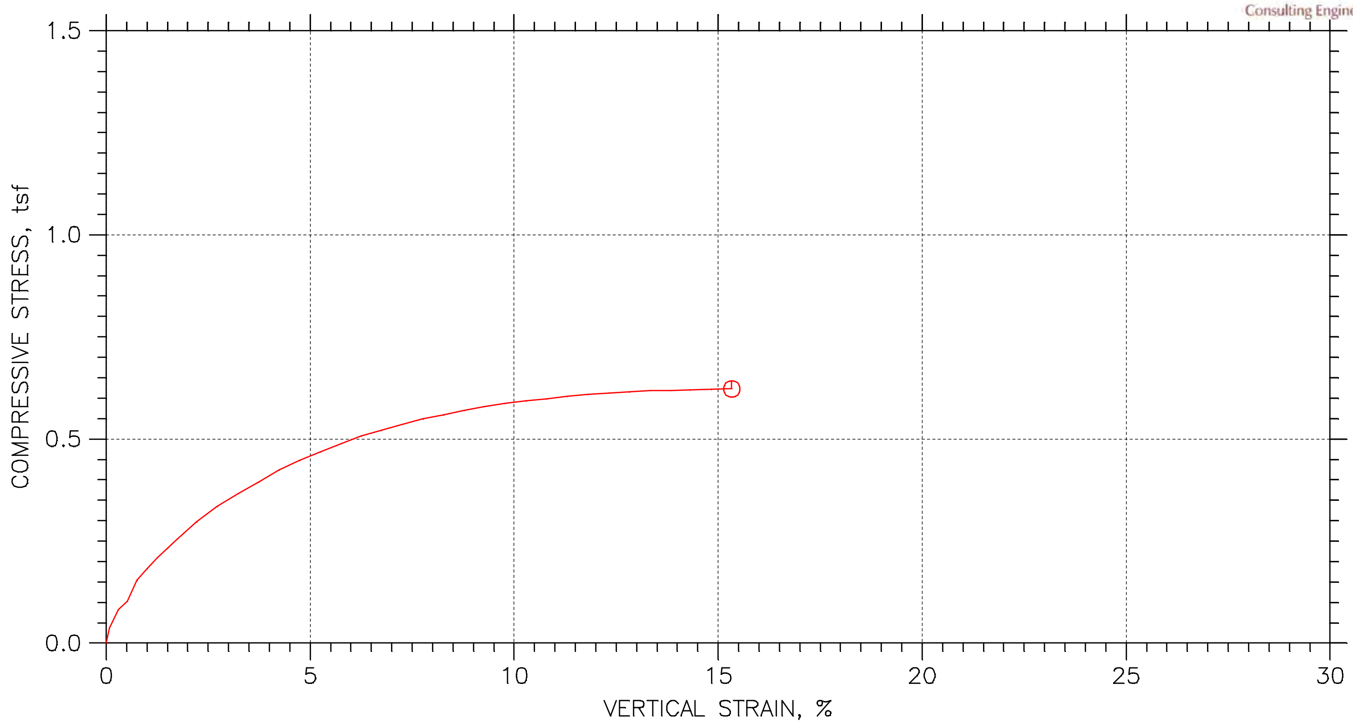

Symbol		⏀			
Test No.		HEN019S2			
Initial	Diameter, in	2.848			
	Height, in	5.8406			
	Water Content, %	33.10			
	Dry Density, pcf	89.03			
	Saturation, %	99.24			
	Void Ratio	0.90719			
Unconfined Compressive Strength, tsf		0.62255			
Undrained Shear Strength, tsf		0.31128			
Time to Failure, min		15.503			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		41			
Plastic Limit		22			
Plasticity Index		19			
Failure Sketch					

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN019 S2
Sample Type: 3.0'' ST
Description: DARK BROWN LEAN CLAY WITH SAND CL
Remarks: TEST PERFORMED AS PER ASTM D2166. 434

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN019 S2
Sample No.: S-2
Test No.: HEN019S2

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/15/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 7.5'-9.5'
Elevation: ----

Soil Description: DARK BROWN LEAN CLAY WITH SAND CL
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 5.84 in
Specimen Area: 6.37 in^2
Specimen Volume: 37.21 in^3

Liquid Limit: 41
Plastic Limit: 22
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.3706	0	0
2	0.25415	0.0046585	0.079761	3.282	6.3757	0.037063	0.018532
3	0.50415	0.01772	0.3034	7.358	6.39	0.082908	0.041454
4	0.75388	0.0306	0.52392	9.1049	6.4041	0.10236	0.051182
5	1.0039	0.044301	0.75851	13.816	6.4193	0.15497	0.077483
6	1.2534	0.058916	1.0087	16.357	6.4355	0.183	0.091501
7	1.5034	0.073439	1.2574	18.686	6.4517	0.20854	0.10427
8	1.7534	0.08778	1.5029	20.91	6.4678	0.23277	0.11638
9	2.0034	0.10203	1.7469	22.921	6.4839	0.25453	0.12726
10	2.5034	0.12925	2.213	26.891	6.5148	0.2972	0.1486
11	3.0034	0.15884	2.7197	30.385	6.5487	0.33407	0.16704
12	3.5034	0.18853	3.228	33.455	6.5831	0.3659	0.18295
13	4.0034	0.21803	3.7331	36.314	6.6176	0.3951	0.19755
14	4.5034	0.24717	4.232	39.172	6.6521	0.42399	0.21199
15	5.0034	0.27658	4.7356	41.554	6.6873	0.44741	0.2237
16	5.5034	0.30645	5.247	43.778	6.7234	0.46881	0.23441
17	6.0034	0.33605	5.7537	45.842	6.7595	0.4883	0.24415
18	6.5034	0.36509	6.251	47.854	6.7954	0.50703	0.25352
19	7.0034	0.39387	6.7437	49.495	6.8313	0.52166	0.26083
20	7.5034	0.42355	7.252	51.136	6.8687	0.53602	0.26801
21	8.0034	0.45351	7.7649	52.671	6.9069	0.54906	0.27453
22	8.5034	0.48293	8.2685	53.994	6.9448	0.55978	0.27989
23	9.0034	0.51206	8.7674	55.265	6.9828	0.56984	0.28492
24	9.5034	0.54111	9.2647	56.482	7.0211	0.57922	0.28961
25	10.003	0.5708	9.773	57.541	7.0606	0.58677	0.29338
26	10.503	0.60094	10.289	58.6	7.1012	0.59415	0.29707
27	11.003	0.63063	10.797	59.394	7.1417	0.59879	0.29939
28	11.503	0.65995	11.299	60.347	7.1821	0.60497	0.30248
29	12.003	0.68936	11.803	61.088	7.2231	0.60892	0.30446
30	12.503	0.71905	12.311	61.776	7.265	0.61223	0.30612
31	13.003	0.74901	12.824	62.464	7.3078	0.61543	0.30771
32	13.503	0.77842	13.328	63.152	7.3502	0.61862	0.30931
33	14.003	0.8071	13.819	63.576	7.3921	0.61924	0.30962
34	14.503	0.83596	14.313	64.052	7.4347	0.6203	0.31015
35	15.003	0.86592	14.826	64.581	7.4795	0.62168	0.31084
36	15.503	0.89543	15.331	65.058	7.5241	0.62255	0.31128

UNCONFINED COMPRESSION TEST
ASTM D2166

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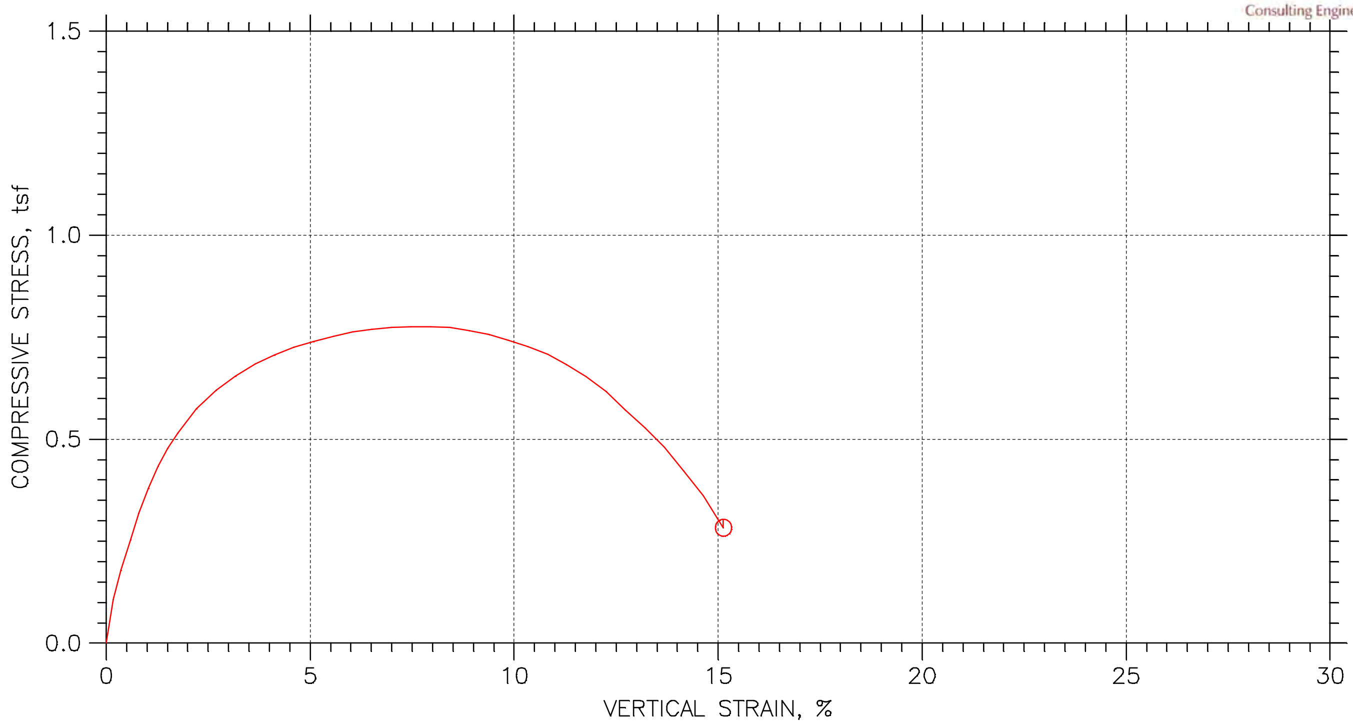

Symbol		○			
Test No.		HEN019S4			
Initial	Diameter, in	2.7374			
	Height, in	6.1728			
	Water Content, %	34.87			
	Dry Density, pcf	86.39			
	Saturation, %	98.22			
	Void Ratio	0.96564			
Unconfined Compressive Strength, tsf		0.77617			
Undrained Shear Strength, tsf		0.38809			
Time to Failure, min		8.5033			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		45			
Plastic Limit		24			
Plasticity Index		21			
Failure Sketch					

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN019 S4
Sample Type: 3.0" ST
Description: GRAY AND BROWN LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D2166. 436

Tue, 22-DEC-2015 15:07:07

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN019 S4
Sample No.: ST-4
Test No.: HEN019S4

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/15/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 12.5'-14.5'
Elevation: ----

Soil Description: GRAY AND BROWN LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 6.17 in
Specimen Area: 5.89 in^2
Specimen Volume: 36.33 in^3

Liquid Limit: 45
Plastic Limit: 24
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	5.8853	0	0
2	0.25017	0.010413	0.16869	8.7873	5.8952	0.10732	0.053661
3	0.50018	0.022288	0.36106	14.716	5.9066	0.17939	0.089693
4	0.75357	0.036628	0.59338	20.751	5.9204	0.25236	0.12618
5	1.0033	0.049233	0.79758	26.309	5.9326	0.31929	0.15965
6	1.2533	0.06394	1.0358	31.391	5.9469	0.38005	0.19003
7	1.5033	0.078828	1.277	35.837	5.9614	0.43283	0.21642
8	1.7533	0.093443	1.5138	39.649	5.9757	0.47772	0.23886
9	2.0033	0.10806	1.7505	42.878	5.9901	0.51538	0.25769
10	2.5033	0.13701	2.2196	48.013	6.0189	0.57434	0.28717
11	3.0033	0.16633	2.6946	52.089	6.0483	0.62008	0.31004
12	3.5033	0.19593	3.1741	55.318	6.0782	0.65527	0.32764
13	4.0033	0.22562	3.655	58.07	6.1085	0.68446	0.34223
14	4.5033	0.25475	4.127	60.241	6.1386	0.70656	0.35328
15	5.0033	0.28407	4.602	62.199	6.1692	0.72592	0.36296
16	5.5033	0.31367	5.0814	63.629	6.2003	0.73887	0.36944
17	6.0033	0.34336	5.5624	65.111	6.2319	0.75225	0.37613
18	6.5033	0.37286	6.0403	66.328	6.2636	0.76244	0.38122
19	7.0033	0.40227	6.5168	67.281	6.2955	0.76947	0.38474
20	7.5033	0.4315	6.9903	67.969	6.3276	0.7734	0.3867
21	8.0033	0.461	7.4683	68.552	6.3603	0.77602	0.38801
22	8.5033	0.4906	7.9477	68.922	6.3934	0.77617	0.38809
23	9.0033	0.5201	8.4257	69.081	6.4268	0.77392	0.38696
24	9.5033	0.54942	8.9007	68.71	6.4603	0.76578	0.38289
25	10.003	0.57884	9.3771	68.287	6.4943	0.75708	0.37854
26	10.503	0.60852	9.8581	67.281	6.5289	0.74197	0.37098
27	11.003	0.63839	10.342	66.222	6.5641	0.72637	0.36319
28	11.503	0.66771	10.817	64.899	6.5991	0.70809	0.35404
29	12.003	0.69648	11.283	62.94	6.6338	0.68313	0.34156
30	12.503	0.72617	11.764	60.558	6.6699	0.65371	0.32686
31	13.003	0.75604	12.248	57.541	6.7067	0.61773	0.30887
32	13.503	0.78563	12.727	53.518	6.7435	0.5714	0.2857
33	14.003	0.81496	13.202	49.707	6.7805	0.52782	0.26391
34	14.503	0.844	13.673	45.472	6.8174	0.48024	0.24012
35	15.003	0.87369	14.154	40.284	6.8556	0.42308	0.21154
36	15.503	0.90392	14.644	34.567	6.8949	0.36096	0.18048
37	16.003	0.93379	15.127	27.262	6.9343	0.28307	0.14153

UNCONFINED COMPRESSION TEST
ASTM D2166

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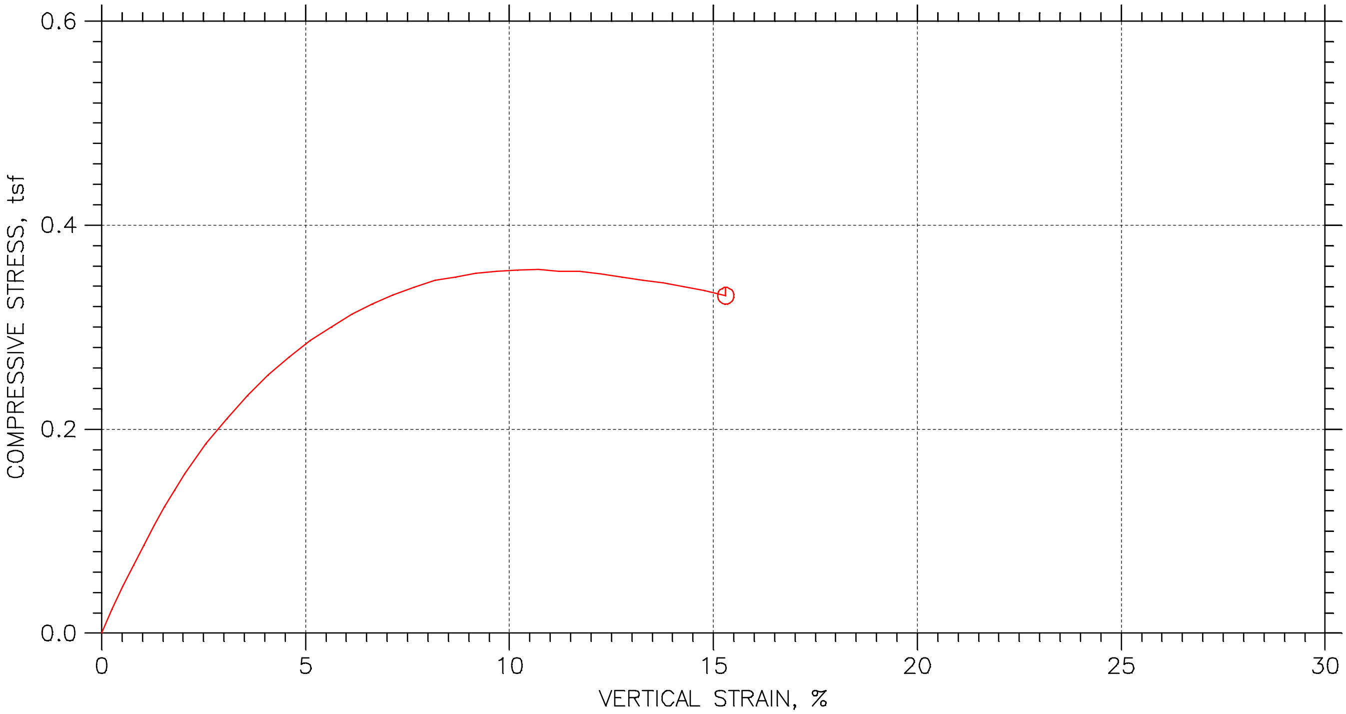

Symbol		⏀			
Test No.		HENB019S6			
Initial	Diameter, in	2.798			
	Height, in	6.1795			
	Water Content, %	33.84			
	Dry Density, pcf	86.79			
	Saturation, %	96.23			
	Void Ratio	0.9565			
Unconfined Compressive Strength, tsf		0.3564			
Undrained Shear Strength, tsf		0.1782			
Time to Failure, min		10.504			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		38			
Plastic Limit		22			
Plasticity Index		16			
Failure Sketch					

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HENB019 S-6
Sample Type: 3.0'' ST
Description: BROWN AND GRAY LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D2166. 438

Tue, 22-DEC-2015 15:09:43

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HENB019 S-6
Sample No.: ST-6
Test No.: HENB019S6

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/14/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 20.0'-22.0'
Elevation: -----

Soil Description: BROWN AND GRAY LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 6.18 in
Specimen Area: 6.15 in^2
Specimen Volume: 38.00 in^3

Liquid Limit: 38
Plastic Limit: 22
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.1489	0	0
2	0.25378	0.016051	0.25974	1.9931	6.1649	0.023277	0.011639
3	0.50378	0.032102	0.51949	3.9337	6.181	0.045822	0.022911
4	0.75378	0.048153	0.77923	5.7694	6.1972	0.06703	0.033515
5	1.0038	0.064019	1.036	7.4478	6.2132	0.086306	0.043153
6	1.2538	0.079517	1.2868	9.1261	6.229	0.10549	0.052744
7	1.5038	0.095014	1.5376	10.752	6.2449	0.12397	0.061983
8	1.7538	0.1106	1.7898	12.168	6.2609	0.13993	0.069966
9	2.0038	0.12619	2.0421	13.637	6.2771	0.15642	0.078209
10	2.5038	0.15783	2.5542	16.312	6.31	0.18612	0.093061
11	3.0038	0.18984	3.0722	18.567	6.3438	0.21073	0.10537
12	3.5038	0.22149	3.5842	20.665	6.3774	0.2333	0.11665
13	4.0038	0.25248	4.0858	22.553	6.4108	0.2533	0.12665
14	4.5038	0.28375	4.5918	24.231	6.4448	0.27071	0.13535
15	5.0038	0.31567	5.1083	25.805	6.4799	0.28673	0.14336
16	5.5038	0.34786	5.6293	27.169	6.5157	0.30022	0.15011
17	6.0038	0.37914	6.1353	28.427	6.5508	0.31245	0.15622
18	6.5038	0.40995	6.6339	29.529	6.5858	0.32283	0.16141
19	7.0038	0.44113	7.1385	30.473	6.6215	0.33135	0.16568
20	7.5038	0.47295	7.6535	31.365	6.6585	0.33915	0.16958
21	8.0038	0.50505	8.173	32.151	6.6961	0.34571	0.17285
22	8.5038	0.53632	8.679	32.623	6.7332	0.34885	0.17442
23	9.0038	0.56713	9.1776	33.2	6.7702	0.35308	0.17654
24	9.5038	0.59822	9.6807	33.515	6.8079	0.35445	0.17723
25	10.004	0.63032	10.2	33.882	6.8473	0.35627	0.17814
26	10.504	0.66252	10.721	34.092	6.8873	0.3564	0.1782
27	11.004	0.69351	11.223	34.144	6.9262	0.35494	0.17747
28	11.504	0.72442	11.723	34.302	6.9654	0.35457	0.17728
29	12.004	0.75587	12.232	34.302	7.0058	0.35253	0.17626
30	12.504	0.78788	12.75	34.197	7.0474	0.34937	0.17469
31	13.004	0.81998	13.269	34.039	7.0896	0.34569	0.17285
32	13.504	0.85079	13.768	33.987	7.1306	0.34318	0.17159
33	14.004	0.88188	14.271	33.83	7.1724	0.3396	0.1698
34	14.504	0.91361	14.785	33.672	7.2157	0.33599	0.168
35	15.004	0.94553	15.301	33.358	7.2597	0.33083	0.16542

UNCONFINED COMPRESSION TEST
ASTM D2166

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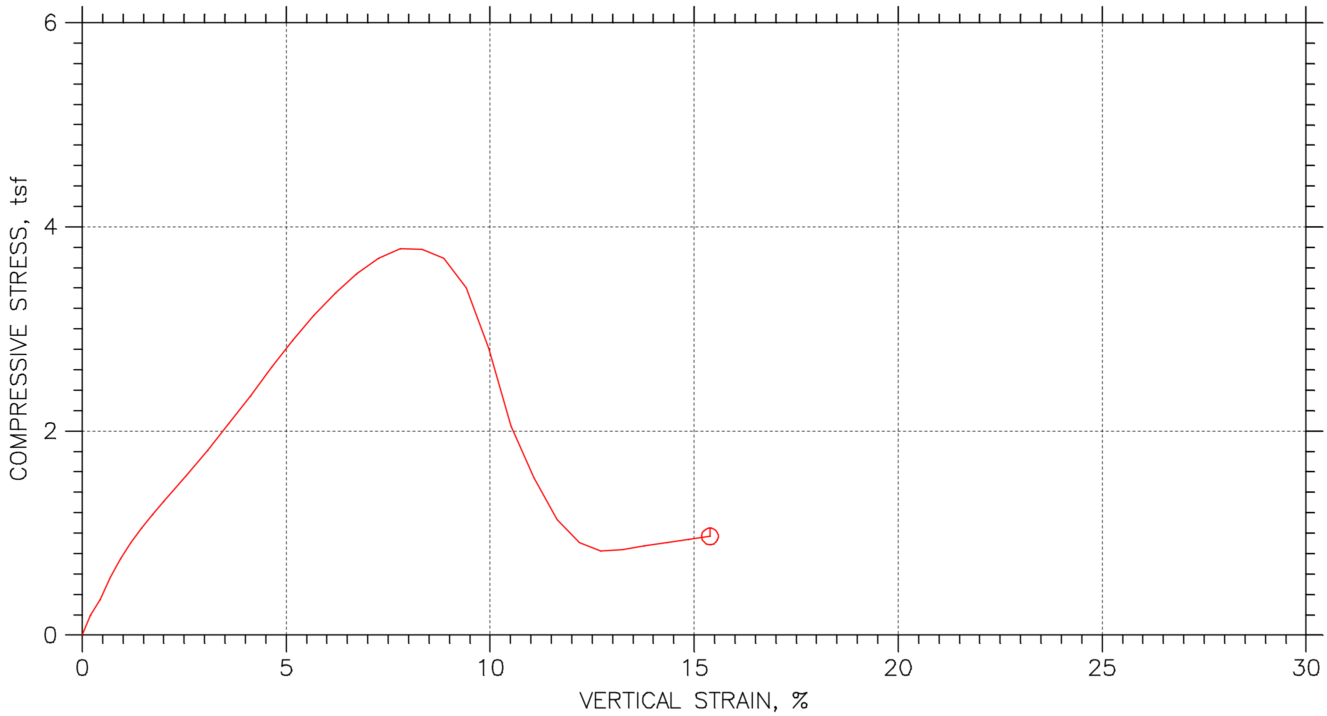

Symbol		⏀			
Test No.		HENB021S3			
Initial	Diameter, in	2.8783			
	Height, in	5.8752			
	Water Content, %	15.80			
	Dry Density, pcf	116.7			
	Saturation, %	94.44			
	Void Ratio	0.45507			
Unconfined Compressive Strength, tsf		3.7833			
Undrained Shear Strength, tsf		1.8917			
Time to Failure, min		7.5002			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		---			
Plastic Limit		---			
Plasticity Index		---			
Failure Sketch					

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HENB021 S-3
Sample Type: 3.0" ST
Description: BROWN TO BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: TEST PERFORMED AS PER ASTM D2166. 440

Tue, 22-DEC-2015 15:11:42

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HENB021 S-3
Sample No.: ST-3
Test No.: HENB021S3

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/14/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 5.0'-6.0'
Elevation: -----

Soil Description: BROWN TO BROWNISH GRAY LEAND CLAY WITH SAND AND GRAVEL CL
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 5.88 in
Specimen Area: 6.51 in^2
Specimen Volume: 38.23 in^3

Liquid Limit: ---
Plastic Limit: ---
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.5069	0	0
2	0.2502	0.012177	0.20725	17.57	6.5204	0.19402	0.097008
3	0.5002	0.026198	0.44591	31.627	6.5361	0.34839	0.1742
4	0.7502	0.040496	0.68928	51.453	6.5521	0.56541	0.2827
5	1.0002	0.055625	0.94678	68.499	6.5691	0.75077	0.37538
6	1.2502	0.070384	1.198	82.607	6.5858	0.90311	0.45156
7	1.5002	0.085882	1.4618	96.192	6.6035	1.0488	0.52441
8	1.7502	0.10156	1.7287	108.52	6.6214	1.18	0.59
9	2.0002	0.11734	1.9972	120.58	6.6395	1.3076	0.6538
10	2.5002	0.14898	2.5357	144.34	6.6762	1.5566	0.77832
11	3.0002	0.18034	3.0696	168.57	6.713	1.808	0.904
12	3.5002	0.21125	3.5956	194.22	6.7496	2.0718	1.0359
13	4.0002	0.24206	4.12	221.02	6.7865	2.3449	1.1724
14	4.5002	0.27277	4.6428	248.71	6.8237	2.6243	1.3121
15	5.0002	0.30331	5.1625	275.1	6.8611	2.8868	1.4434
16	5.5002	0.33403	5.6854	300.38	6.8992	3.1347	1.5674
17	6.0002	0.36484	6.2098	322.93	6.9377	3.3514	1.6757
18	6.5002	0.39583	6.7373	343.07	6.977	3.5404	1.7702
19	7.0002	0.42683	7.2649	359.91	7.0167	3.6931	1.8465
20	7.5002	0.45791	7.794	370.82	7.0569	3.7833	1.8917
21	8.0002	0.48937	8.3294	372.39	7.0982	3.7773	1.8887
22	8.5002	0.5211	8.8695	366.3	7.1402	3.6937	1.8469
23	9.0002	0.55311	9.4144	339.24	7.1832	3.4004	1.7002
24	9.5002	0.58522	9.9608	282.54	7.2268	2.815	1.4075
25	10	0.6175	10.51	206.7	7.2711	2.0468	1.0234
26	10.5	0.65071	11.076	156.61	7.3174	1.541	0.77051
27	11	0.68355	11.635	115.91	7.3637	1.1334	0.56668
28	11.5	0.71584	12.184	93.15	7.4097	0.90513	0.45256
29	12	0.74665	12.708	85.282	7.4542	0.82373	0.41187
30	12.5	0.77792	13.241	87.013	7.5	0.83533	0.41766
31	13	0.80947	13.778	91.629	7.5467	0.87419	0.4371
32	13.5	0.84129	14.319	95.3	7.5944	0.90351	0.45175
33	14	0.87275	14.855	99.811	7.6422	0.94036	0.47018
34	14.5	0.90402	15.387	103.38	7.6902	0.96787	0.48394

UNCONFINED COMPRESSION TEST
ASTM D2166

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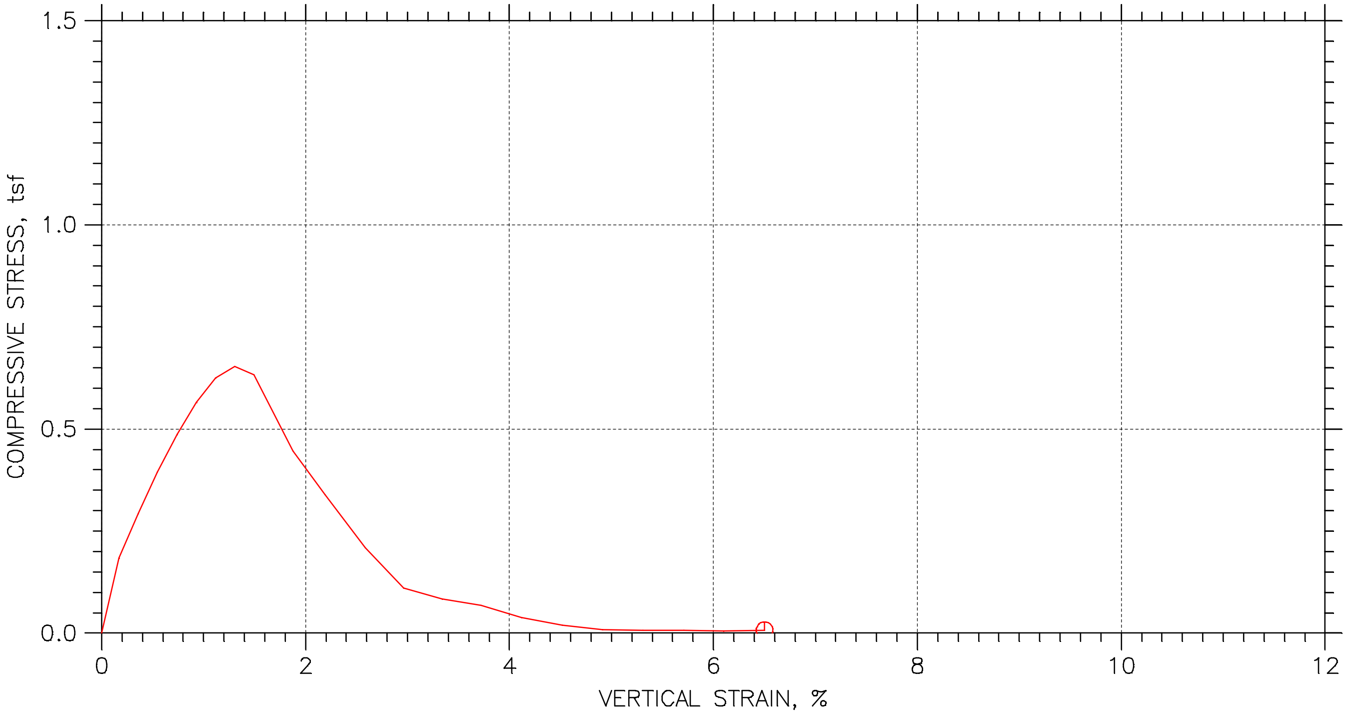

Symbol					
Test No.		HENB021S8			
Initial	Diameter, in	2.8717			
	Height, in	6.0697			
	Water Content, %	31.90			
	Dry Density, pcf	65.24			
	Saturation, %	61.09			
	Void Ratio	1.201			
Unconfined Compressive Strength, tsf		0.65256			
Undrained Shear Strength, tsf		0.32628			
Time to Failure, min		1.7542			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.30			
Liquid Limit		NP			
Plastic Limit		NP			
Plasticity Index		NP			
Failure Sketch					

Project: DYNERGY HENNEPIN	
Location: HENNEPIN, IL	
Project No.: MR155233	
Boring No.: HENB021 S-8	
Sample Type: 3.0" ST	
Description: DARK GRAY VARVED FLY ASH	
Remarks: TEST PERFORMED AS PER ASTM D2166.	

Tue, 22-DEC-2015 15:16:20

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HENB021 S-8
Sample No.: S-8
Test No.: HENB021S8

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/14/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 22.0'-24.0'
Elevation: -----

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Soil Description: DARK GRAY VARVED FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 6.07 in
Specimen Area: 6.48 in^2
Specimen Volume: 39.31 in^3

Liquid Limit: NP
Plastic Limit: NP
Estimated Specific Gravity: 2.30

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.4767	0	0
2	0.25415	0.010239	0.1687	16.626	6.4876	0.18452	0.09226
3	0.50415	0.02177	0.35867	26.434	6.5	0.29281	0.14641
4	0.75415	0.033301	0.54865	35.665	6.5124	0.39431	0.19715
5	1.0042	0.044832	0.73862	44.11	6.5249	0.48674	0.24337
6	1.2542	0.056363	0.9286	51.348	6.5374	0.56552	0.28276
7	1.5042	0.067894	1.1186	56.802	6.55	0.6244	0.3122
8	1.7542	0.07924	1.3055	59.477	6.5624	0.65256	0.32628
9	2.0042	0.090587	1.4924	57.799	6.5748	0.63295	0.31647
10	2.5042	0.11402	1.8785	40.963	6.6007	0.44682	0.22341
11	3.0042	0.13311	2.1931	31.155	6.6219	0.33874	0.16937
12	3.5042	0.15691	2.5852	19.354	6.6486	0.20959	0.10479
13	4.0042	0.17988	2.9636	10.228	6.6745	0.11033	0.055164
14	4.5042	0.20276	3.3405	7.7625	6.7005	0.083411	0.041705
15	5	0.22591	3.722	6.2939	6.7271	0.067364	0.033682
16	5.5	0.24999	4.1187	3.5141	6.7549	0.037456	0.018728
17	6	0.27425	4.5184	1.8882	6.7832	0.020042	0.010021
18	6.5	0.29833	4.915	0.73429	6.8115	0.0077617	0.0038808
19	7	0.3224	5.3117	0.68184	6.84	0.0071772	0.0035886
20	7.5	0.34657	5.7099	0.62939	6.8689	0.0065973	0.0032986
21	8	0.3701	6.0974	0.47204	6.8973	0.0049276	0.0024638
22	8.5	0.39463	6.5017	0.73429	6.9271	0.0076322	0.0038161

UNCONFINED COMPRESSION TEST REPORT

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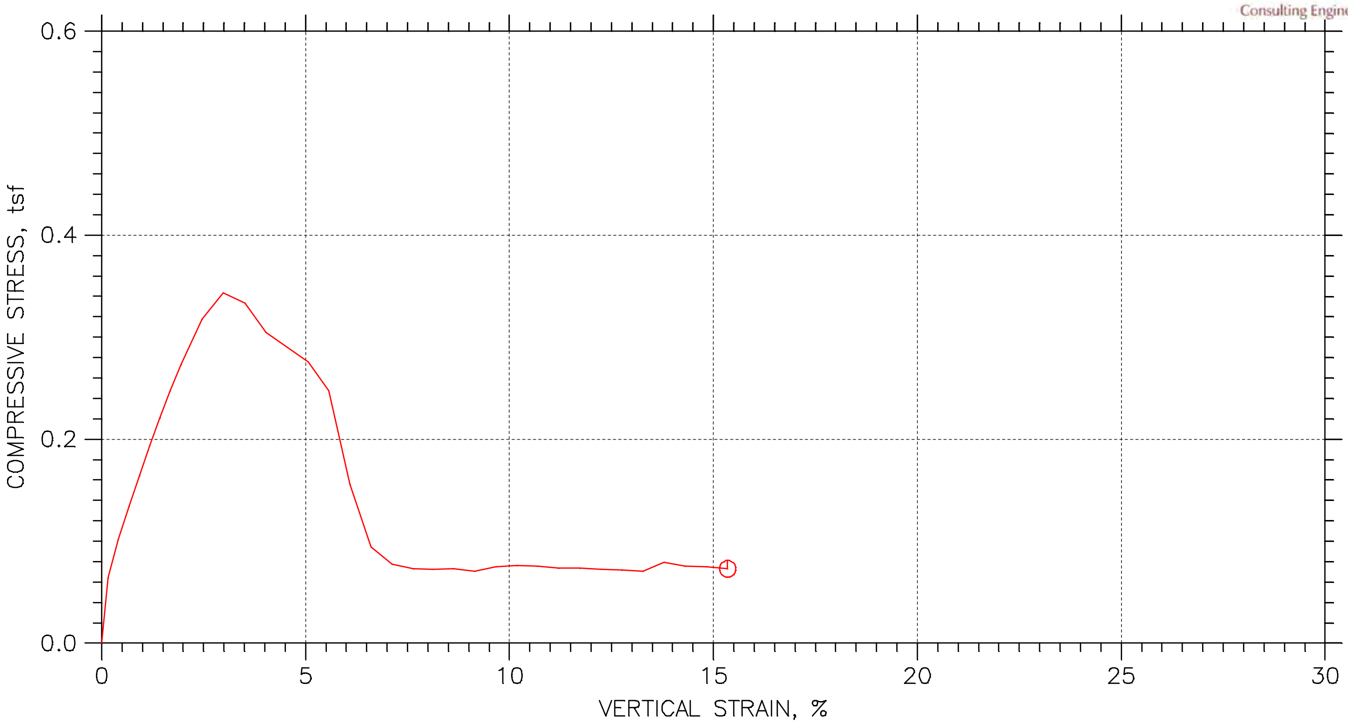

Symbol		①			
Test No.		HENB022S2			
Initial	Diameter, in	2.8346			
	Height, in	6.0874			
	Water Content, %	26.87			
	Dry Density, pcf	84.39			
	Saturation, %	88.11			
	Void Ratio	0.70142			
Unconfined Compressive Strength, tsf		0.34367			
Undrained Shear Strength, tsf		0.17183			
Time to Failure, min		3.0002			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.30			
Liquid Limit		NP			
Plastic Limit		NP			
Plasticity Index		NP			
Failure Sketch					

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HENB022 S-2
Sample Type: 3.0'' ST
Description: VERY DARK GRAY VARVED FLY ASH WITH SAND AND GRAVEL
Remarks: TEST PERFORMED AS PER ASTM D2166. 444

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HENB022 S-2
Sample No.: ST-2
Test No.: HENB022S2

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/14/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 2.5'-4.5'
Elevation: -----

Soil Description: VERY DARK GRAY VARVED FLY ASH WITH SAND AND GRAVEL
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 6.09 in
Specimen Area: 6.31 in^2
Specimen Volume: 38.42 in^3

Liquid Limit: NP
Plastic Limit: NP
Estimated Specific Gravity: 2.30

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.3108	0	0
2	0.2502	0.0095937	0.1576	5.6121	6.3208	0.063927	0.031963
3	0.5002	0.025183	0.4137	8.9688	6.3371	0.1019	0.050951
4	0.7502	0.040681	0.66828	11.853	6.3533	0.13433	0.067166
5	1.0002	0.056086	0.92135	14.528	6.3695	0.16423	0.082113
6	1.2502	0.071491	1.1744	17.151	6.3858	0.19337	0.096687
7	1.5002	0.086804	1.426	19.668	6.4021	0.2212	0.1106
8	1.7502	0.10267	1.6866	22.081	6.4191	0.24767	0.12384
9	2.0002	0.11854	1.9473	24.441	6.4362	0.27342	0.13671
10	2.5002	0.15027	2.4685	28.532	6.4706	0.31749	0.15874
11	3.0002	0.18182	2.9868	31.05	6.5051	0.34367	0.17183
12	3.5041	0.21392	3.5142	30.263	6.5407	0.33314	0.16657
13	4.0041	0.24547	4.0324	27.798	6.576	0.30436	0.15218
14	4.5041	0.27665	4.5446	26.644	6.6113	0.29017	0.14508
15	5.0041	0.30811	5.0614	25.438	6.6473	0.27553	0.13776
16	5.5041	0.3391	5.5705	22.973	6.6831	0.24749	0.12375
17	6.0041	0.37028	6.0827	14.528	6.7196	0.15567	0.077836
18	6.5041	0.40192	6.6025	8.8639	6.757	0.094451	0.047225
19	7.0041	0.43365	7.1238	7.2904	6.7949	0.077251	0.038625
20	7.5041	0.46465	7.6329	6.9233	6.8324	0.072958	0.036479
21	8.0041	0.49491	8.13	6.9233	6.8693	0.072566	0.036283
22	8.5041	0.52535	8.6301	6.9757	6.9069	0.072717	0.036359
23	9.0041	0.5568	9.1468	6.8184	6.9462	0.070675	0.035338
24	9.5041	0.58798	9.659	7.238	6.9856	0.074601	0.037301
25	10.004	0.61962	10.179	7.4478	7.026	0.076322	0.038161
26	10.504	0.65071	10.689	7.3953	7.0662	0.075354	0.037677
27	11.004	0.68189	11.202	7.2904	7.1069	0.073859	0.036929
28	11.504	0.71362	11.723	7.2904	7.1489	0.073425	0.036713
29	12.004	0.74554	12.247	7.238	7.1916	0.072464	0.036232
30	12.504	0.77681	12.761	7.238	7.234	0.07204	0.03602
31	13.004	0.8079	13.272	7.1331	7.2766	0.07058	0.03529
32	13.504	0.83917	13.785	8.0772	7.3199	0.079448	0.039724
33	14.004	0.87127	14.313	7.71	7.365	0.075373	0.037687
34	14.504	0.90328	14.839	7.71	7.4104	0.074911	0.037455
35	15.004	0.93437	15.349	7.5527	7.4552	0.072942	0.036471

UNCONFINED COMPRESSION TEST REPORT

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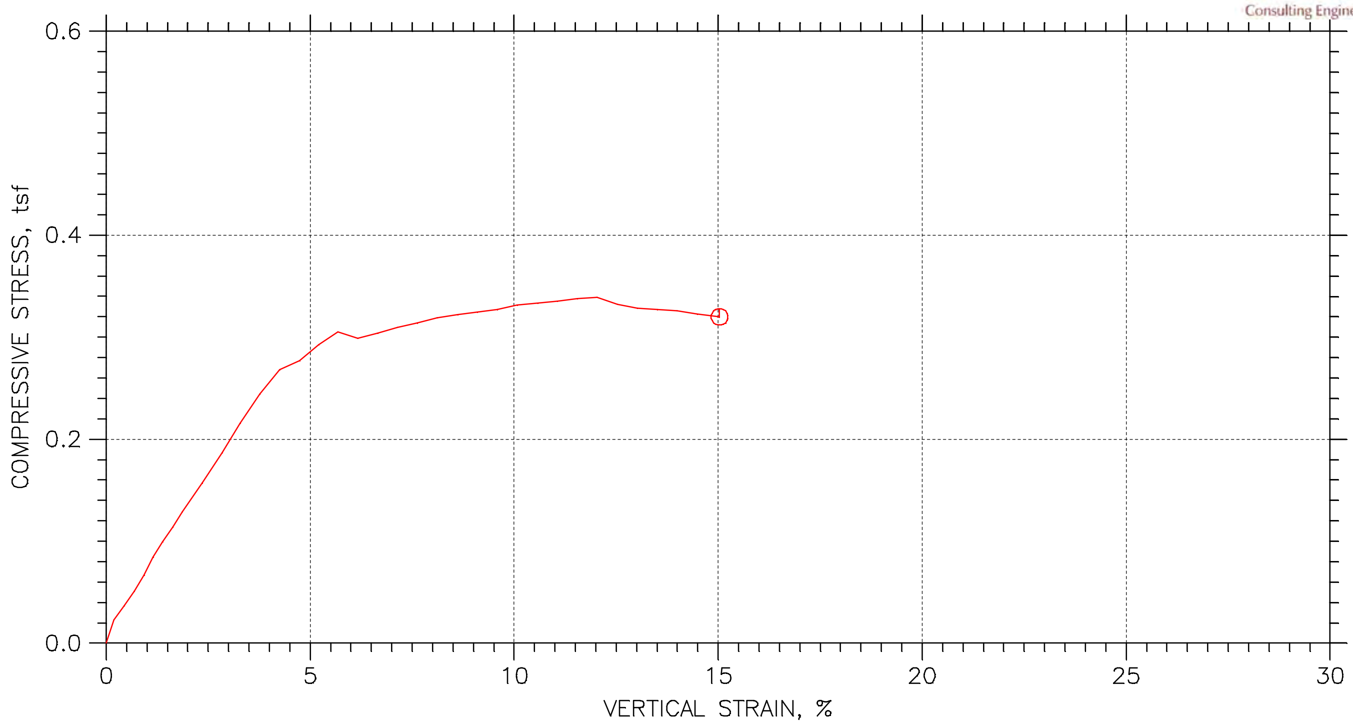

Symbol		⦶			
Test No.		HEN025S9			
Initial	Diameter, in	2.8591			
	Height, in	6.0091			
	Water Content, %	36.14			
	Dry Density, pcf	75.78			
	Saturation, %	92.89			
	Void Ratio	0.89482			
Unconfined Compressive Strength, tsf		0.33892			
Undrained Shear Strength, tsf		0.16946			
Time to Failure, min		12.504			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.30			
Liquid Limit		NP			
Plastic Limit		NP			
Plasticity Index		NP			
Failure Sketch					

Project: DYNERGY HENNEPIN	
Location: HENNEPIN, IL	
Project No.: MR155233	
Boring No.: HEN025 S9	
Sample Type: 3.0'' ST	
Description: DARK GRAY TO GRAY FLY ASH WITH SAND	
Remarks: TEST PERFORMED AS PER ASTM D2166.	446

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN025 S9
Sample No.: S-9
Test No.: HEN025S9

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/15/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 25.0'-27.0'
Elevation: ----

Soil Description: DARK GRAY TO GRAY FLY ASH WITH SAND
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 6.01 in
Specimen Area: 6.42 in^2
Specimen Volume: 38.58 in^3

Liquid Limit: NP
Plastic Limit: NP
Estimated Specific Gravity: 2.30

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.42	0	0
2	0.25405	0.011783	0.19609	2.0116	6.4326	0.022515	0.011258
3	0.50407	0.026307	0.43778	3.282	6.4482	0.036646	0.018323
4	0.75407	0.041104	0.68403	4.6054	6.4642	0.051296	0.025648
5	1.0041	0.055536	0.92421	6.0347	6.4799	0.067053	0.033526
6	1.2538	0.068507	1.1401	7.6227	6.494	0.084514	0.042257
7	1.5038	0.083304	1.3863	8.9991	6.5103	0.099525	0.049762
8	1.7538	0.097919	1.6295	10.322	6.5263	0.11388	0.05694
9	2.0038	0.11253	1.8727	11.699	6.5425	0.12874	0.064372
10	2.5038	0.14158	2.3561	14.346	6.5749	0.15709	0.078547
11	3.0038	0.17063	2.8395	17.151	6.6076	0.18689	0.093444
12	3.5038	0.19712	3.2803	19.851	6.6377	0.21532	0.10766
13	4.0038	0.22635	3.7667	22.656	6.6713	0.24452	0.12226
14	4.5038	0.25521	4.2471	24.986	6.7048	0.26831	0.13416
15	5.0038	0.28444	4.7335	25.938	6.739	0.27713	0.13856
16	5.5038	0.3134	5.2154	27.527	6.7732	0.29261	0.1463
17	6.0038	0.34116	5.6775	28.85	6.8064	0.30518	0.15259
18	6.5038	0.37048	6.1654	28.426	6.8418	0.29915	0.14957
19	7.0038	0.39971	6.6519	29.009	6.8775	0.30369	0.15185
20	7.5038	0.42885	7.1368	29.75	6.9134	0.30983	0.15492
21	8.0038	0.45836	7.6277	30.332	6.9501	0.31423	0.15711
22	8.5038	0.48777	8.1172	30.967	6.9872	0.31911	0.15955
23	9.0038	0.51736	8.6097	31.444	7.0248	0.32228	0.16114
24	9.5038	0.54687	9.1007	31.814	7.0628	0.32432	0.16216
25	10.004	0.576	9.5856	32.291	7.1006	0.32743	0.16371
26	10.504	0.60533	10.074	32.873	7.1392	0.33153	0.16577
27	11.004	0.63492	10.566	33.244	7.1785	0.33343	0.16672
28	11.504	0.66451	11.059	33.614	7.2182	0.33529	0.16765
29	12.004	0.69393	11.548	34.038	7.2582	0.33765	0.16882
30	12.504	0.72316	12.034	34.355	7.2983	0.33892	0.16946
31	13.004	0.75284	12.528	33.879	7.3395	0.33235	0.16617
32	13.504	0.78235	13.019	33.667	7.381	0.32842	0.16421
33	14.004	0.81158	13.506	33.72	7.4225	0.32709	0.16355
34	14.503	0.84099	13.995	33.773	7.4647	0.32575	0.16288
35	15.003	0.8704	14.485	33.667	7.5074	0.32288	0.16144
36	15.503	0.90009	14.979	33.561	7.5511	0.32001	0.16
37	15.558	0.90328	15.032	33.561	7.5558	0.31981	0.1599

UNCONFINED COMPRESSION TEST REPORT

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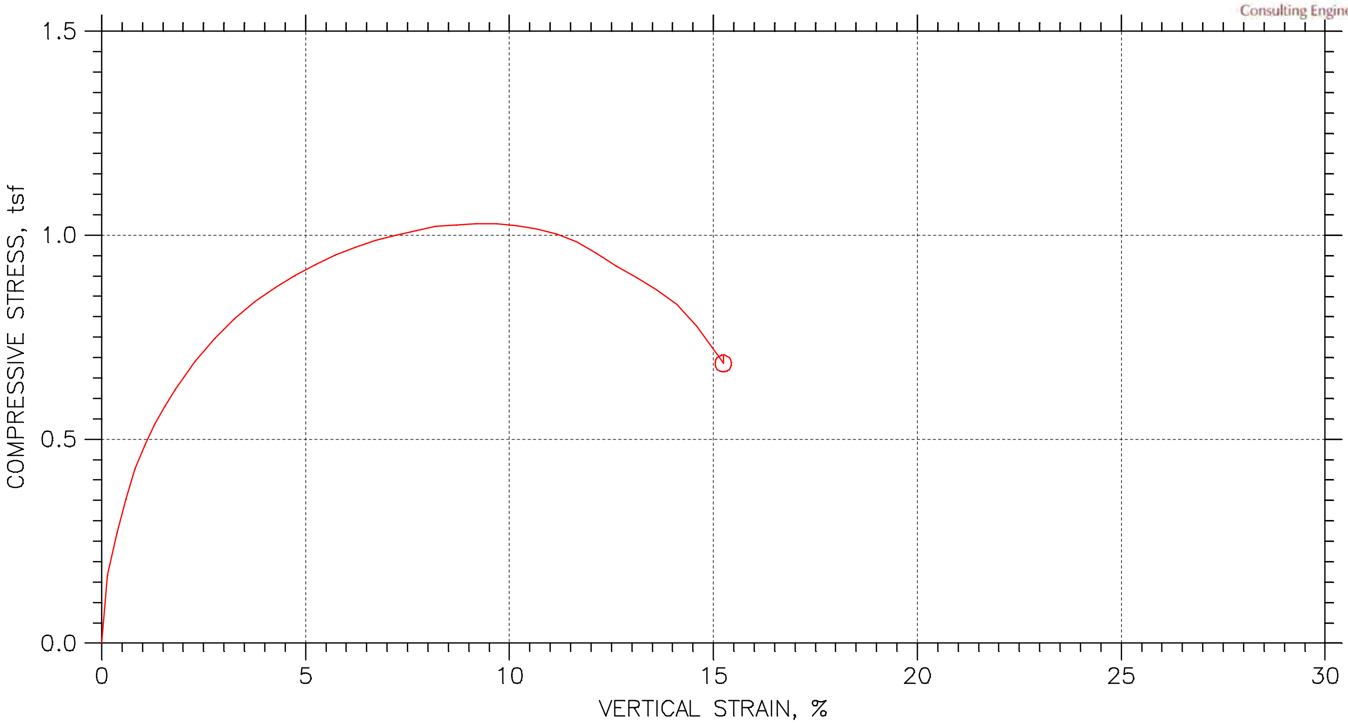

Symbol		⦶			
Test No.		HEN027S2			
Initial	Diameter, in	2.8106			
	Height, in	5.9756			
	Water Content, %	36.30			
	Dry Density, pcf	84.59			
	Saturation, %	98.00			
	Void Ratio	1.0075			
Unconfined Compressive Strength, tsf		1.0288			
Undrained Shear Strength, tsf		0.51438			
Time to Failure, min		10			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		---			
Plastic Limit		---			
Plasticity Index		---			
Failure Sketch					

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN027 S2
Sample Type: 3.0'' ST
Description: GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: TEST PERFORMED AS PER ASTM D2166.

Tue, 22-DEC-2015 15:22:36

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN027 S2
Sample No.: ST-2
Test No.: HEN027S2

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/15/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: ----

Soil Description: GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 5.98 in
Specimen Area: 6.20 in^2
Specimen Volume: 37.07 in^3

Liquid Limit: ---
Plastic Limit: ---
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.2044	0	0
2	0.2501	0.0081295	0.13604	14.346	6.2128	0.16625	0.083125
3	0.5001	0.022196	0.37145	23.345	6.2275	0.2699	0.13495
4	0.7501	0.035806	0.59921	30.597	6.2418	0.35294	0.17647
5	1.0001	0.048959	0.81932	37.055	6.2556	0.42649	0.21324
6	1.2501	0.063392	1.0608	42.348	6.2709	0.48623	0.24311
7	1.5001	0.078098	1.3069	46.954	6.2865	0.53777	0.26888
8	1.7501	0.092895	1.5546	50.871	6.3023	0.58117	0.29058
9	2.0001	0.1076	1.8007	54.63	6.3181	0.62255	0.31127
10	2.5001	0.13729	2.2975	60.876	6.3503	0.69022	0.34511
11	3.0001	0.16633	2.7836	66.222	6.382	0.7471	0.37355
12	3.5001	0.19529	3.2681	70.934	6.414	0.79626	0.39813
13	4.0001	0.22443	3.7557	74.851	6.4465	0.836	0.418
14	4.5001	0.25411	4.2525	78.451	6.4799	0.87168	0.43584
15	5.0001	0.28353	4.7447	81.574	6.5134	0.90173	0.45086
16	5.5001	0.31266	5.2324	84.326	6.5469	0.92738	0.46369
17	6.0001	0.34189	5.7215	86.867	6.5809	0.9504	0.4752
18	6.5001	0.37158	6.2183	89.144	6.6158	0.97016	0.48508
19	7.0001	0.40136	6.7166	91.155	6.6511	0.98678	0.49339
20	7.5001	0.43095	7.2119	92.849	6.6866	0.99978	0.49989
21	8.0001	0.46018	7.701	94.437	6.722	1.0115	0.50576
22	8.5001	0.48941	8.1902	95.972	6.7578	1.0225	0.51126
23	9.0001	0.51892	8.6839	96.66	6.7944	1.0243	0.51215
24	9.5001	0.54851	9.1792	97.56	6.8314	1.0282	0.51412
25	10	0.57801	9.6729	98.143	6.8688	1.0288	0.51438
26	10.5	0.60733	10.164	98.09	6.9063	1.0226	0.51131
27	11	0.63675	10.656	97.878	6.9443	1.0148	0.50741
28	11.5	0.66625	11.15	97.296	6.9829	1.0032	0.5016
29	12	0.69557	11.64	95.919	7.0217	0.98355	0.49177
30	12.5	0.72507	12.134	93.749	7.0612	0.95592	0.47796
31	13	0.75412	12.62	91.155	7.1004	0.92433	0.46217
32	13.5	0.78353	13.112	88.826	7.1407	0.89564	0.44782
33	14	0.81313	13.608	86.444	7.1816	0.86665	0.43333
34	14.5	0.84254	14.1	83.321	7.2227	0.83058	0.41529
35	15	0.87214	14.595	78.345	7.2646	0.77648	0.38824
36	15.504	0.90191	15.093	71.834	7.3073	0.70779	0.3539
37	15.654	0.91086	15.243	69.716	7.3202	0.68572	0.34286

UNCONFINED COMPRESSION TEST REPORT

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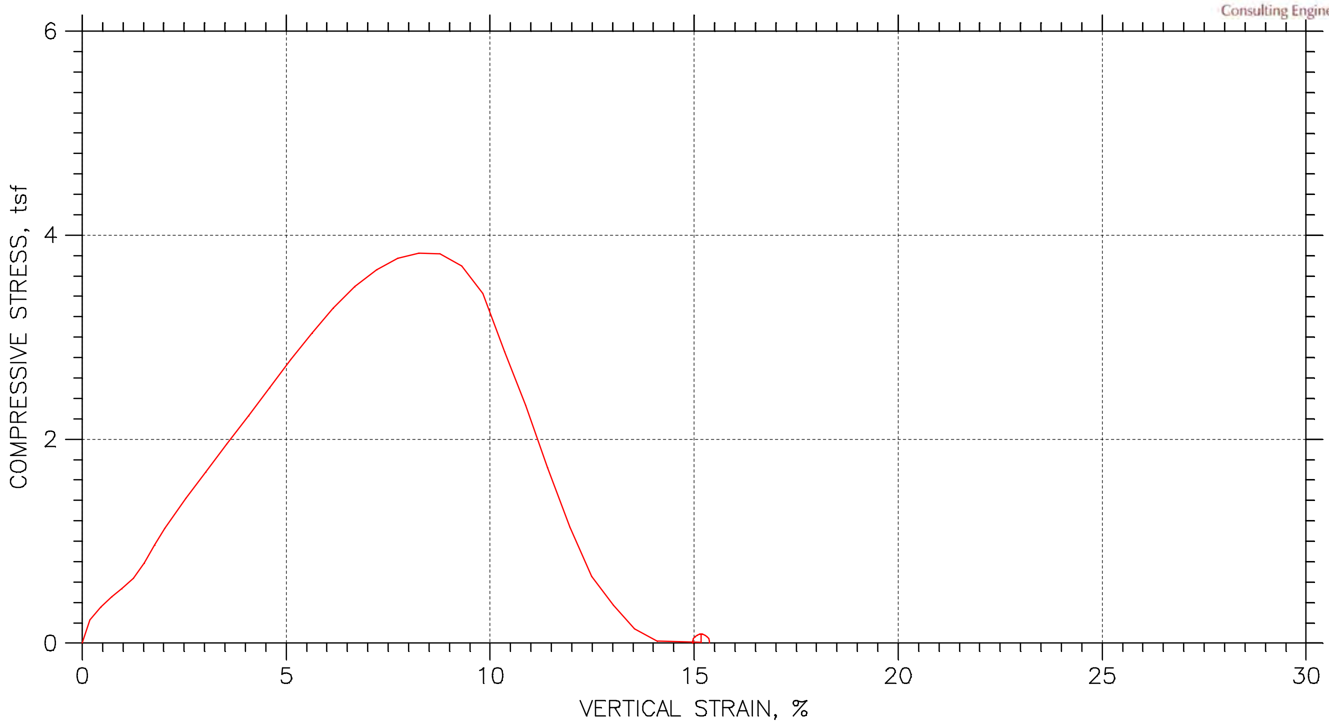


Symbol		①			
Test No.		HEN032S3			
Initial	Diameter, in	2.8303			
	Height, in	5.85			
	Water Content, %	14.10			
	Dry Density, pcf	115.8			
	Saturation, %	82.27			
	Void Ratio	0.46619			
Unconfined Compressive Strength, tsf		3.8231			
Undrained Shear Strength, tsf		1.9116			
Time to Failure, min		8.0041			
Strain Rate, %/min		1.14			
Estimated Specific Gravity		2.72			
Liquid Limit		35			
Plastic Limit		18			
Plasticity Index		17			
Failure Sketch					

Project: DYNERGY HENNEPIN
Location: HENNEPIN, IL
Project No.: MR155233
Boring No.: HEN032 S-3
Sample Type: 3.0'' ST
Description: DARK BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: TEST PERFORMED AS PER ASTM D2166. 450

UNCONFINED COMPRESSION TEST

Project: DYNERGY HENNEPIN
Boring No.: HEN032 S-3
Sample No.: ST-3
Test No.: HEN032S3

Location: HENNEPIN, IL
Tested By: BCM
Test Date: 12/15/15
Sample Type: 3.0" ST

Project No.: MR155233
Checked By: WPQ
Depth: 5.0'-7.0'
Elevation: ----

Soil Description: DARK BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 5.85 in
Specimen Area: 6.29 in^2
Specimen Volume: 36.81 in^3

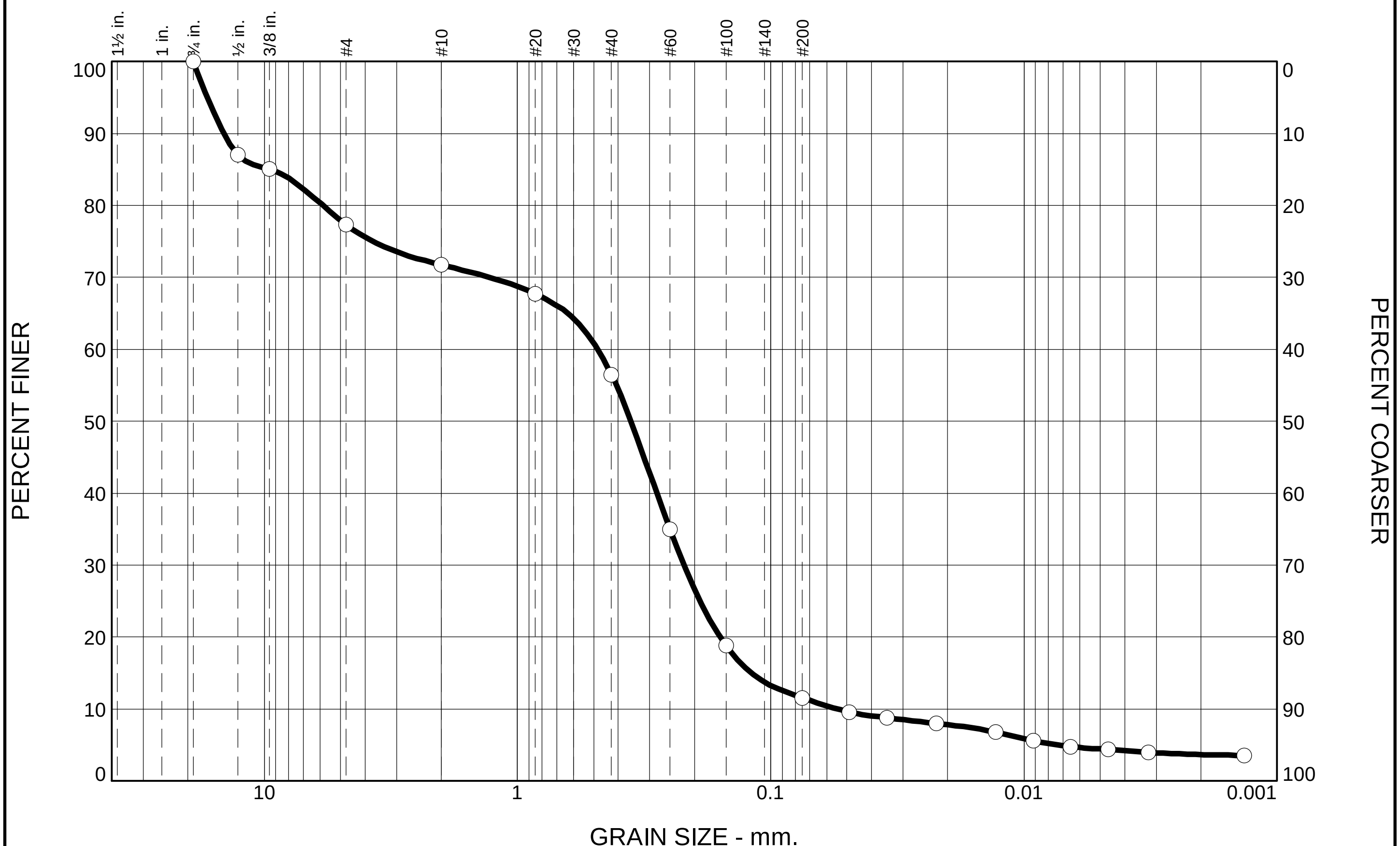
Liquid Limit: 35
Plastic Limit: 18
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.2916	0	0
2	0.25403	0.011115	0.18999	20.059	6.3036	0.22911	0.11456
3	0.50403	0.026602	0.45474	30.798	6.3203	0.35085	0.17543
4	0.75403	0.041999	0.71793	39.748	6.3371	0.45161	0.22581
5	1.004	0.057395	0.98111	47.382	6.3539	0.53692	0.26846
6	1.254	0.073065	1.249	56.543	6.3711	0.63899	0.31949
7	1.504	0.088735	1.5168	69.915	6.3885	0.78796	0.39398
8	1.7541	0.10358	1.7707	85.657	6.405	0.96289	0.48144
9	2.0041	0.11853	2.0261	100.35	6.4217	1.1251	0.56254
10	2.504	0.14841	2.5369	127.09	6.4553	1.4175	0.70875
11	3.004	0.17738	3.0321	151.41	6.4883	1.6802	0.8401
12	3.5041	0.20726	3.5429	176.95	6.5227	1.9532	0.97661
13	4.0041	0.23833	4.074	203.01	6.5588	2.2285	1.1143
14	4.5041	0.26903	4.5988	229.49	6.5949	2.5055	1.2527
15	5.0041	0.29937	5.1174	256.29	6.6309	2.7828	1.3914
16	5.5041	0.32943	5.6313	281.66	6.667	3.0418	1.5209
17	6.0041	0.36004	6.1545	305.56	6.7042	3.2816	1.6408
18	6.5041	0.39092	6.6825	327.41	6.7421	3.4965	1.7482
19	7.0041	0.42172	7.2089	344.52	6.7804	3.6584	1.8292
20	7.5041	0.45215	7.729	357.32	6.8186	3.773	1.8865
21	8.0041	0.48248	8.2476	364.11	6.8571	3.8231	1.9116
22	8.5041	0.51319	8.7724	365.79	6.8966	3.8189	1.9094
23	9.0041	0.54443	9.3066	356.58	6.9372	3.7009	1.8504
24	9.5041	0.57495	9.8283	332.2	6.9773	3.428	1.714
25	10.004	0.60556	10.352	278.29	7.0181	2.8551	1.4275
26	10.504	0.63636	10.878	228.38	7.0595	2.3293	1.1646
27	11.004	0.66724	11.406	169.79	7.1016	1.7214	0.8607
28	11.504	0.69895	11.948	113.14	7.1453	1.14	0.57002
29	12.004	0.73056	12.488	65.651	7.1894	0.65748	0.32874
30	12.504	0.76144	13.016	37.169	7.233	0.36999	0.185
31	13.004	0.79242	13.546	14.32	7.2773	0.14168	0.070839
32	13.504	0.82403	14.086	2.3165	7.3231	0.022775	0.011388
33	14.004	0.85619	14.636	1.5794	7.3703	0.015429	0.0077146
34	14.503	0.88735	15.168	0.7897	7.4165	0.0076665	0.0038332

Particle Size Analysis of Soils
ASTM D 422

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	22.7	5.6	15.2	44.9	7.2	4.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	87.0		
.375	85.1		
#4	77.3		
#10	71.7		
#20	67.7		
#40	56.5		
#60	35.0		
#100	18.8		
#200	11.6		

* (no specification provided)

BROWN POORLY GRADED SAND WITH SILT AND GRAVEL

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 14.4606 D_{85}= 9.3898 D_{60}= 0.4813
D_{50}= 0.3560 D_{30}= 0.2199 D_{15}= 0.1189
D_{10}= 0.0546 C_u= 8.82 C_c= 1.84

Classification

USCS= SP-SM AASHTO=

Remarks

F.M.=2.70

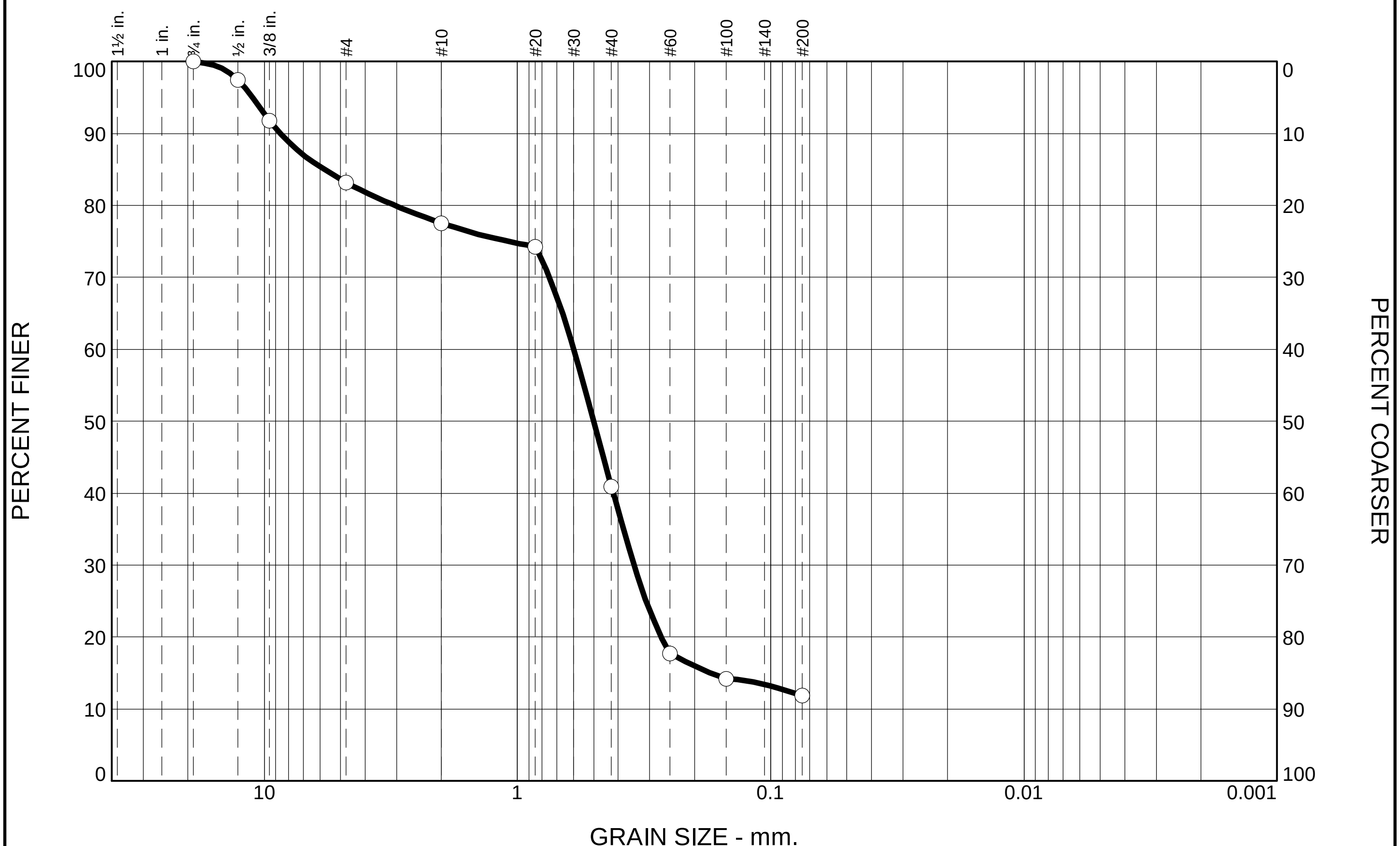
Source of Sample: HEN-B002 **Depth:** 15.0'-16.5'
Sample Number: S-6
Date: 12-4-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	16.8	5.7	36.6	29.0	11.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	97.4		
.375	91.8		
#4	83.2		
#10	77.5		
#20	74.3		
#40	40.9		
#60	17.7		
#100	14.2		
#200	11.9		

* (no specification provided)

BROWN POORLY GRADED SAND WITH SILT AND GRAVEL

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 8.6465 D_{85}= 5.7731 D_{60}= 0.6002
D_{50}= 0.4992 D_{30}= 0.3457 D_{15}= 0.1731
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO=

Remarks

F.M.=2.74

Source of Sample: HEN-B002 **Depth:** 55.0'-56.5'
Sample Number: S-14 **Date:** 11-25-15

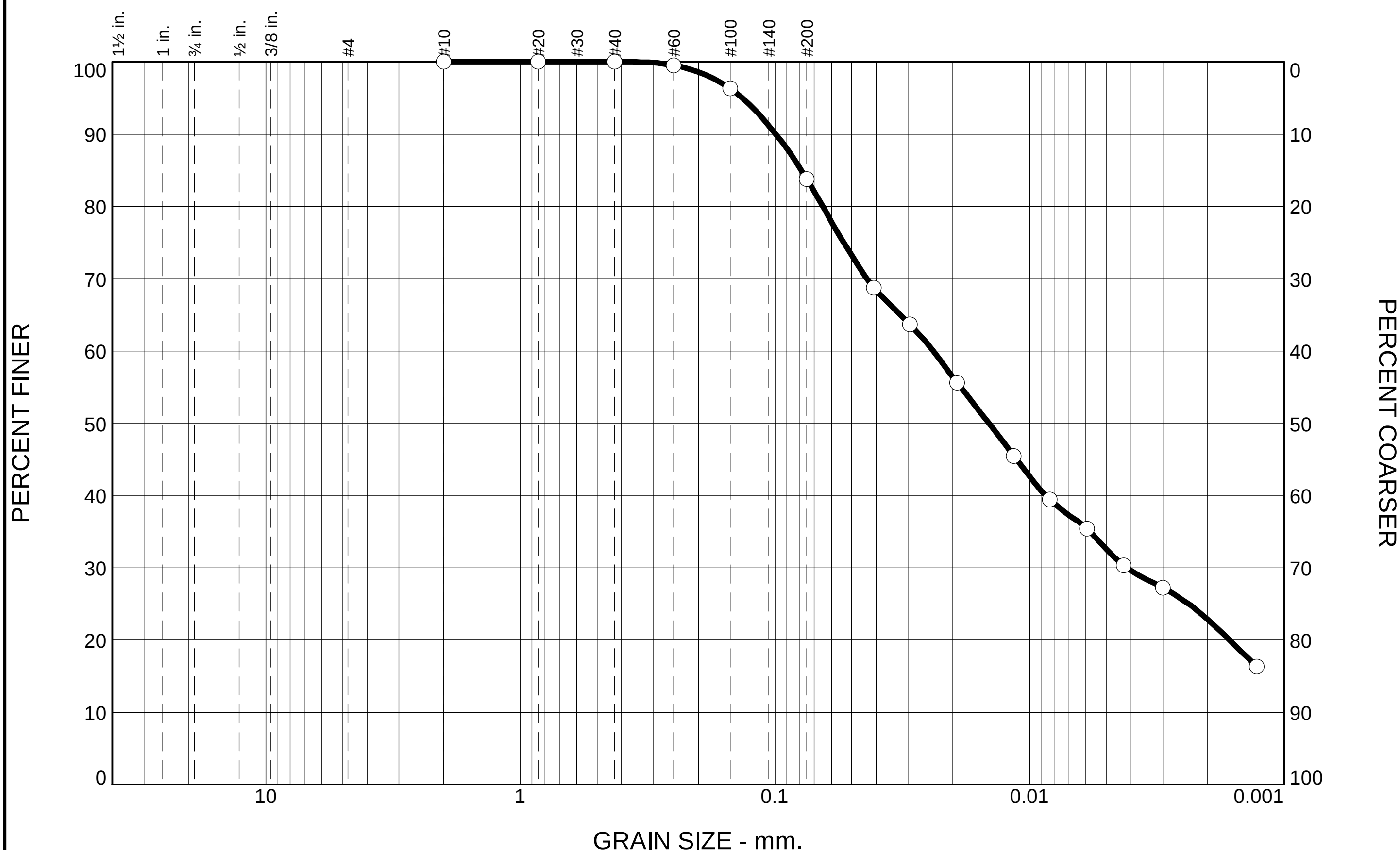
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	16.2	51.2	32.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	100.0		
#60	99.5		
#100	96.3		
#200	83.8		

* (no specification provided)

DARK GRAY LEAN CLAY WITH SAND AND FLY ASH

Atterberg Limits

PL= 24 LL= 43 PI= 19

Coefficients

D_{90}= 0.0992 D_{85}= 0.0788 D_{60}= 0.0240
D_{50}= 0.0145 D_{30}= 0.0042 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(17)

Remarks

F.M.=0.04

Source of Sample: HEN-B005 **Depth:** 12.5'-14.5'
Sample Number: S-4

Date: 12-17-15

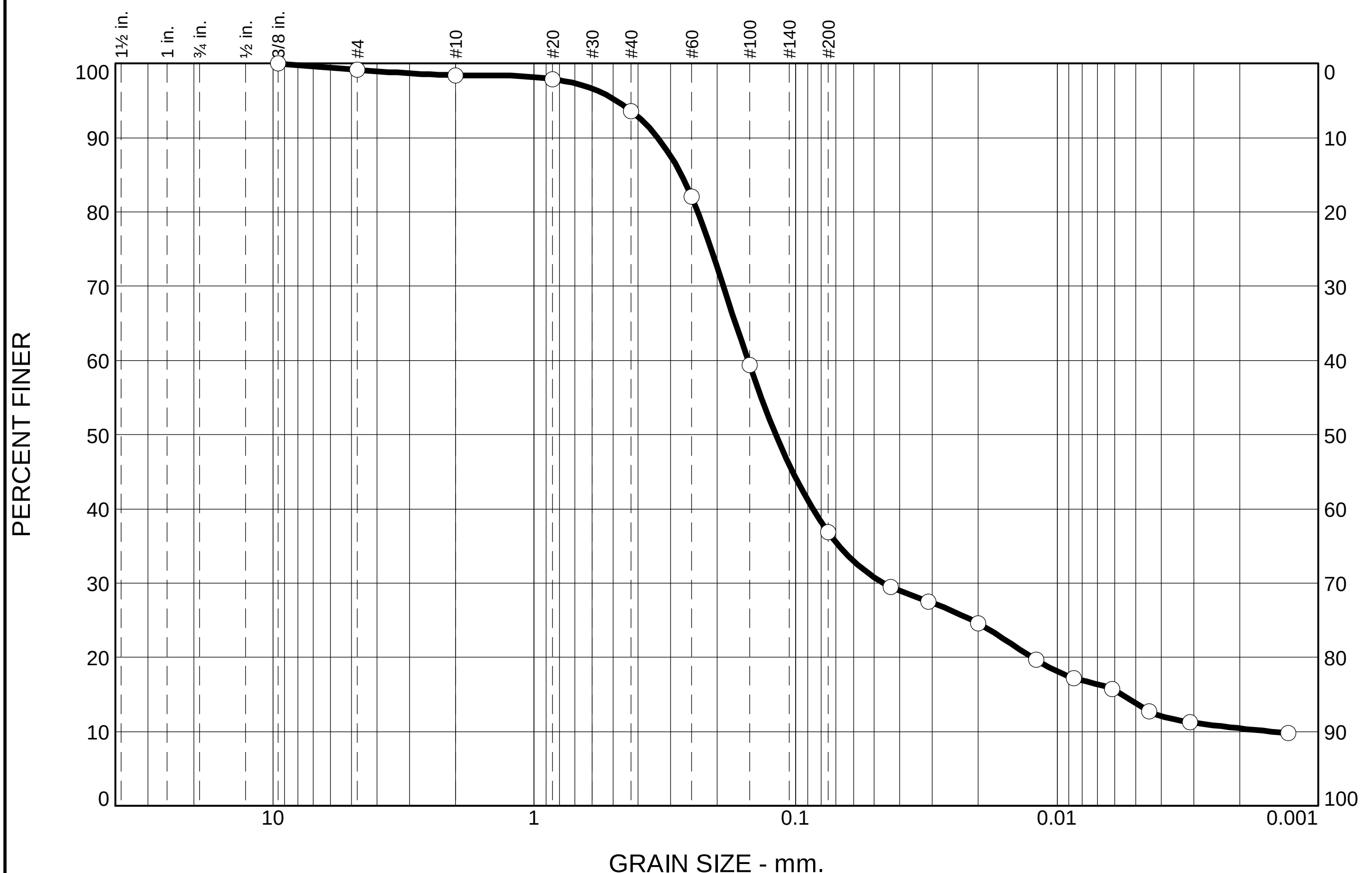
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.8	0.8	4.8	56.7	23.1	13.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.2		
#10	98.4		
#20	97.9		
#40	93.6		
#60	82.0		
#100	59.4		
#200	36.9		

* (no specification provided)

BROWN SILTY SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3360 D_{85}= 0.2738 D_{60}= 0.1522
D_{50}= 0.1189 D_{30}= 0.0460 D_{15}= 0.0056
D_{10}= 0.0015 C_u= 99.90 C_c= 9.12

Classification

USCS= SM AASHTO=

Remarks

F.M.=0.61

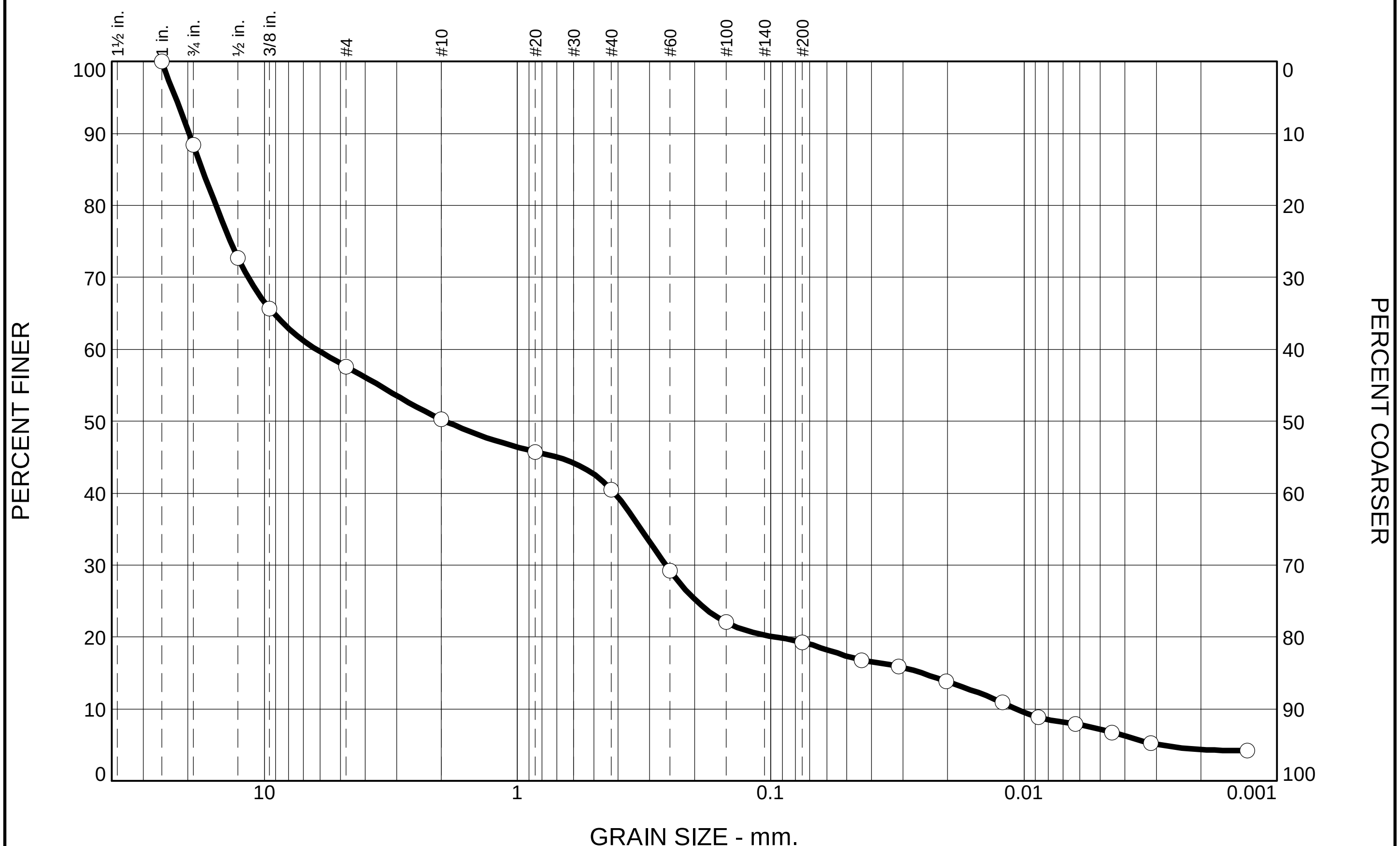
Source of Sample: HEN-B006 **Depth:** 15.0'-16.5'
Sample Number: S-6 **Date:** 12-4-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.6	30.8	7.3	9.8	21.2	12.1	7.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	88.4		
.5	72.7		
.375	65.7		
#4	57.6		
#10	50.3		
#20	45.7		
#40	40.5		
#60	29.2		
#100	22.1		
#200	19.3		

* (no specification provided)

LIGHT BROWN SILTY GRAVEL WITH SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 19.7935 D_{85}= 17.5429 D_{60}= 6.2349
D_{50}= 1.9279 D_{30}= 0.2598 D_{15}= 0.0252
D_{10}= 0.0107 C_u= 583.74 C_c= 1.01

Classification

USCS= GM AASHTO=

Remarks

F.M.=3.90

Source of Sample: HEN-B006 **Depth:** 30.0'-31.5'
Sample Number: S-9 **Date:** 12-9-15

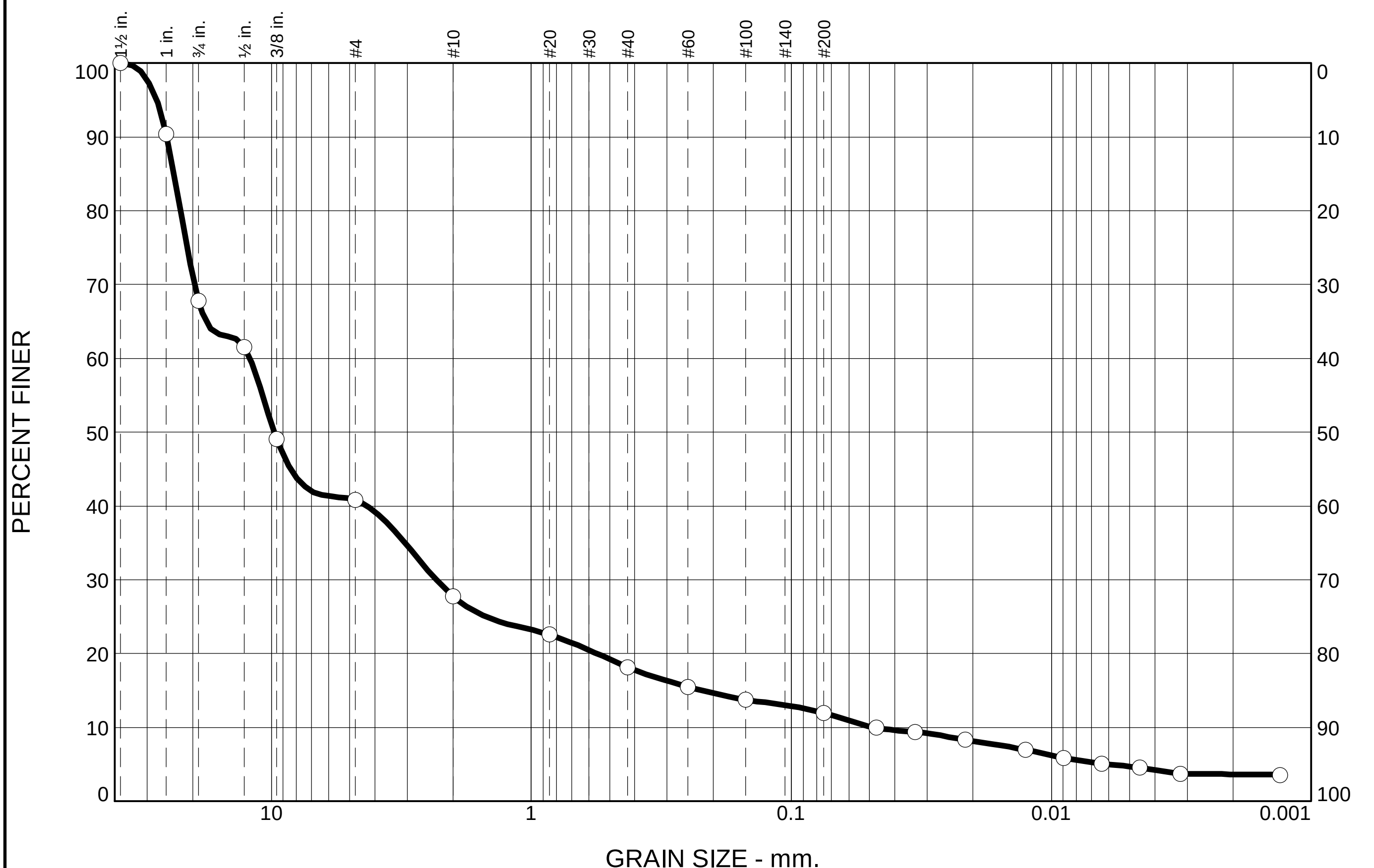
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	32.2	27.0	13.0	9.6	6.3	7.2	4.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1	90.4		
.75	67.8		
.5	61.5		
.375	49.0		
#4	40.8		
#10	27.8		
#20	22.6		
#40	18.2		
#60	15.5		
#100	13.8		
#200	11.9		

* (no specification provided)

BROWN GRAVEL WITH POORLY GRADED SAND AND SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 25.2429 D_{85}= 23.6694 D_{60}= 12.0960
D_{50}= 9.7410 D_{30}= 2.3148 D_{15}= 0.2213
D_{10}= 0.0481 C_u= 251.61 C_c= 9.21

Classification

USCS= GP AASHTO=

Remarks

F.M.=5.38

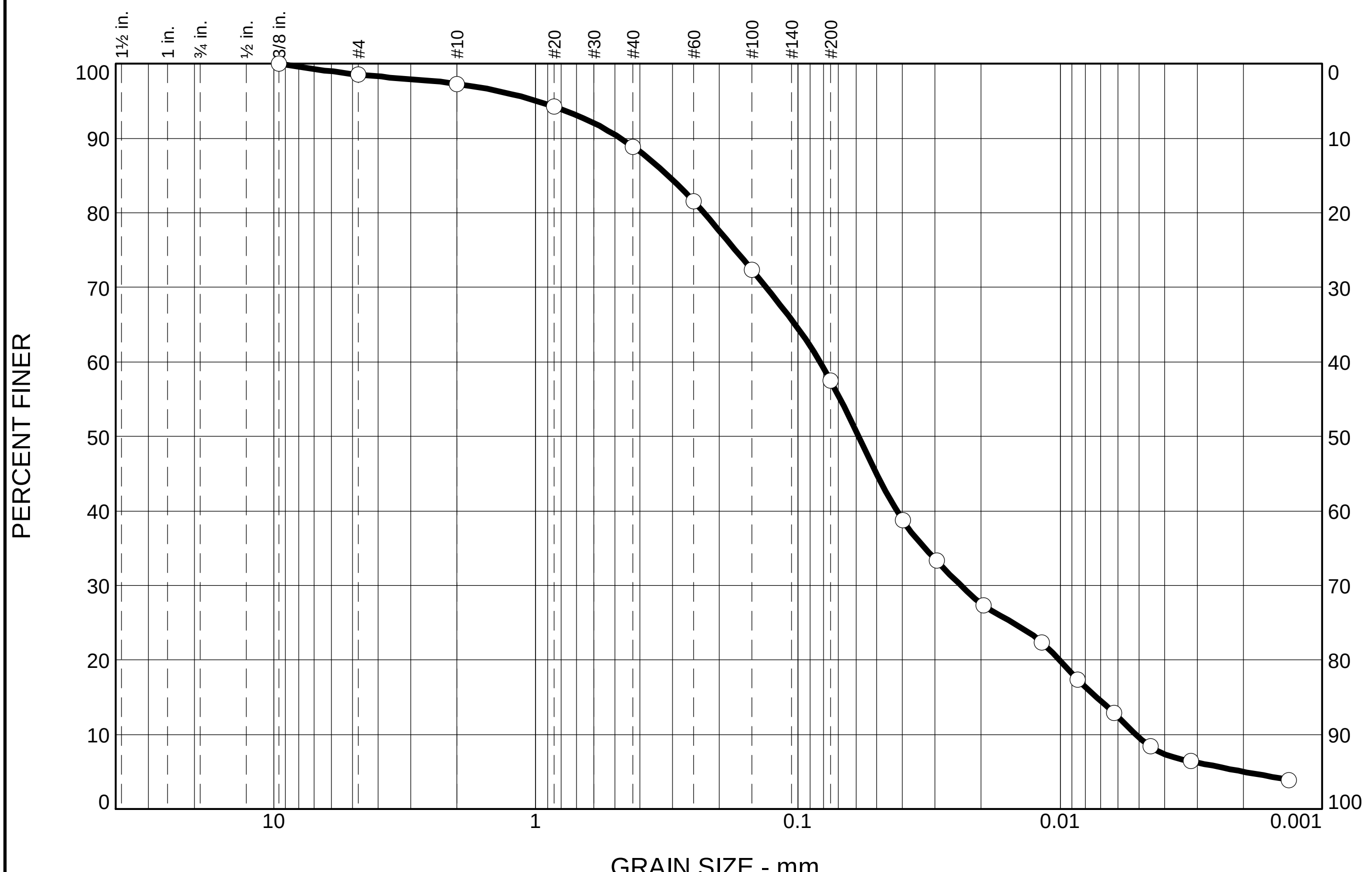
Source of Sample: HEN-B007 **Depth:** 15.0'-16.5'
Sample Number: S-6 **Date:** 12-9-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.5	1.2	8.4	31.4	47.9	9.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	98.5		
#10	97.3		
#20	94.2		
#40	88.9		
#60	81.6		
#100	72.3		
#200	57.5		

* (no specification provided)

DARK GRAY TO BLACK SANDY SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4739 D_{85}= 0.3125 D_{60}= 0.0824
D_{50}= 0.0587 D_{30}= 0.0239 D_{15}= 0.0073
D_{10}= 0.0051 C_u= 16.02 C_c= 1.35

Classification

USCS= ML AASHTO=

Remarks

F.M.=0.59

Source of Sample: HEN-B008 **Depth:** 5.0'-6.5'
Sample Number: S-3

Date: 12-4-15

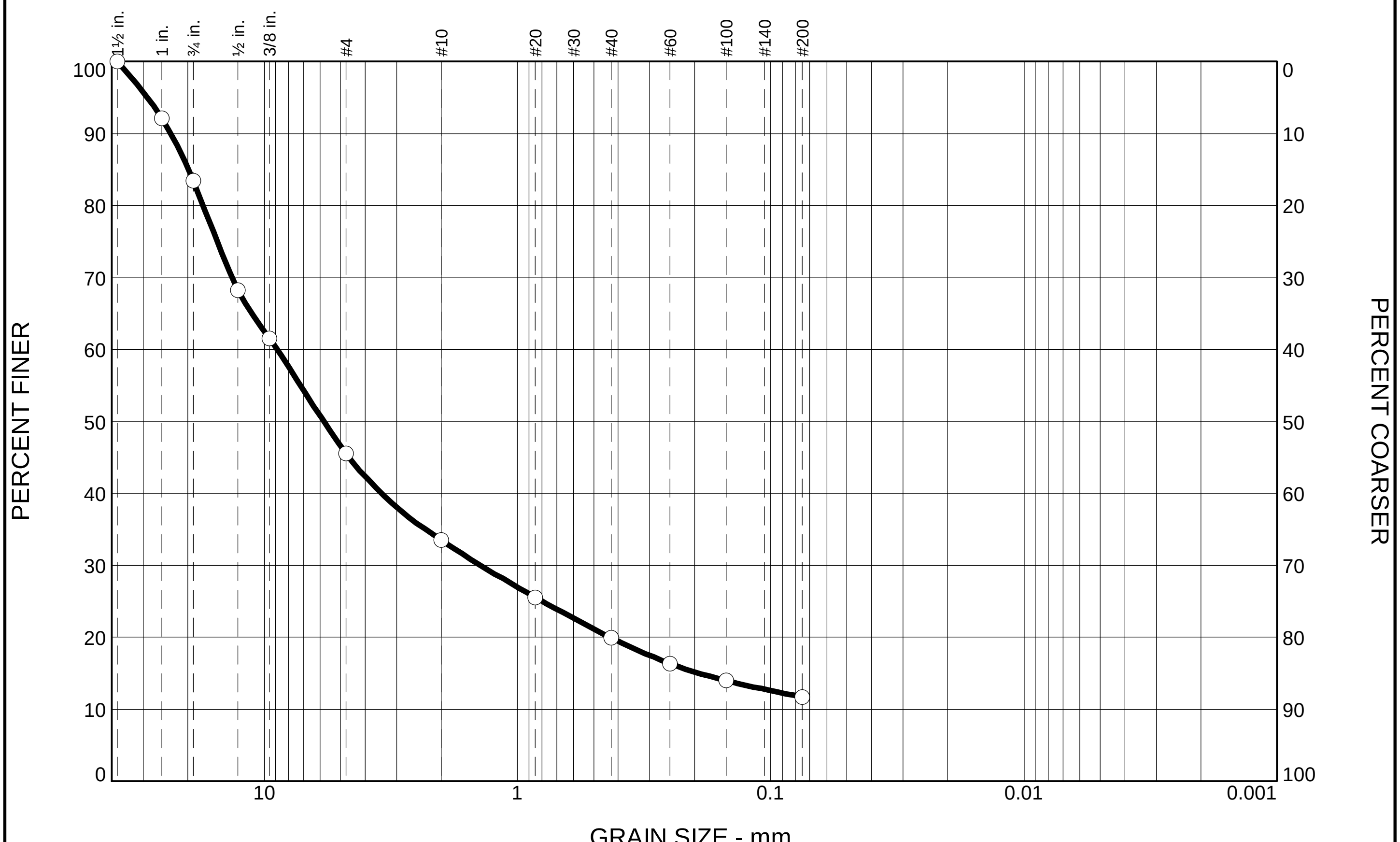
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	16.6	37.8	12.1	13.6	8.2	11.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	92.1		
.75	83.4		
.5	68.3		
.375	61.5		
#4	45.6		
#10	33.5		
#20	25.6		
#40	19.9		
#60	16.3		
#100	14.0		
#200	11.7		

* (no specification provided)

BROWN POORLY GRADED GRAVEL WITH SILT AND SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 23.4043 D_{85}= 19.9202 D_{60}= 8.8946
D_{50}= 5.8205 D_{30}= 1.3976 D_{15}= 0.1913
D_{10}= C_u= C_c=

Classification

USCS= GP-GM AASHTO=

Remarks

F.M.=4.92

Source of Sample: HEN-B008 **Depth:** 20.0'-21.5'
Sample Number: S-7

Date: 11-25-15

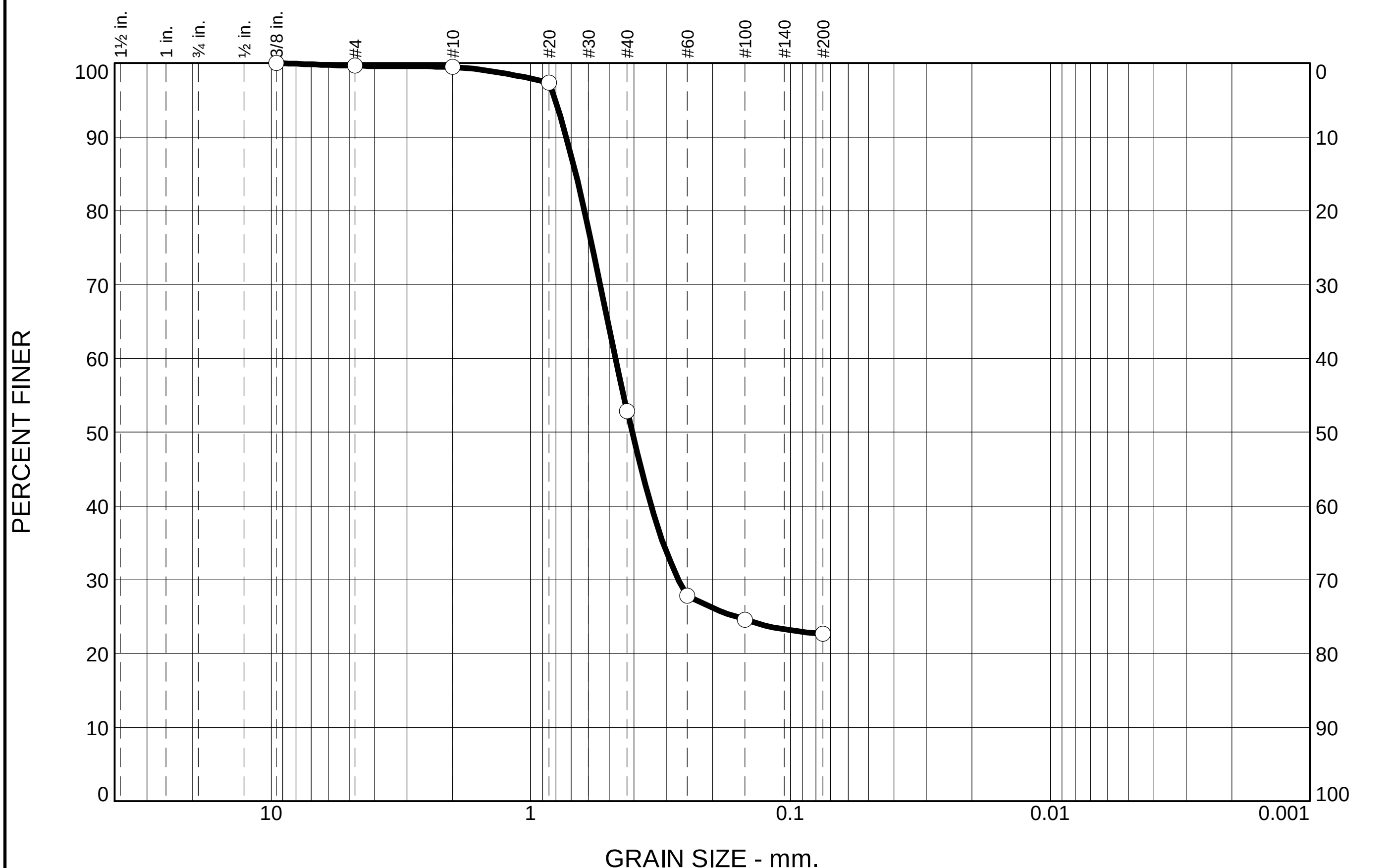
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.4	0.1	46.7	30.1	22.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.6		
#10	99.5		
#20	97.4		
#40	52.8		
#60	27.9		
#100	24.6		
#200	22.7		

* (no specification provided)

BROWN SILTY SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.7292 D_{85}= 0.6712 D_{60}= 0.4713
D_{50}= 0.4071 D_{30}= 0.2705 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

F.M.=1.67

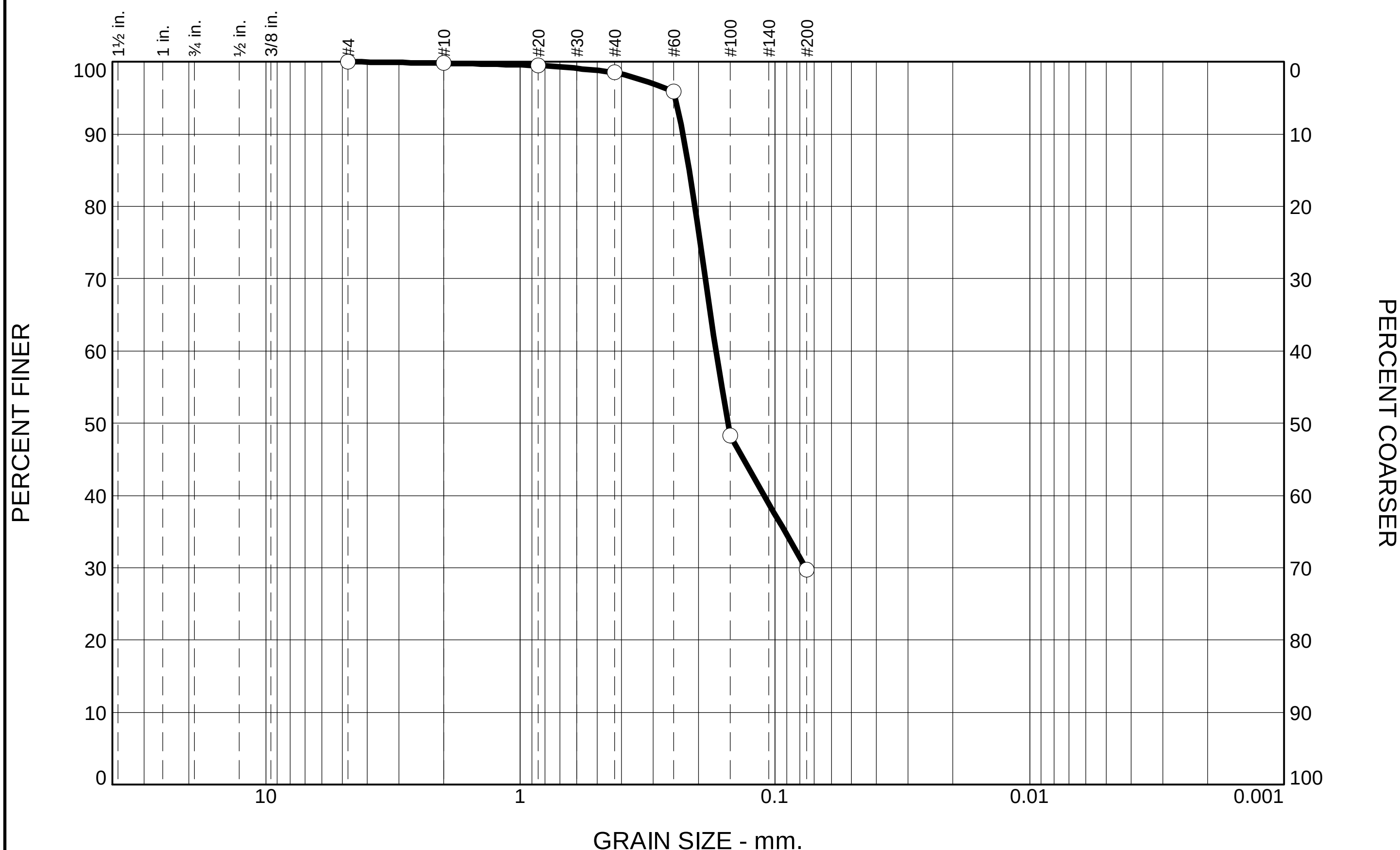
Source of Sample: HEN-B009 **Depth:** 25.0'-26.5'
Sample Number: S-8 **Date:** 11-25-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	1.3	68.8	29.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.8		
#20	99.5		
#40	98.5		
#60	95.9		
#100	48.3		
#200	29.7		

* (no specification provided)

BROWN SILTY SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2298 D_{85}= 0.2170 D_{60}= 0.1702
D_{50}= 0.1531 D_{30}= 0.0759 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

F.M.=0.56

Source of Sample: HEN-B009 **Depth:** 40.0'-41.5'
Sample Number: S-11 **Date:** 11-25-15

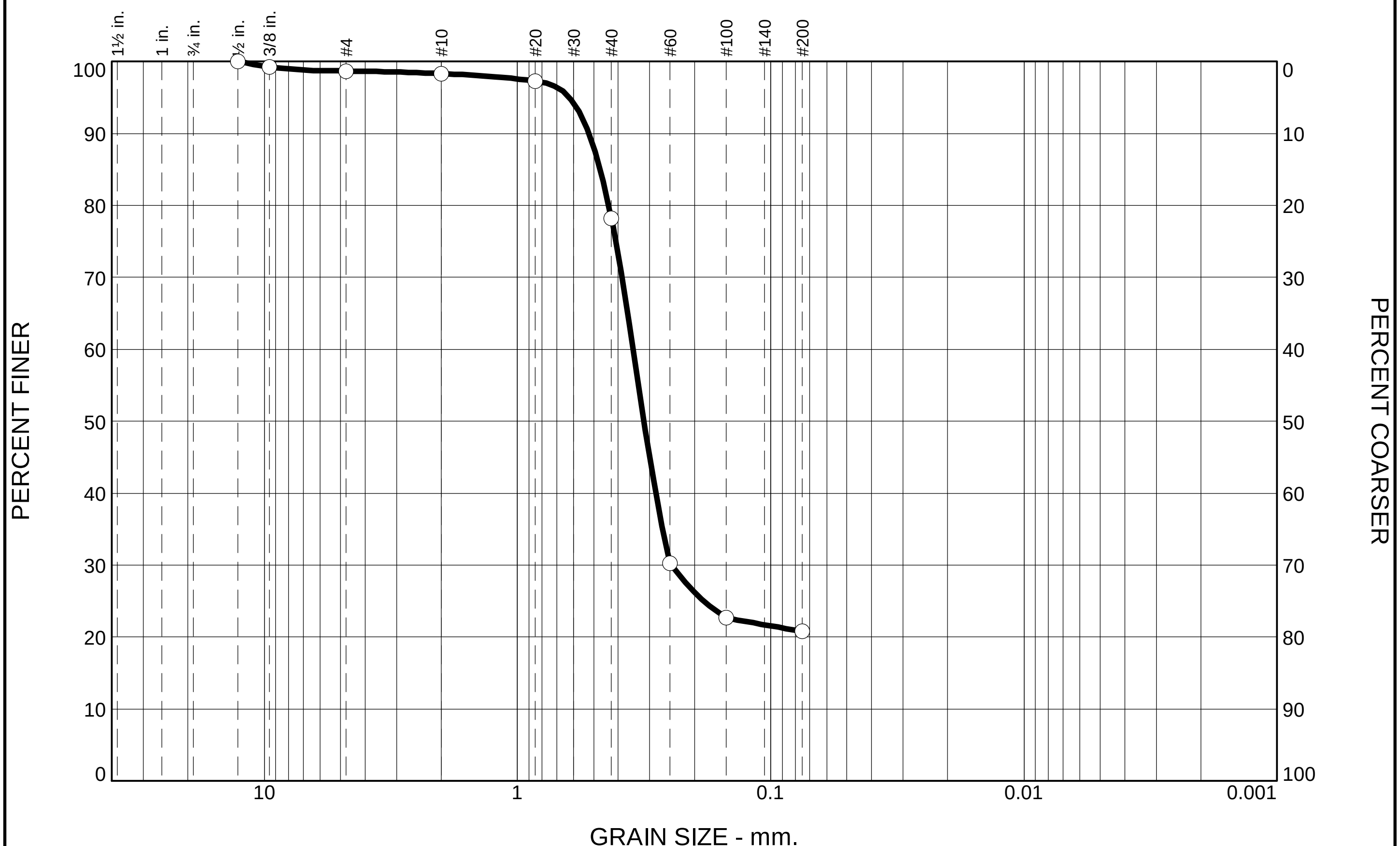
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.3	0.4	20.1	57.4	20.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.50	100.0		
.375	99.2		
#4	98.7		
#10	98.3		
#20	97.3		
#40	78.2		
#60	30.2		
#100	22.7		
#200	20.8		

* (no specification provided)

BROWN AND DARK BROWN SILTY SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5217 D_{85}= 0.4703 D_{60}= 0.3489
D_{50}= 0.3162 D_{30}= 0.2471 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

F.M.=1.44

Source of Sample: HEN-B010 **Depth:** 7.5'-9.0'
Sample Number: S-4

Date: 11-25-15

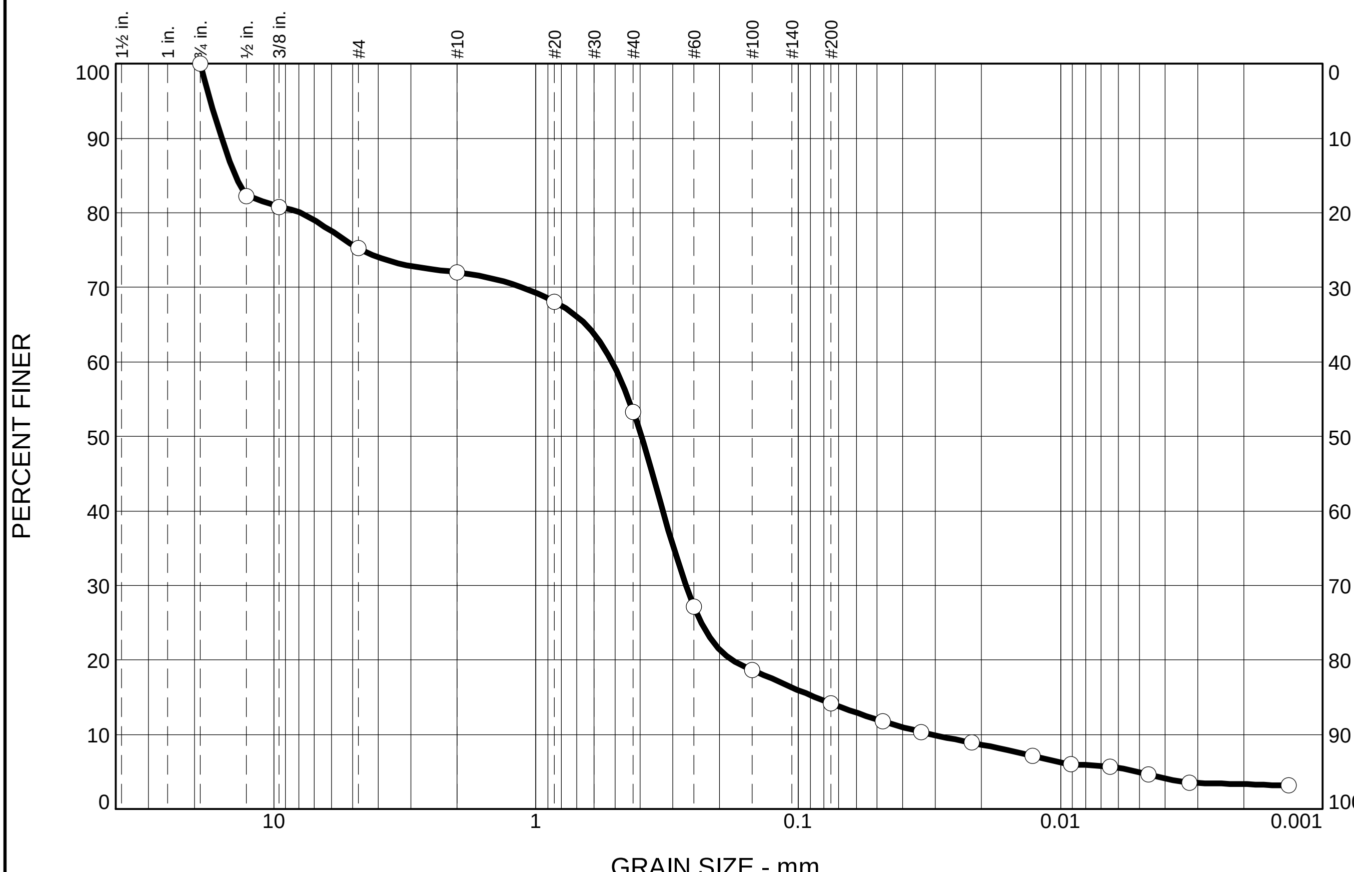
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	24.8	3.2	18.7	39.1	9.3	4.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	82.2		
.375	80.7		
#4	75.2		
#10	72.0		
#20	68.1		
#40	53.3		
#60	27.1		
#100	18.7		
#200	14.2		

* (no specification provided)

BROWN TO DARK BROWN POORLY GRADED SAND WITH SILT AND GRAVEL

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 15.7800 D_{85}= 14.0146 D_{60}= 0.5125
D_{50}= 0.3959 D_{30}= 0.2684 D_{15}= 0.0861
D_{10}= 0.0310 C_u= 16.55 C_c= 4.54

Classification

USCS= SP-SM AASHTO=

Remarks

F.M.=2.84

Source of Sample: HEN-B010 **Depth:** 20.0'-21.5'
Sample Number: S-7

Date: 12-4-15

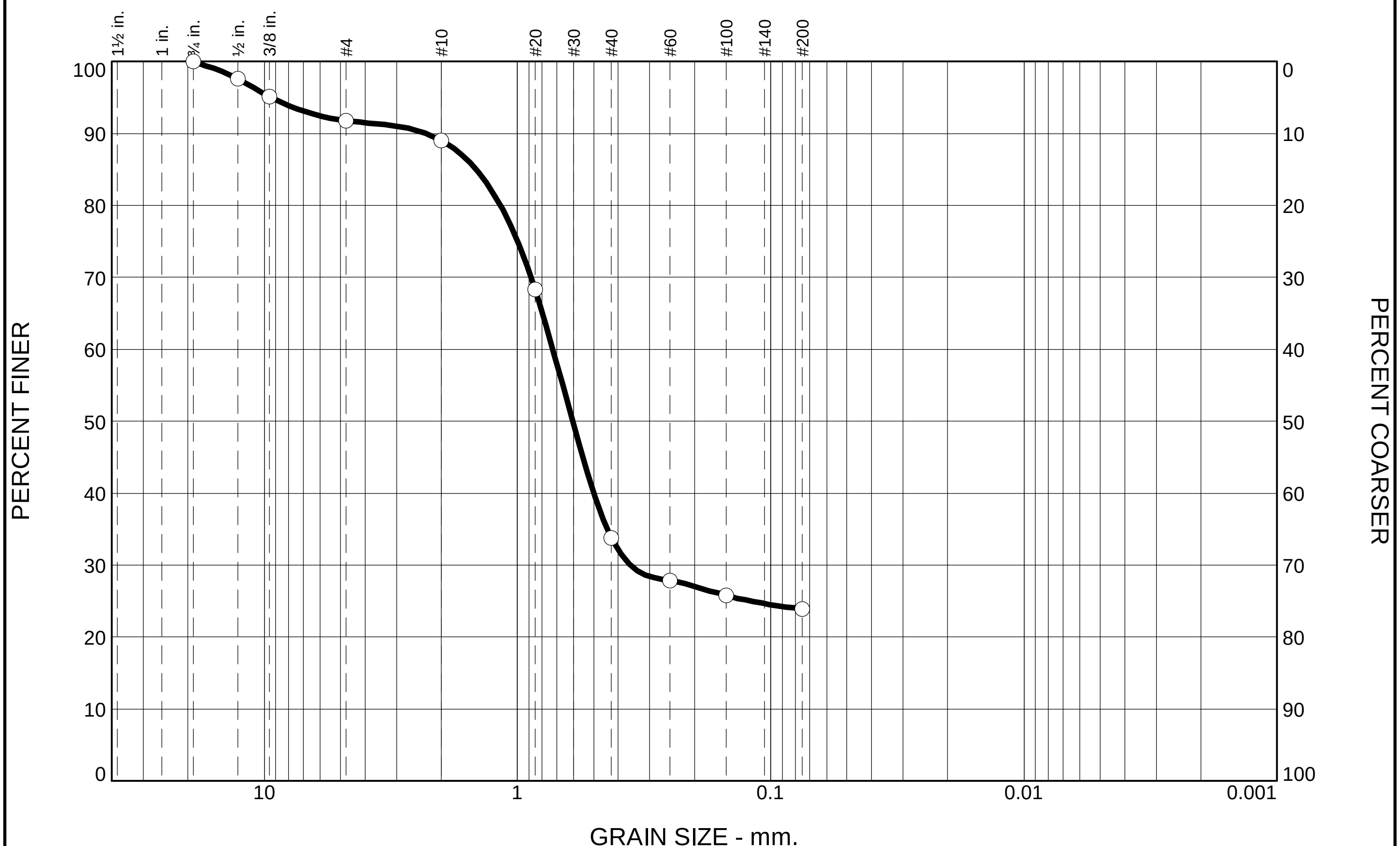
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	8.2	2.8	55.2	9.9	23.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	97.6		
.375	95.1		
#4	91.8		
#10	89.0		
#20	68.3		
#40	33.8		
#60	27.9		
#100	25.8		
#200	23.9		

* (no specification provided)

BROWN SILTY SAND WITH GRAVEL

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 2.3059 D_{85}= 1.4549 D_{60}= 0.7240
D_{50}= 0.6053 D_{30}= 0.3582 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

F.M.=2.39

Source of Sample: HEN-B010 **Depth:** 40.0'-41.5'
Sample Number: S-11

Date: 11-25-15

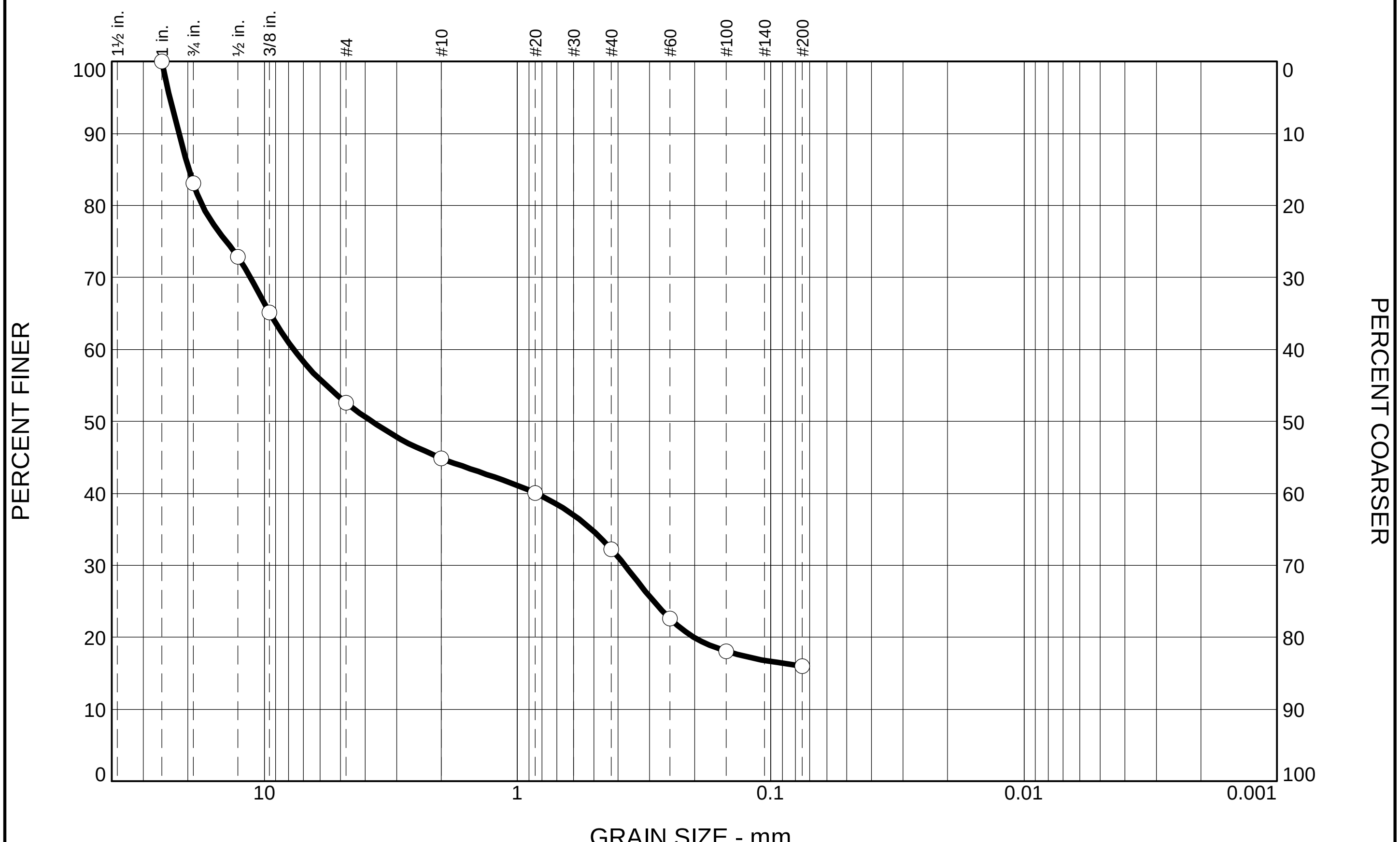
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	16.9	30.5	7.7	12.7	16.2	16.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	83.1		
.5	72.9		
.375	65.1		
#4	52.6		
#10	44.9		
#20	40.0		
#40	32.2		
#60	22.6		
#100	18.1		
#200	16.0		

* (no specification provided)

BROWN SILTY GRAVEL WITH SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 21.7378 D_{85}= 19.8442 D_{60}= 7.6494
D_{50}= 3.7604 D_{30}= 0.3762 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= GM AASHTO=

Remarks

F.M.=4.30

Source of Sample: HEN-B011 **Depth:** 15.0'-16.5'
Sample Number: S-6 **Date:** 11-25-15

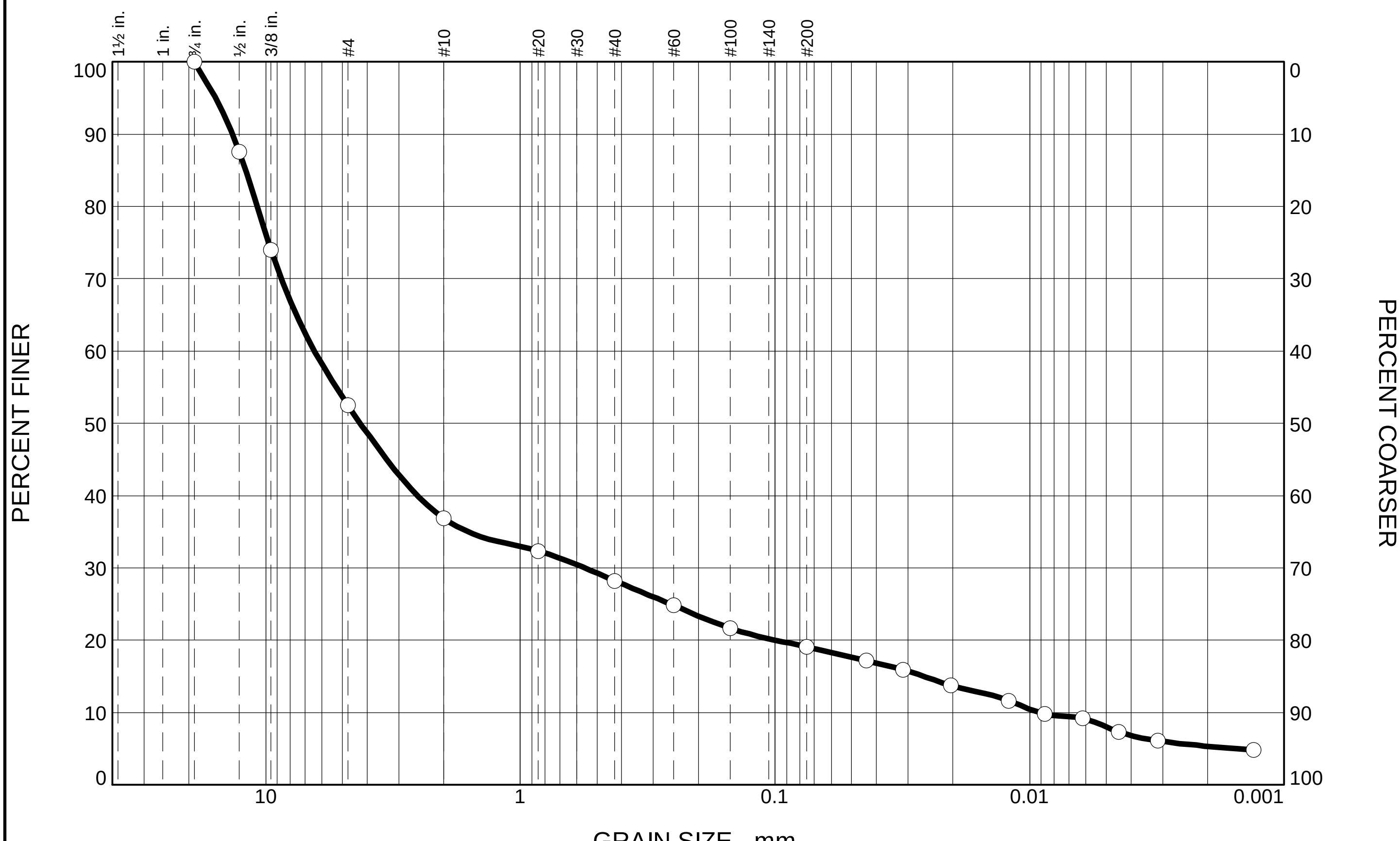
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	47.5	15.6	8.7	9.1	11.1	8.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	87.6		
.375	74.0		
#4	52.5		
#10	36.9		
#20	32.3		
#40	28.2		
#60	24.8		
#100	21.7		
#200	19.1		

* (no specification provided)

LIGHT BROWN AND LIGHT GRAY SILTY GRAVEL WITH SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 13.5067 D_{85}= 11.9845 D_{60}= 6.4325
D_{50}= 4.2474 D_{30}= 0.5575 D_{15}= 0.0261
D_{10}= 0.0092 C_u= 701.49 C_c= 5.27

Classification

USCS= GM AASHTO=

Remarks

F.M.=4.23

Source of Sample: HEN-B012 **Depth:** 2.5'-4.0'
Sample Number: S-2 **Date:** 12-4-15

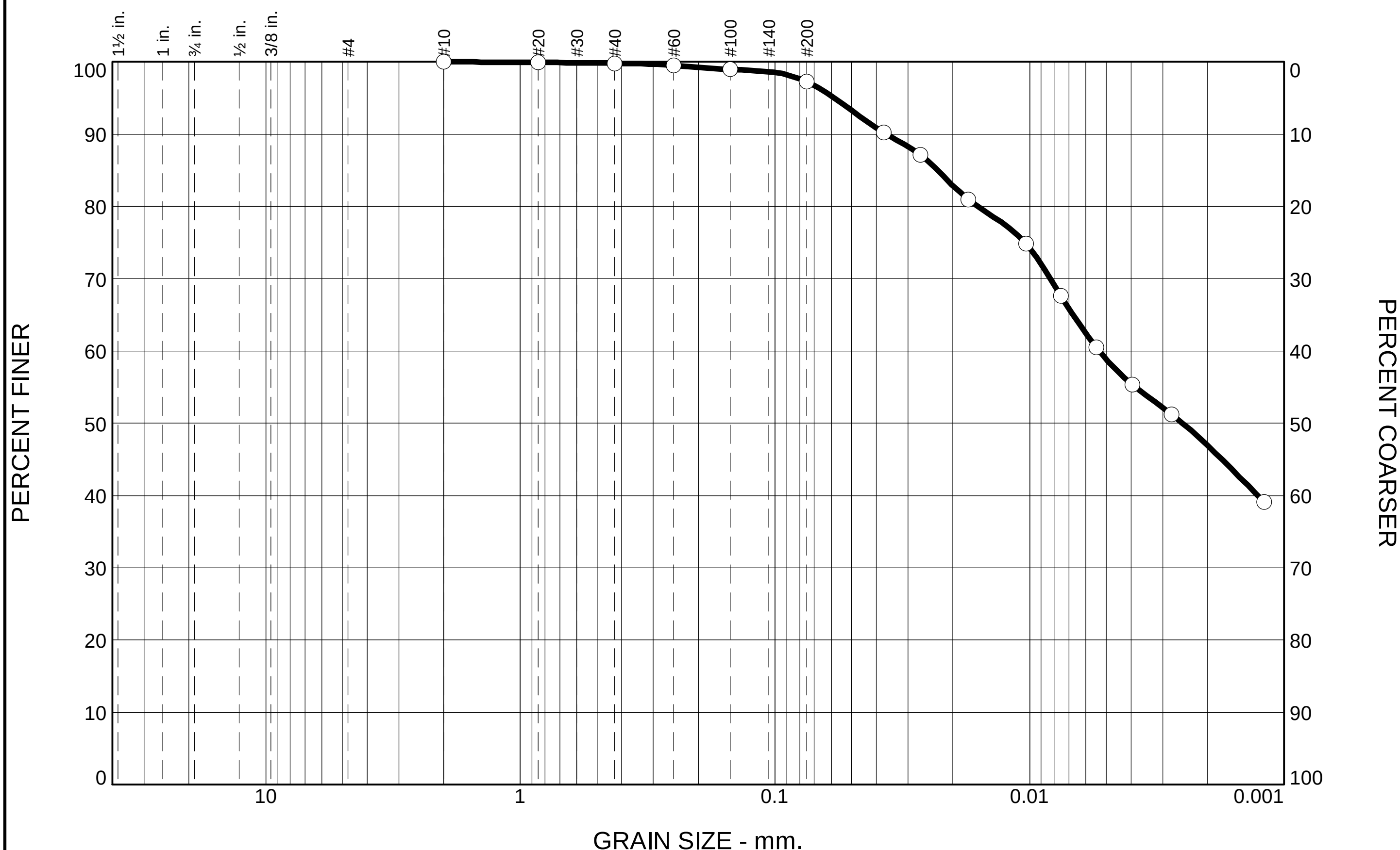
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	2.5	38.5	58.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.9		
#40	99.8		
#60	99.5		
#100	98.9		
#200	97.3		

* (no specification provided)

VERY DARK GRAY LEAN CLAY - ORGANICS NOTED

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0366 D_{85}= 0.0230 D_{60}= 0.0053
D_{50}= 0.0025 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

F.M.=0.02

Source of Sample: HEN-B012 **Depth:** 20.0'-22.0'
Sample Number: S-7 **Date:** 12-17-15

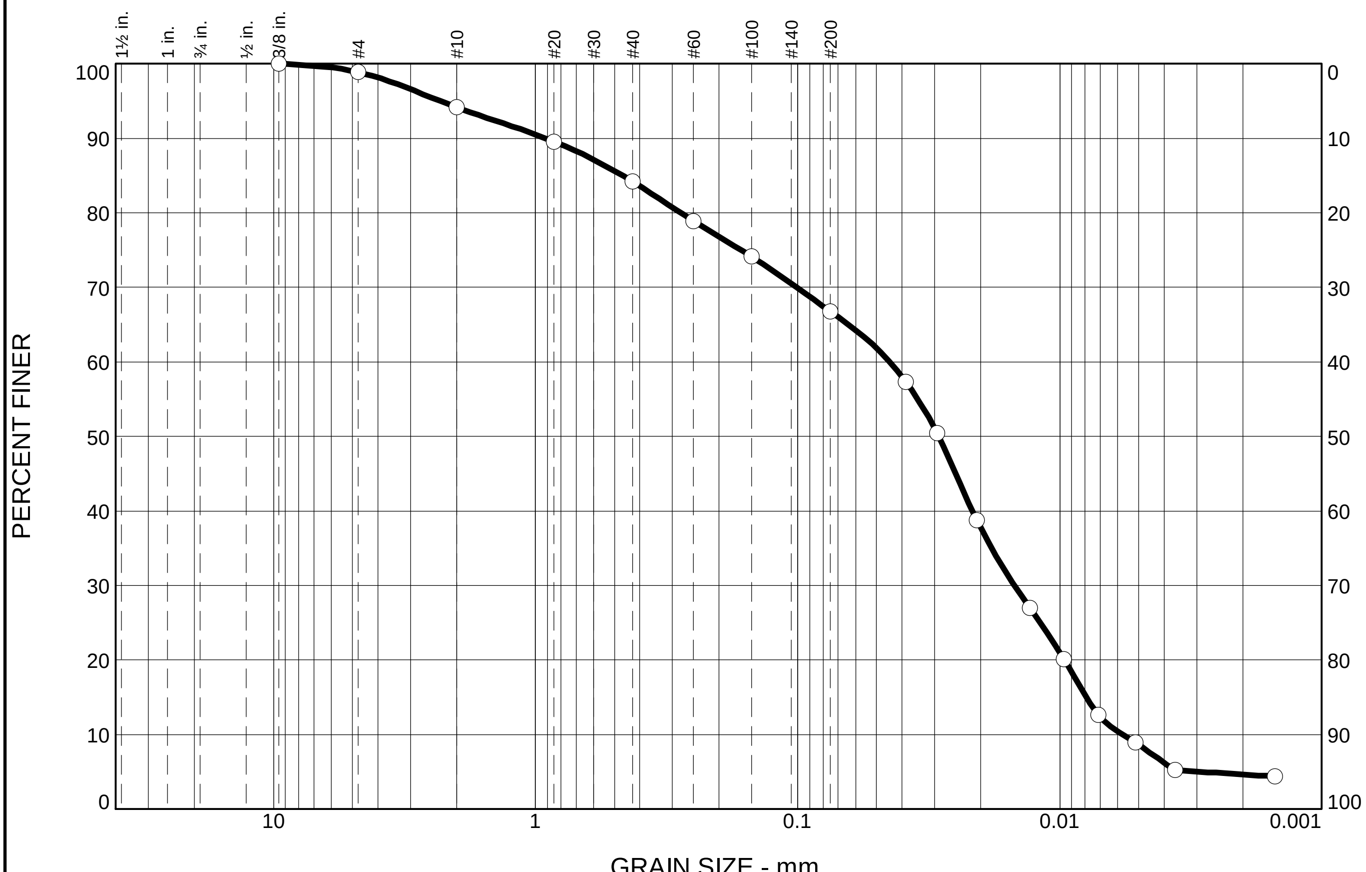
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.1	4.7	10.0	17.4	58.1	8.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	98.9		
#10	94.2		
#20	89.5		
#40	84.2		
#60	78.9		
#100	74.1		
#200	66.8		

* (no specification provided)

DARK GRAY FLY ASH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.9160 D_{85}= 0.4652 D_{60}= 0.0445
D_{50}= 0.0290 D_{30}= 0.0149 D_{15}= 0.0079
D_{10}= 0.0058 C_u= 7.71 C_c= 0.86

Classification

USCS= AASHTO=

Remarks

F.M.=0.73

Source of Sample: HEN-B014 **Depth:** 7.5'-9.0'
Sample Number: S-4

Date: 12-9-15

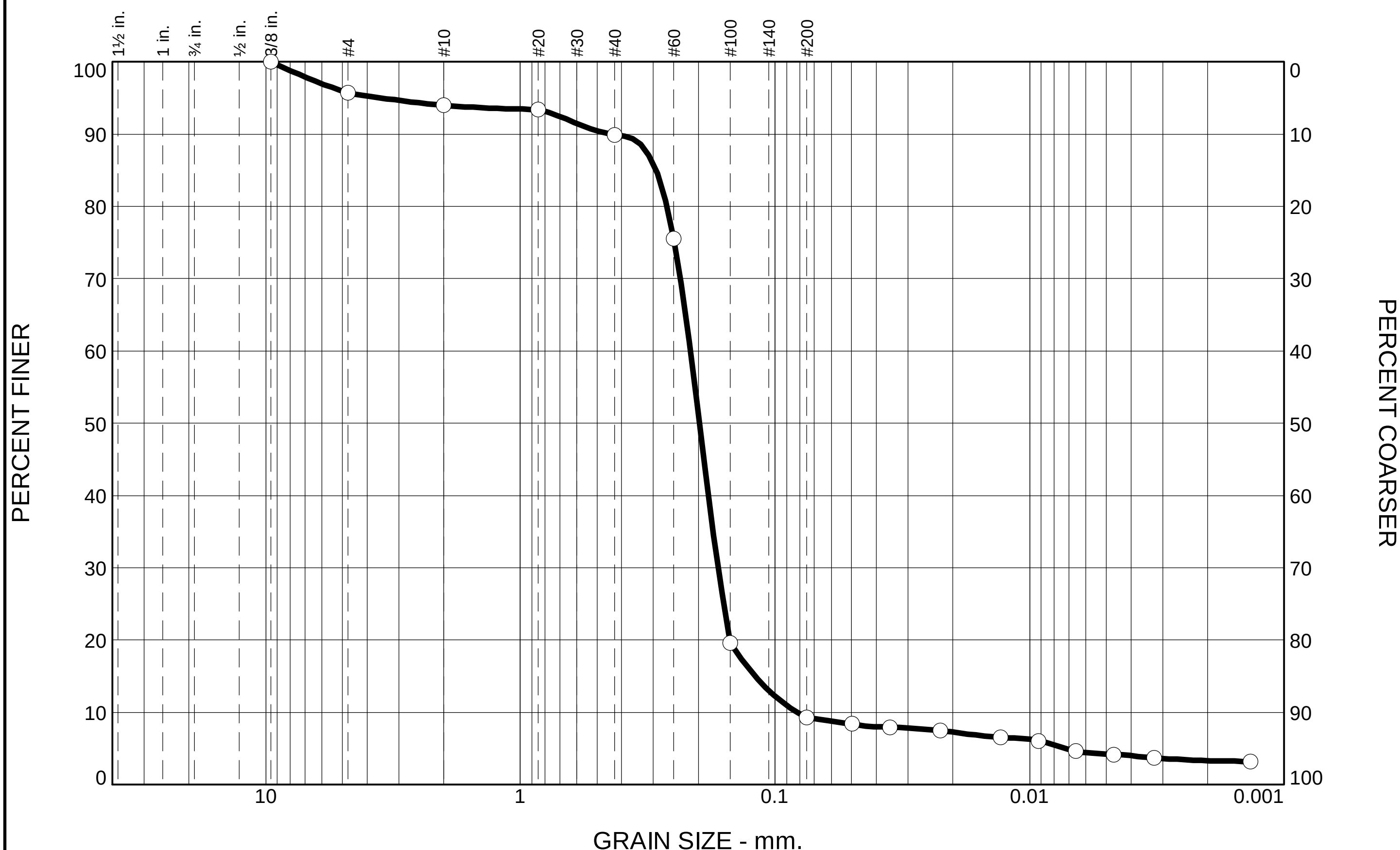
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.3	1.7	4.1	80.6	5.1	4.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	95.7		
#10	94.0		
#20	93.4		
#40	89.9		
#60	75.6		
#100	19.6		
#200	9.3		

* (no specification provided)

GRAY POORLY GRADED SAND WITH SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4408 D_{85}= 0.2931 D_{60}= 0.2146
D_{50}= 0.1976 D_{30}= 0.1670 D_{15}= 0.1195
D_{10}= 0.0819 C_u= 2.62 C_c= 1.59

Classification

USCS= SP-SM AASHTO=

Remarks

F.M.=1.20

Source of Sample: HEN-B014 **Depth:** 45.0'-46.5'
Sample Number: S-12

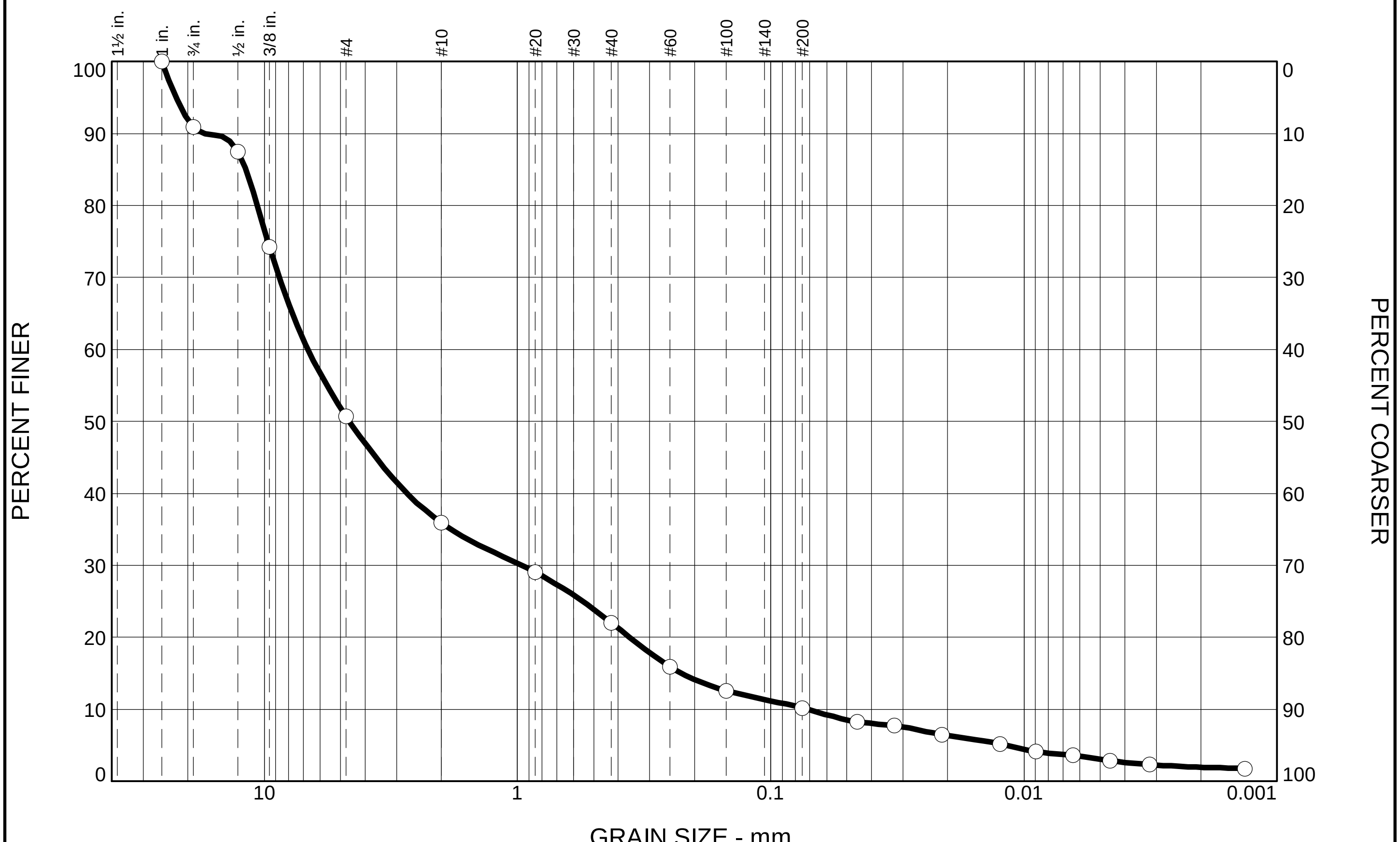
Date: 12-4-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.1	40.2	14.8	13.9	11.8	7.1	3.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	90.9		
.5	87.5		
.375	74.2		
#4	50.7		
#10	35.9		
#20	29.1		
#40	22.0		
#60	15.9		
#100	12.6		
#200	10.2		

* (no specification provided)

GRAY AND BROWN POORLY GRADED GRAVEL WITH SILT AND SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 17.2255 D_{85}= 11.8295 D_{60}= 6.7167
D_{50}= 4.6068 D_{30}= 0.9599 D_{15}= 0.2250
D_{10}= 0.0718 C_u= 93.58 C_c= 1.91

Classification

USCS= GP-GM AASHTO=

Remarks

F.M.=4.59

Source of Sample: HEN-B015 **Depth:** 45.0'-46.5'
Sample Number: S-12

Date: 12-4-15

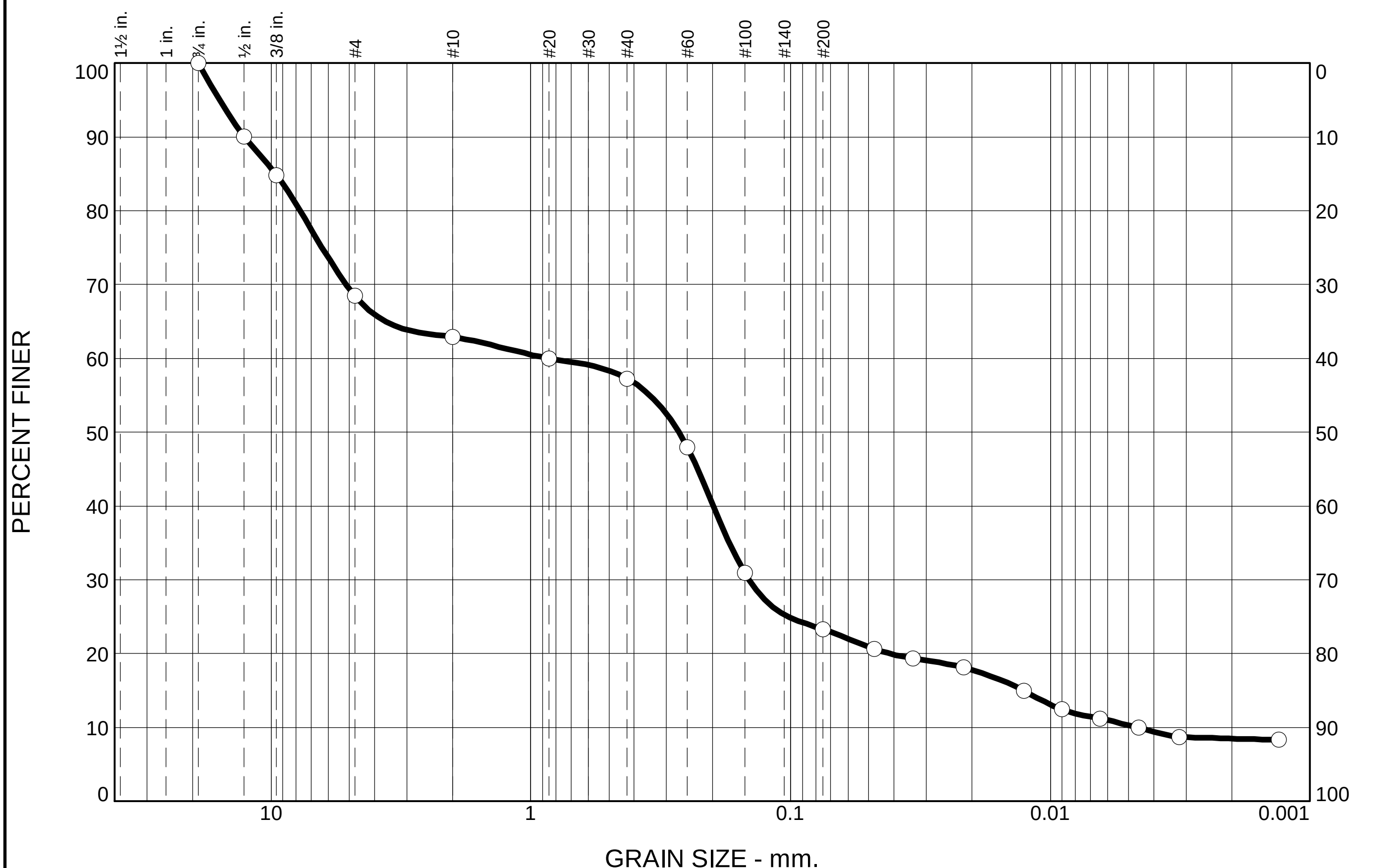
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	31.5	5.6	5.7	33.9	13.0	10.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	90.1		
.375	84.8		
#4	68.5		
#10	62.9		
#20	60.0		
#40	57.2		
#60	48.0		
#100	30.9		
#200	23.3		

* (no specification provided)

DARK BROWN AND BROWN SILTY SAND WITH GRAVEL

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 12.6514 D_{85}= 9.6003 D_{60}= 0.8530
D_{50}= 0.2690 D_{30}= 0.1447 D_{15}= 0.0127
D_{10}= 0.0046 C_u= 183.51 C_c= 5.28

Classification

USCS= AASHTO=

Remarks

F.M.=2.80

Source of Sample: HEN-B016 **Depth:** 5.0'-6.5'
Sample Number: S-3 **Date:** 12-9-15

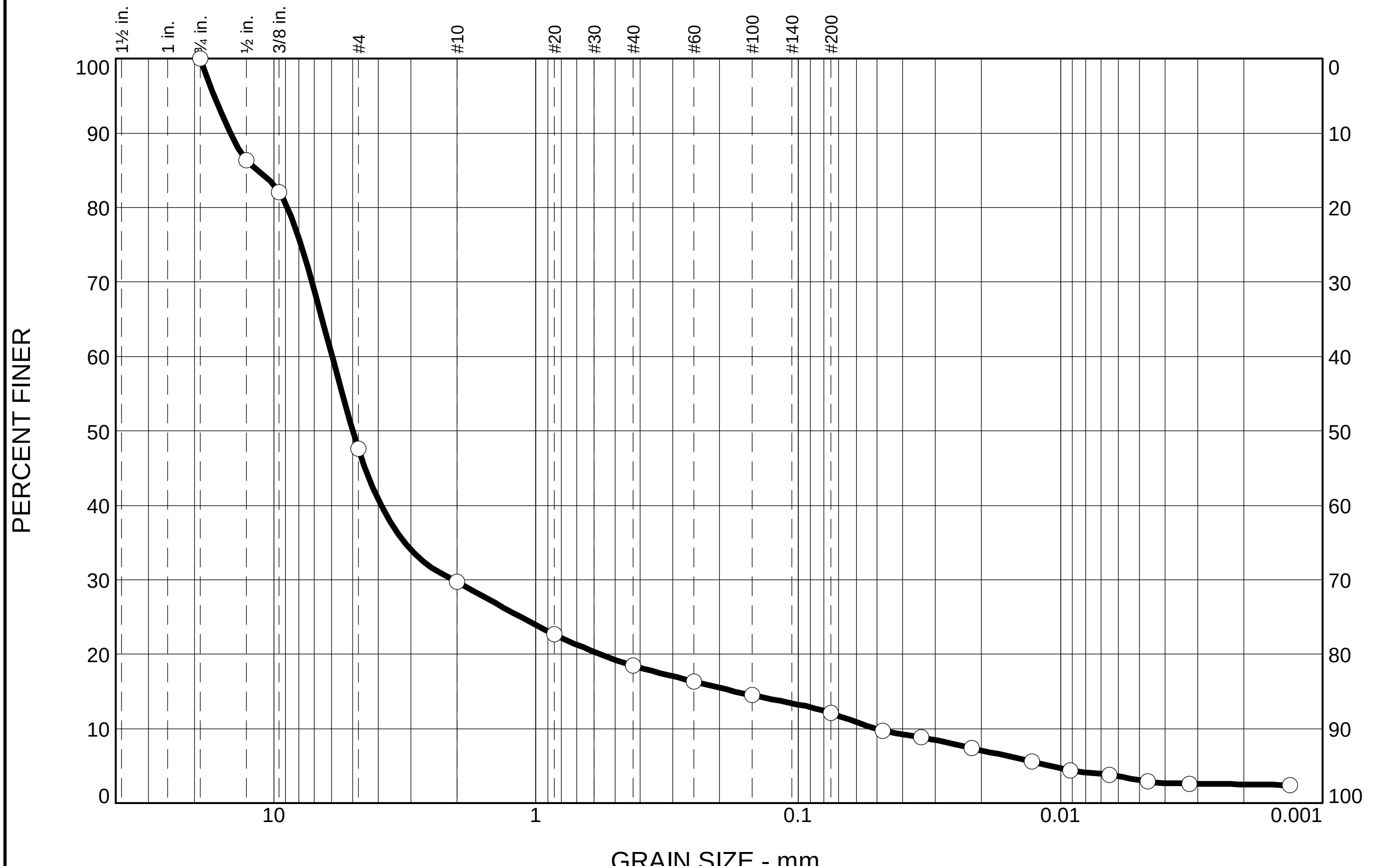
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	52.4	17.9	11.2	6.4	9.0	3.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	86.4		
.375	82.1		
#4	47.6		
#10	29.7		
#20	22.7		
#40	18.5		
#60	16.3		
#100	14.5		
#200	12.1		

* (no specification provided)

BROWNISH GRAY GRAVEL WITH SILT AND SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 14.6414 D_{85}= 11.5354 D_{60}= 5.9837
D_{50}= 4.9929 D_{30}= 2.0751 D_{15}= 0.1743
D_{10}= 0.0507 C_u= 117.95 C_c= 14.19

Classification

USCS= GP-GM AASHTO=

Remarks

F.M.=4.62

Source of Sample: HEN-B016 **Depth:** 70.0'-71.5'
Sample Number: S-17

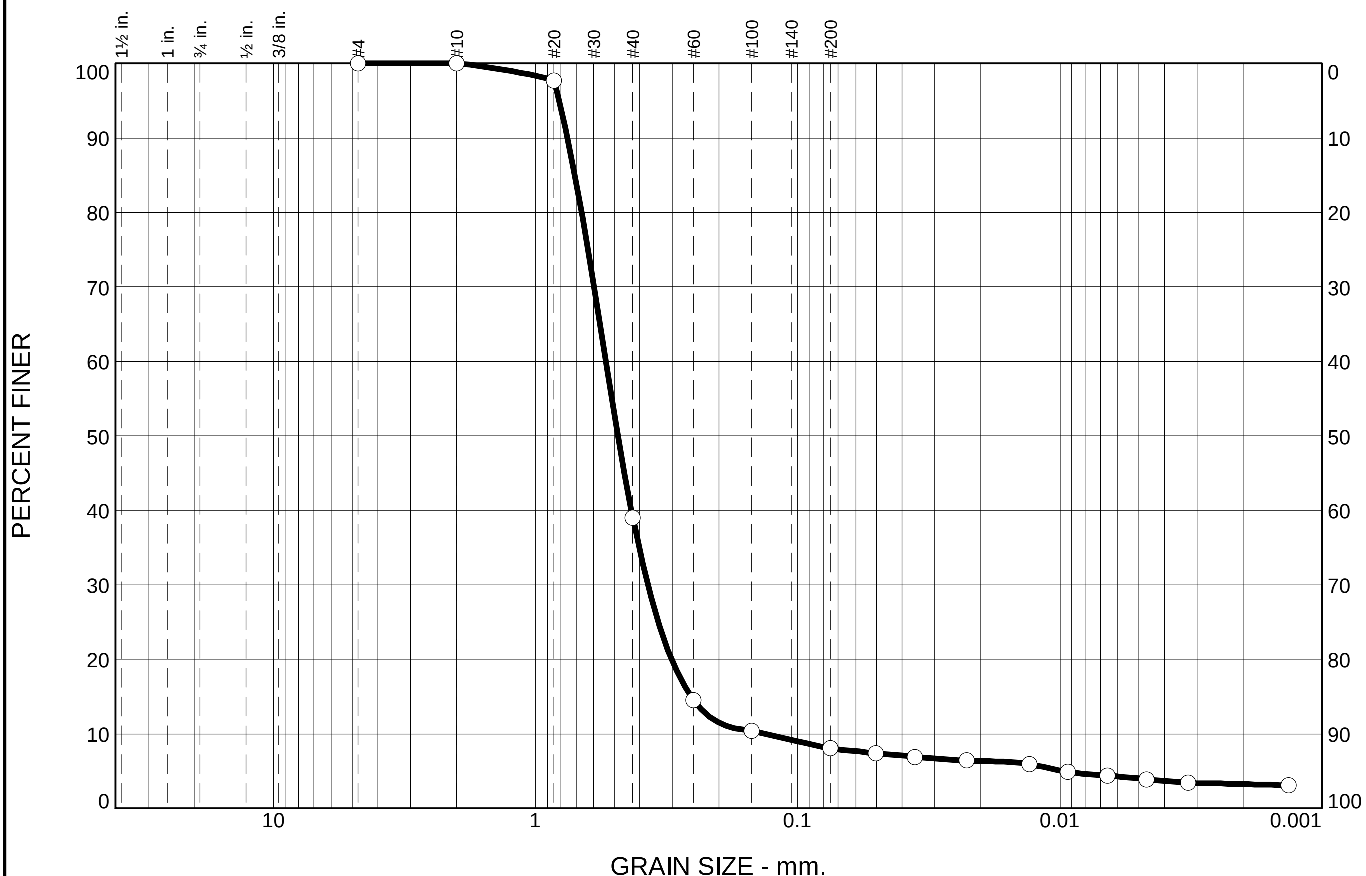
Date: 12-9-15

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	60.9	31.0	4.1	4.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	97.7		
#40	39.1		
#60	14.5		
#100	10.4		
#200	8.1		

* (no specification provided)

DARK GRAY SAND WITH SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.7541 D_{85}= 0.7076 D_{60}= 0.5389
D_{50}= 0.4840 D_{30}= 0.3721 D_{15}= 0.2553
D_{10}= 0.1325 C_u= 4.07 C_c= 1.94

Classification

USCS= SM AASHTO=

Remarks

F.M.=2.01

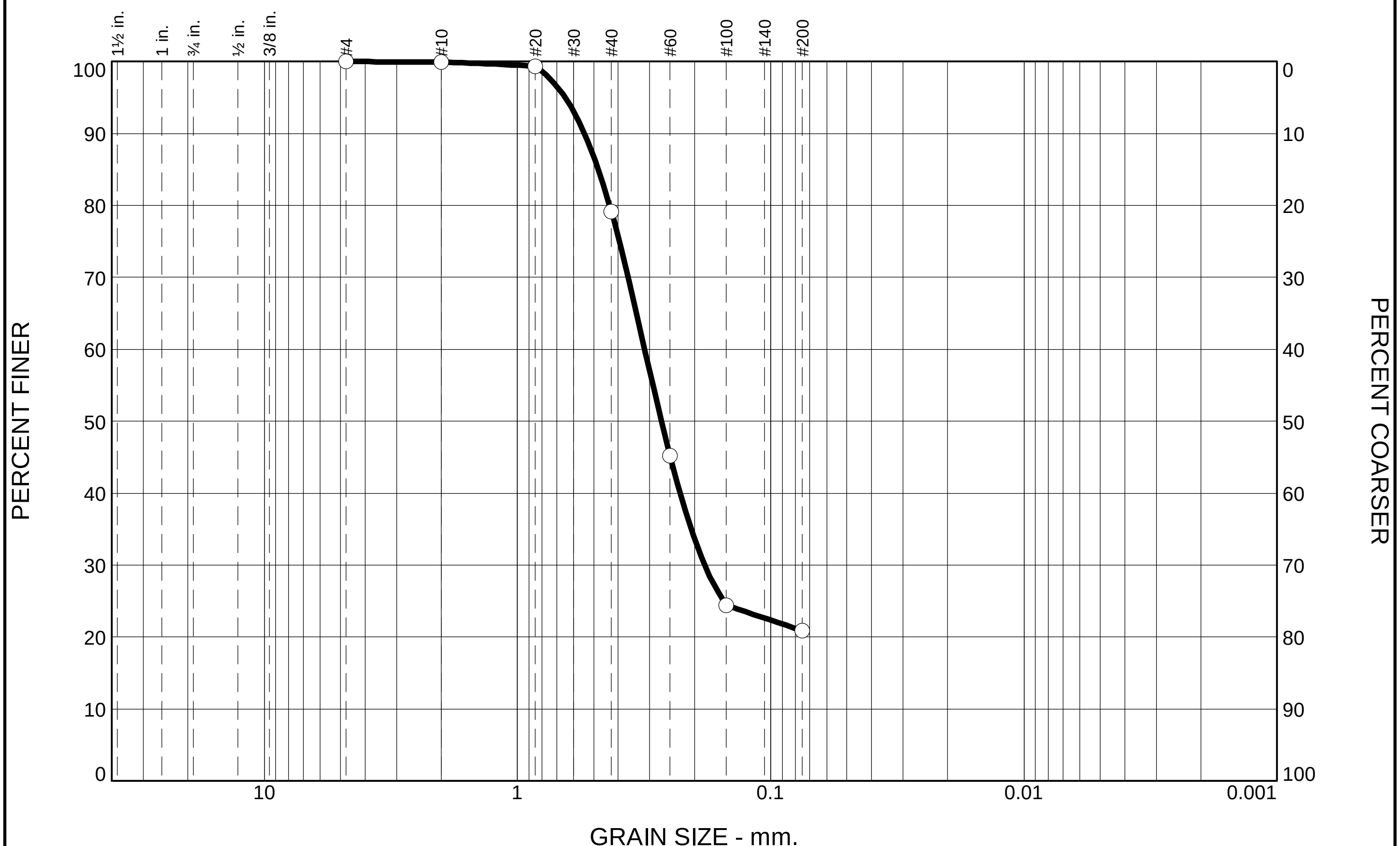
Source of Sample: HEN-B017 **Depth:** 45.0'-46.5'
Sample Number: S-12 **Date:** 12-9-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	20.7	58.3	20.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.3		
#40	79.2		
#60	45.2		
#100	24.4		
#200	20.9		

* (no specification provided)

GRAY AND BROWN SILTY SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5438 D_{85}= 0.4786 D_{60}= 0.3142
D_{50}= 0.2703 D_{30}= 0.1817 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

F.M.=1.26

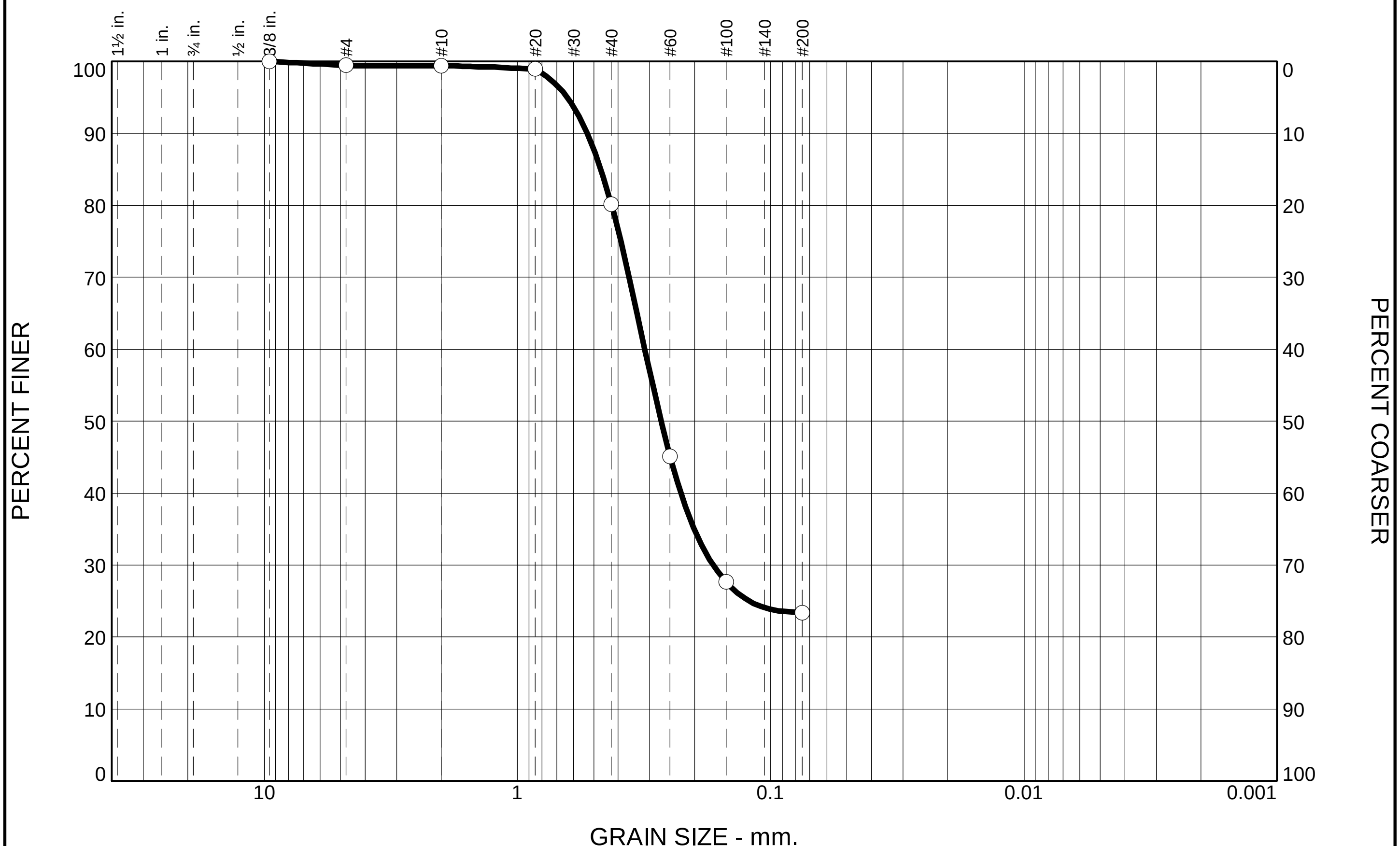
Source of Sample: HEN-B018 **Depth:** 55.0'-56.5'
Sample Number: S-14 **Date:** 12-7-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.5	0.1	19.3	56.7	23.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.5		
#10	99.4		
#20	99.0		
#40	80.1		
#60	45.2		
#100	27.7		
#200	23.4		

* (no specification provided)

BROWN AND GRAY SILTY SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5299 D_{85}= 0.4677 D_{60}= 0.3138
D_{50}= 0.2709 D_{30}= 0.1686 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

F.M.=1.24

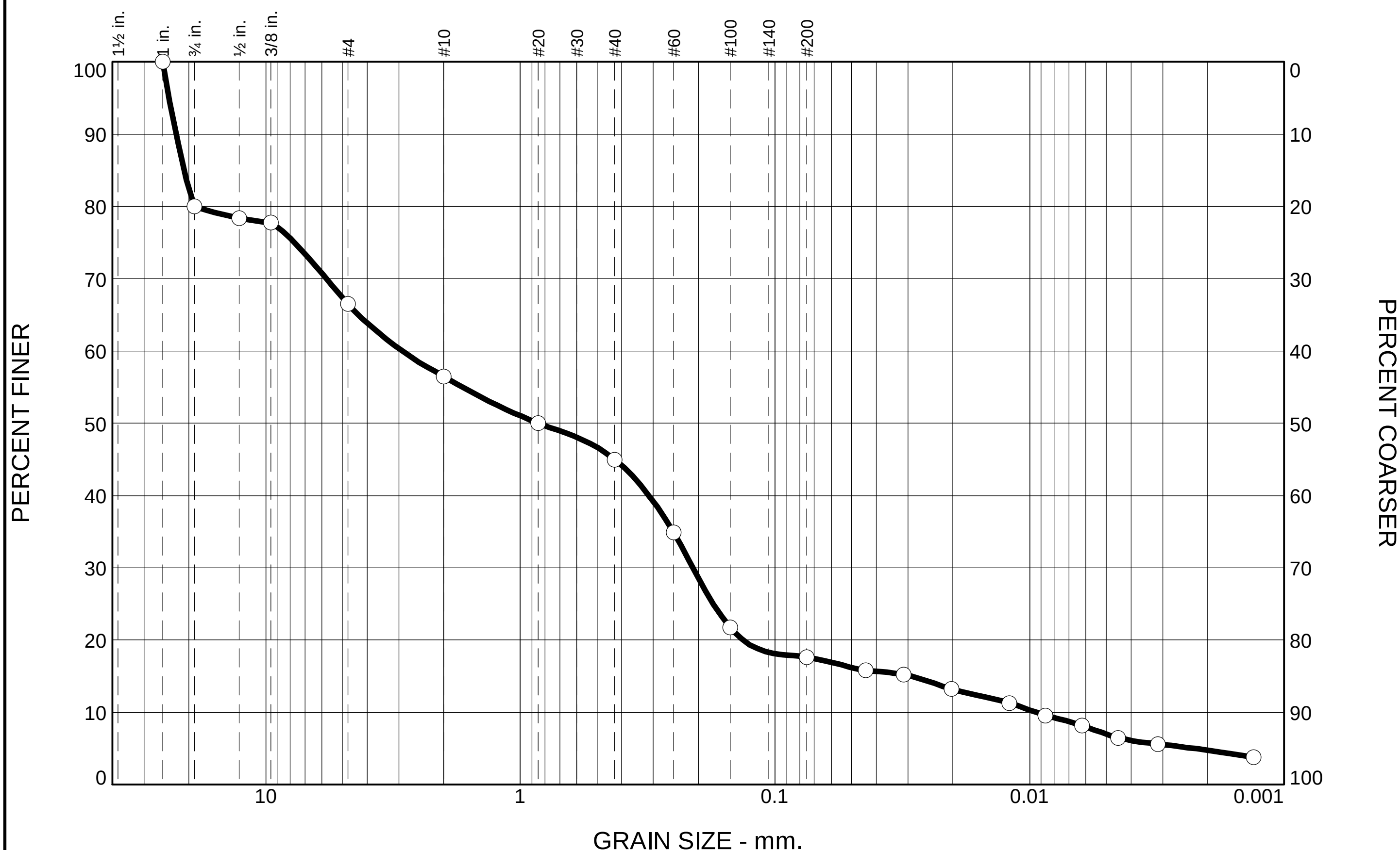
Source of Sample: HEN-B019 **Depth:** 40.0'-41.5'
Sample Number: S-10 **Date:** 12-7-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	20.0	13.5	10.0	11.5	27.4	10.6	7.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	80.0		
.5	78.4		
.375	77.7		
#4	66.5		
#10	56.5		
#20	50.0		
#40	45.0		
#60	34.8		
#100	21.7		
#200	17.6		

* (no specification provided)

BROWN AND REDDISH BROWN SILTY SAND WITH GRAVEL

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 22.4706 D_{85}= 20.9381 D_{60}= 2.9071
D_{50}= 0.8484 D_{30}= 0.2097 D_{15}= 0.0290
D_{10}= 0.0094 C_u= 309.22 C_c= 1.61

Classification

USCS= SM AASHTO=

Remarks

F.M.=3.57

Source of Sample: HEN-B020 **Depth:** 20.0'-21.4'
Sample Number: S-7

Date: 12-9-15

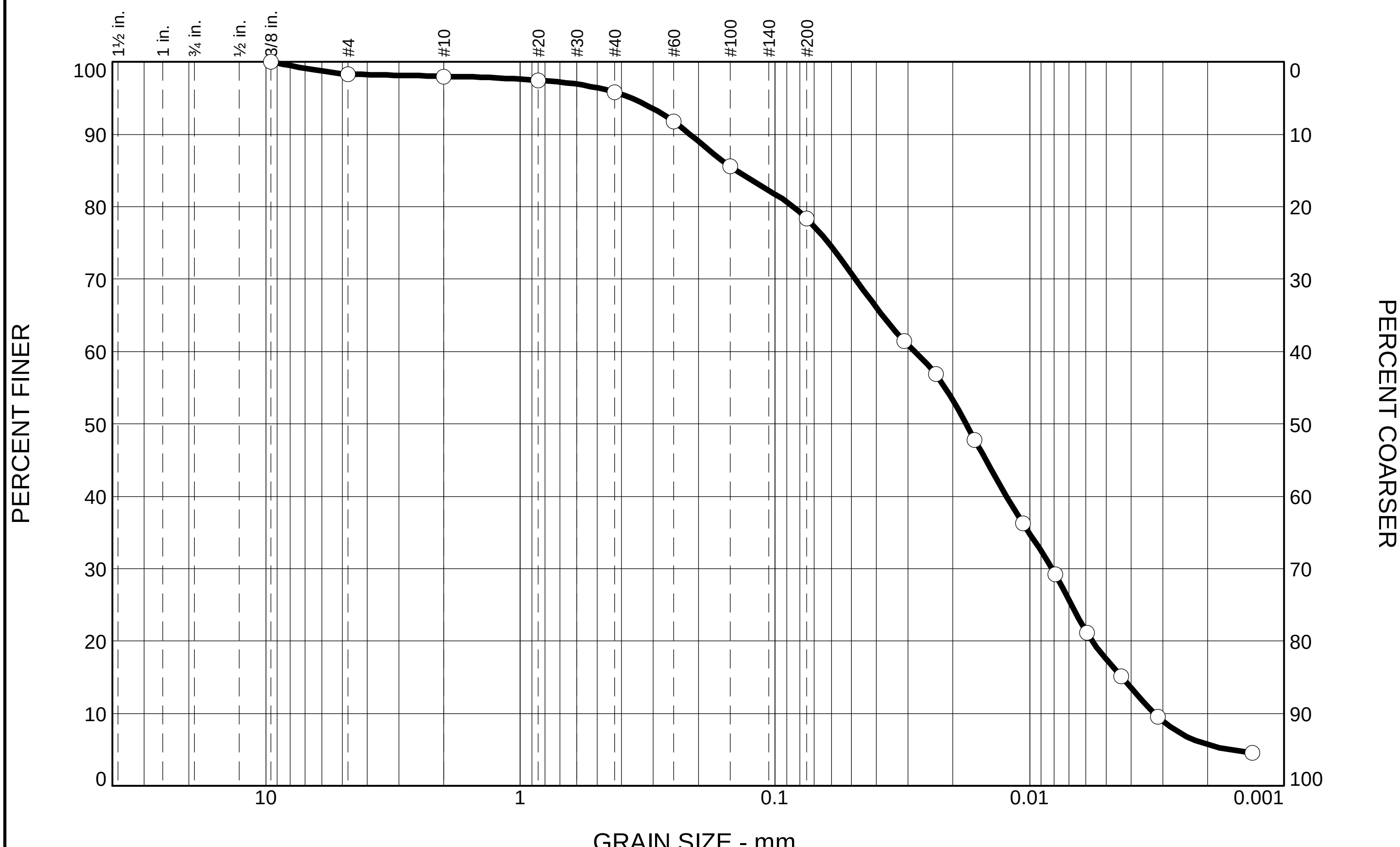
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.7	0.3	2.2	17.5	60.8	17.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	98.3		
#10	98.0		
#20	97.5		
#40	95.8		
#60	91.7		
#100	85.5		
#200	78.3		

* (no specification provided)

DARK GRAY VARVED FLY ASH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2157 D_{85}= 0.1423 D_{60}= 0.0283
D_{50}= 0.0178 D_{30}= 0.0082 D_{15}= 0.0043
D_{10}= 0.0032 C_u= 8.74 C_c= 0.73

Classification

USCS= AASHTO=

Remarks

F.M.=0.30

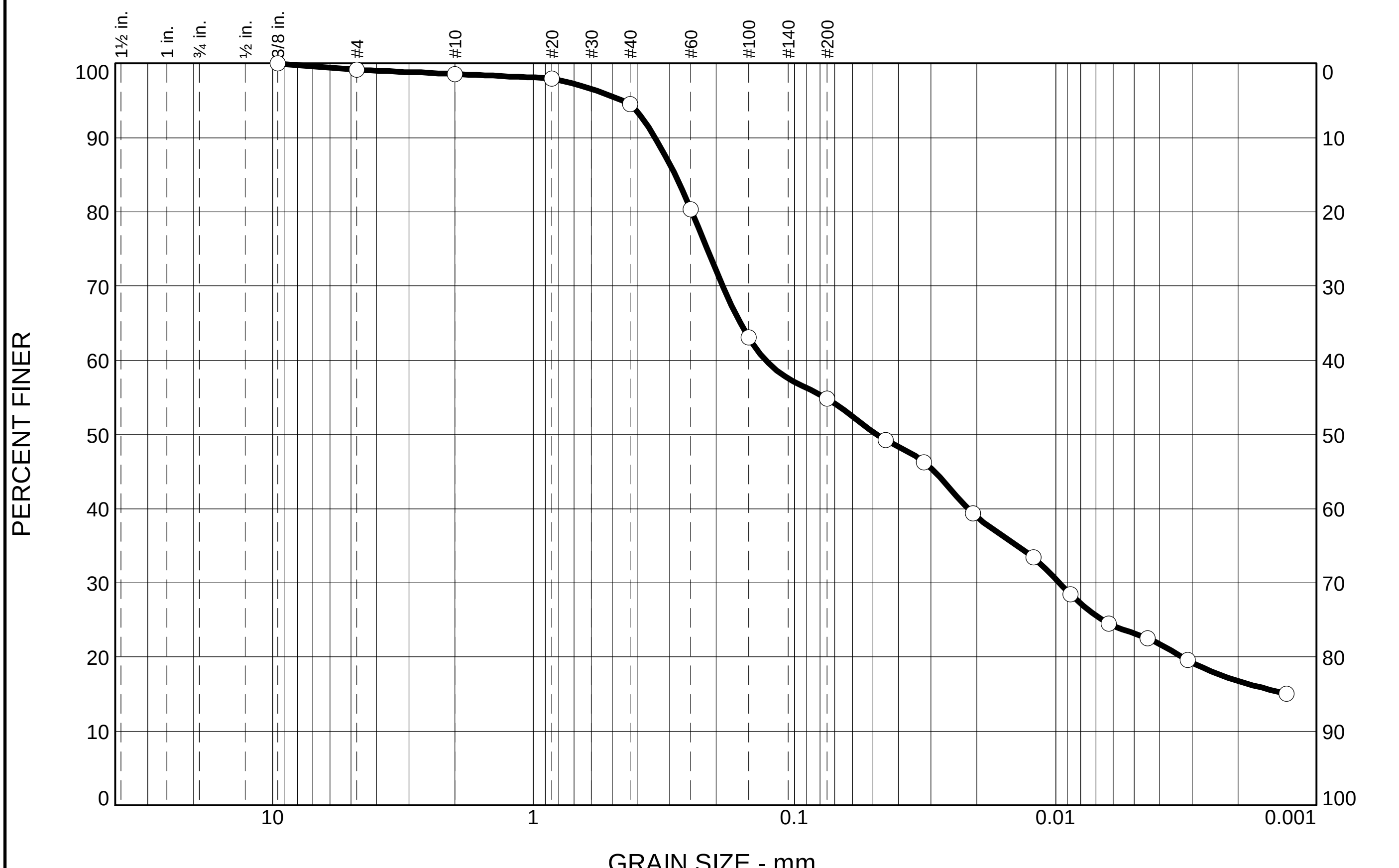
Source of Sample: HEN-B021 **Depth:** 22.0'-24.0'
Sample Number: S-8 **Date:** 12-17-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.9	0.5	4.1	39.7	31.6	23.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.1		
#10	98.6		
#20	98.0		
#40	94.5		
#60	80.4		
#100	63.1		
#200	54.8		

* (no specification provided)

DARK GRAY AND BLACK SILTY SAND WITH CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3417 D_{85}= 0.2870 D_{60}= 0.1290
D_{50}= 0.0484 D_{30}= 0.0097 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

F.M.=0.58

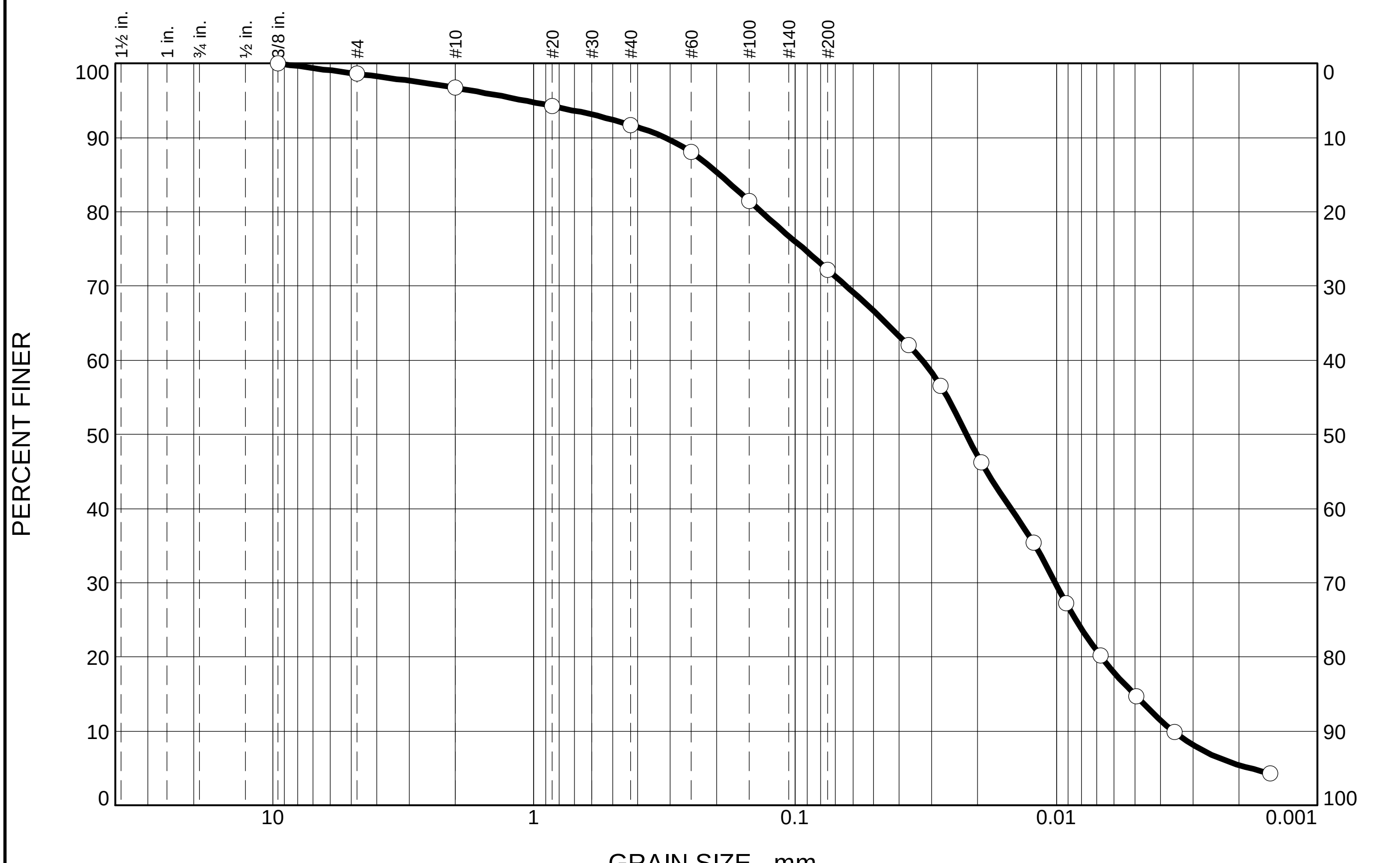
Source of Sample: HEN-B021 **Depth:** 35.0'-36.5'
Sample Number: S-11 **Date:** 12-9-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.4	1.9	5.0	19.5	57.3	14.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	98.6		
#10	96.7		
#20	94.2		
#40	91.7		
#60	88.0		
#100	81.5		
#200	72.2		

* (no specification provided)

VERY DARK GRAY VARVED FLY ASH WITH SAND - SAND SEAMS NOTED

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3145 D_{85}= 0.1939 D_{60}= 0.0327
D_{50}= 0.0221 D_{30}= 0.0101 D_{15}= 0.0050
D_{10}= 0.0036 C_u= 9.15 C_c= 0.88

Classification

USCS= AASHTO=

Remarks

F.M.=0.45

Source of Sample: HEN-B022 **Depth:** 7.5'-9.0'
Sample Number: S-4

Date: 12-15-15

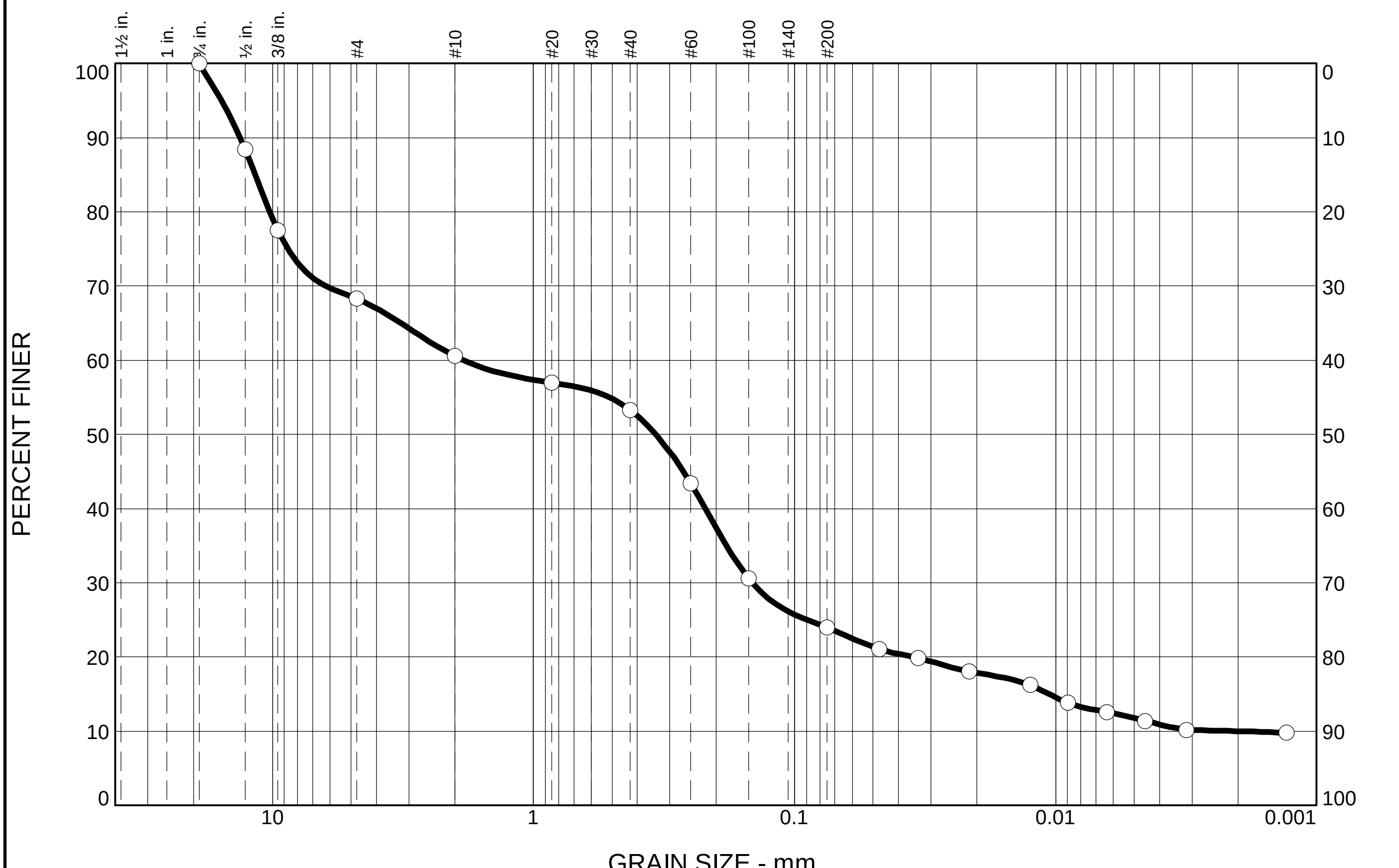
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	31.7	7.8	7.2	29.3	12.2	11.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	88.4		
.375	77.5		
#4	68.3		
#10	60.5		
#20	57.0		
#40	53.3		
#60	43.4		
#100	30.6		
#200	24.0		

* (no specification provided)

BROWN AND TAN SILTY SAND WITH GRAVEL

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 13.2956 D_{85}= 11.6290 D_{60}= 1.8552
D_{50}= 0.3396 D_{30}= 0.1452 D_{15}= 0.0106
D_{10}= 0.0021 C_u= 894.27 C_c= 5.48

Classification

USCS= SM AASHTO=

Remarks

F.M.=3.00

Source of Sample: HEN-B023 **Depth:** 2.5'-4.0'
Sample Number: S-2

Date: 12-9-15

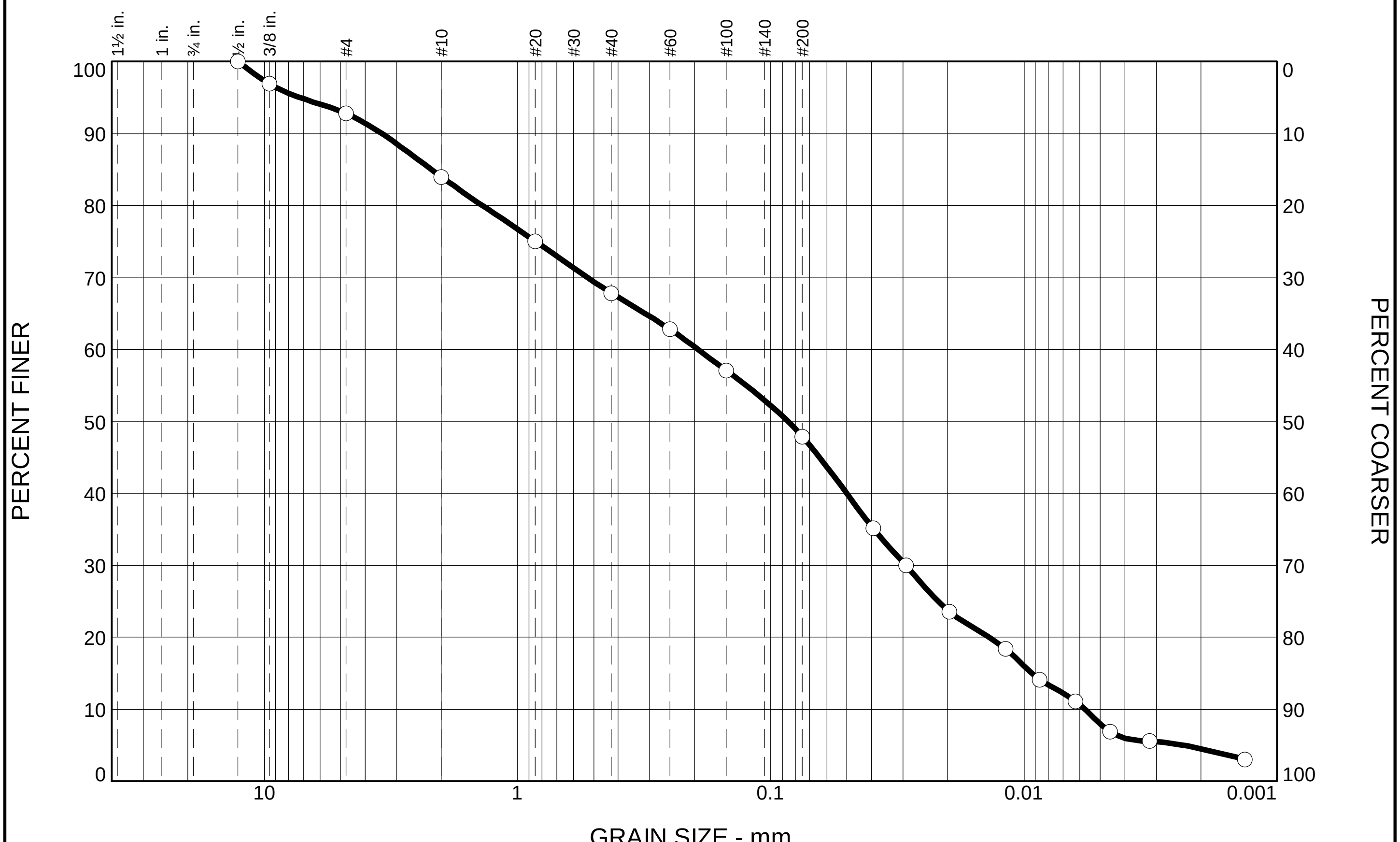
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.2	8.8	16.2	19.9	39.9	8.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.5	100.0		
.375	96.9		
#4	92.8		
#10	84.0		
#20	75.0		
#40	67.8		
#60	62.8		
#100	57.1		
#200	47.9		

* (no specification provided)

DARK GRAY AND BLACK SILTY SAND AND FLY ASH - CINDERS NOTED

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 3.4369 D_{85}= 2.1877 D_{60}= 0.1934
D_{50}= 0.0854 D_{30}= 0.0293 D_{15}= 0.0093
D_{10}= 0.0058 C_u= 33.63 C_c= 0.77

Classification

USCS= SM AASHTO=

Remarks

F.M.=1.53

Source of Sample: HEN-B023 **Depth:** 20.0'-21.5'
Sample Number: S-7

Date: 12-17-15

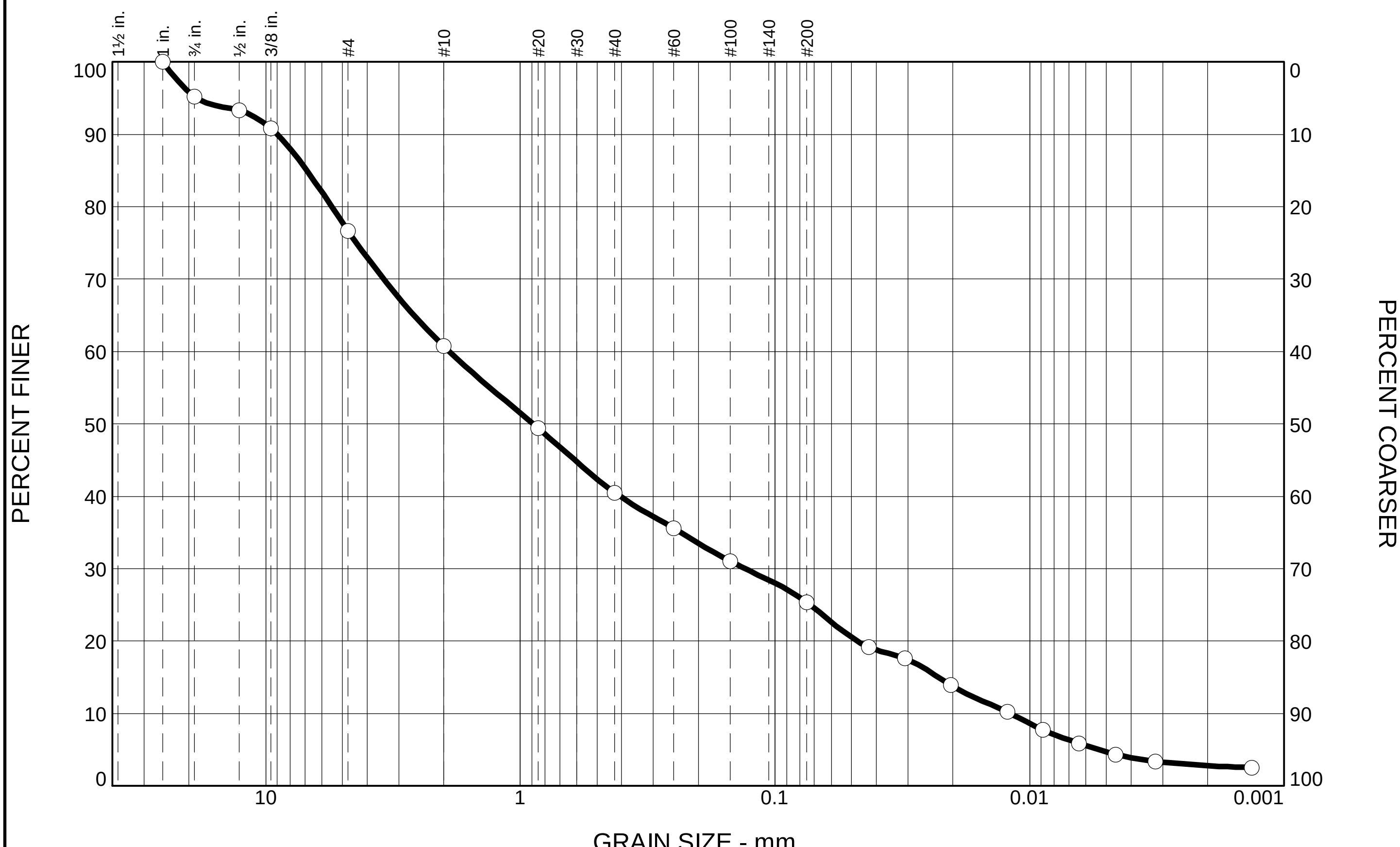
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.8	18.5	16.0	20.2	15.2	20.6	4.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	95.2		
.5	93.3		
.375	90.8		
#4	76.7		
#10	60.7		
#20	49.4		
#40	40.5		
#60	35.6		
#100	31.0		
#200	25.3		

* (no specification provided)

DARK GRAY FLY ASH WITH SAND AND CINDERS

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 9.0077 D_{85}= 6.8824 D_{60}= 1.9019
D_{50}= 0.8884 D_{30}= 0.1309 D_{15}= 0.0229
D_{10}= 0.0119 C_u= 159.31 C_c= 0.75

Classification

USCS= AASHTO=

Remarks

F.M.=3.07

Source of Sample: HEN-B023 **Depth:** 35.0'-36.5'
Sample Number: S-11 **Date:** 12-17-15

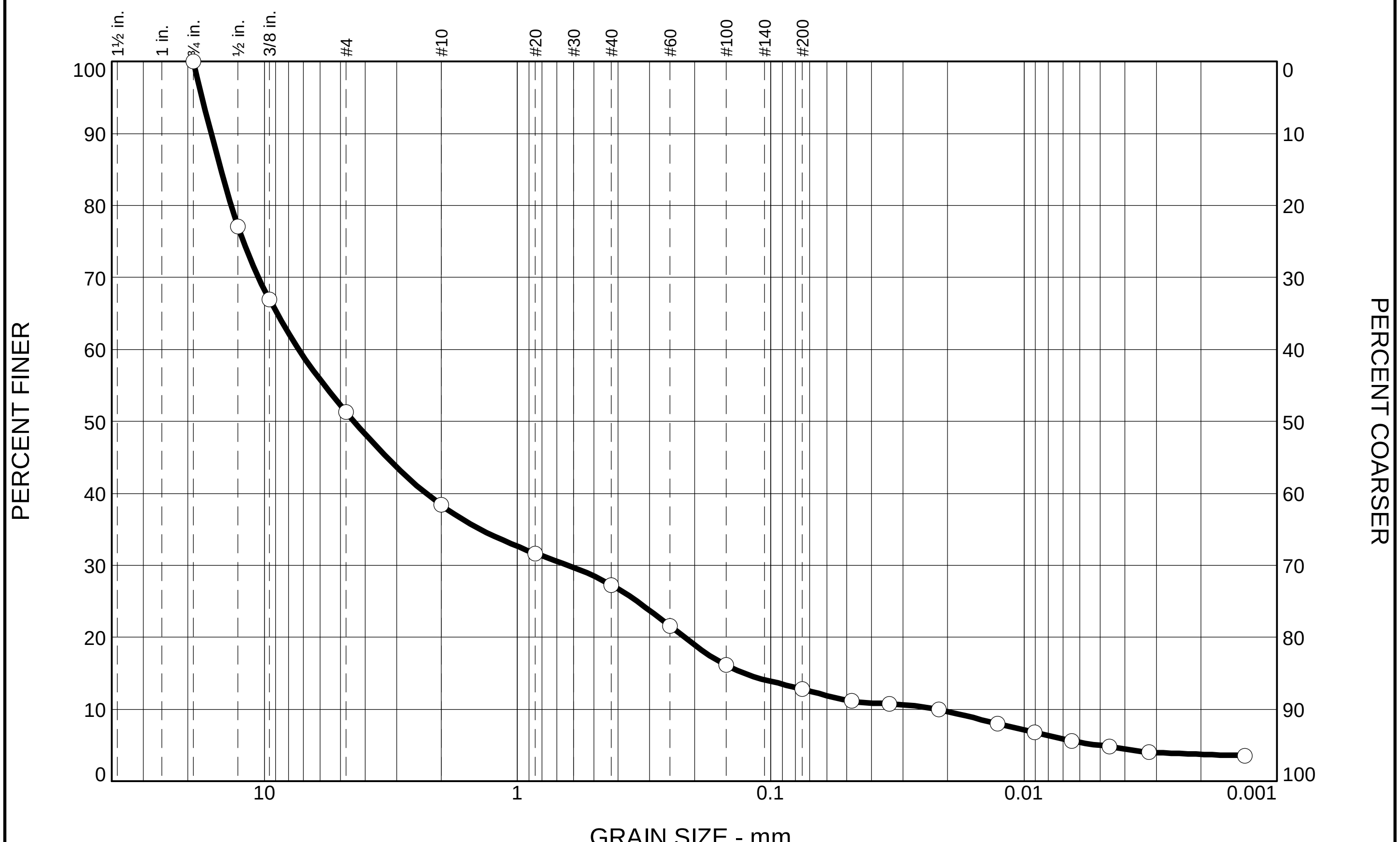
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	48.7	12.9	11.1	14.5	7.8	5.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	77.1		
.375	66.9		
#4	51.3		
#10	38.4		
#20	31.7		
#40	27.3		
#60	21.6		
#100	16.1		
#200	12.8		

* (no specification provided)

LIGHT BROWN POORLY GRADED GRAVEL WITH SAND AND SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 16.1906 D_{85}= 14.8494 D_{60}= 7.2956
D_{50}= 4.4253 D_{30}= 0.6301 D_{15}= 0.1271
D_{10}= 0.0221 C_u= 330.63 C_c= 2.47

Classification

USCS= GP-GM AASHTO=

Remarks

F.M.=4.38

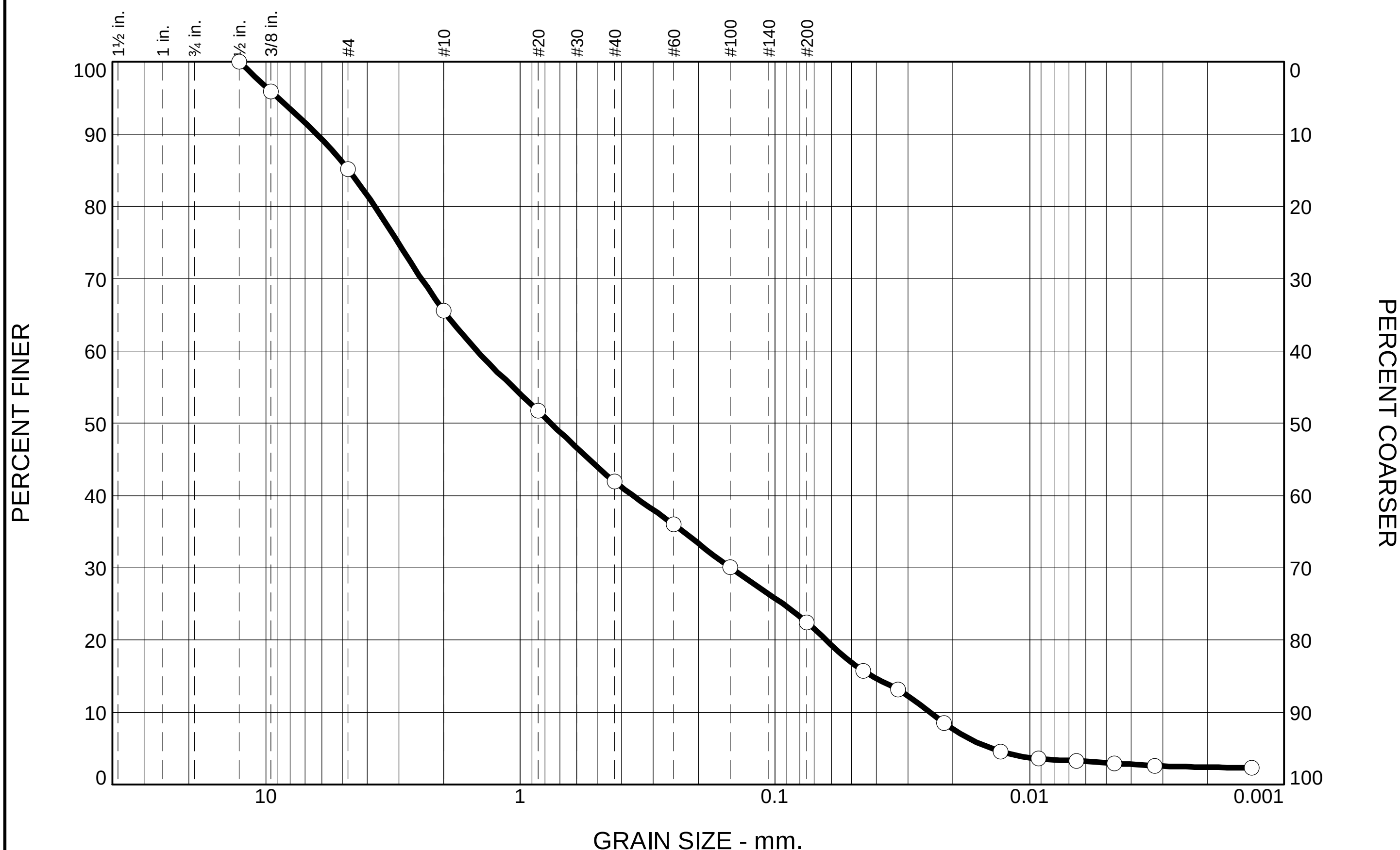
Source of Sample: HEN-B023 **Depth:** 50.0'-51.0'
Sample Number: S-14 **Date:** 12-15-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	14.8	19.6	23.7	19.5	19.4	3.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.50	100.0		
.375	95.9		
#4	85.2		
#10	65.6		
#20	51.7		
#40	41.9		
#60	36.0		
#100	30.0		
#200	22.4		

* (no specification provided)

BLACK FLY ASH WITH CINCERS AND SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 6.3009 D_{85}= 4.7122 D_{60}= 1.4780
D_{50}= 0.7577 D_{30}= 0.1495 D_{15}= 0.0415
D_{10}= 0.0247 C_u= 59.92 C_c= 0.61

Classification

USCS= AASHTO=

Remarks

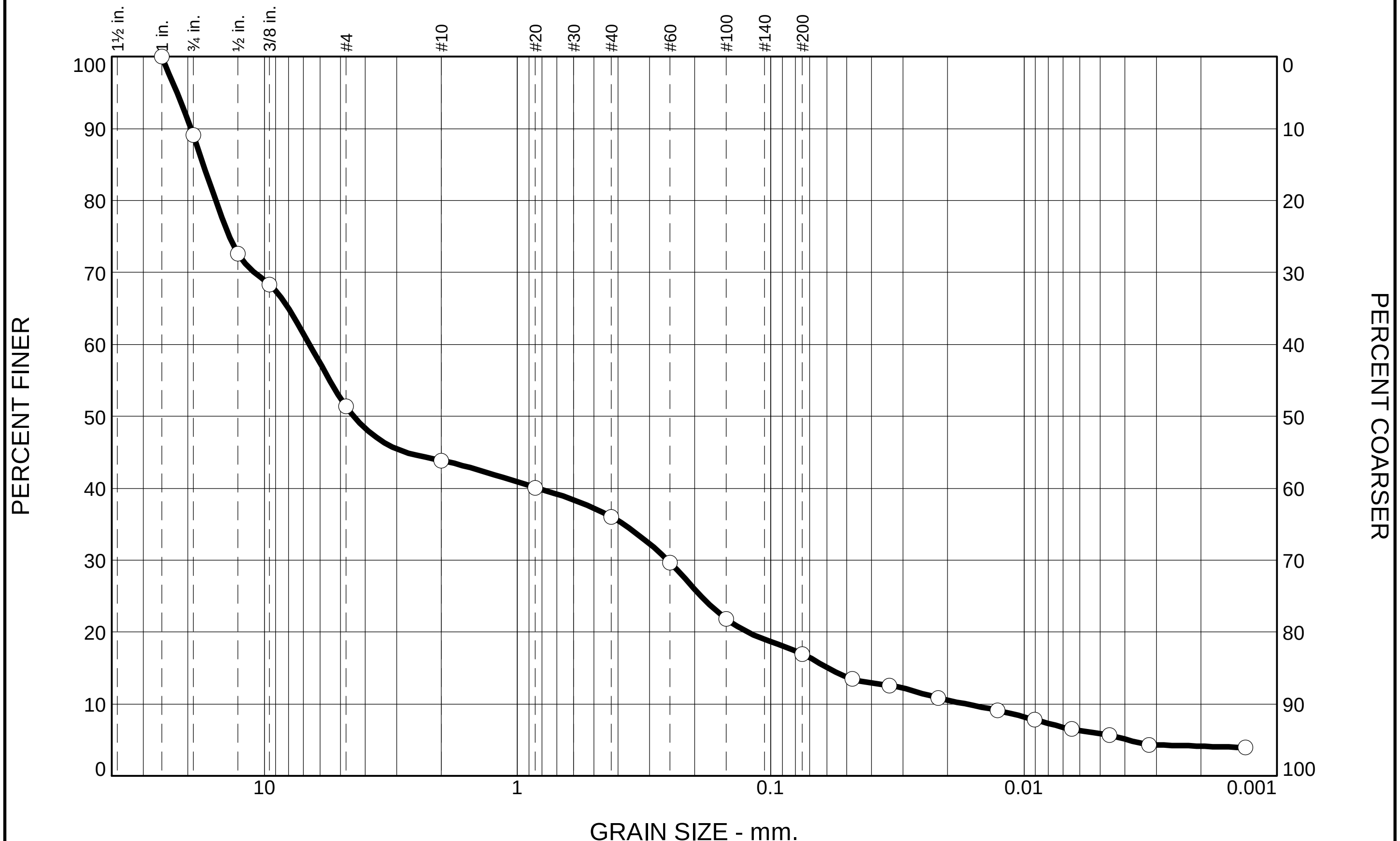
F.M.=2.79

Source of Sample: HEN-B024 **Depth:** 15.0'-16.5'
Sample Number: S-6 **Date:** 12-17-15

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.9	37.7	7.5	7.9	19.0	11.1	5.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	89.1		
.5	72.6		
.375	68.3		
#4	51.4		
#10	43.9		
#20	40.1		
#40	36.0		
#60	29.6		
#100	21.8		
#200	17.0		

* (no specification provided)

BROWN AND DARK BROWN SILTY GRAVEL WITH SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 19.4555 D_{85}= 17.3788 D_{60}= 6.6192
D_{50}= 4.4334 D_{30}= 0.2558 D_{15}= 0.0594
D_{10}= 0.0170 C_u= 390.47 C_c= 0.58

Classification

USCS= GM AASHTO=

Remarks

F.M.=4.13

Source of Sample: HEN-B024 **Depth:** 45.0'-46.5'
Sample Number: S-13

Date: 12-17-15

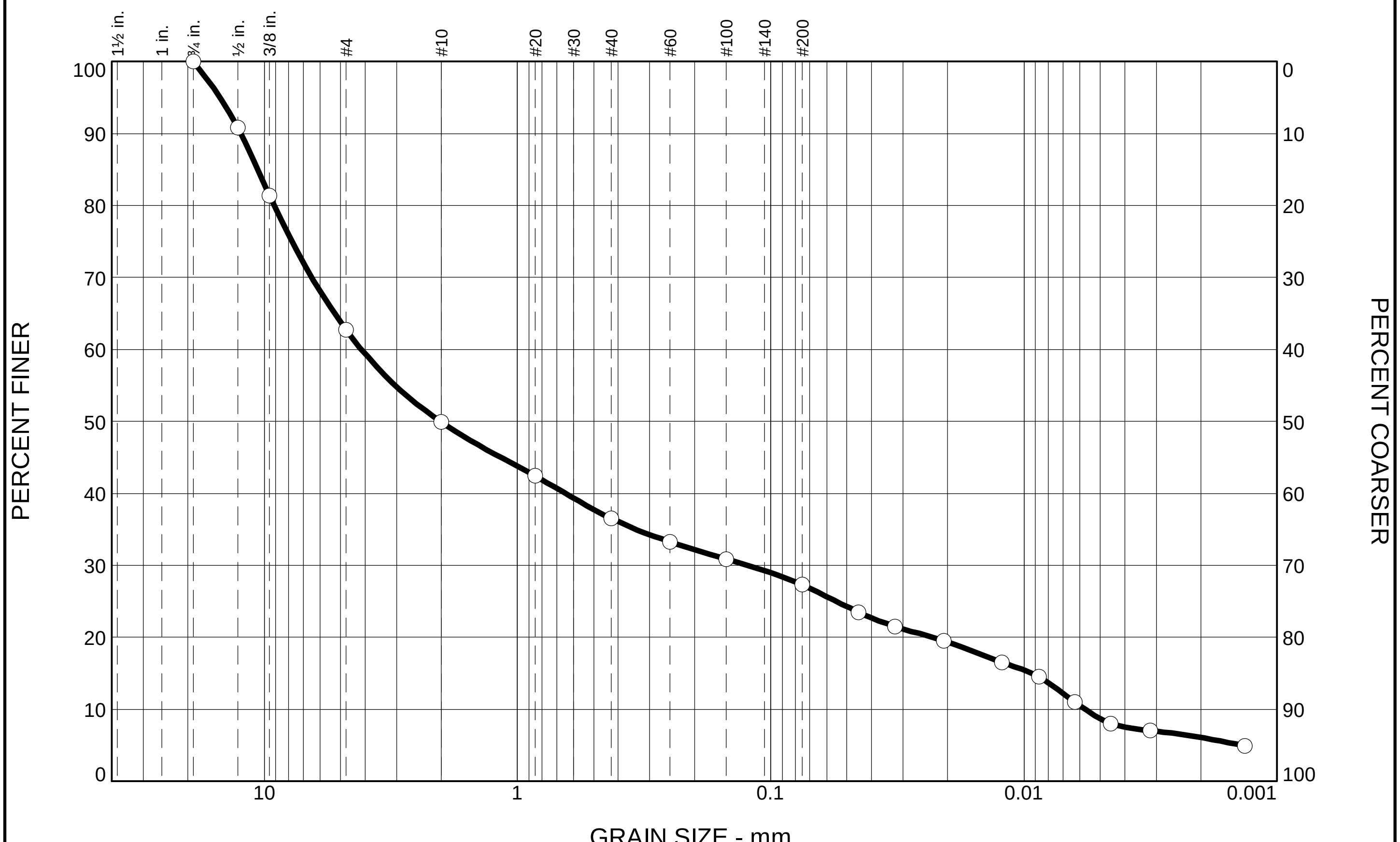
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	37.3	12.8	13.4	9.2	18.6	8.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	90.8		
.375	81.4		
#4	62.7		
#10	49.9		
#20	42.4		
#40	36.5		
#60	33.3		
#100	30.9		
#200	27.3		

* (no specification provided)

BROWN AND GRAY SILTY GRAVEL WITH SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 12.3694 D_{85}= 10.6049 D_{60}= 4.1296
D_{50}= 2.0193 D_{30}= 0.1239 D_{15}= 0.0093
D_{10}= 0.0057 C_u= 719.10 C_c= 0.65

Classification

USCS= GM AASHTO=

Remarks

F.M.=3.55

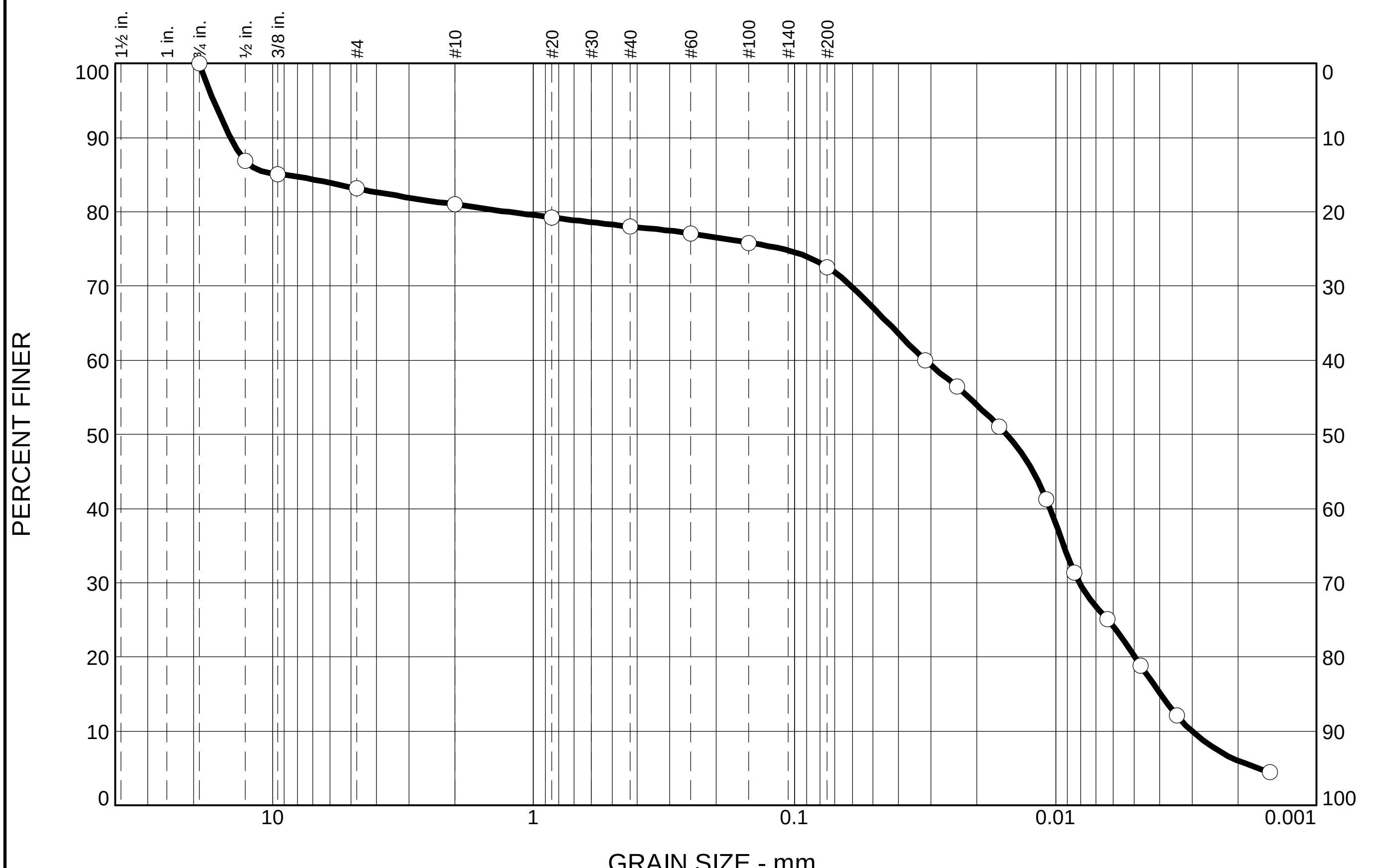
Source of Sample: HEN-B025 **Depth:** 5.0'-6.5'
Sample Number: S-3 **Date:** 12-15-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	16.8	2.2	3.0	5.5	52.3	20.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	86.9		
.375	85.1		
#4	83.2		
#10	81.0		
#20	79.2		
#40	78.0		
#60	77.1		
#100	75.8		
#200	72.5		

* (no specification provided)

VERY DARK GRAY FLY ASH WITH SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 14.4848 D_{85}= 9.0363 D_{60}= 0.0315
D_{50}= 0.0154 D_{30}= 0.0081 D_{15}= 0.0040
D_{10}= 0.0030 C_u= 10.52 C_c= 0.70

Classification

USCS= AASHTO=

Remarks

F.M.=1.39

Source of Sample: HEN-B025 **Depth:** 11.5'-14.0'
Sample Number: S-6

Date: 12-15-15

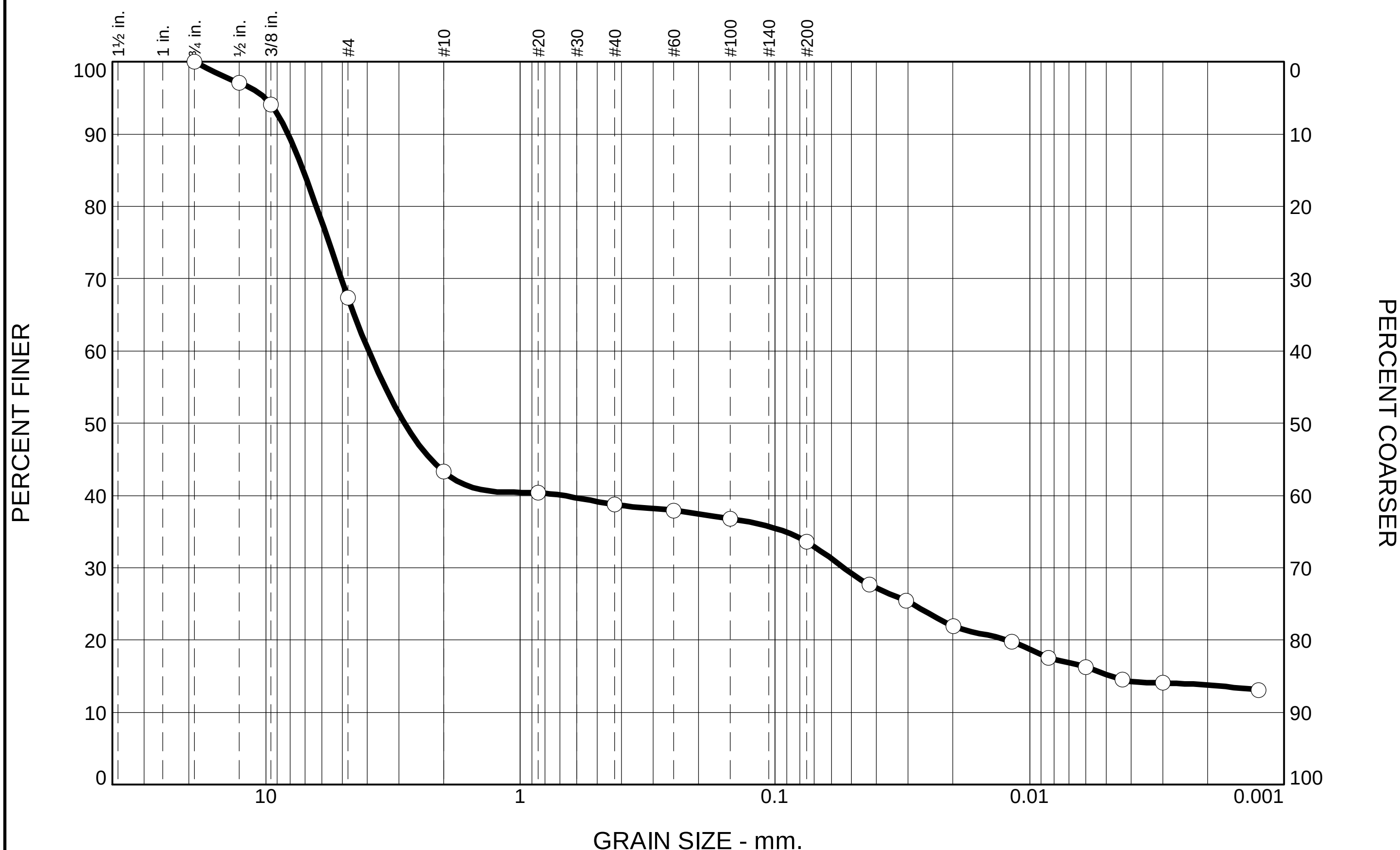
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	32.6	24.1	4.6	5.1	18.4	15.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	97.1		
.375	94.1		
#4	67.4		
#10	43.3		
#20	40.4		
#40	38.7		
#60	37.9		
#100	36.8		
#200	33.6		

* (no specification provided)

BROWN SILTY SAND WITH GRAVEL

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 8.1578 D_{85}= 7.1123 D_{60}= 3.9390
D_{50}= 2.8475 D_{30}= 0.0538 D_{15}= 0.0048
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

F.M.=3.38

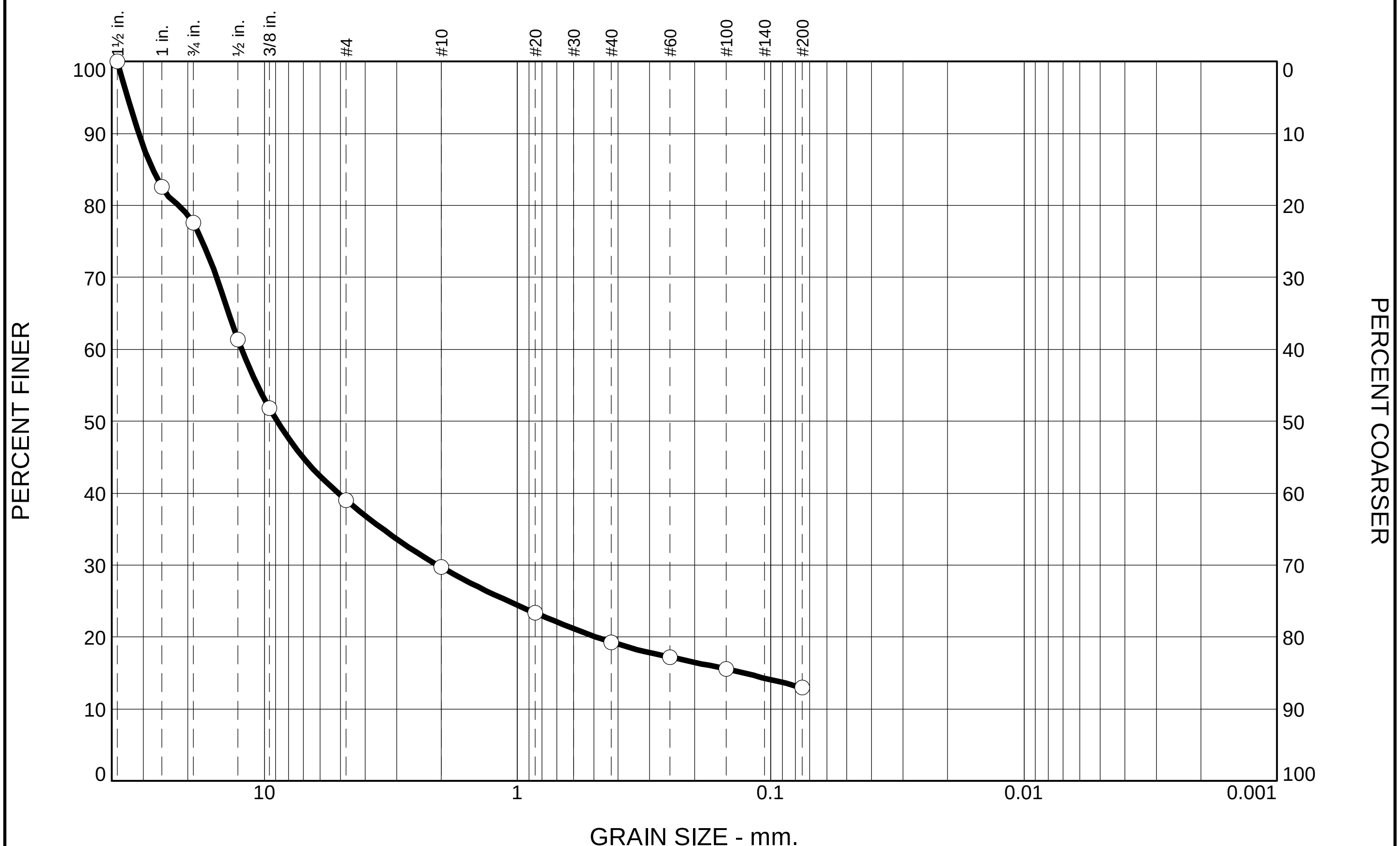
Source of Sample: HEN-B026A **Depth:** 13.5'-15.0'
Sample Number: S-2 **Date:** 12-15-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	22.4	38.6	9.3	10.4	6.3	13.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	82.5		
.75	77.6		
.5	61.4		
.375	51.8		
#4	39.0		
#10	29.7		
#20	23.4		
#40	19.3		
#60	17.2		
#100	15.6		
#200	13.0		

* (no specification provided)

LIGHT BROWN POORLY GRADED GRAVEL WITH SAND AND CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 31.2310 D_{85}= 27.6077 D_{60}= 12.2743
D_{50}= 8.8861 D_{30}= 2.0649 D_{15}= 0.1281
D_{10}= C_u= C_c=

Classification

USCS= GP-GC AASHTO=

Remarks

F.M.=5.20

Source of Sample: HEN-B029 **Depth:** 35.0'-36.5'
Sample Number: S-10 **Date:** 12-10-15

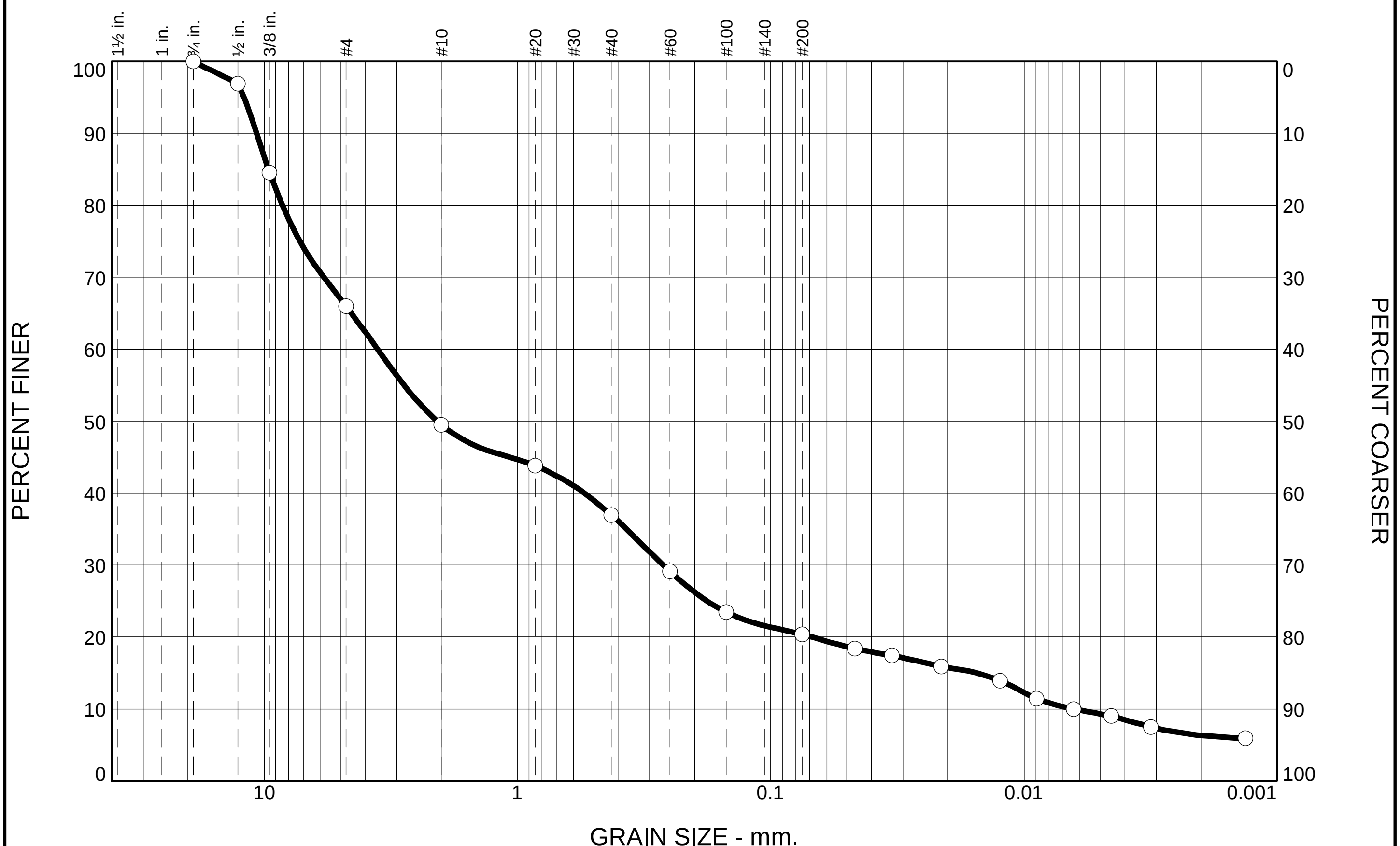
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	34.0	16.5	12.6	16.6	11.0	9.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	97.0		
.375	84.6		
#4	66.0		
#10	49.5		
#20	43.8		
#40	36.9		
#60	29.1		
#100	23.5		
#200	20.3		

* (no specification provided)

BROWN AND LIGHT BROWN SILTY SAND WITH GRAVEL

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 10.7082 D_{85}= 9.6174 D_{60}= 3.5682
D_{50}= 2.0785 D_{30}= 0.2659 D_{15}= 0.0154
D_{10}= 0.0064 C_u= 557.69 C_c= 3.10

Classification

USCS= SM AASHTO=

Remarks

F.M.=3.56

Source of Sample: HEN-B030 **Depth:** 2.5'-4.0'
Sample Number: S-2 **Date:** 12-15-15

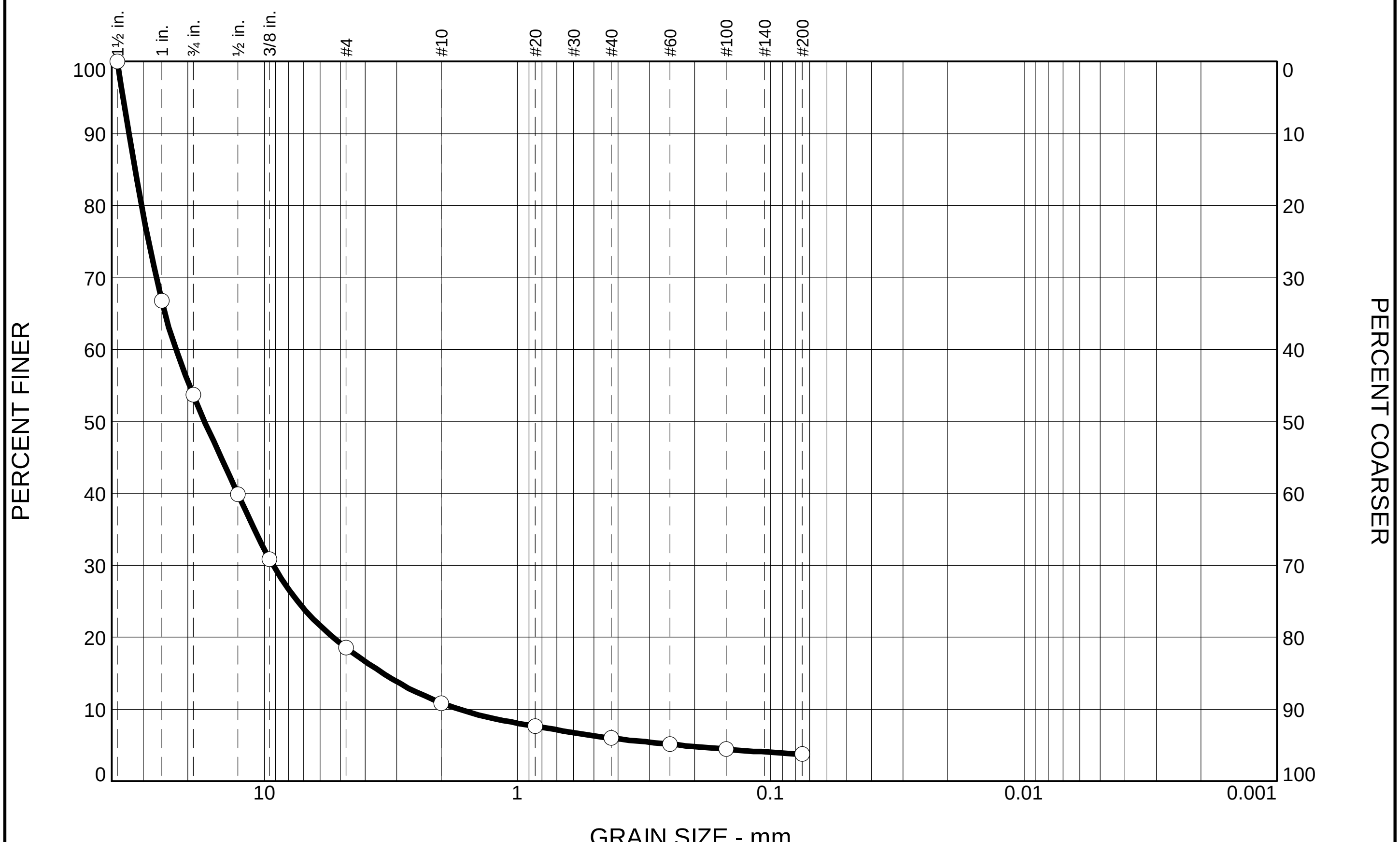
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	46.3	35.1	7.7	4.9	2.2	3.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	66.8		
.75	53.7		
.5	39.9		
.375	30.9		
#4	18.6		
#10	10.9		
#20	7.6		
#40	6.0		
#60	5.1		
#100	4.4		
#200	3.8		

* (no specification provided)

LIGHT BROWN AND TAN WELL GRADED GRAVEL WITH SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 34.1590 D_{85}= 32.2869 D_{60}= 22.3306
D_{50}= 17.1780 D_{30}= 9.2189 D_{15}= 3.3953
D_{10}= 1.7025 C_u= 13.12 C_c= 2.24

Classification

USCS= GW AASHTO=

Remarks

F.M.=6.60

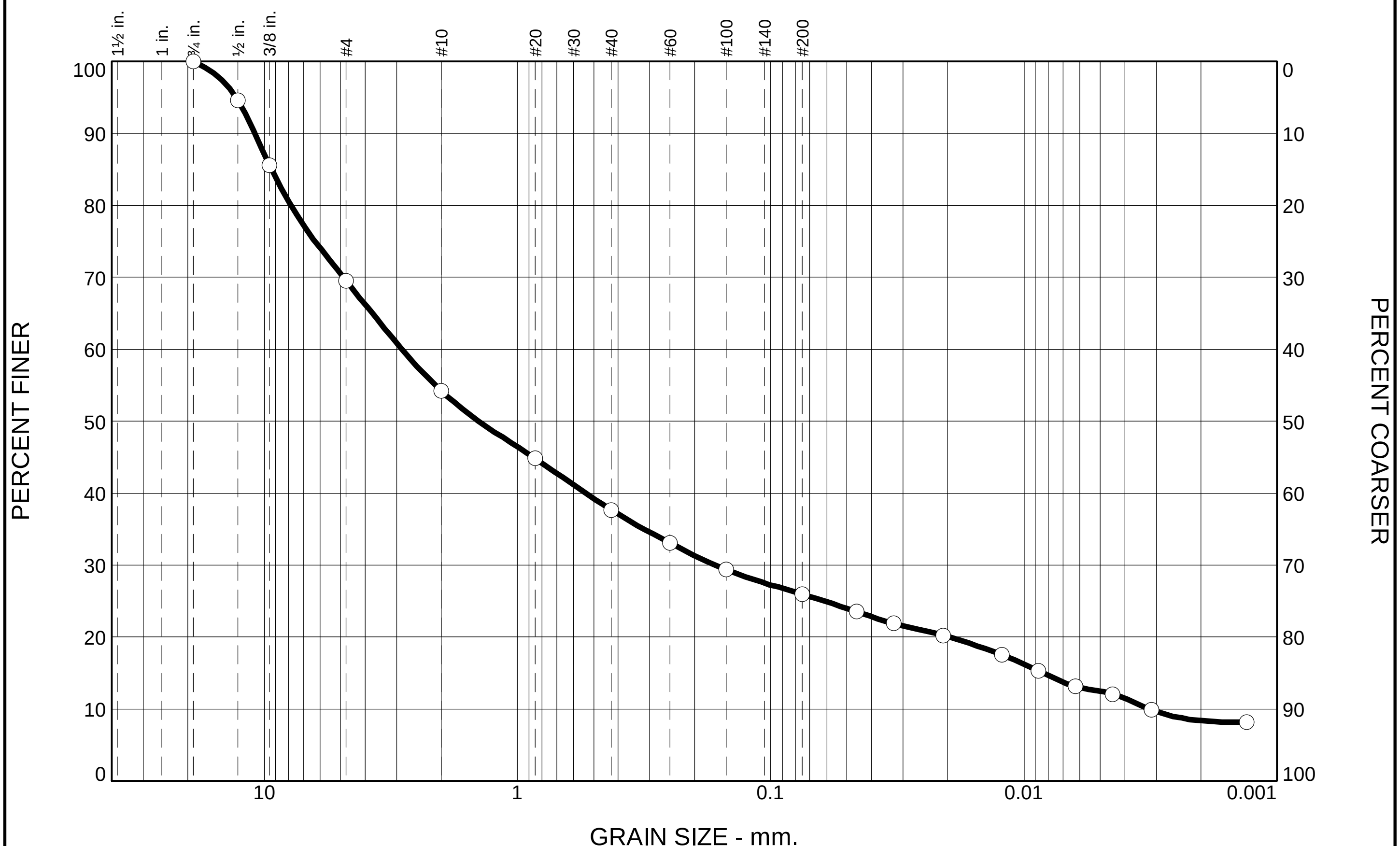
Source of Sample: HEN-B030 **Depth:** 15.0'-16.5'
Sample Number: S-6 **Date:** 12-10-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	30.5	15.3	16.5	11.8	13.4	12.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	94.6		
.375	85.6		
#4	69.5		
#10	54.2		
#20	44.8		
#40	37.7		
#60	33.1		
#100	29.4		
#200	25.9		

* (no specification provided)

BROWN SILTY SAND WITH GRAVEL

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 10.8888 D_{85}= 9.3568 D_{60}= 2.8565
D_{50}= 1.4206 D_{30}= 0.1654 D_{15}= 0.0084
D_{10}= 0.0032 C_u= 894.95 C_c= 3.00

Classification

USCS= SM AASHTO=

Remarks

F.M.=3.35

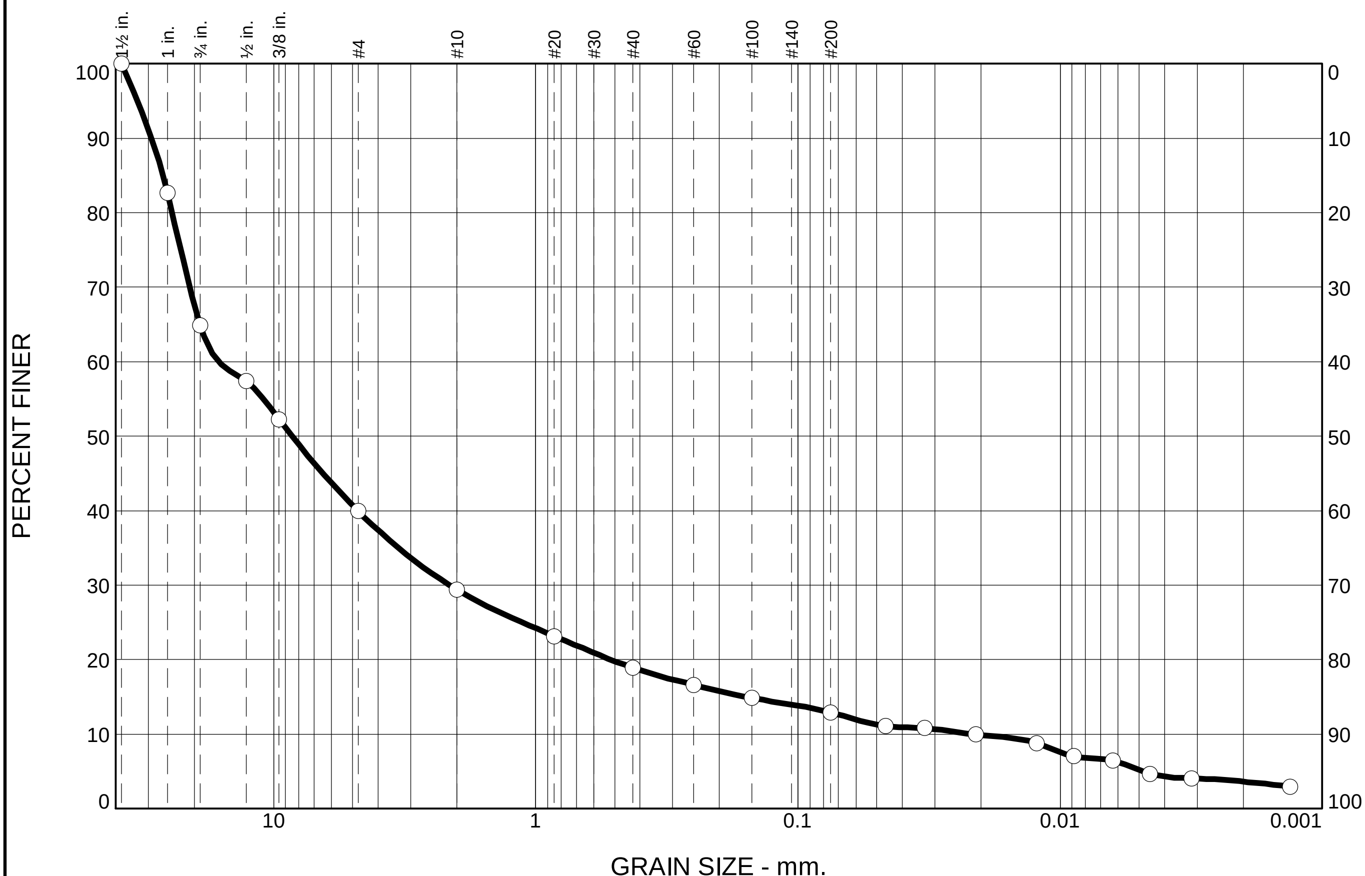
Source of Sample: HEN-B032 **Depth:** 20.0'-21.5'
Sample Number: S-7
Date: 12-15-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	35.1	25.0	10.5	10.5	6.0	7.7	5.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	82.7		
.75	64.9		
.5	57.4		
.375	52.3		
#4	39.9		
#10	29.4		
#20	23.2		
#40	18.9		
#60	16.6		
#100	14.8		
#200	12.9		

* (no specification provided)

BROWN AND LIGHT BROWN POORLY GRADED GRAVEL WITH SILT AND SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 29.2016 D_{85}= 26.4297 D_{60}= 16.1803
D_{50}= 8.4958 D_{30}= 2.1337 D_{15}= 0.1581
D_{10}= 0.0218 C_u= 742.74 C_c= 12.92

Classification

USCS= GP-GM AASHTO=

Remarks

F.M.=5.34

Source of Sample: HEN-B034 **Depth:** 10.0'-11.5'
Sample Number: S-5

Date: 12-17-15

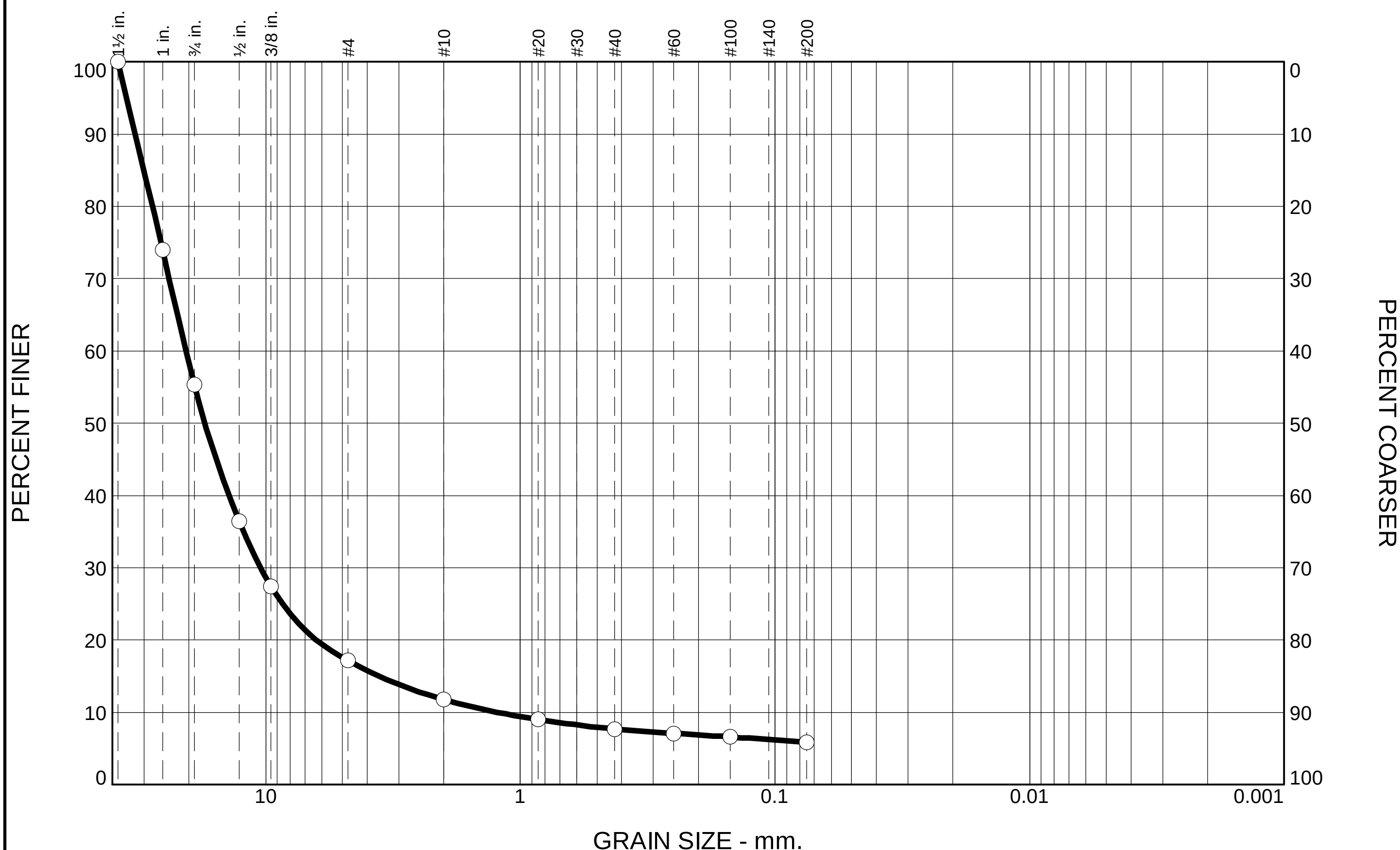
Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN

Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	44.7	38.1	5.4	4.1	1.8	5.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	74.0		
.75	55.3		
.5	36.4		
.375	27.4		
#4	17.2		
#10	11.8		
#20	9.0		
#40	7.7		
#60	7.1		
#100	6.6		
#200	5.9		

* (no specification provided)

LIGHT BROWN AND TAN POORLY GRADED GRAVEL WITH SAND AND SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 32.5083 D_{85}= 30.0560 D_{60}= 20.5658
D_{50}= 17.3171 D_{30}= 10.4646 D_{15}= 3.5815
D_{10}= 1.2300 C_u= 16.72 C_c= 4.33

Classification

USCS= GP-GM AASHTO=

Remarks

F.M.=6.56

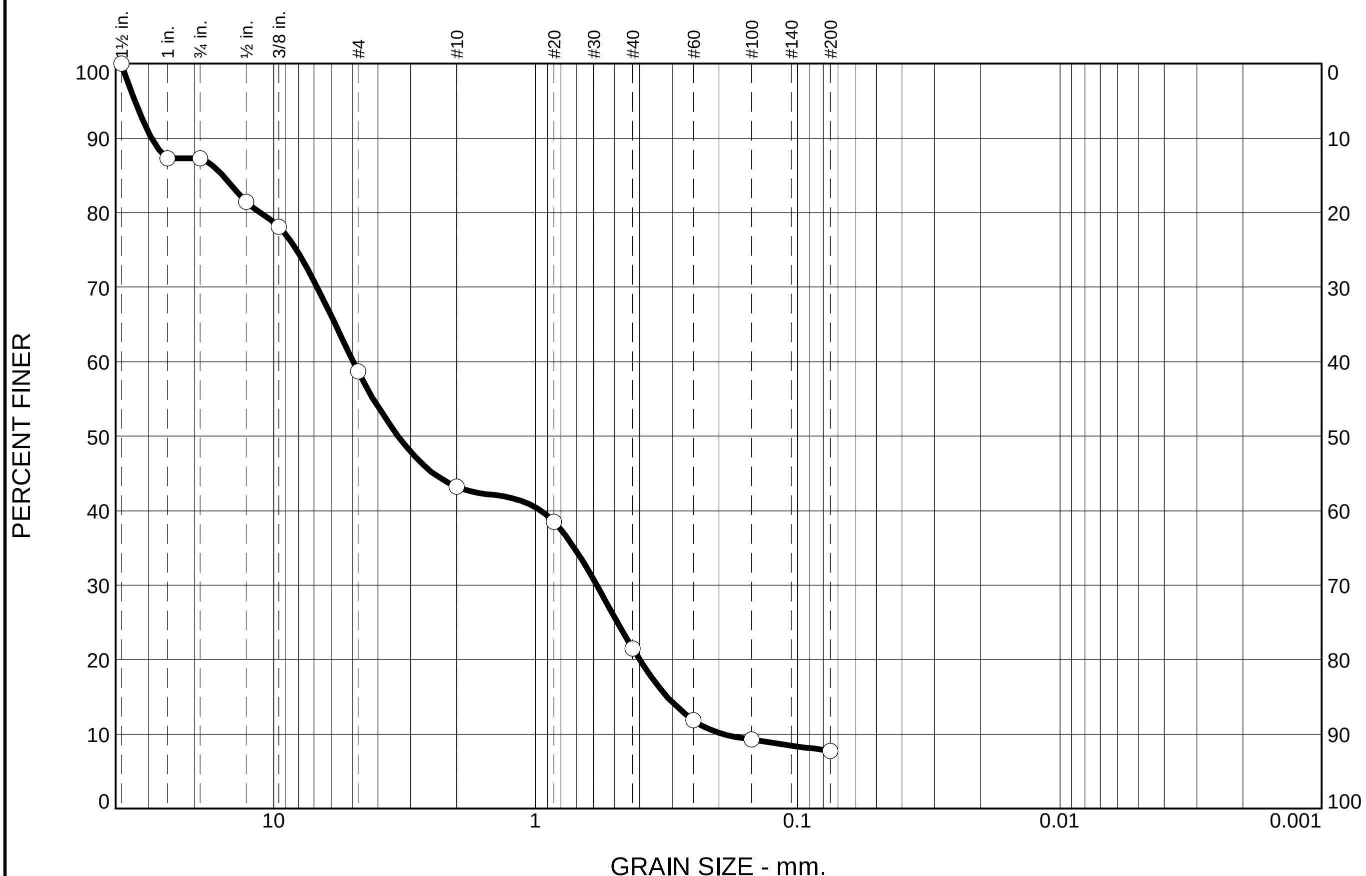
Source of Sample: HEN-B034 **Depth:** 35.0'-36.5'
Sample Number: S-10 **Date:** 12-10-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	12.7	28.6	15.5	21.8	13.7	7.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	87.3		
.75	87.3		
.5	81.5		
.375	78.1		
#4	58.7		
#10	43.2		
#20	38.5		
#40	21.4		
#60	11.8		
#100	9.2		
#200	7.7		

* (no specification provided)

BROWN AND DARK BROWN SILTY SAND WITH GRAVEL

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 29.1386 D_{85}= 15.6078 D_{60}= 4.9602
D_{50}= 3.3485 D_{30}= 0.5840 D_{15}= 0.3138
D_{10}= 0.1928 C_u= 25.73 C_c= 0.36

Classification

USCS= SM AASHTO=

Remarks

F.M.=4.36

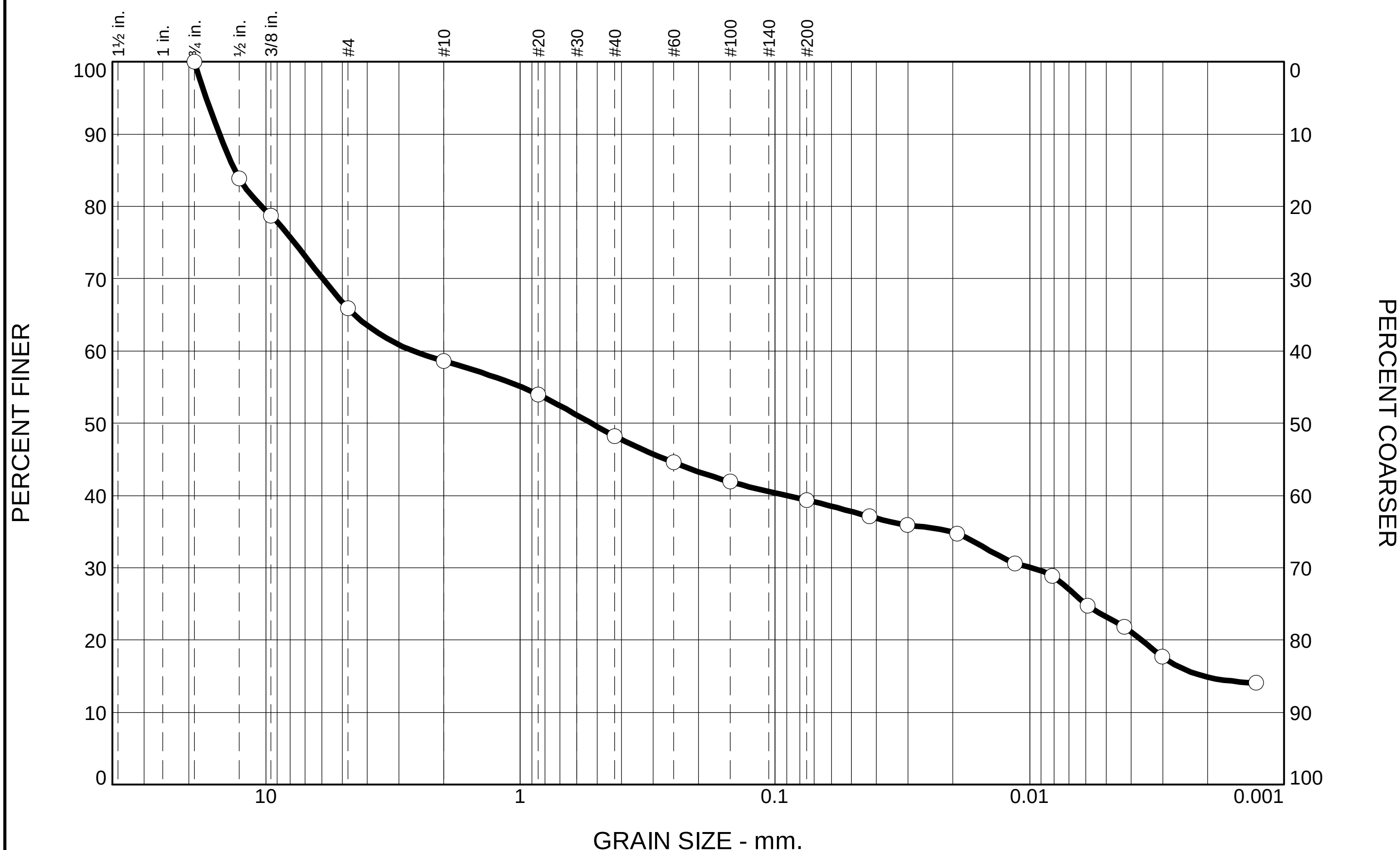
Source of Sample: HEN-B037 **Depth:** 5.0'-6.5'
Sample Number: S-3 **Date:** 12-10-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	34.1	7.3	10.4	8.8	16.2	23.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	83.9		
.375	78.7		
#4	65.9		
#10	58.6		
#20	54.0		
#40	48.2		
#60	44.6		
#100	41.9		
#200	39.4		

* (no specification provided)

BROWN AND LIGHT BROWN CLAYEY GRAVEL WIRTH SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 15.2090 D_{85}= 13.2128 D_{60}= 2.6302
D_{50}= 0.5271 D_{30}= 0.0099 D_{15}= 0.0021
D_{10}= C_u= C_c=

Classification

USCS= GC AASHTO=

Remarks

F.M.=3.01

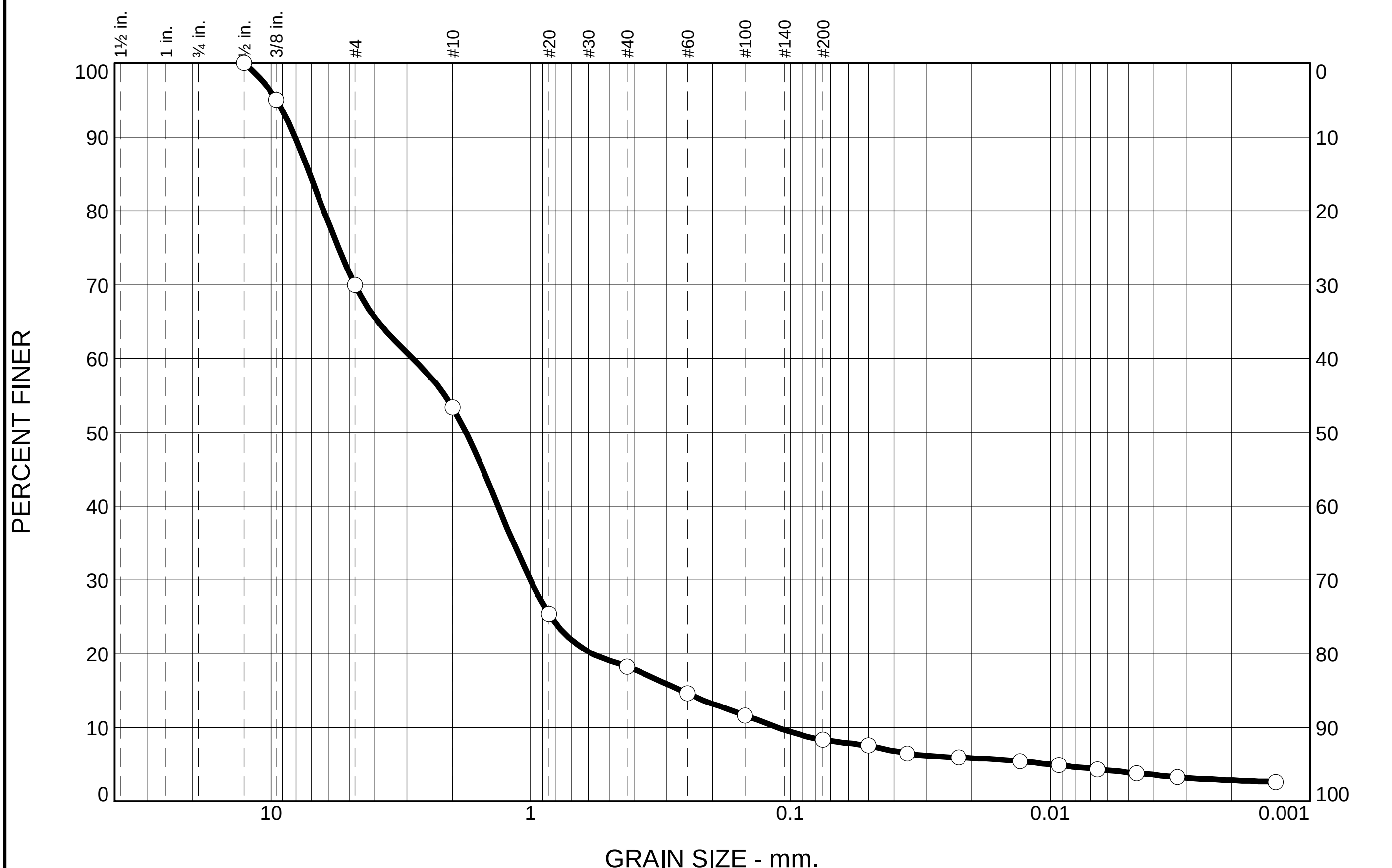
Source of Sample: HEN-B037 **Depth:** 15.0'-16.5'
Sample Number: S-6 **Date:** 12-15-15

Terracon

Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	30.1	16.5	35.2	9.9	4.4	3.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.50	100.0		
.375	95.0		
#4	69.9		
#10	53.4		
#20	25.4		
#40	18.2		
#60	14.6		
#100	11.6		
#200	8.3		

* (no specification provided)

TAN POORLY GRADED SAND WITH GRAVEL AND SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 8.0898 D_{85}= 7.0874 D_{60}= 2.8508
D_{50}= 1.7783 D_{30}= 1.0044 D_{15}= 0.2652
D_{10}= 0.1120 C_u= 25.46 C_c= 3.16

Classification

USCS= SP-SM AASHTO=

Remarks

F.M.=3.95

Source of Sample: HEN-B038 **Depth:** 5.0'-5.9'
Sample Number: S-3

Date: 12-15-15

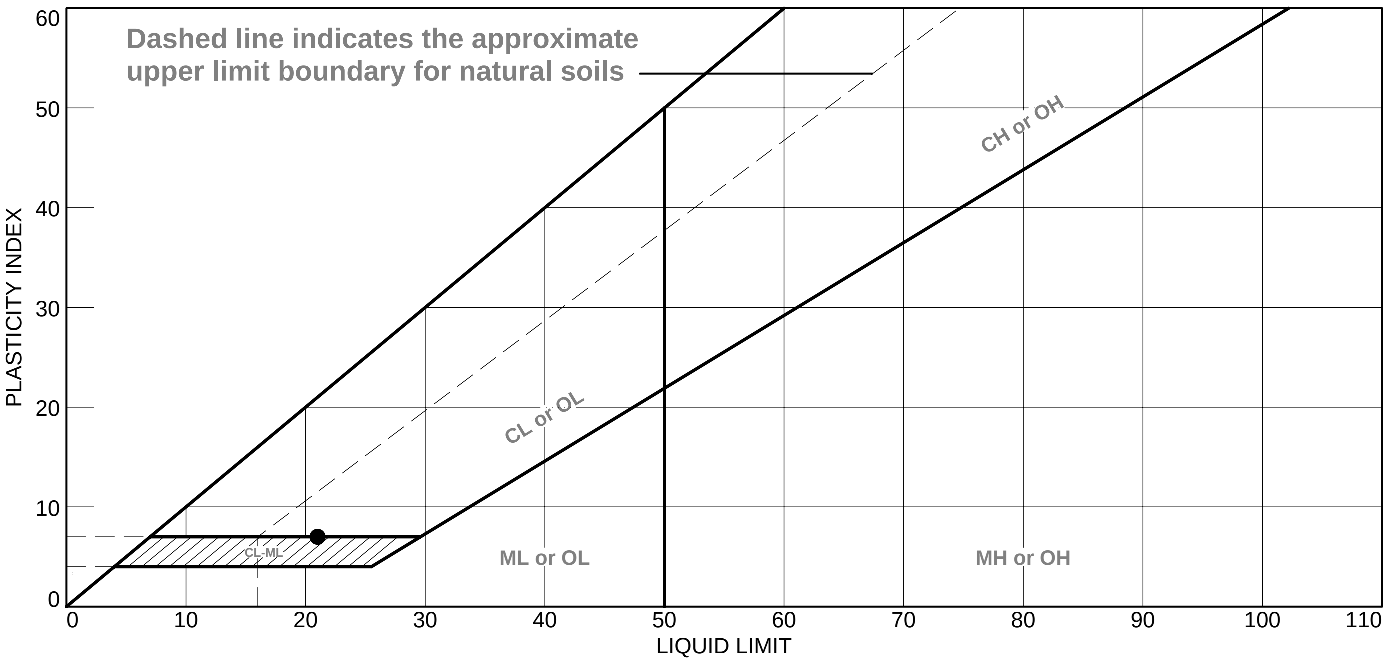
Terracon

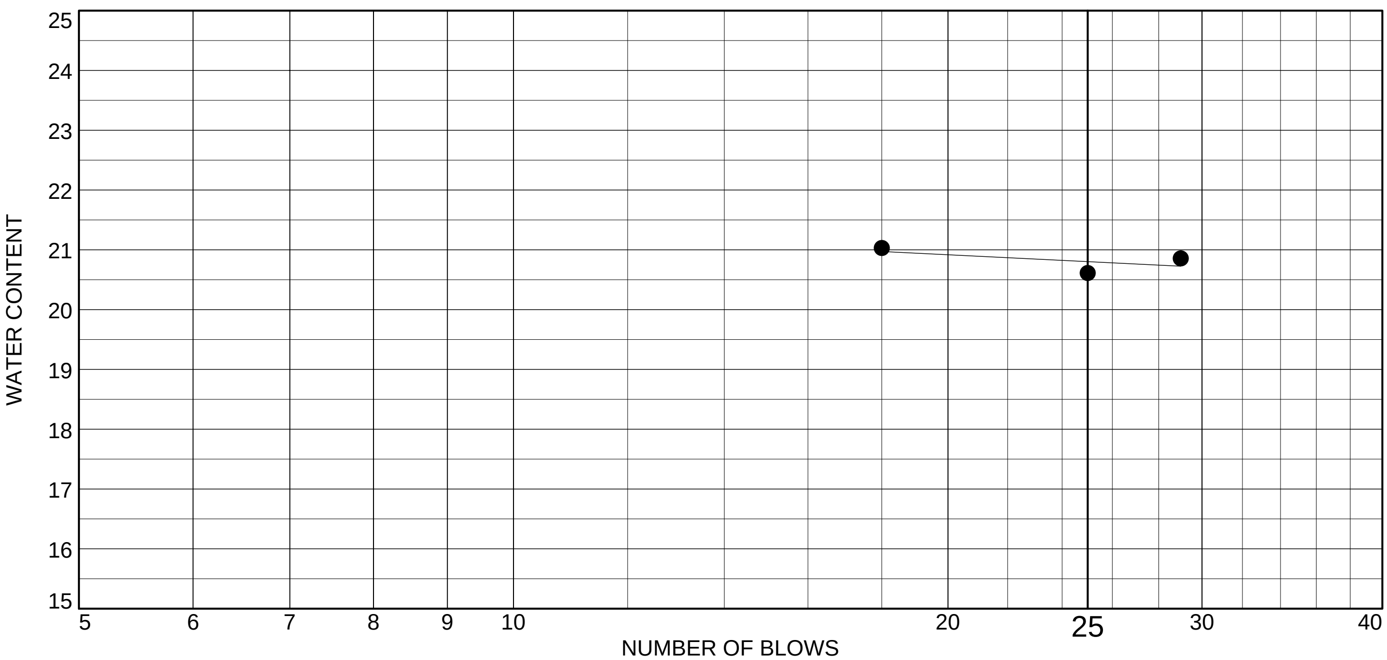
Client: AECOM
Project: DYNERGY - HENNEPIN
Project No: MR155233 **Figure**

Tested By: SJH **Checked By:** WPQ

Liquid Limit, Plastic Limit and Plasticity Index of Soils ASTM D 4318

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAY LEAN CLAY WITH SAND - SAND SEAMS NOTED	21	14	7			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B001 **Depth:** 7.5'-9.5'
Sample Number: S-4

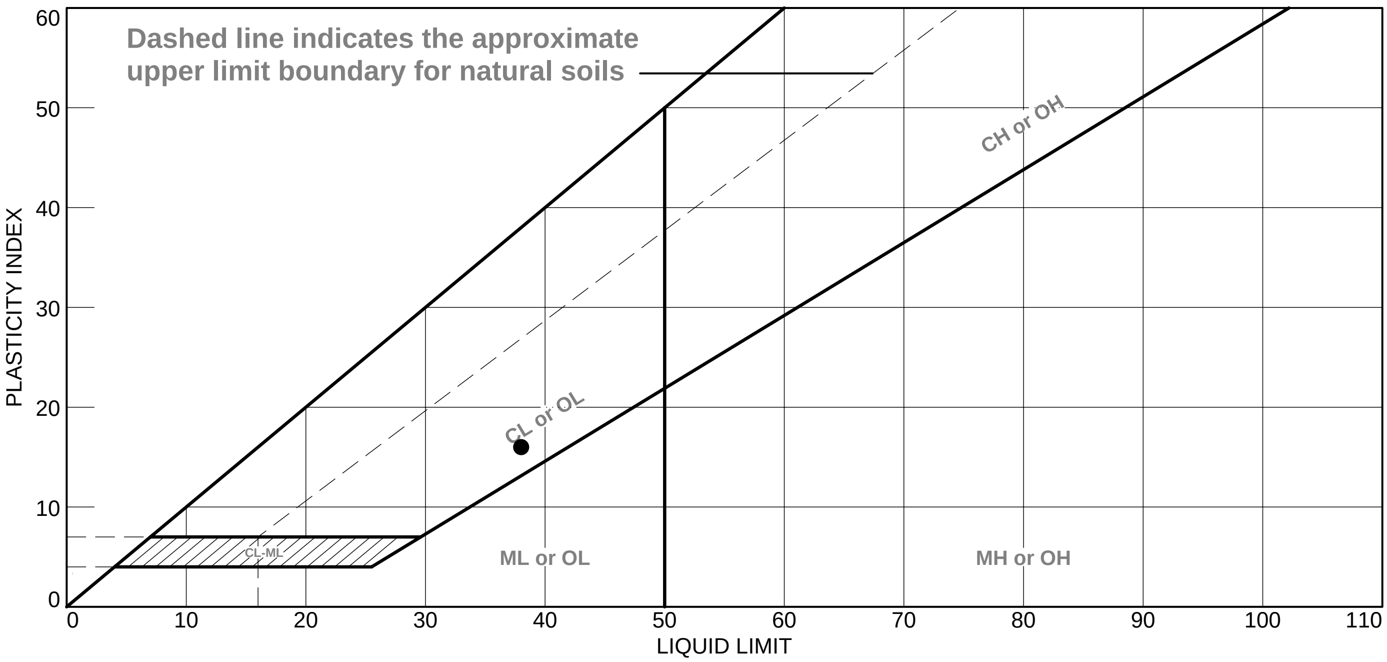
Terracon

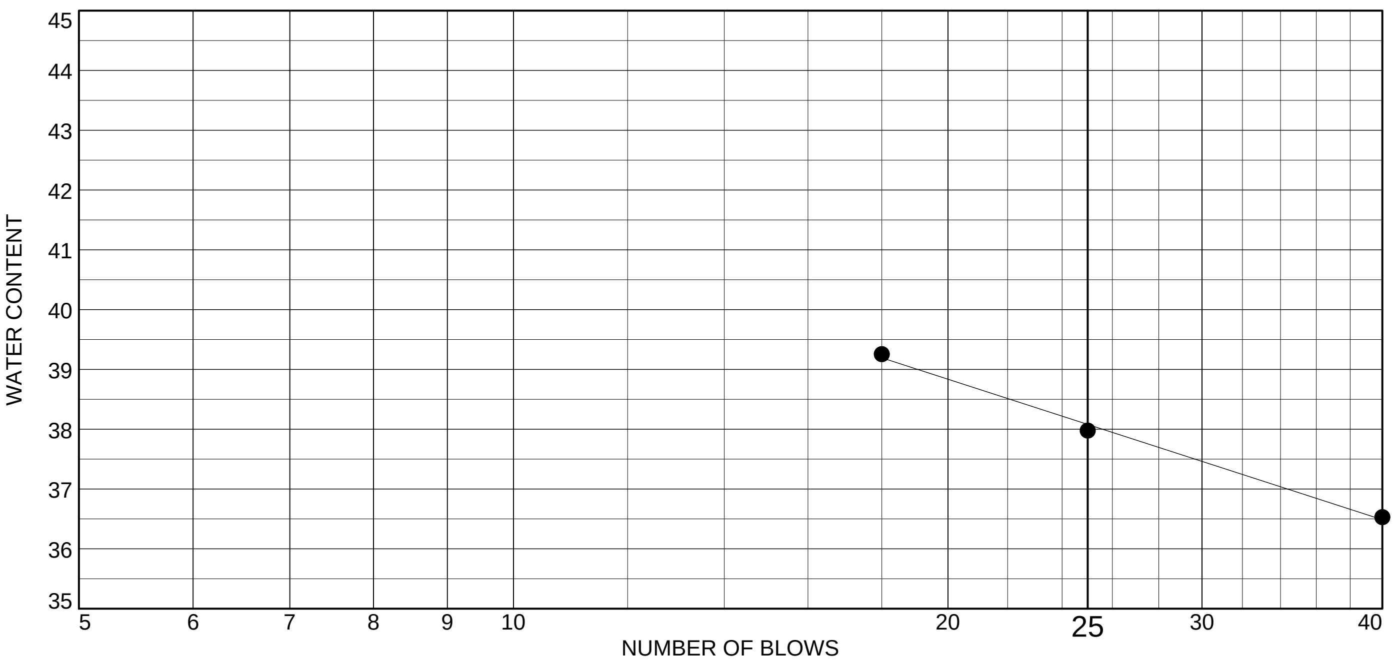
Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY ORGANIC LEAN CLAY - SHELL NOTED	38	22	16			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B001 **Depth:** 20.0'-22.0'
Sample Number: S-7

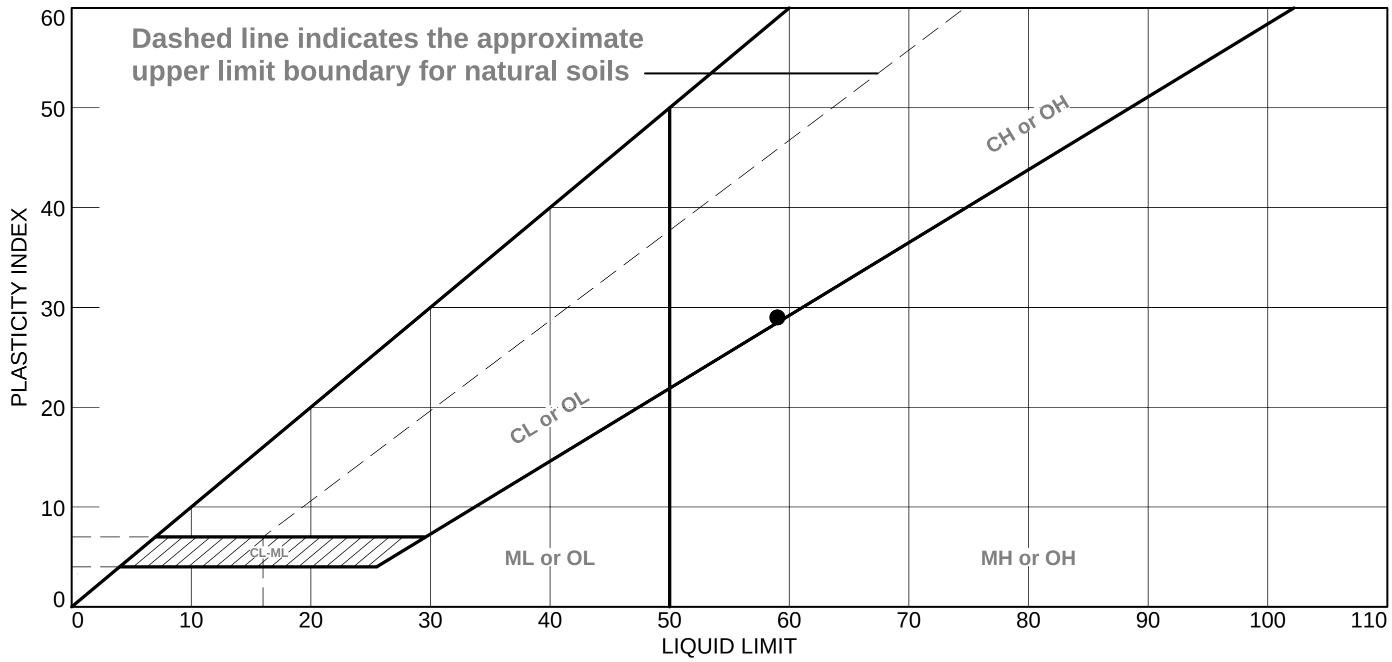
Terracon

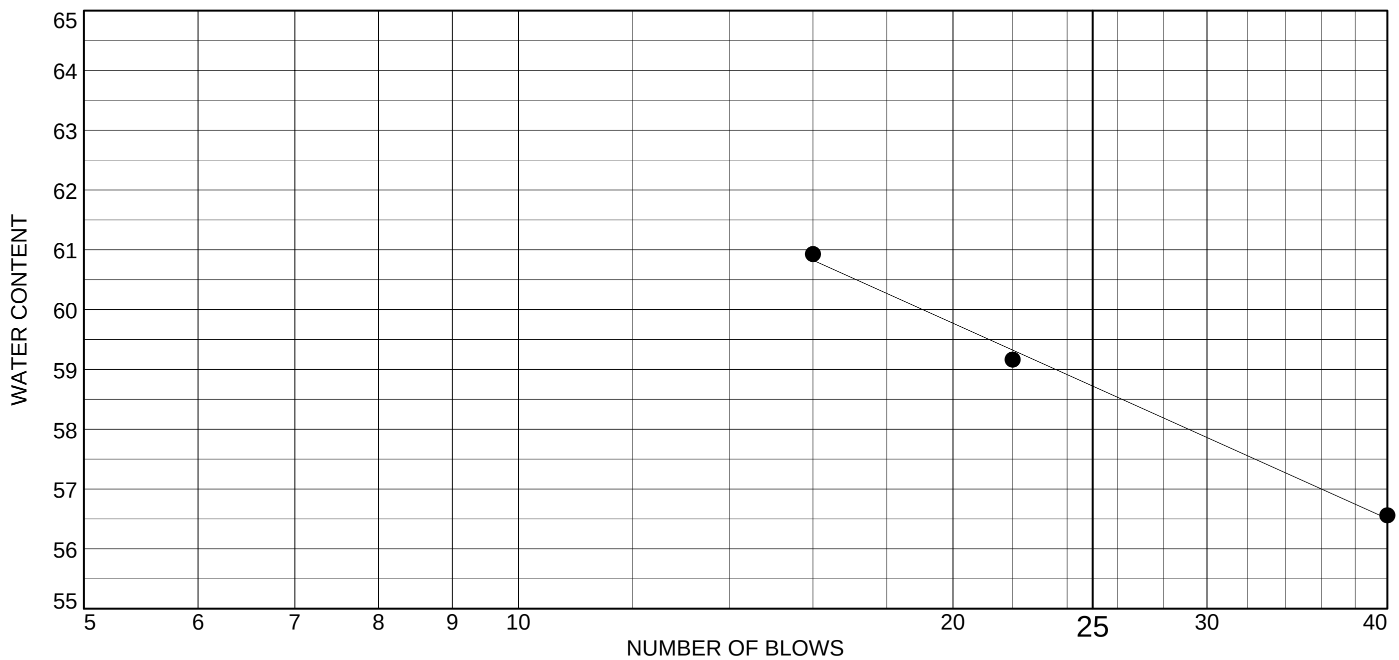
Remarks:

Figure

Tested By: HP **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY FAT CLAY	59	30	29			CH

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B001 **Depth:** 40.0'-41.5'
Sample Number: S-11

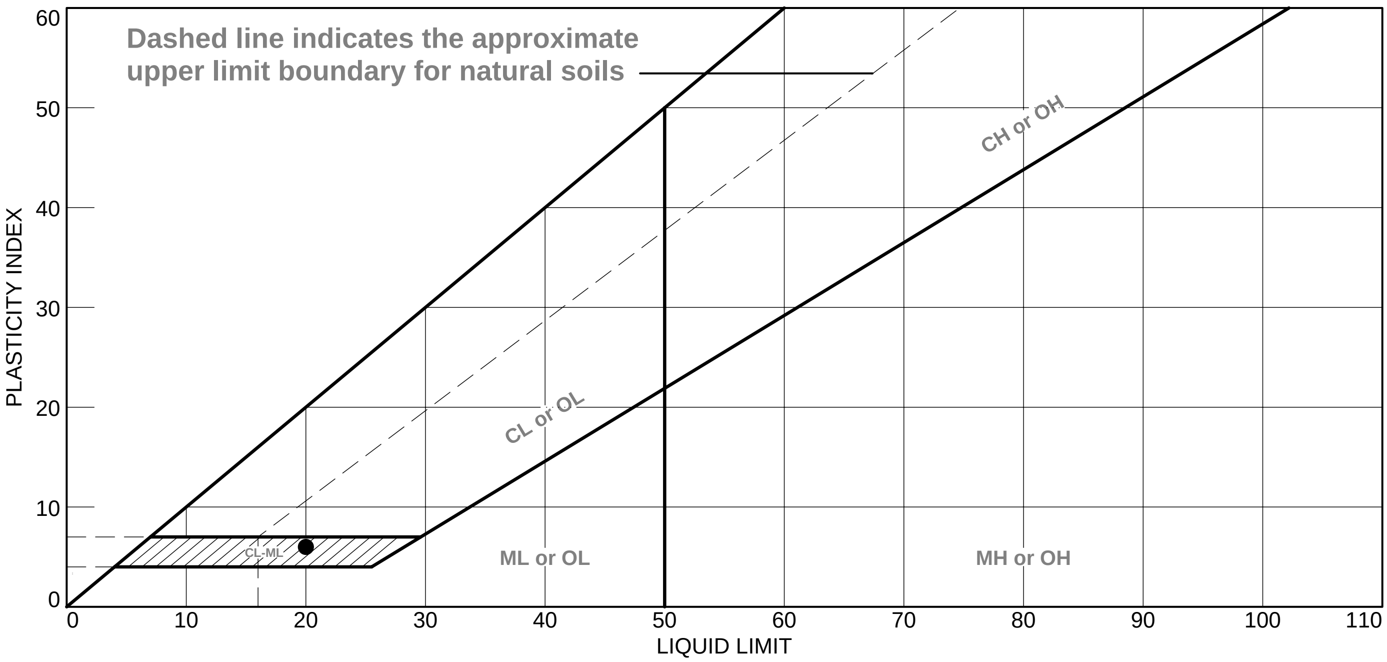
Terracon

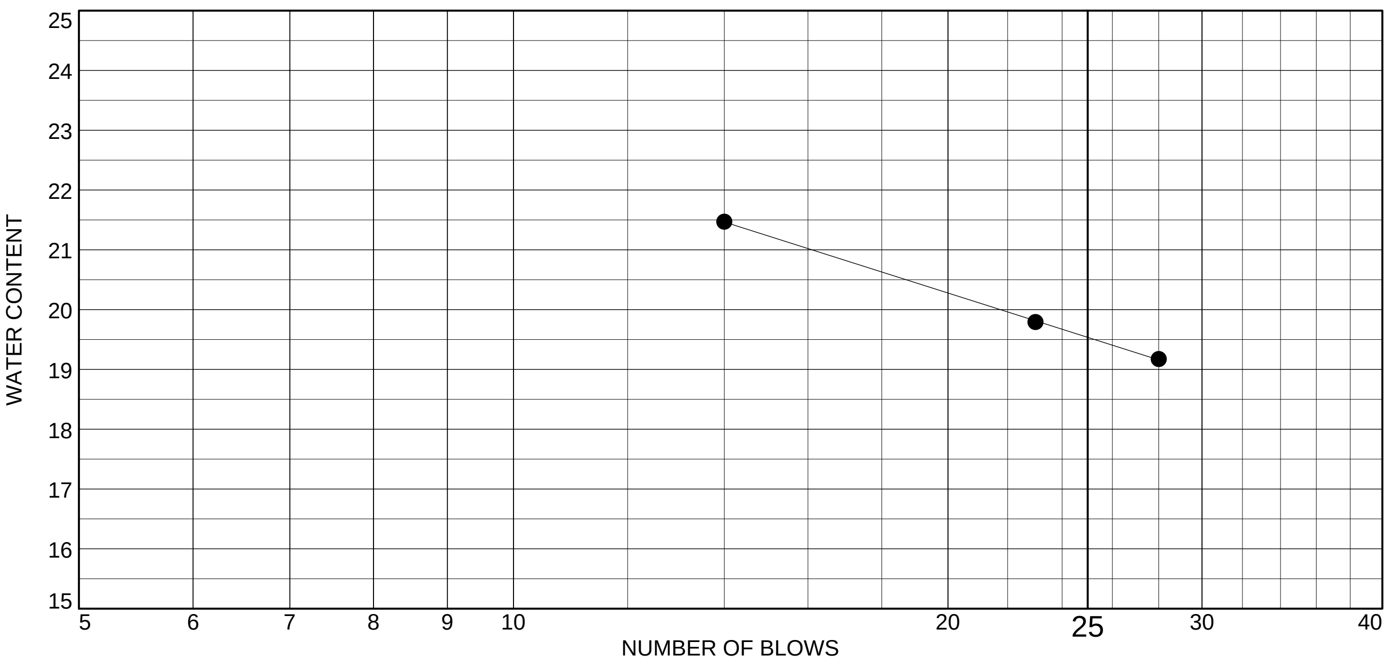
Remarks:

Figure

Tested By: HP **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN SILT WITH CLAY	20	14	6			ML

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B002 **Depth:** 7.5'-9.0'
Sample Number: S-4

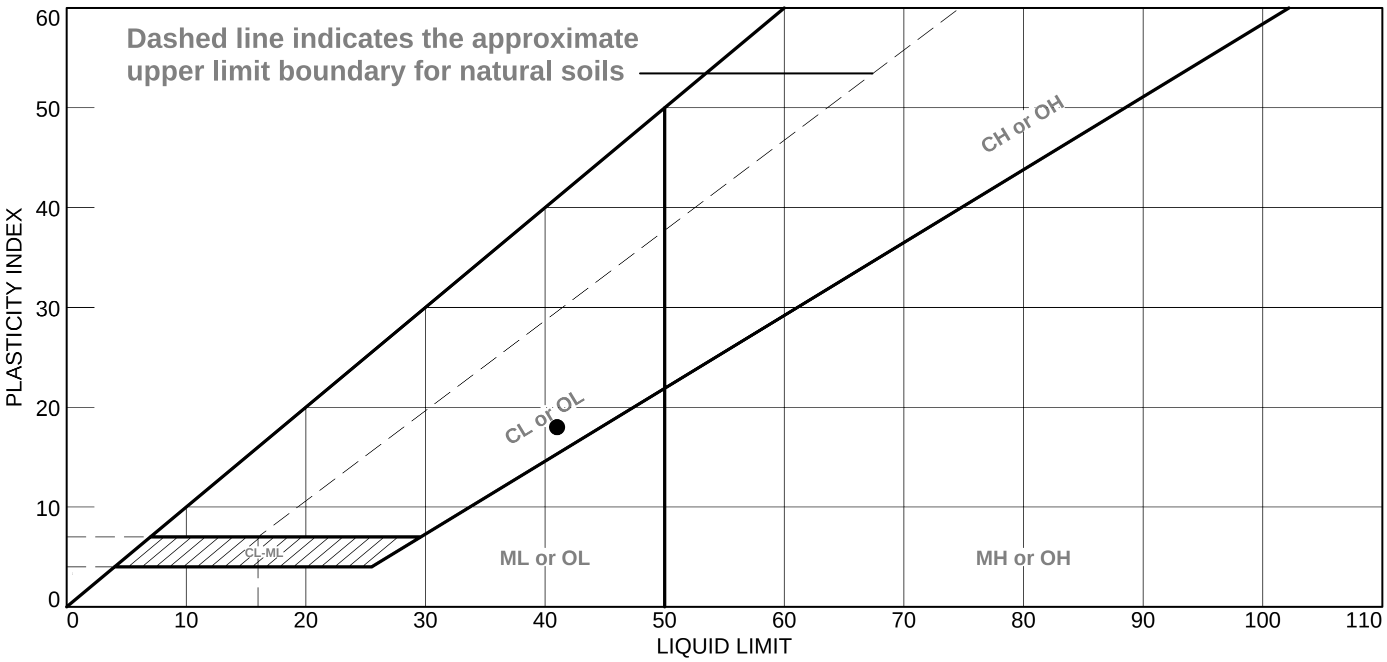
Terracon

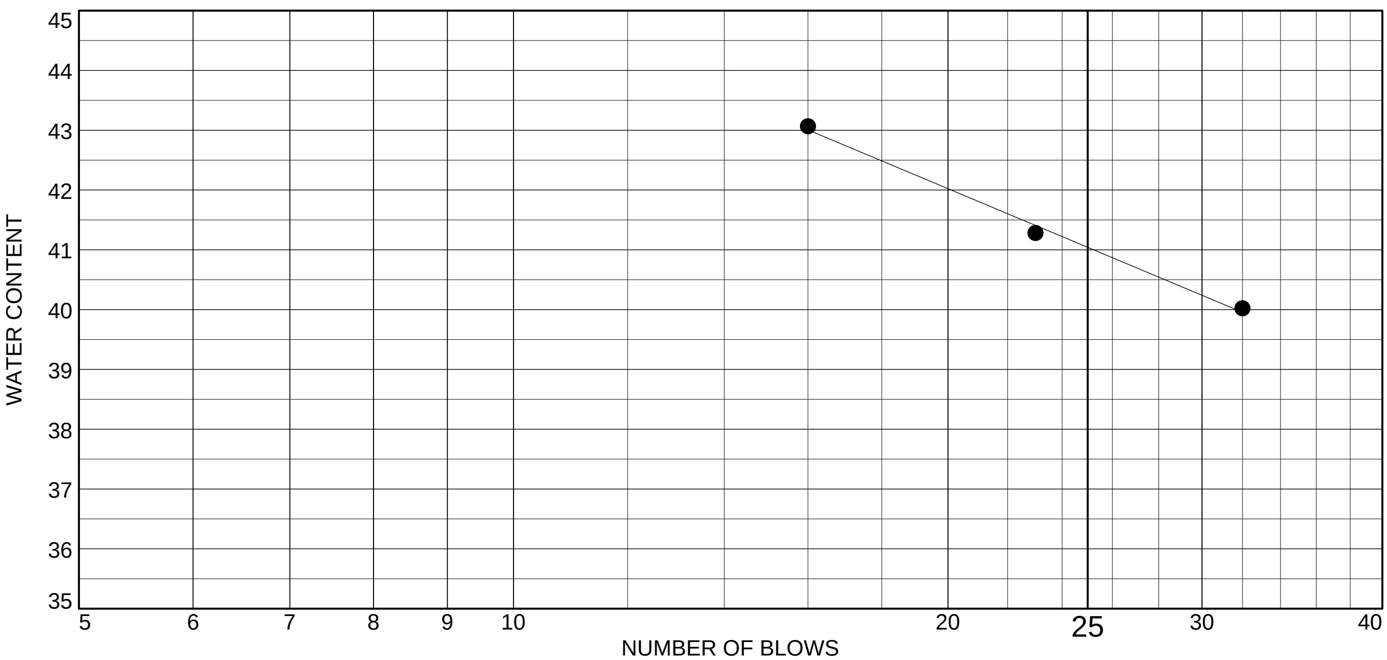
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY LEAN CLAY WITH SAND AND GRAVEL - FLY ASH NOTED	41	23	18			OL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B002 **Depth:** 25.0'-27.0'
Sample Number: S-8

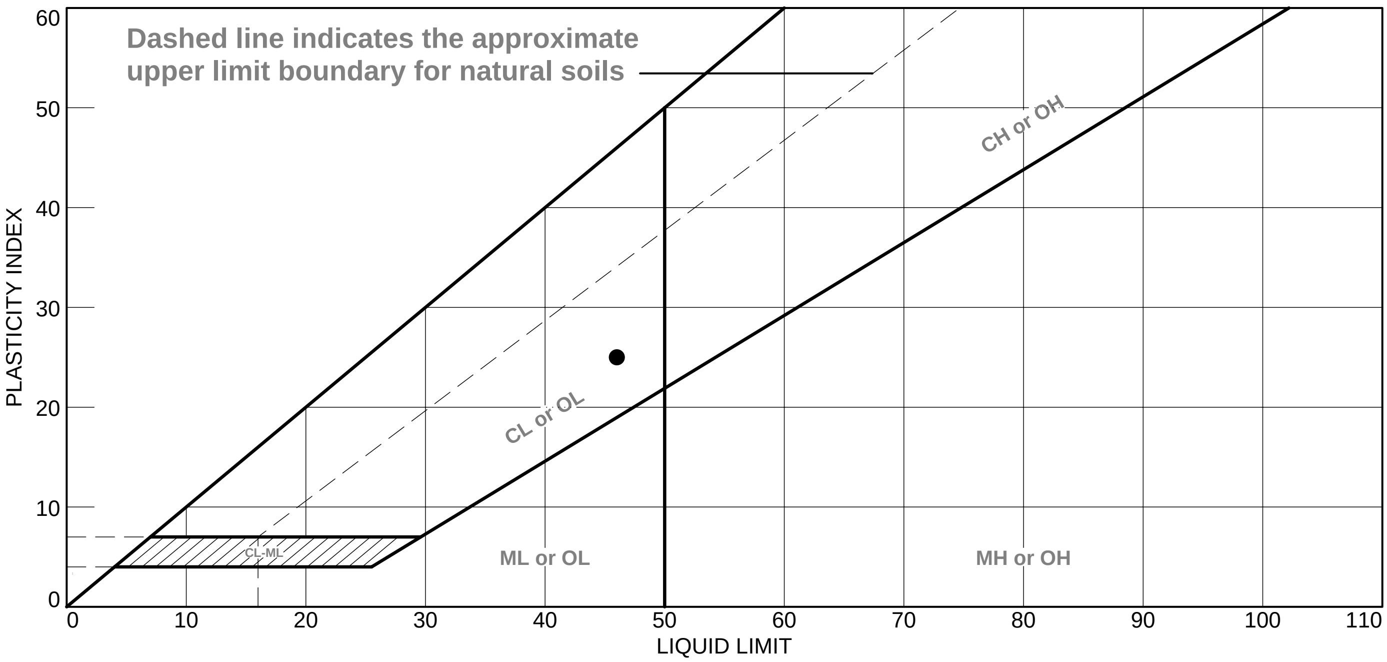
Terracon

Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY LEAN CLAY	46	21	25			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B002 **Depth:** 35.0'-37.0'

Sample Number: S-10

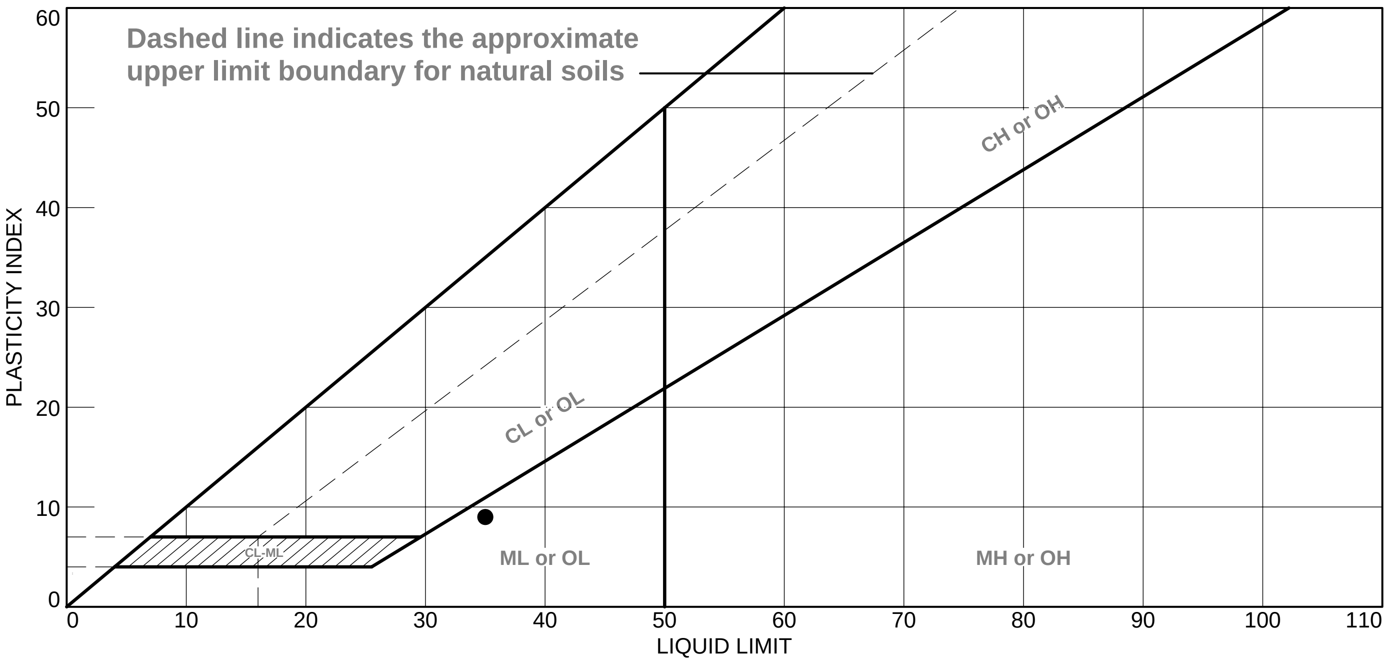
Remarks:

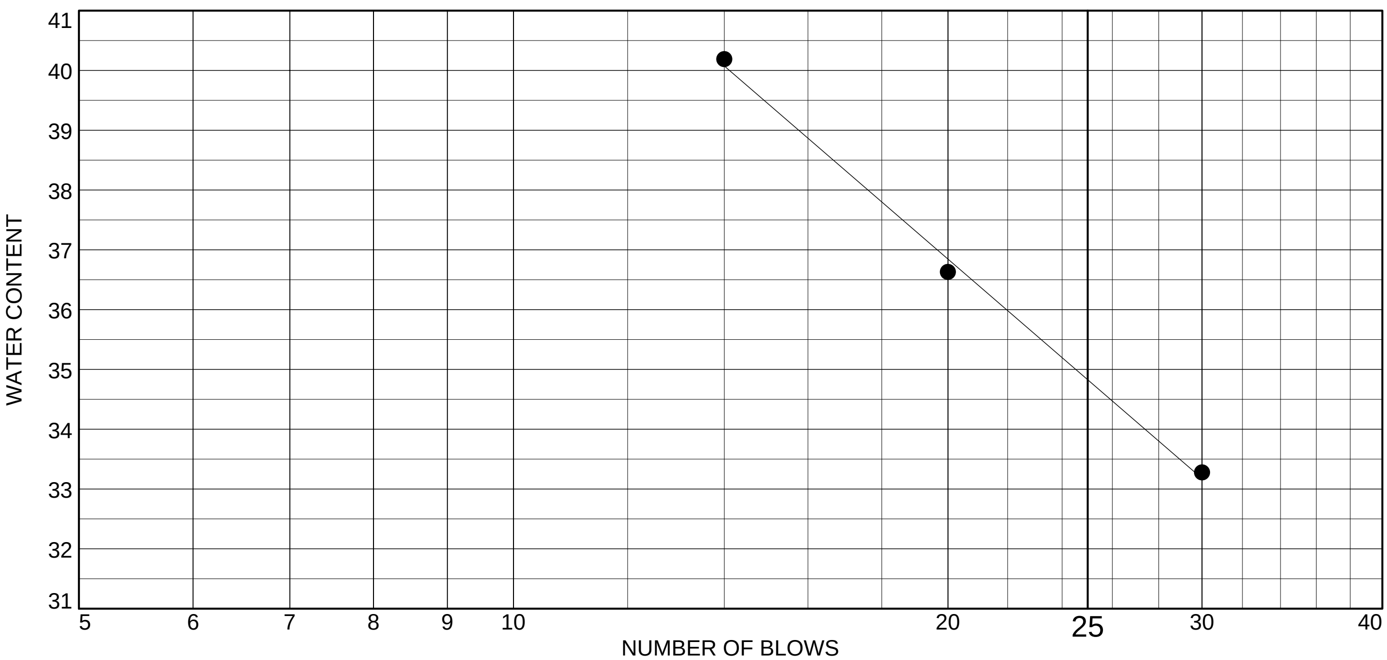
Terracon

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLACK ORGANIC CLAY WITH SAND - WOOD NOTED	35	26	9			OL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B003 **Depth:** 10.0'-12.0'
Sample Number: S-5

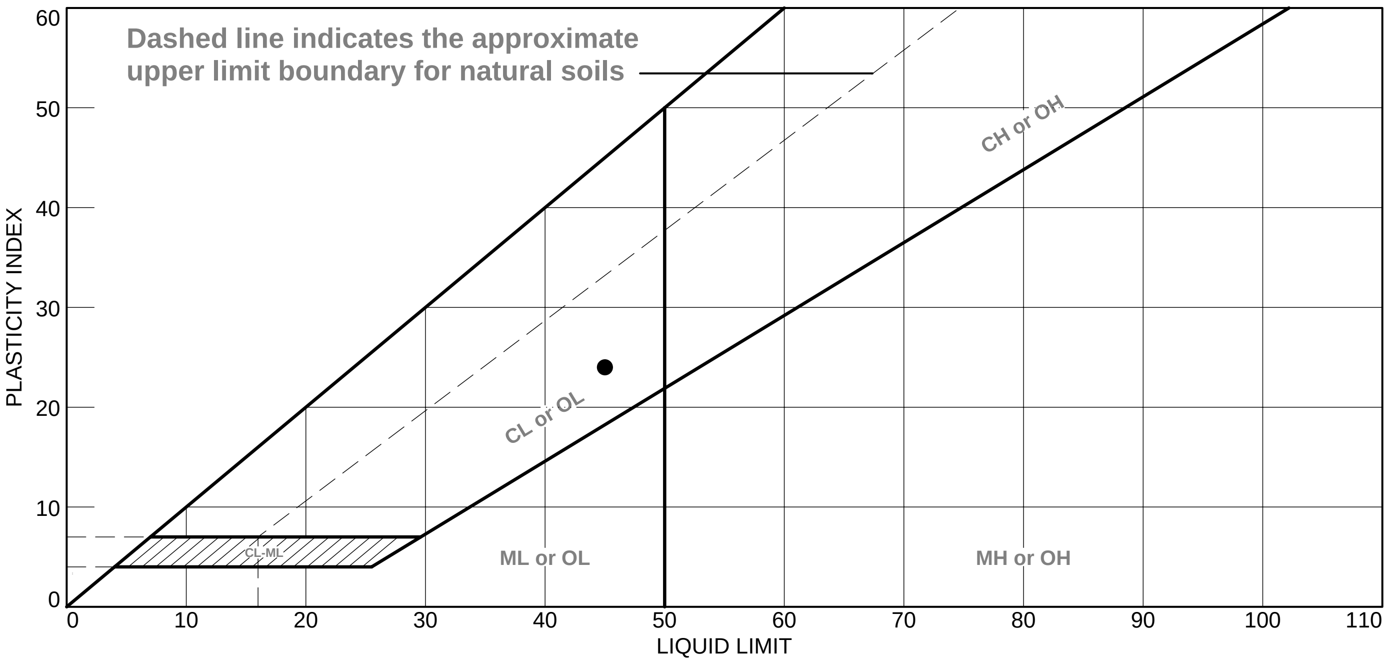
Terracon

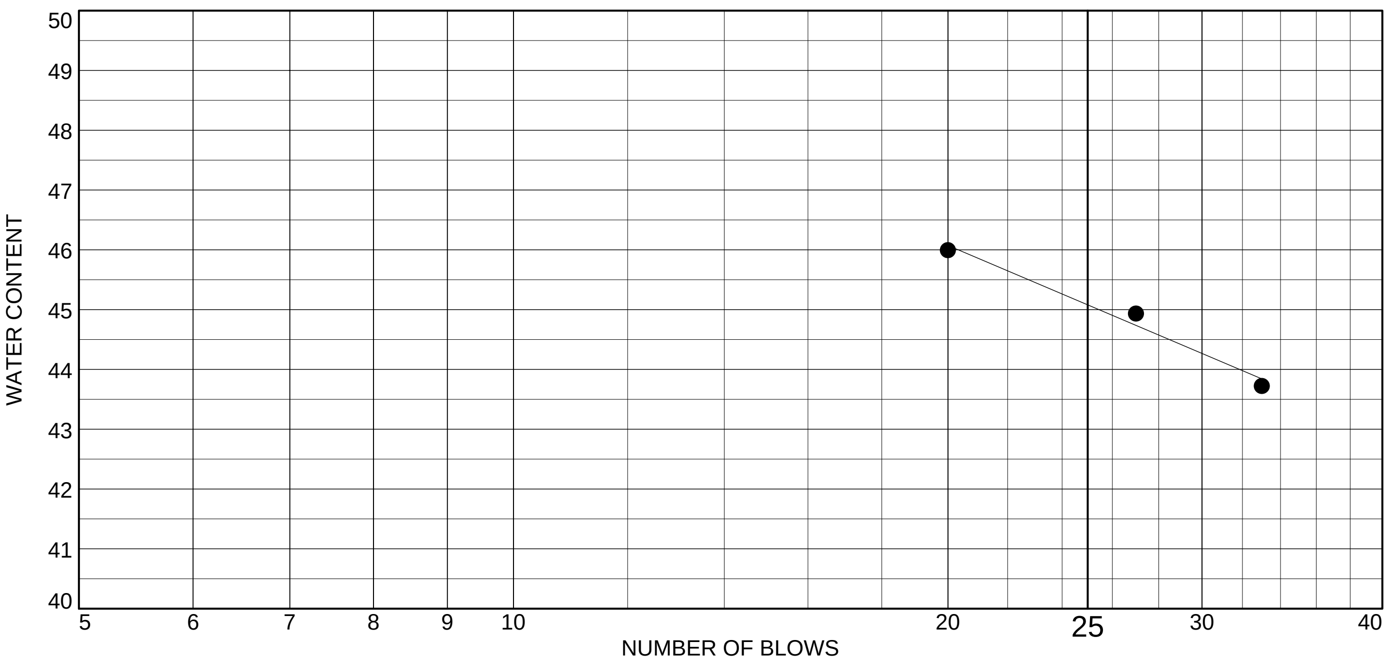
Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY LEAN CLAY	45	21	24			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B003 **Depth:** 25.0'-27.5'
Sample Number: S-8

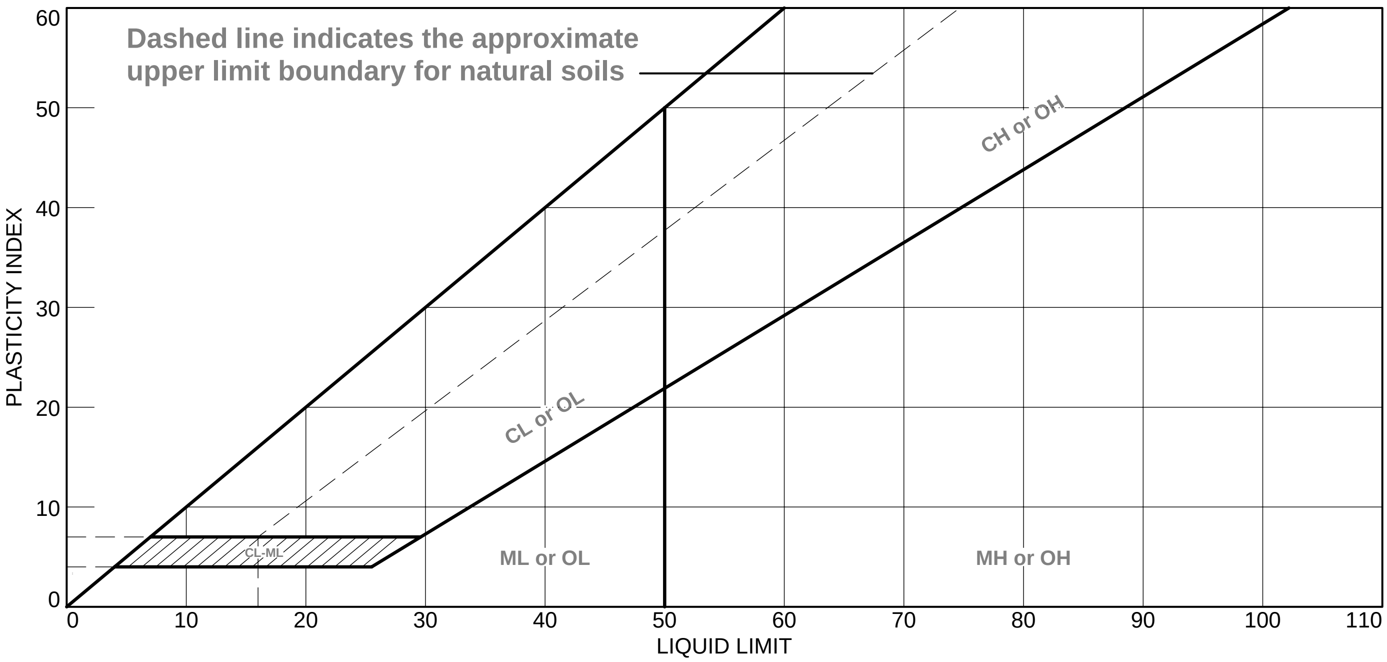
Terracon

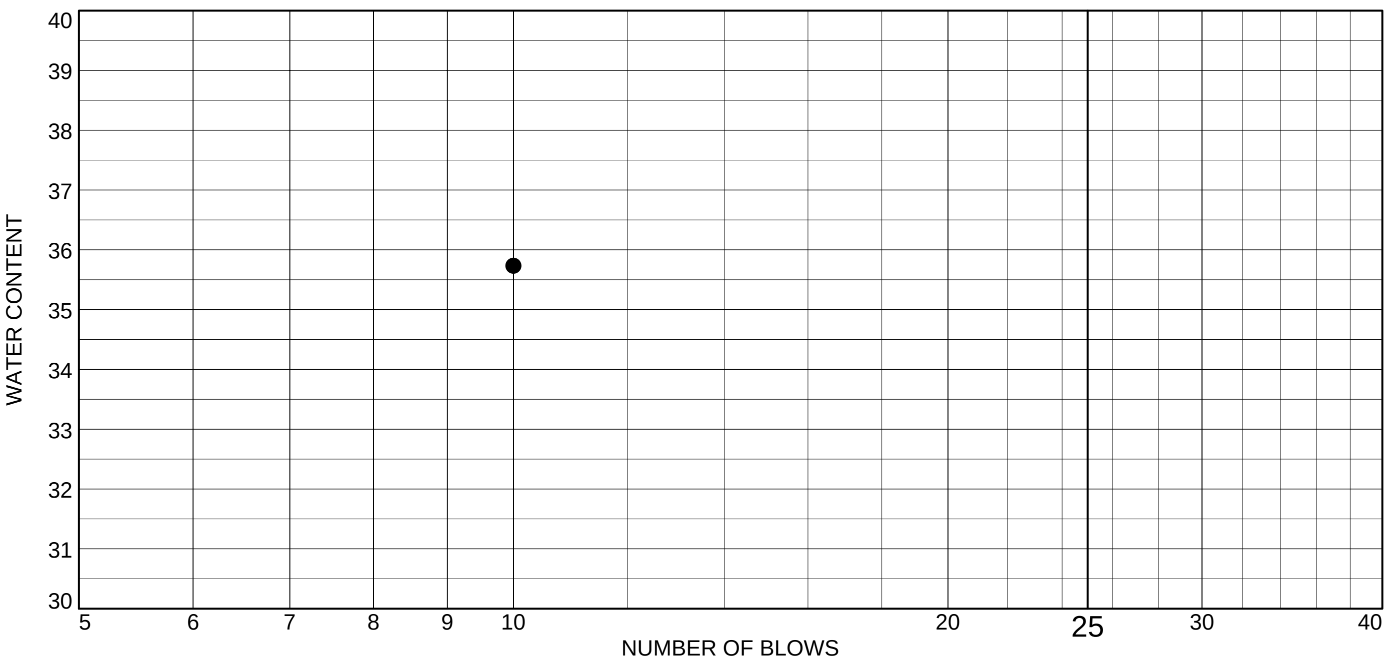
Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN BLACK AND GRAY SANDY SILT WITH GRAVEL	32	35	NP			ML

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B004 **Depth:** 10.0'-12.0'
Sample Number: S-5

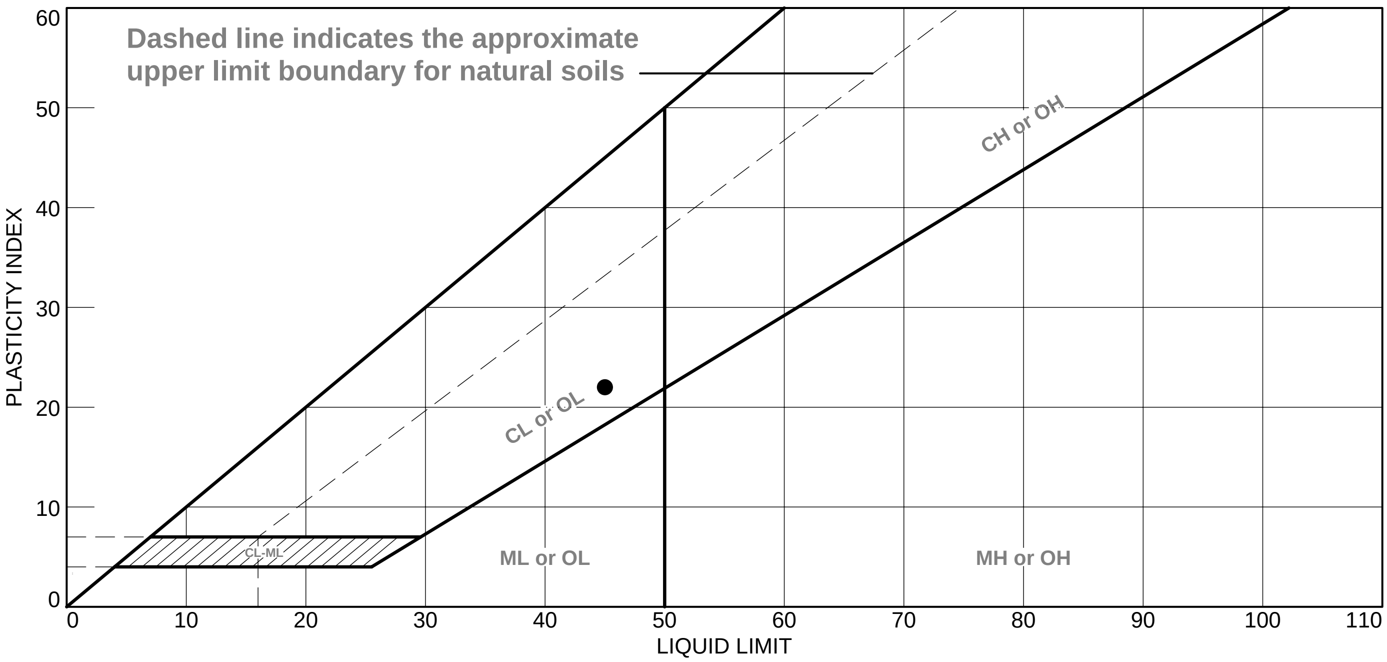
Terracon

Remarks:
● A single point test was performed because of difficultly obtaining high blow counts due to type of material.

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	VERY DARK GRAY LEAN CLAY - ORGANICS NOTED	45	23	22			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

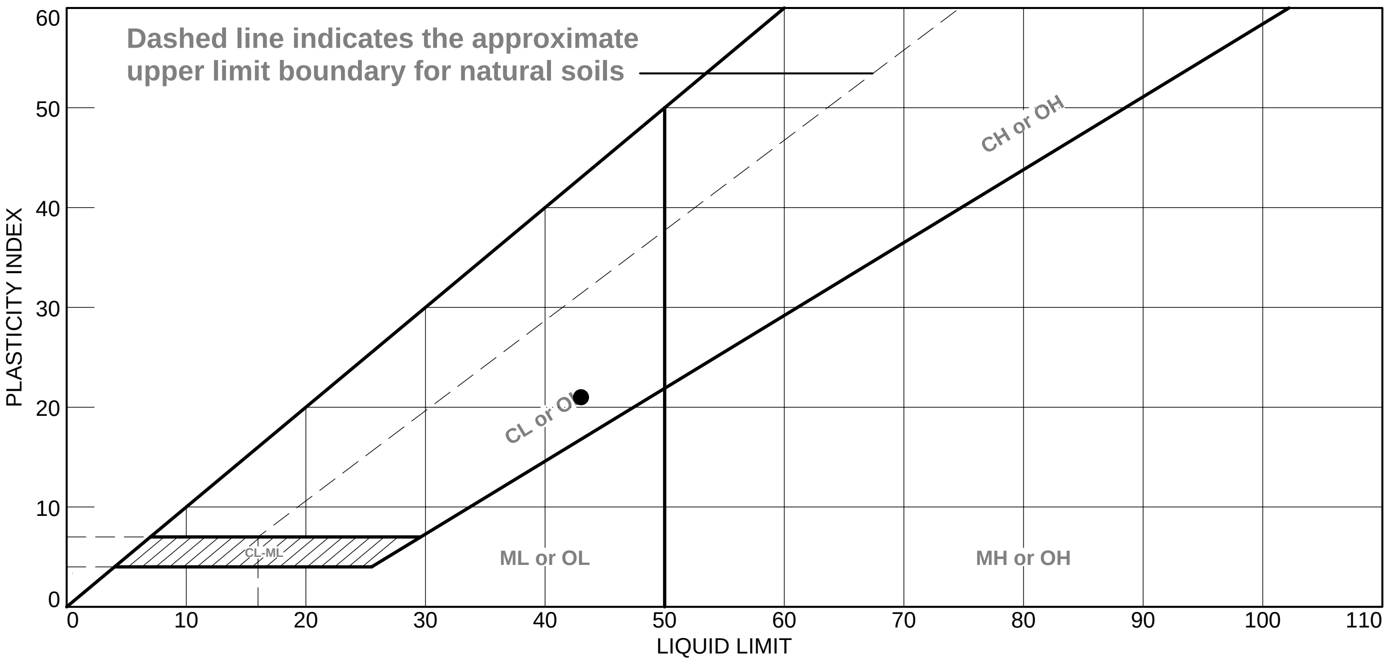
Source of Sample: HEN-B004 **Depth:** 20.0'-22.0'
Sample Number: S-7

Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAY LEAN CLAY	43	22	21			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B004 **Depth:** 30.0'-32.0'
Sample Number: S-9

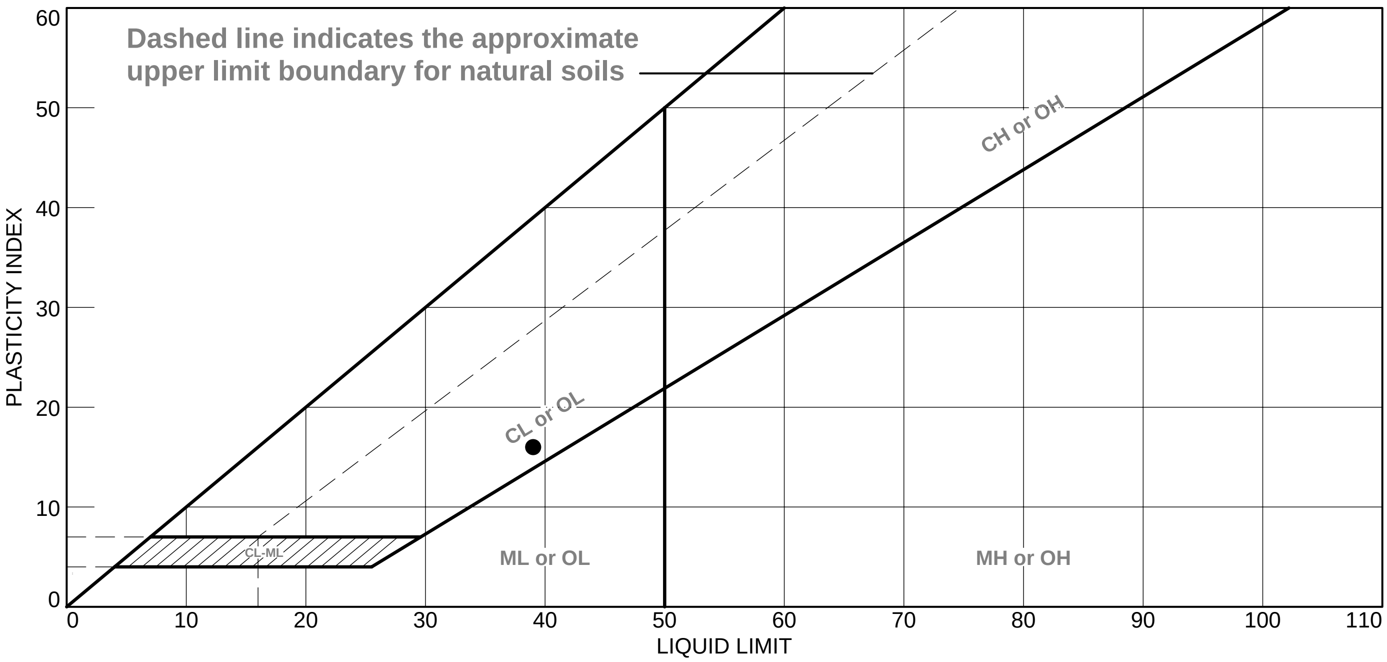
Terracon

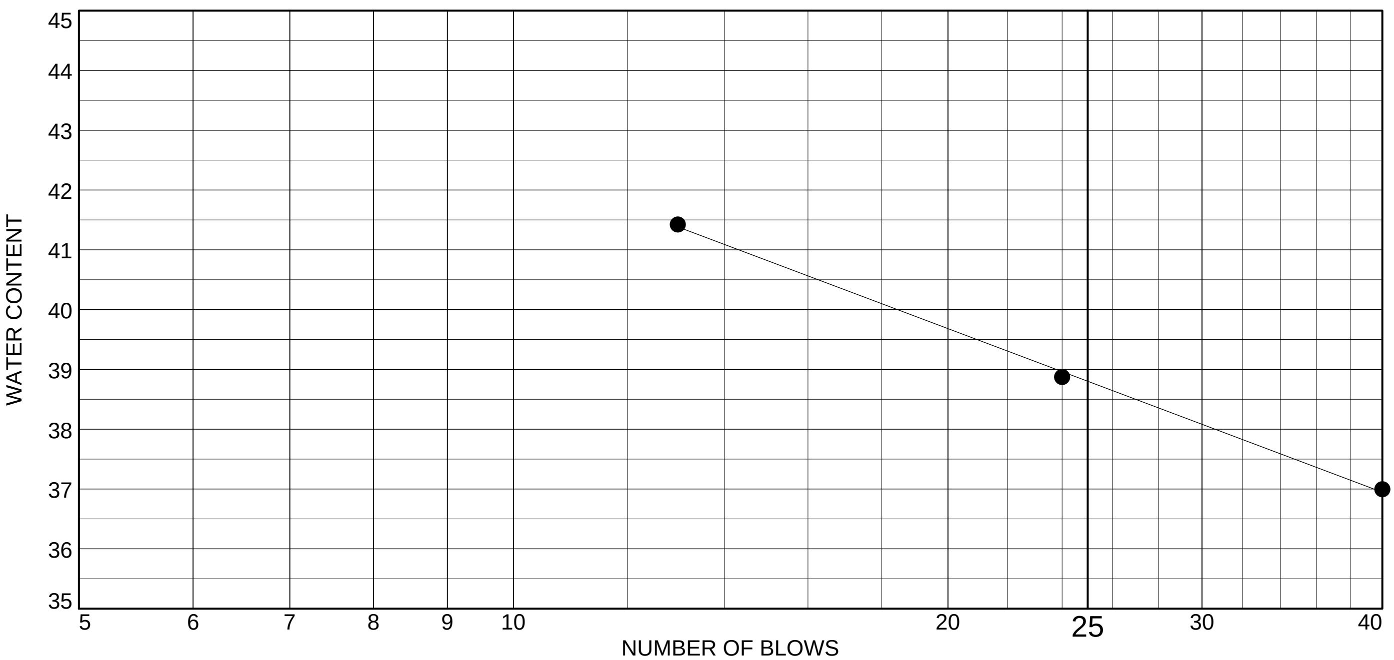
Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLACK TO VERY DARK GRAY ORGANIC CLAY	39	23	16			OL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

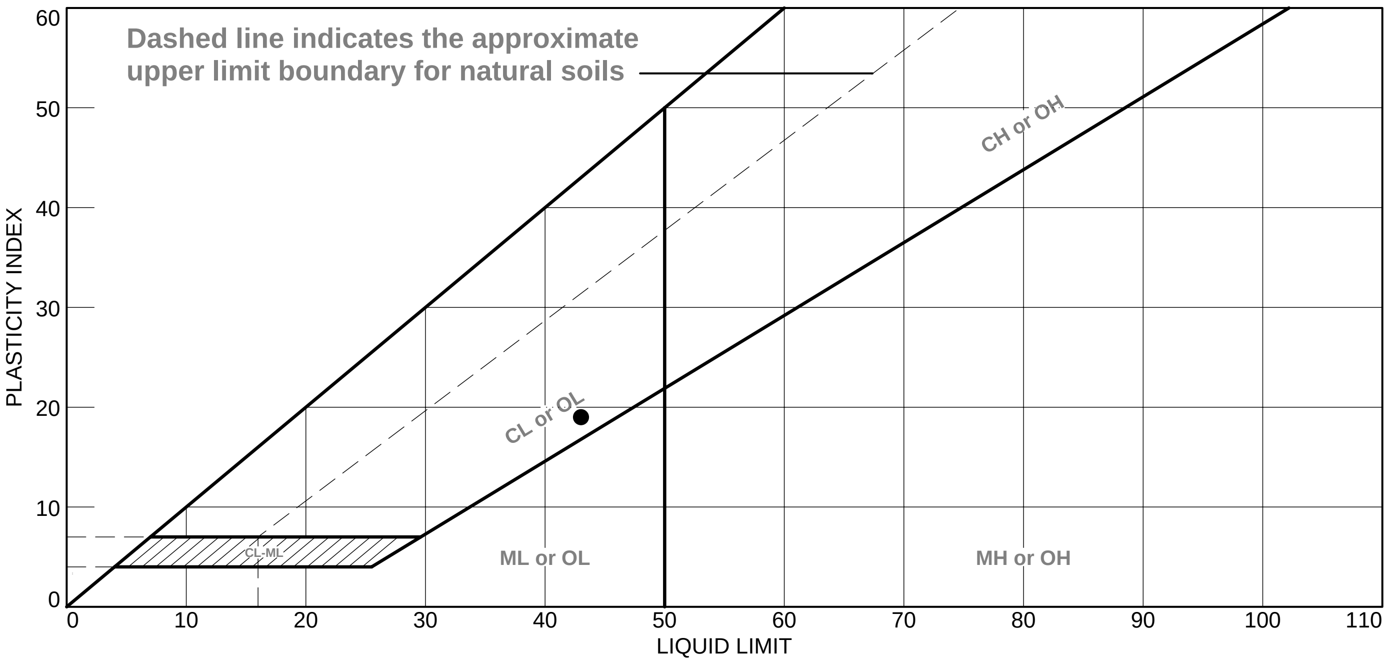
Source of Sample: HEN-B005 **Depth:** 7.5'-9.5'
Sample Number: S-2

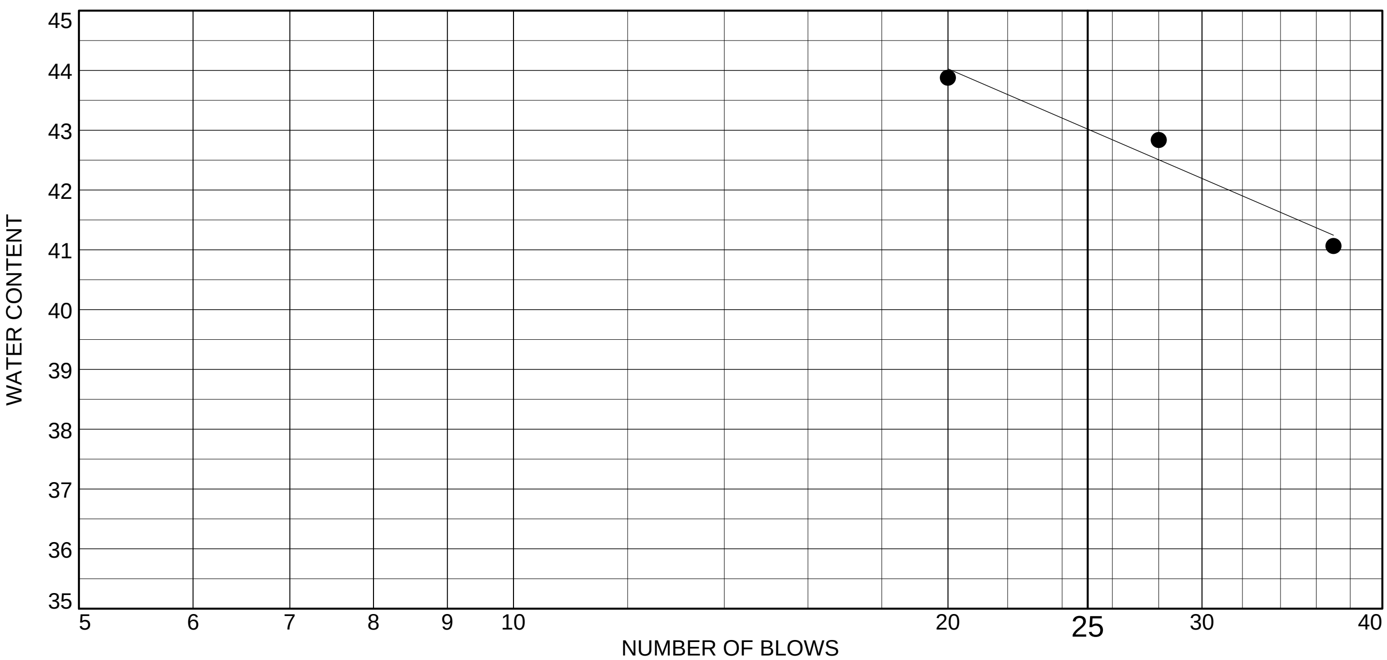
Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY LEAN CLAY WITH SAND AND FLY ASH	43	24	19	100.0	83.8	CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B005 **Depth:** 12.5'-14.5'
Sample Number: S-4

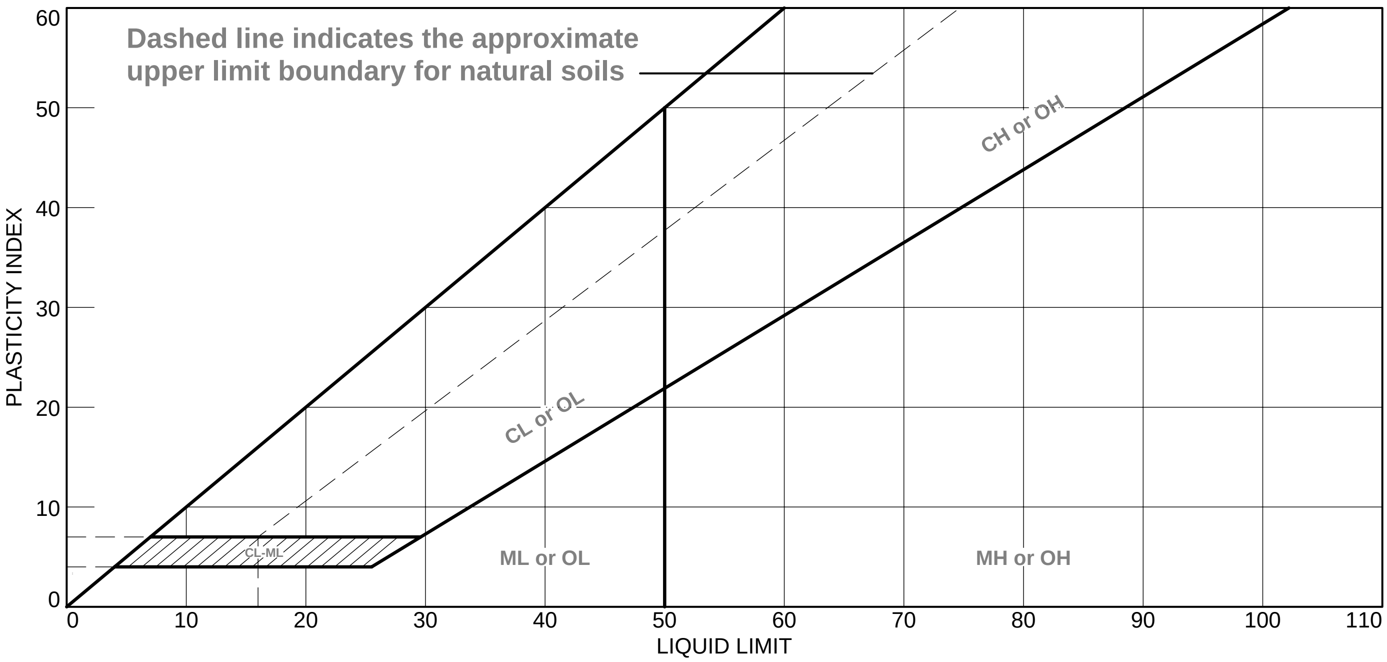
Terracon

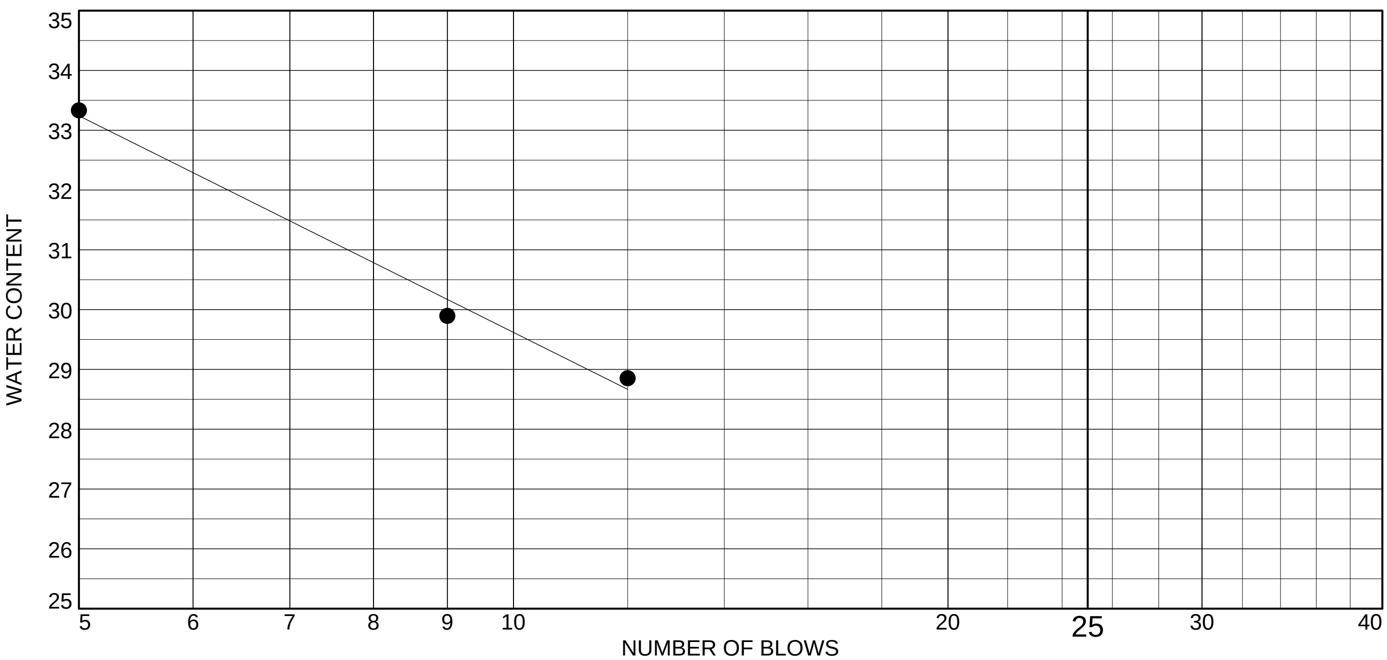
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	MULTI STRATA SAMPLE: TOP, FLY ASH - MIDDLE, FLY ASH LEAN CLAY WITH SAND MIX - BOTTOM, BROWN SANDY CLAY	25	28	NP			

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B008 **Depth:** 7.5'-9.5'
Sample Number: S-4

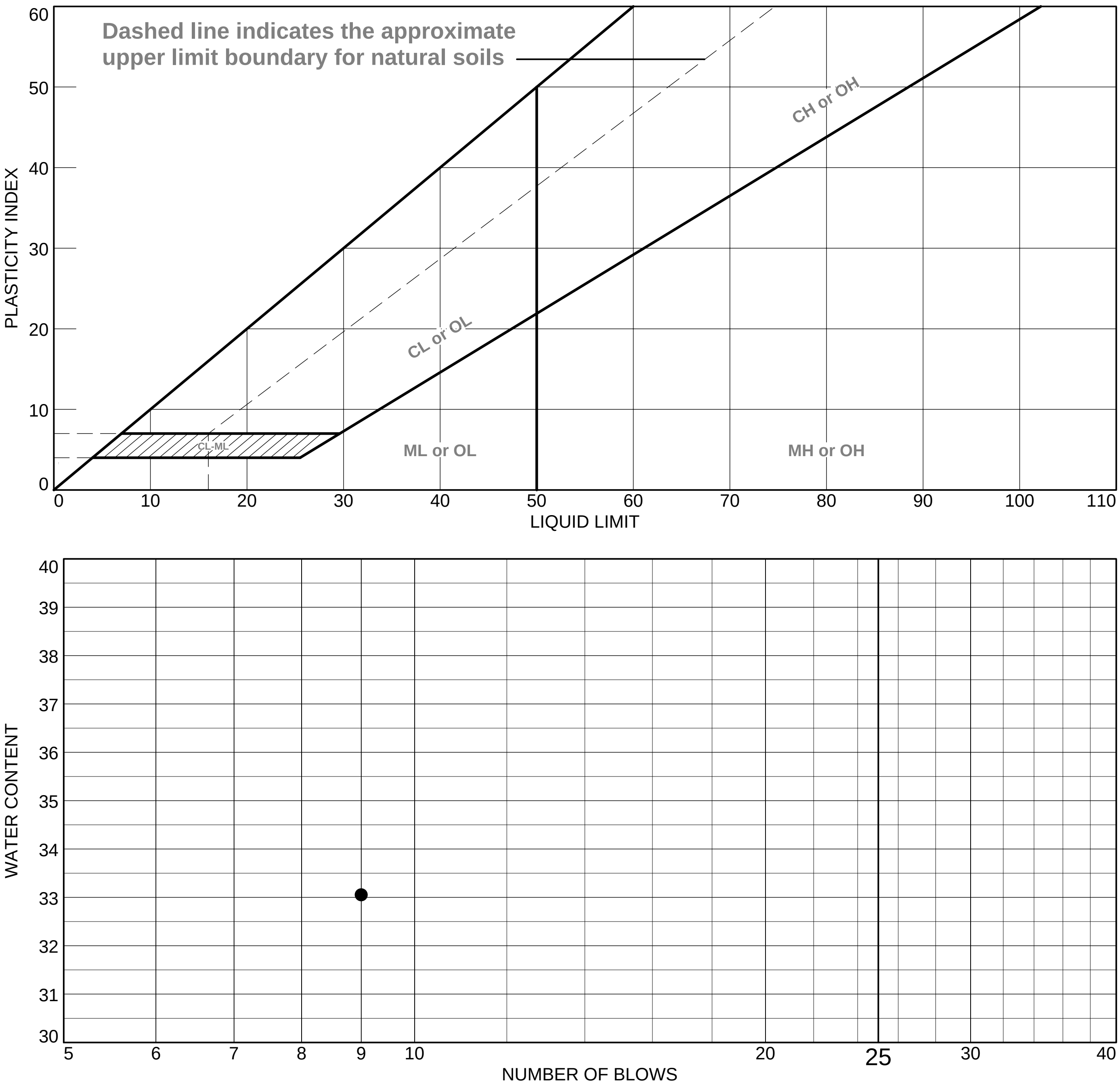
Terracon

Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	VERY DARK GRAY FLY ASH WITH SAND AND GRAVEL	29	33	NP			

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B010 **Depth:** 10.0'-11.5'

Sample Number: S-5

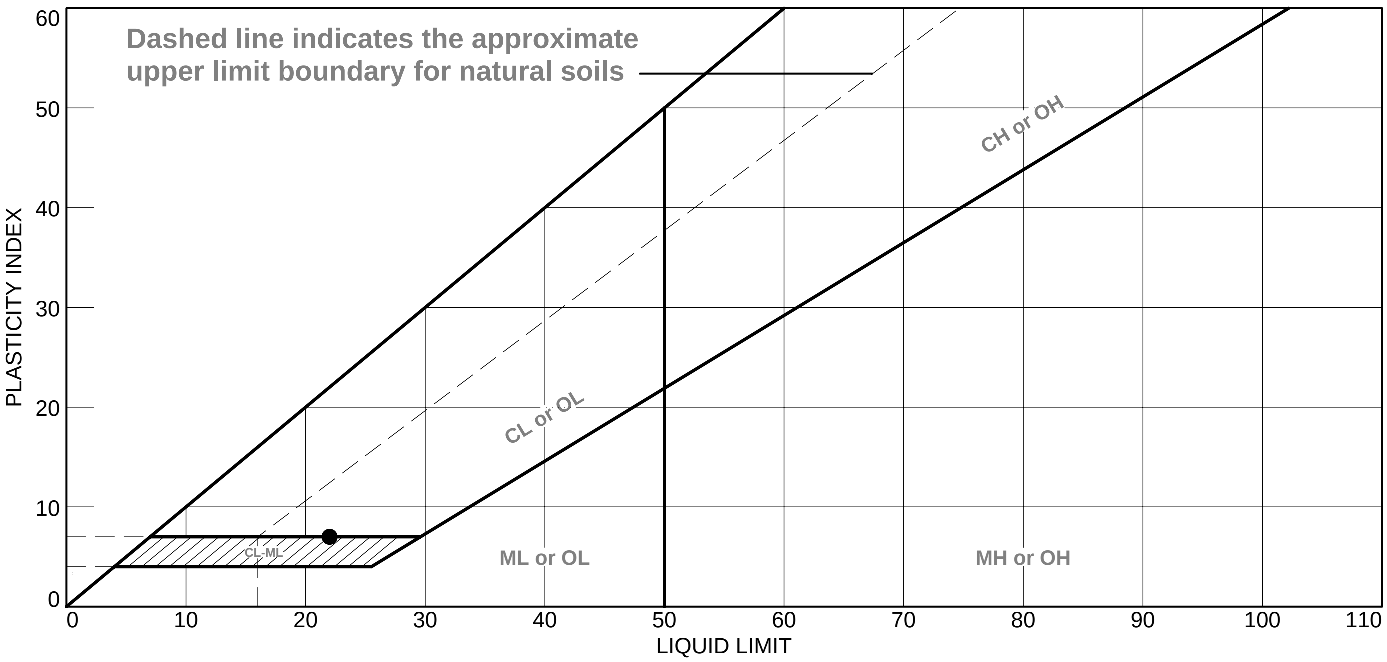
Remarks:

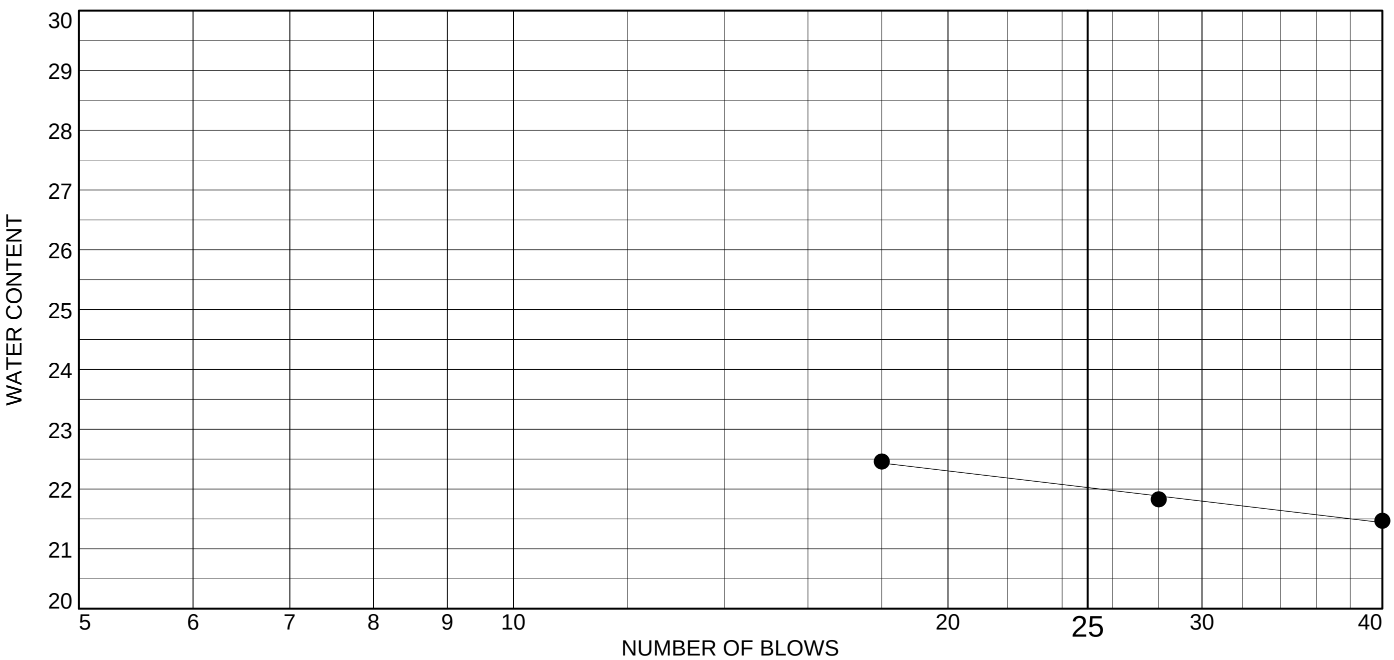
● A single point test was performed because of difficultly obtaining high blow counts due to type of material.

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	RUST BROWN SANDY LEAN CLAY	22	15	7			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

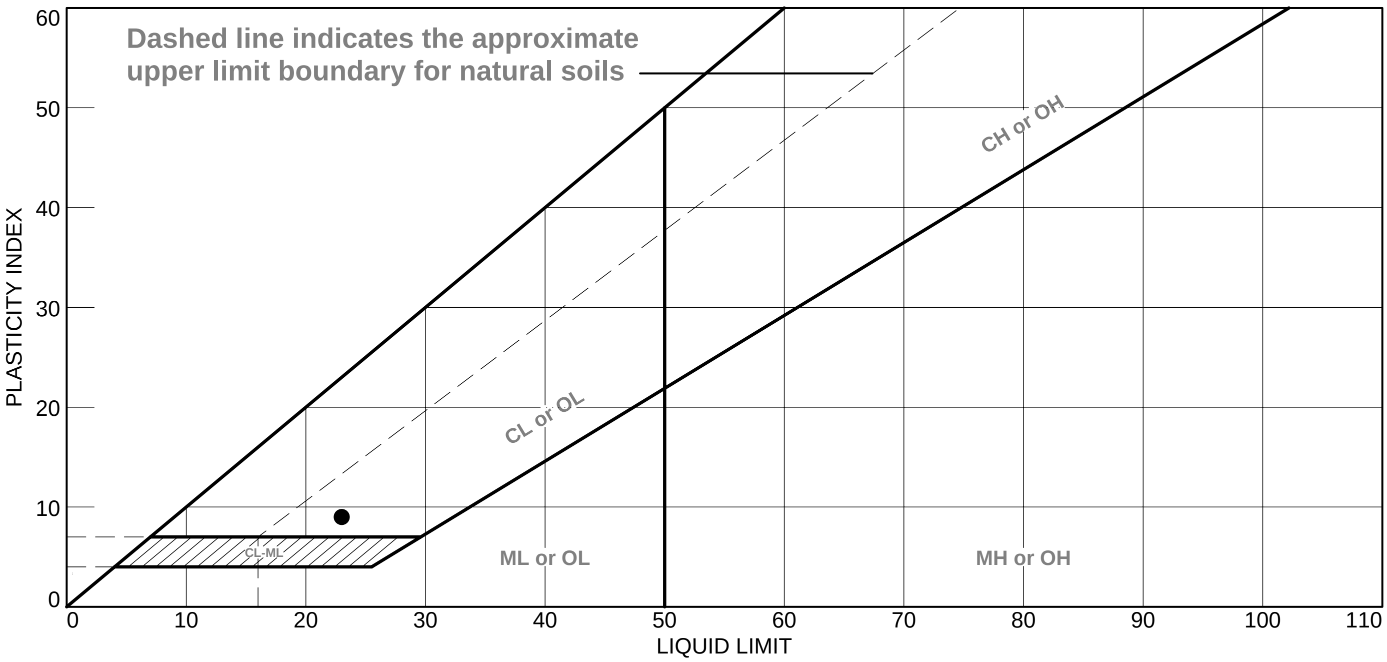
Source of Sample: HEN-B011 **Depth:** 2.5'-4.0'
Sample Number: S-2

Remarks:

Figure

Tested By: HP **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK BROWN LEAN CLAY WITH SILT AND SAND - SILT AND SAND SEAM NOTED	23	14	9			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B012 **Depth:** 10.0'-11.5'
Sample Number: S-5

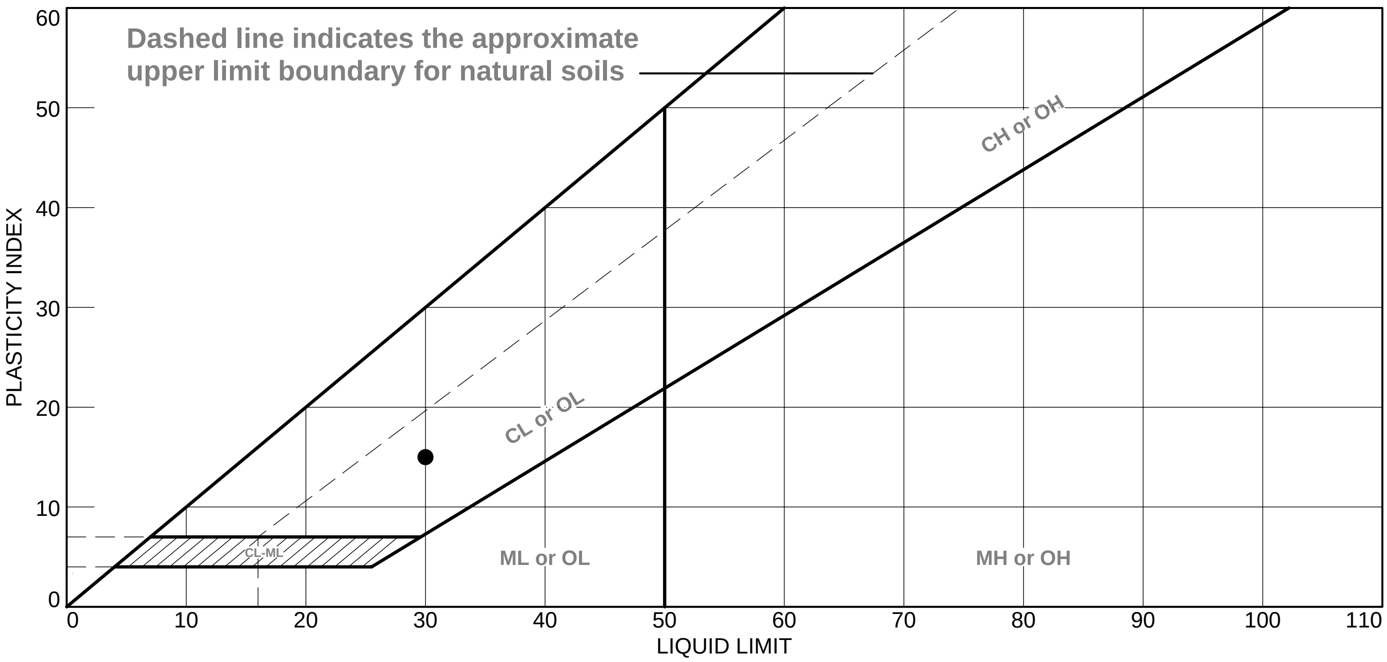
Terracon

Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND	30	15	15			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B012 **Depth:** 30.0'-32.0'

Sample Number: S-9

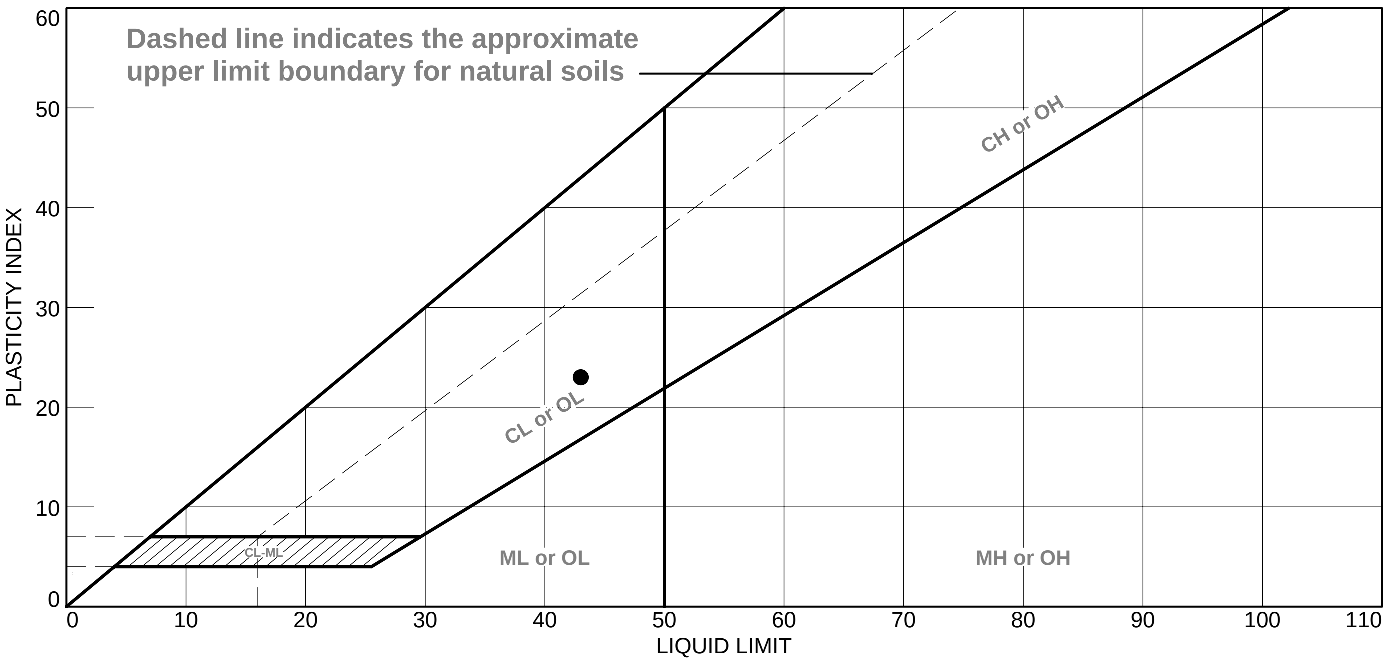
Terracon

Remarks:

Figure

Tested By: HP **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAY LEAN CLAY	43	20	23			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B014 **Depth:** 25.0'-27.0'
Sample Number: S-8

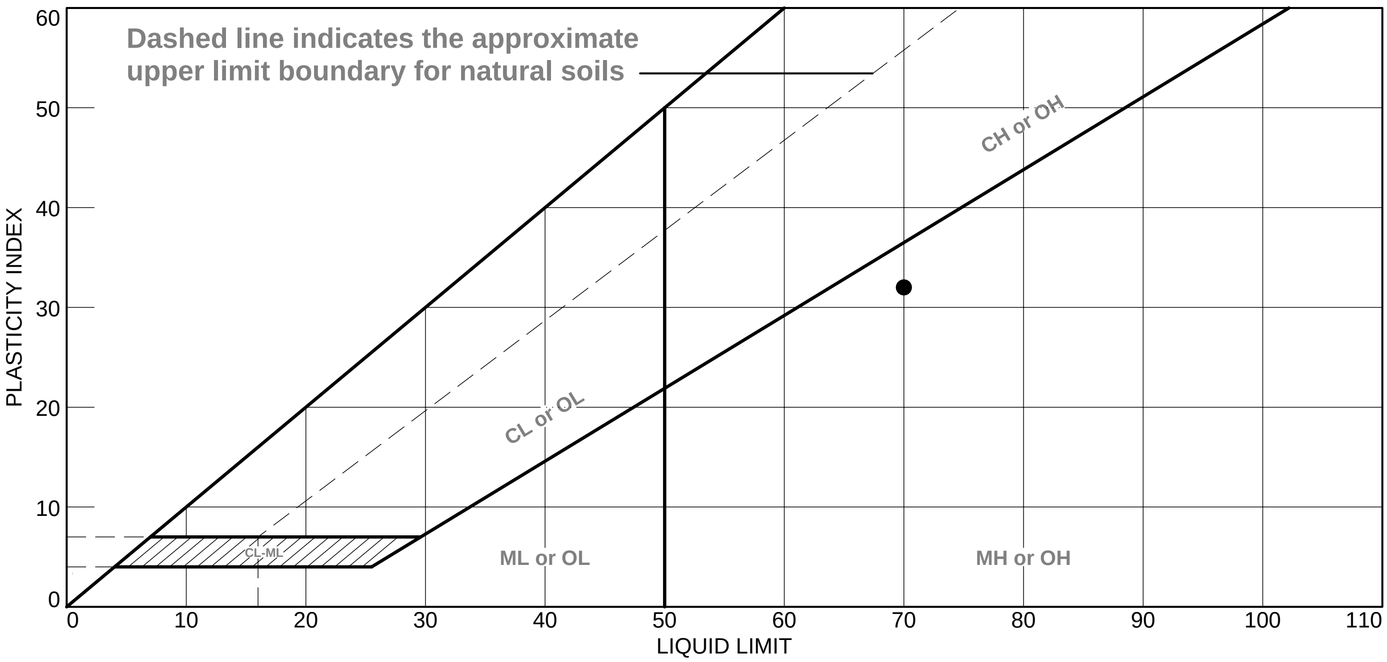
Terracon

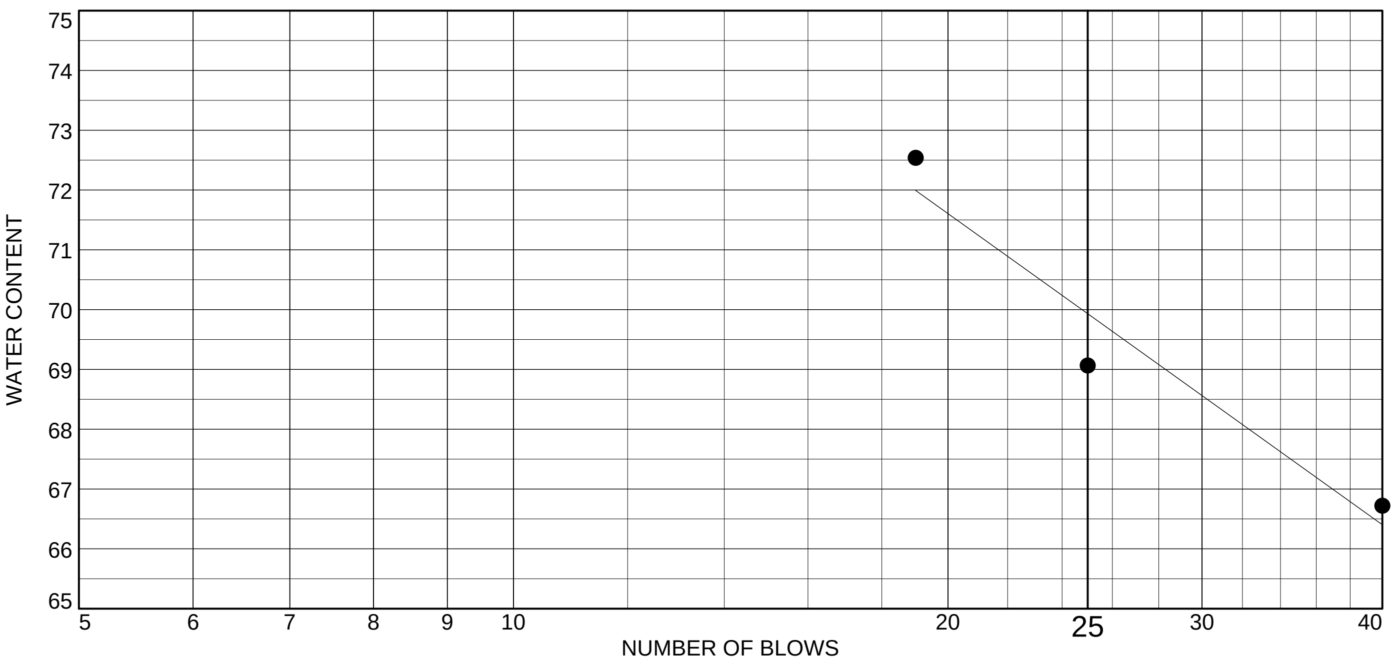
Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	VERY DARK BROWNISH GRAY ORGANIC SILT	70	38	32			OH

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

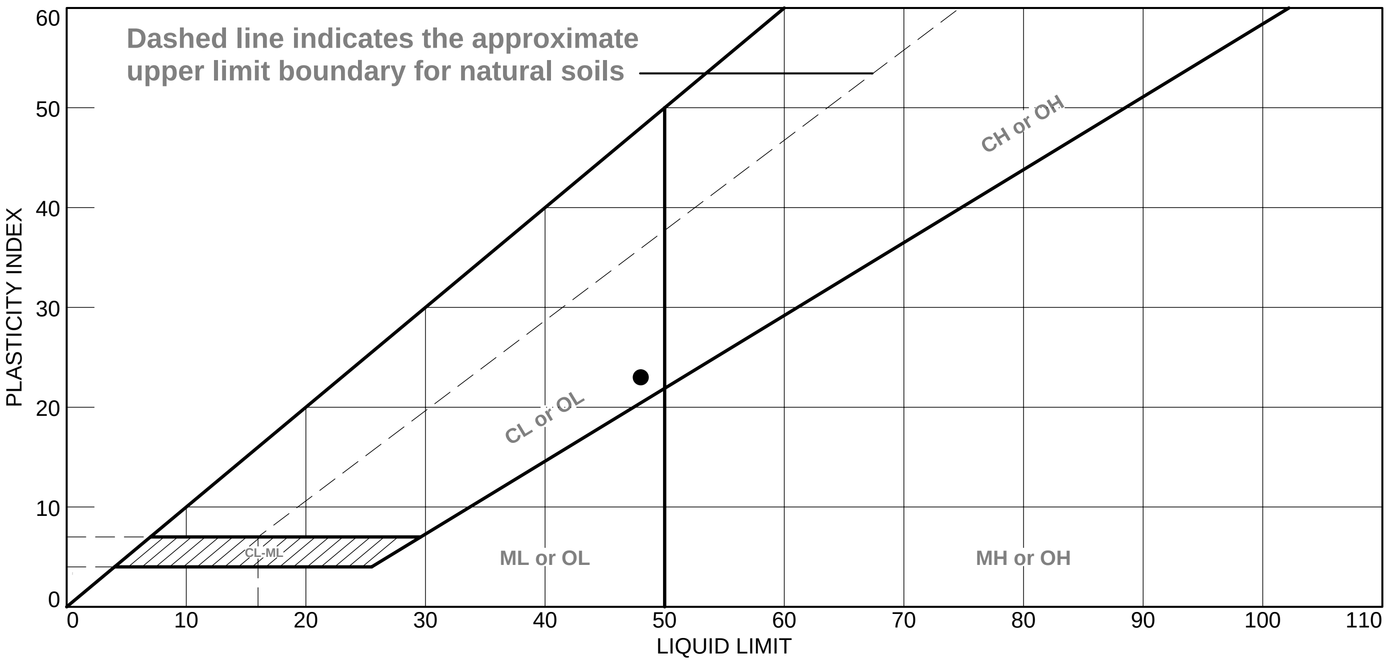
Source of Sample: HEN-B014 **Depth:** 35.0'-37.0'
Sample Number: S-10

Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLACK AND DARK GRAY ORGANIC LEAN CLAY WITH SAND AND GRAVEL	48	25	23			OL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

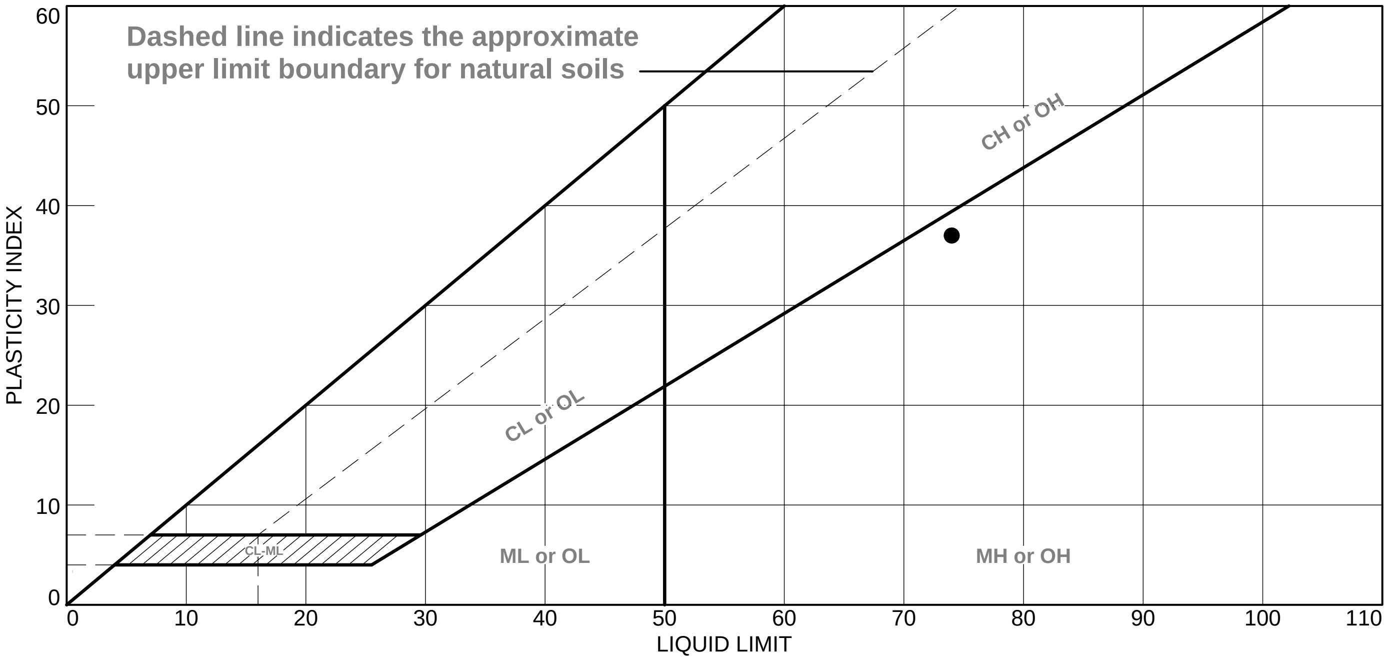
Source of Sample: HEN-B015 **Depth:** 7.5'-9.5'
Sample Number: S-4

Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLACK ORGANIC SILT WITH SAND	74	37	37			OH

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B015 **Depth:** 25.0'-27.0'
Sample Number: S-8

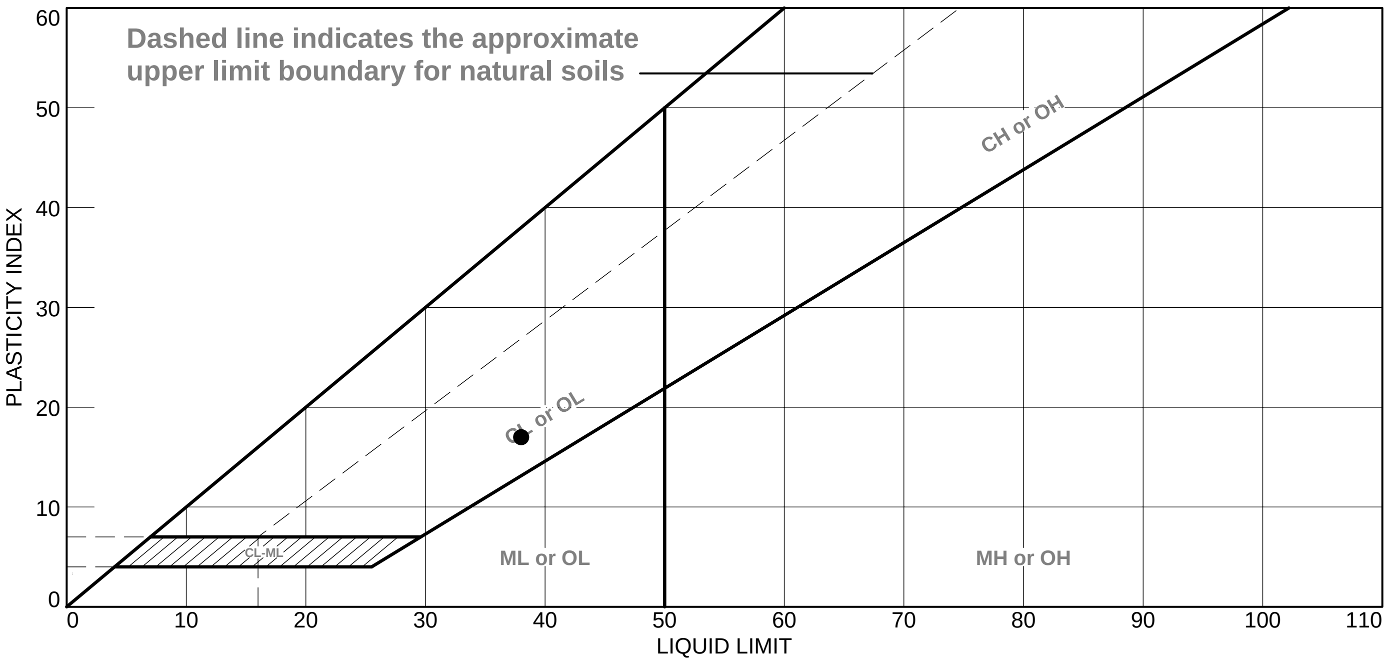
Remarks:

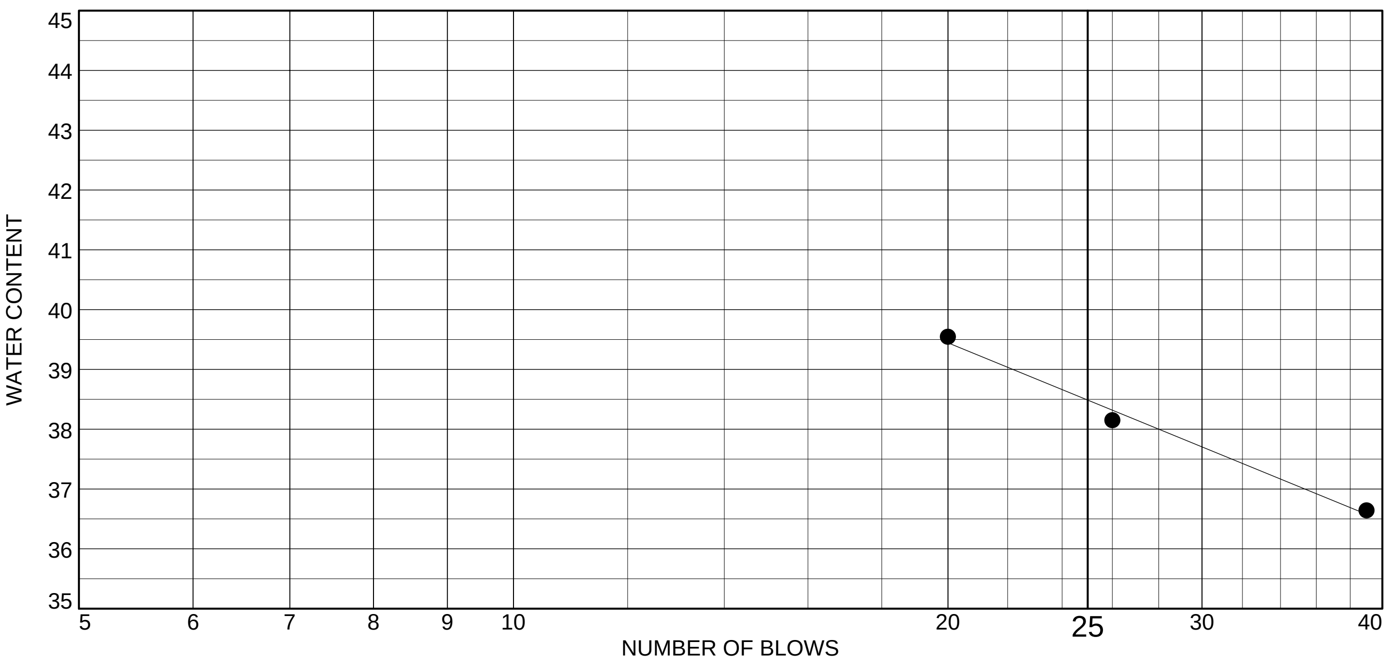
Terracon

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	VERY DARK GRAY CLAY WITH SAND AND GRAVEL - ORGANICS AND ASH NOTED	38	21	17			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B016 **Depth:** 20.0'-22.0'
Sample Number: S-7

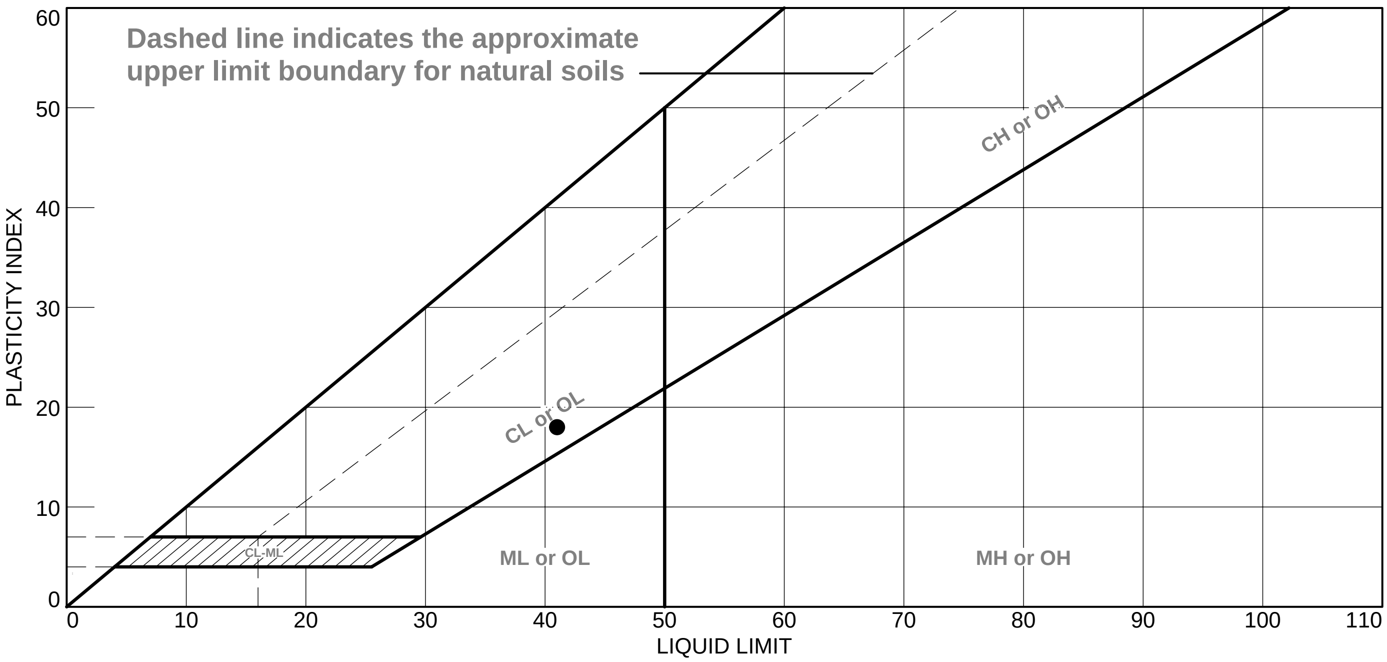
Terracon

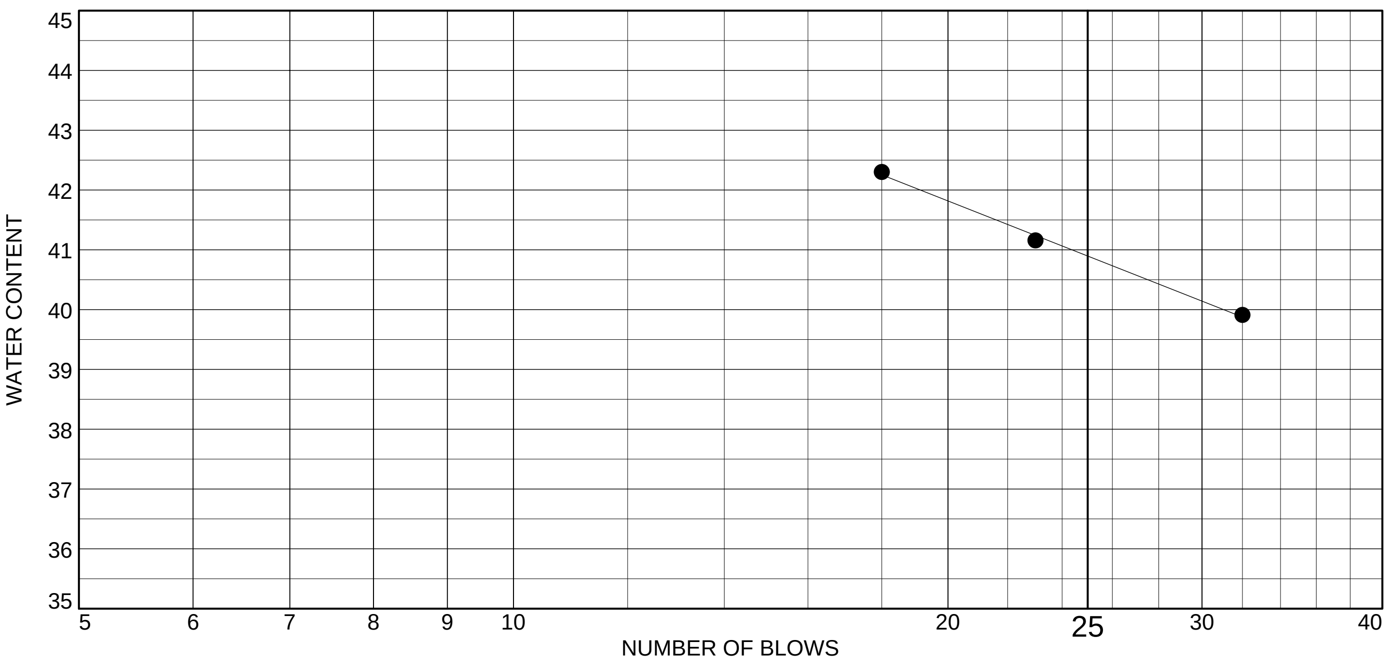
Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY LEAN CLAY WITH SAND - FLY ASH AND ORGANICS NOTED	41	23	18			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B016 **Depth:** 35.0'-37.0'
Sample Number: S-10

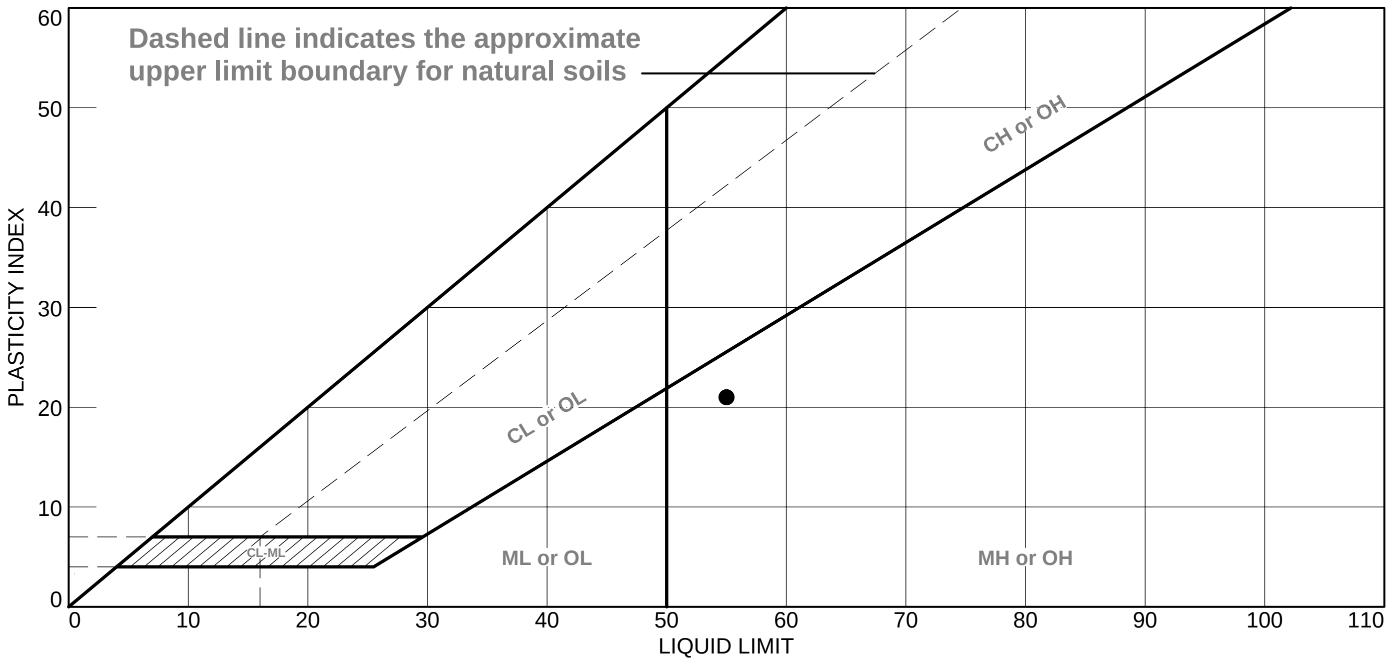
Terracon

Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY LEAN CLAY WITH SILT	55	34	21			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

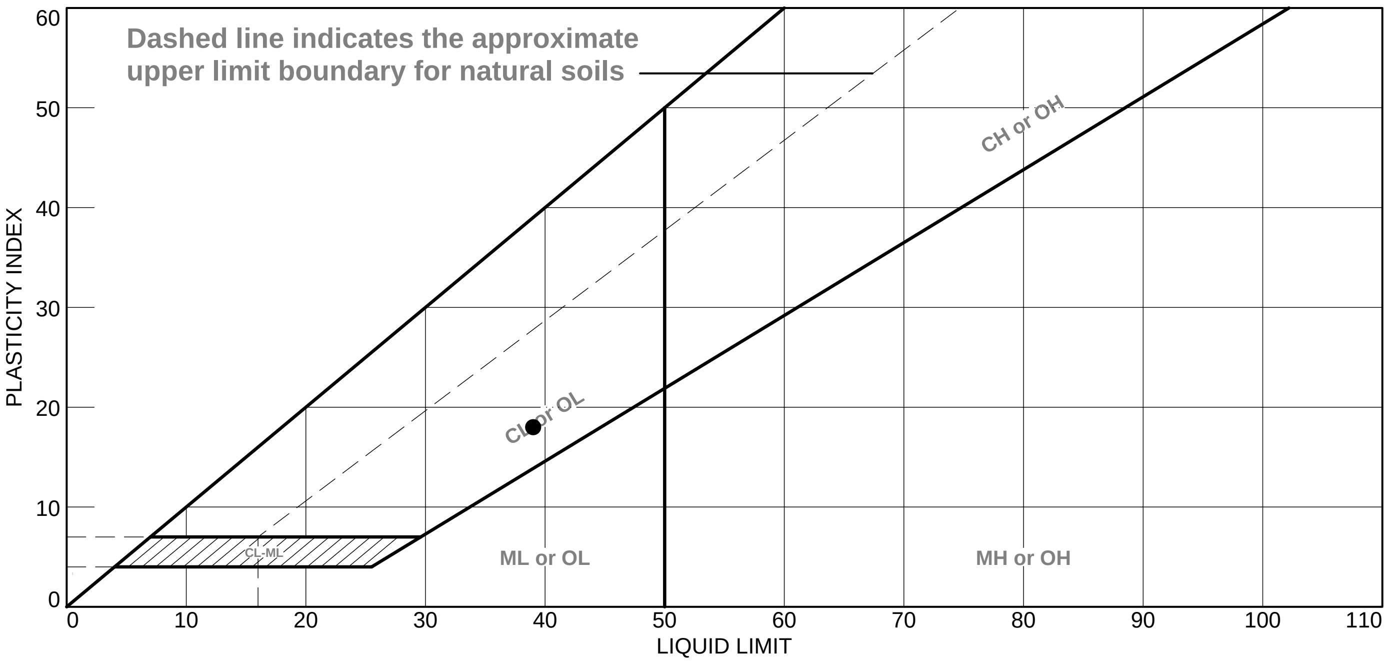
Source of Sample: HEN-B016 **Depth:** 60.0'-61.5'
Sample Number: S-15

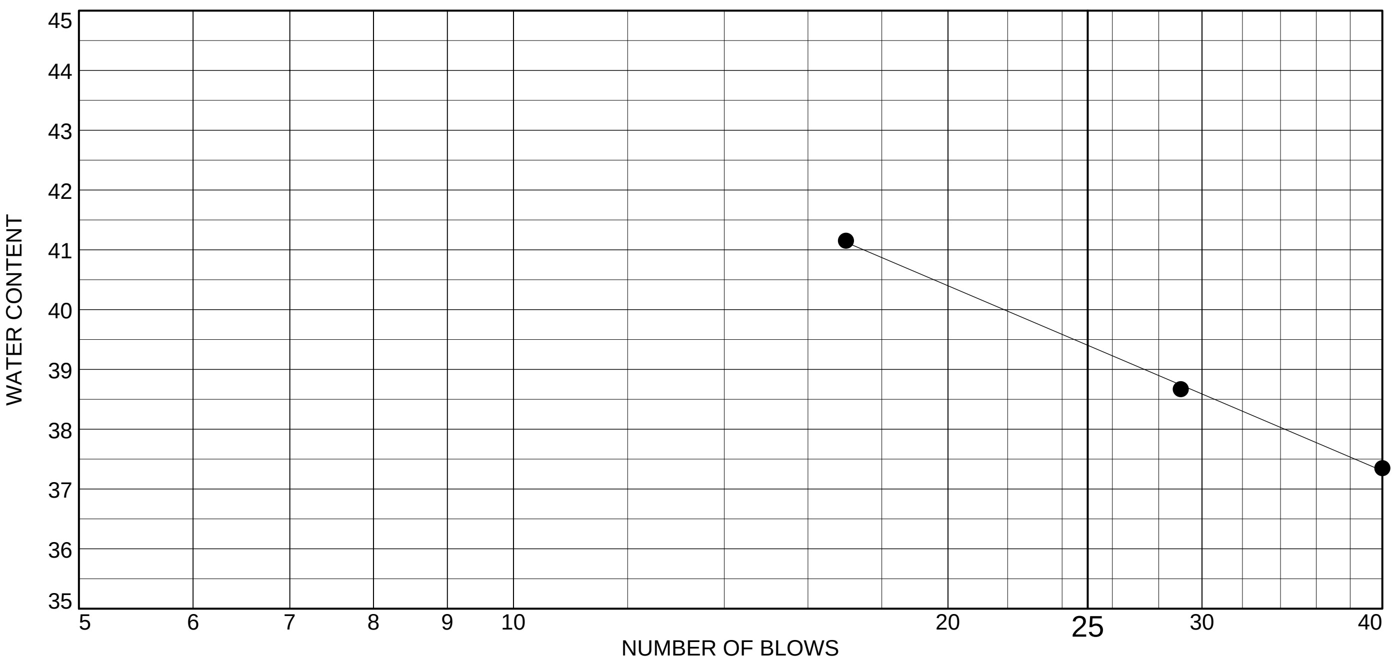
Remarks:

Figure

Tested By: HP **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	VERY DARK GRAY LEAN CLAY WITH SAND	39	21	18			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

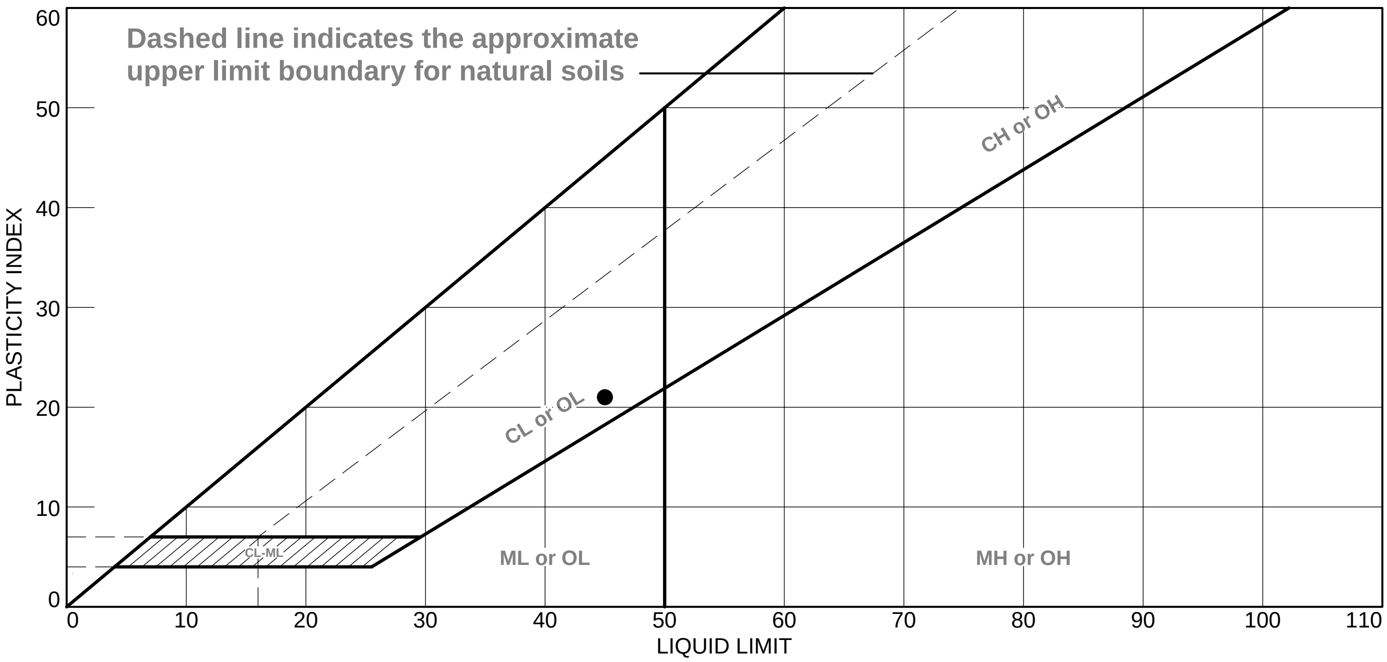
Source of Sample: HEN-B017 **Depth:** 5.0'-7.0'
Sample Number: S-3

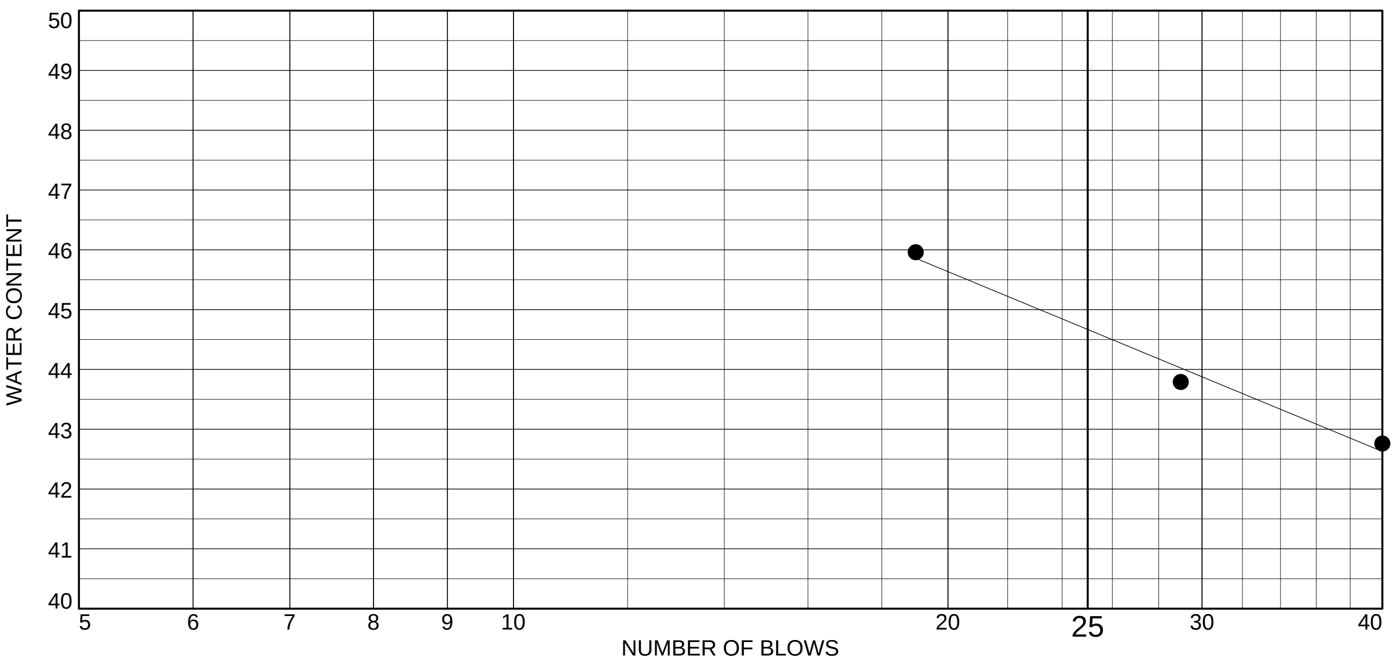
Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAY LEAN CLAY	45	24	21			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

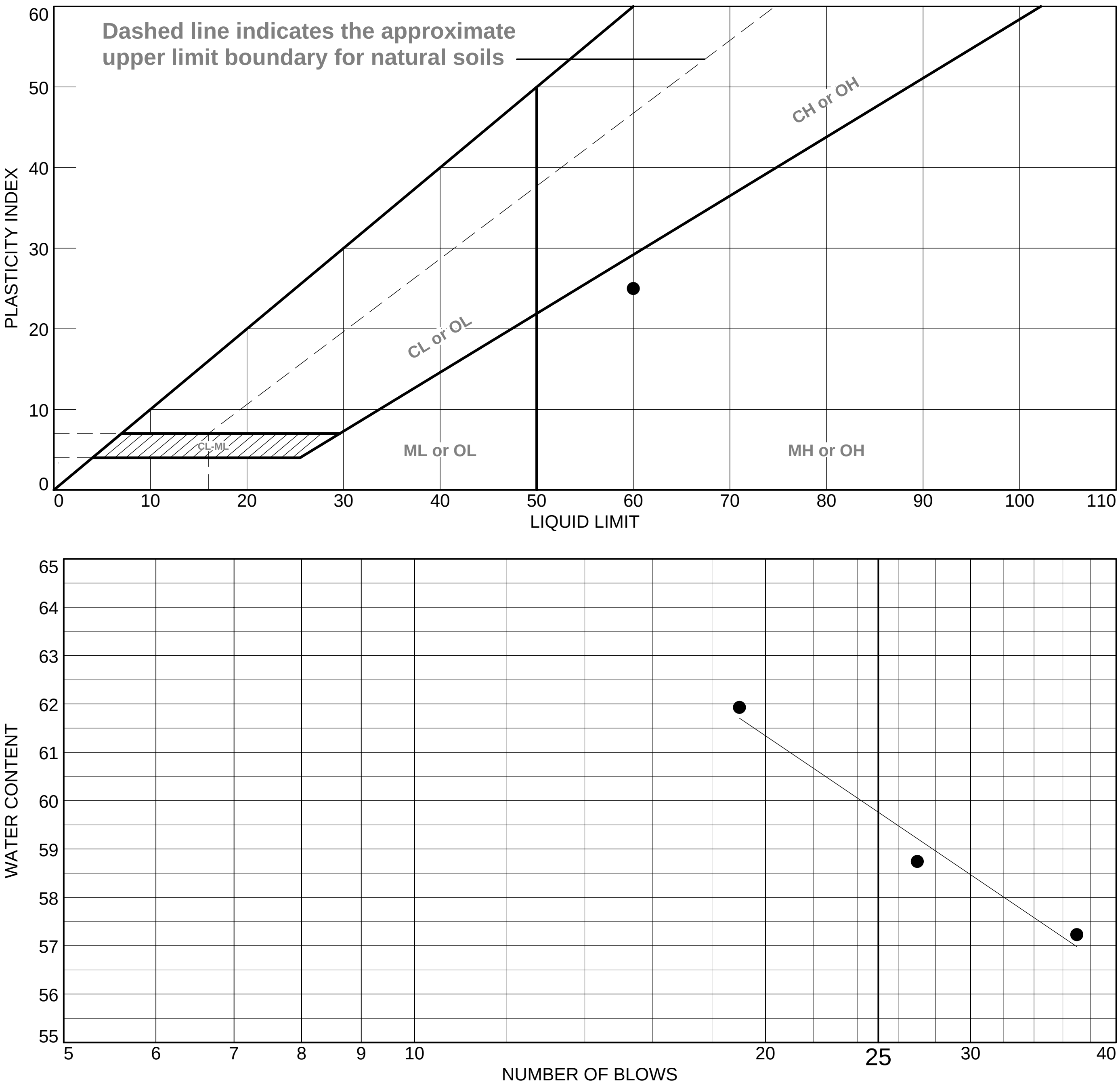
Source of Sample: HEN-B017 **Depth:** 15.0'-17.0'
Sample Number: S-6

Remarks:

Figure

Tested By: HP **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK BROWNISH GRAY ORGANIC CLAY WITH SAND - SAND SEAMS AND SHELL NOTED	60	35	25			OL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

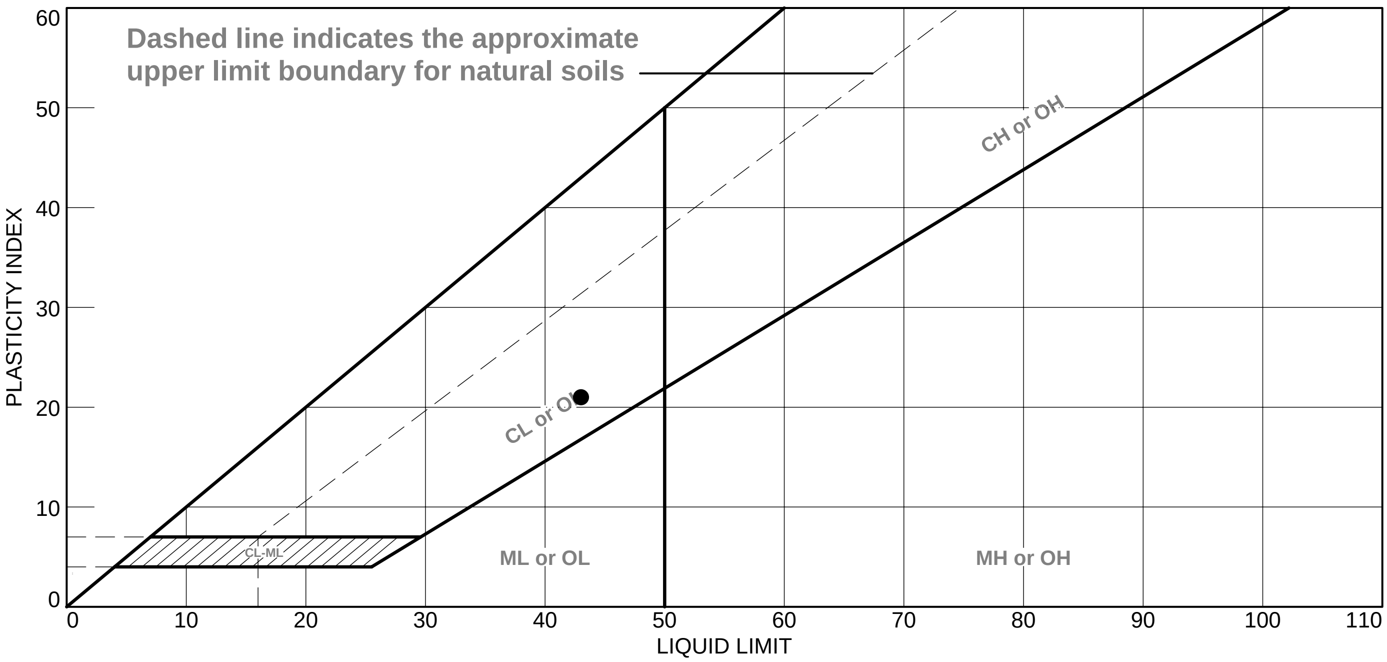
Source of Sample: HEN-B017 **Depth:** 30.0'-32.0'
Sample Number: S-9

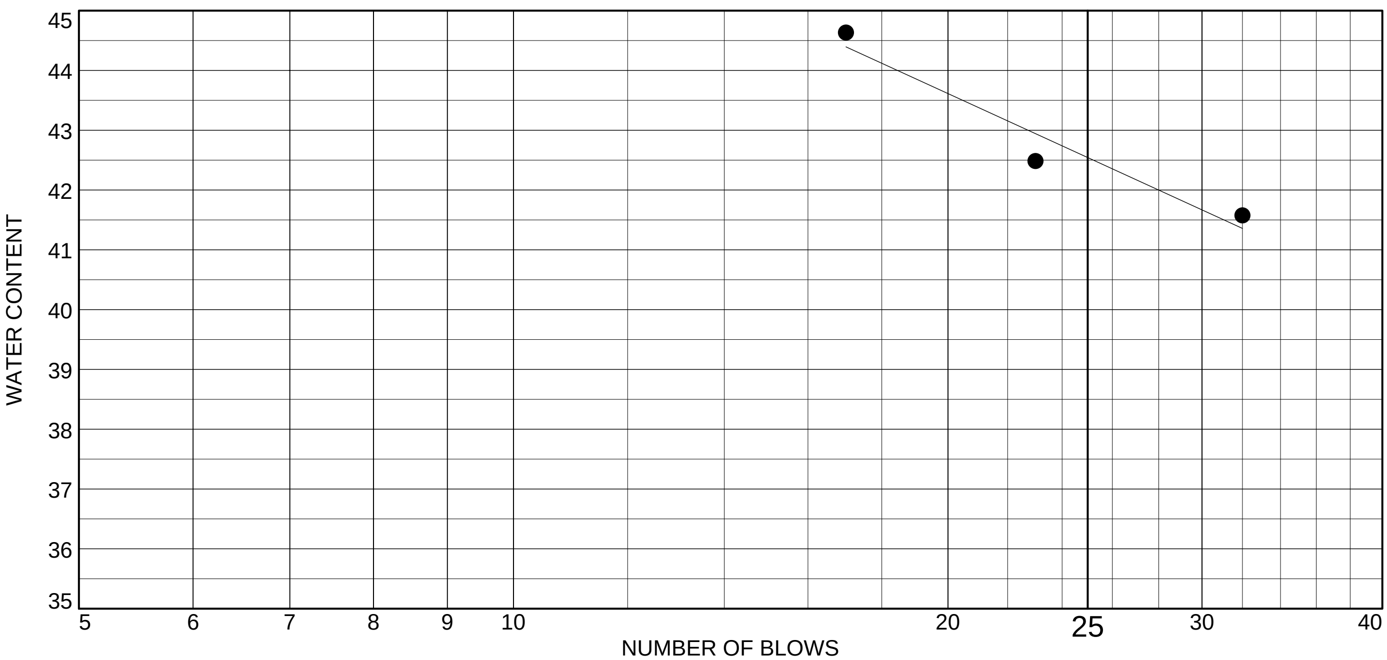
Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK BROWNISH GRAY LEAN CLAY	43	22	21			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B018 **Depth:** 25.0'-27.0'
Sample Number: S-8

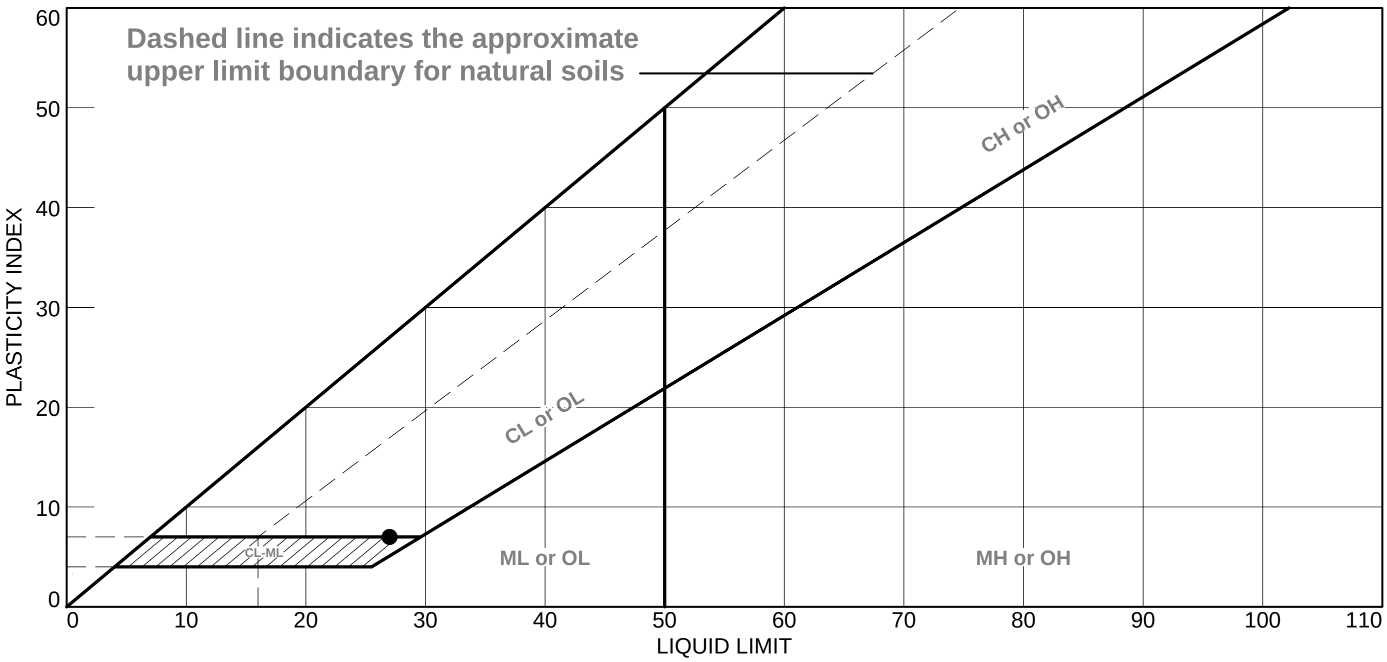
Terracon

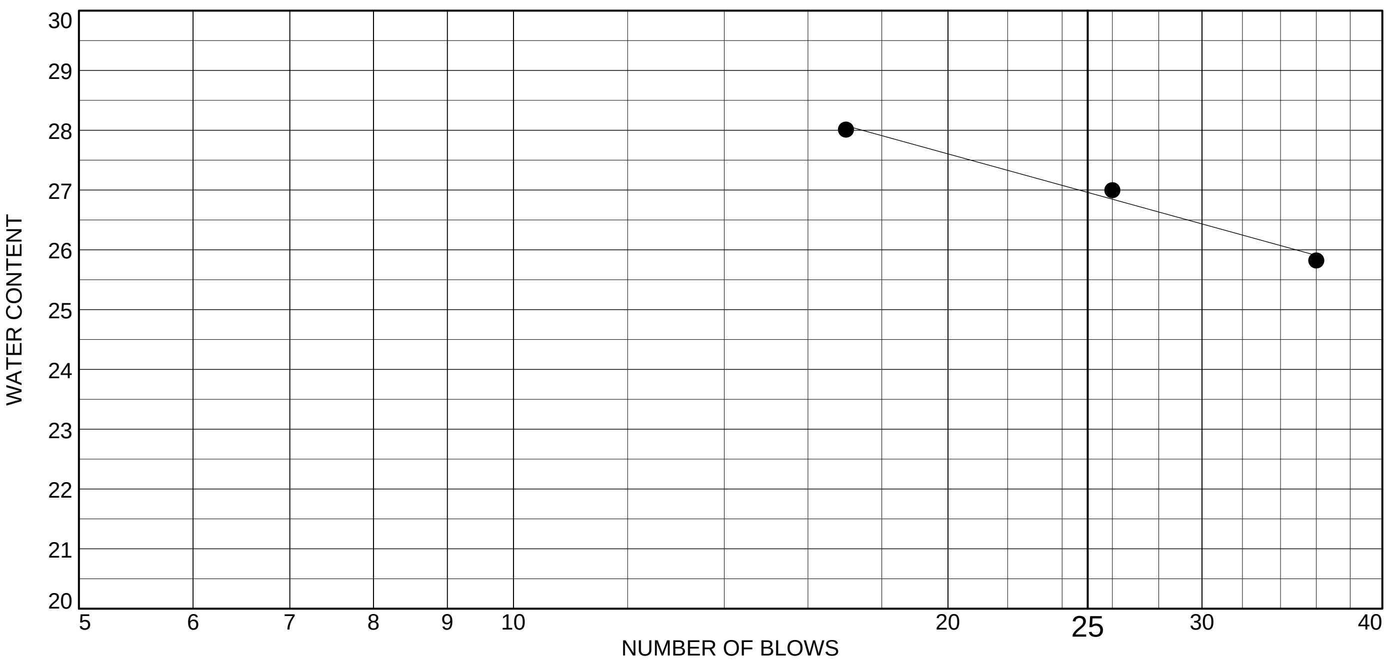
Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK BROWN AND GRAY ORGANIC CLAY WITH SAND - SAND SEAMS AND SHELL NOTED	27	20	7			OL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B018 **Depth:** 40.0'-42.0'
Sample Number: S-11

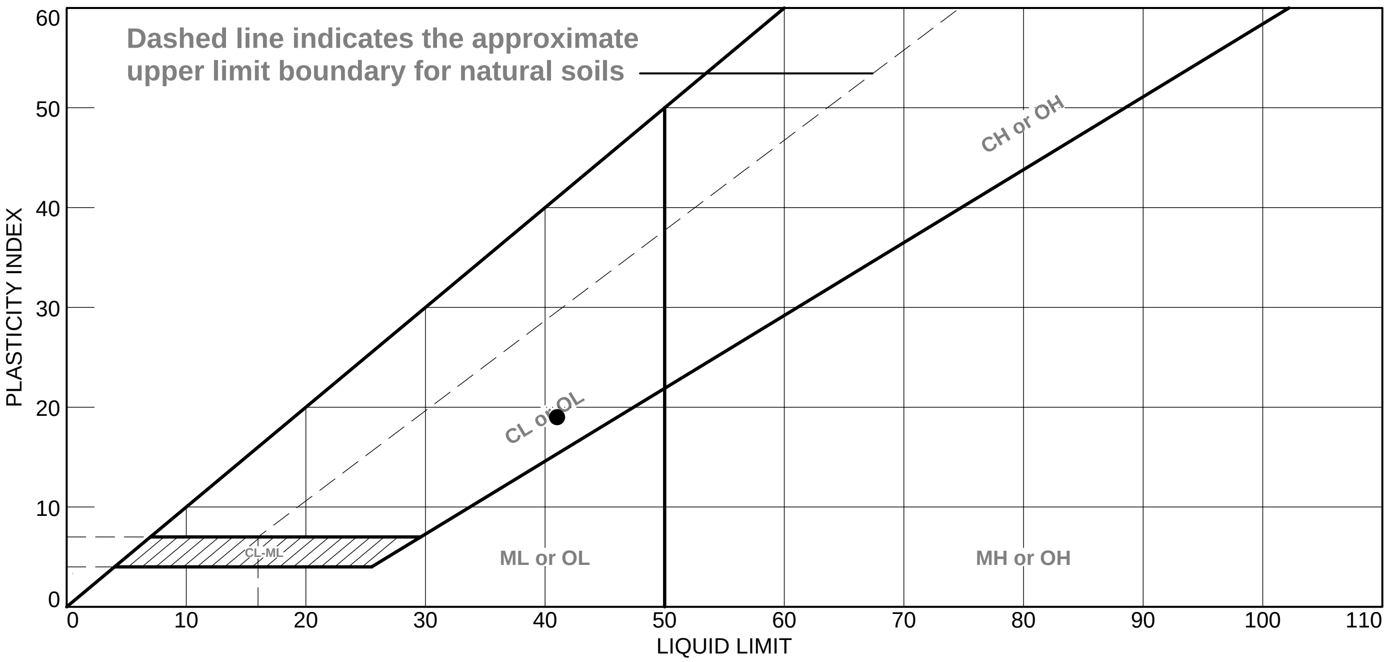
Terracon

Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK BROWN LEAN CLAY WITH SAND	41	22	19			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B019 **Depth:** 7.5'-9.5'
Sample Number: S-2

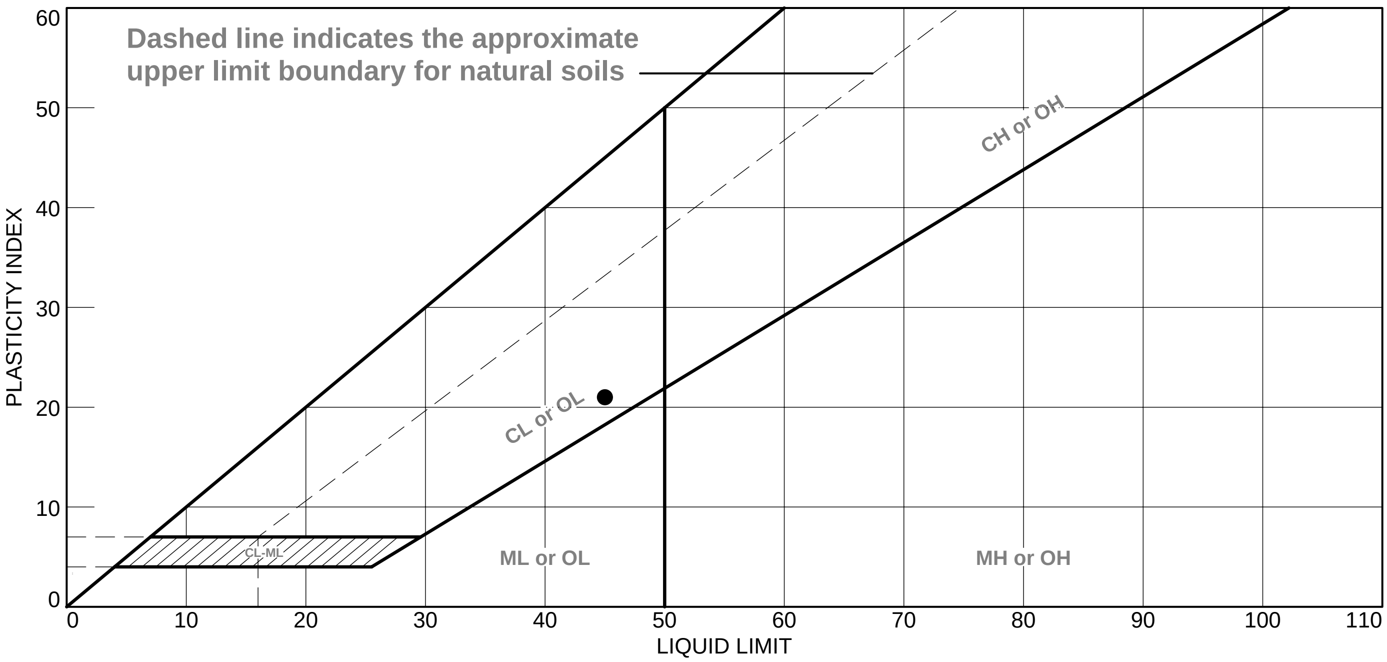
Terracon

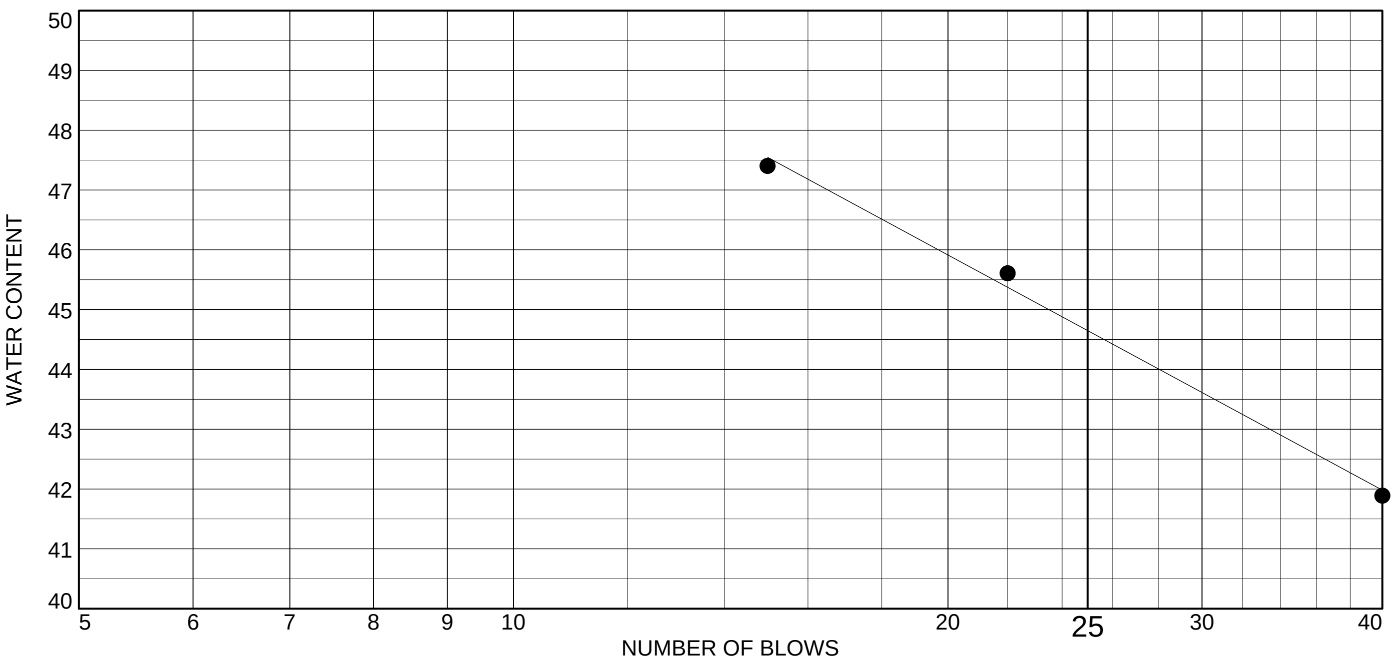
Remarks:

Figure

Tested By: HP **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND BROWN LEAN CLAY	45	24	21			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

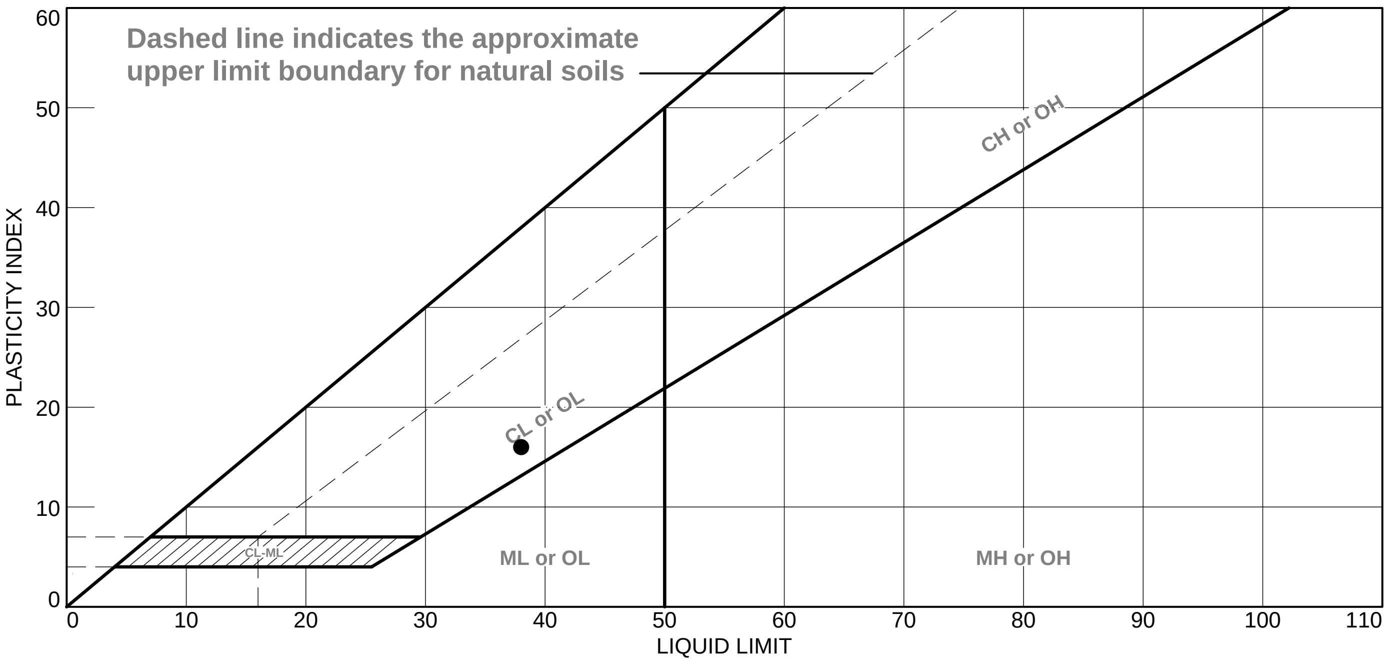
Source of Sample: HEN-B019 **Depth:** 12.5'-14.5'
Sample Number: S-4

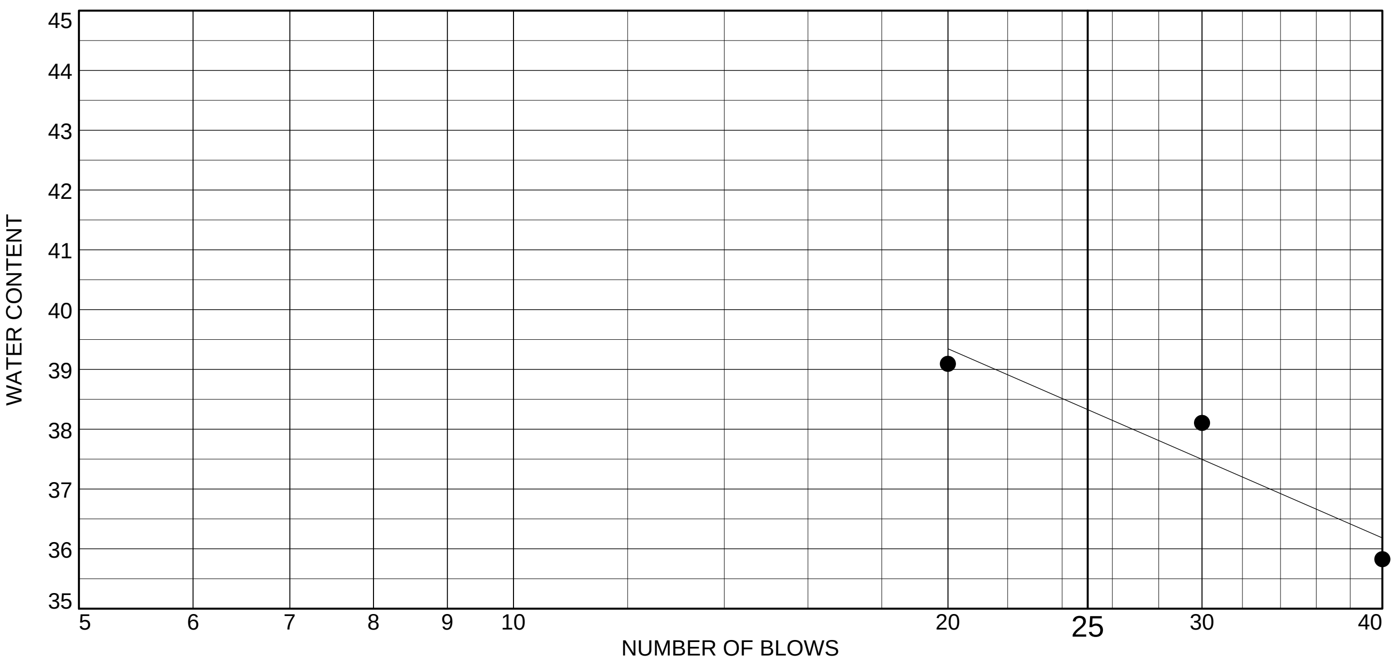
Remarks:

Figure

Tested By: HP **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAY LEAN CLAY	38	22	16			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B019 **Depth:** 20.0'-22.0'
Sample Number: S-6

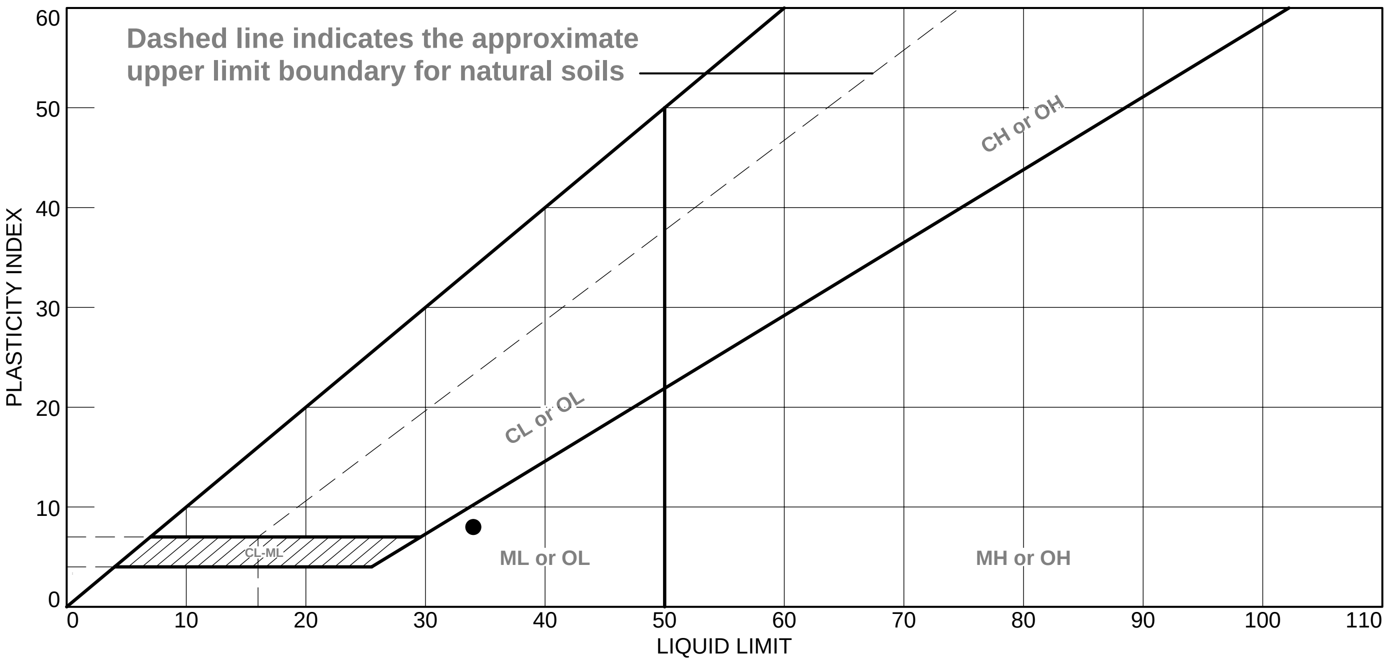
Remarks:

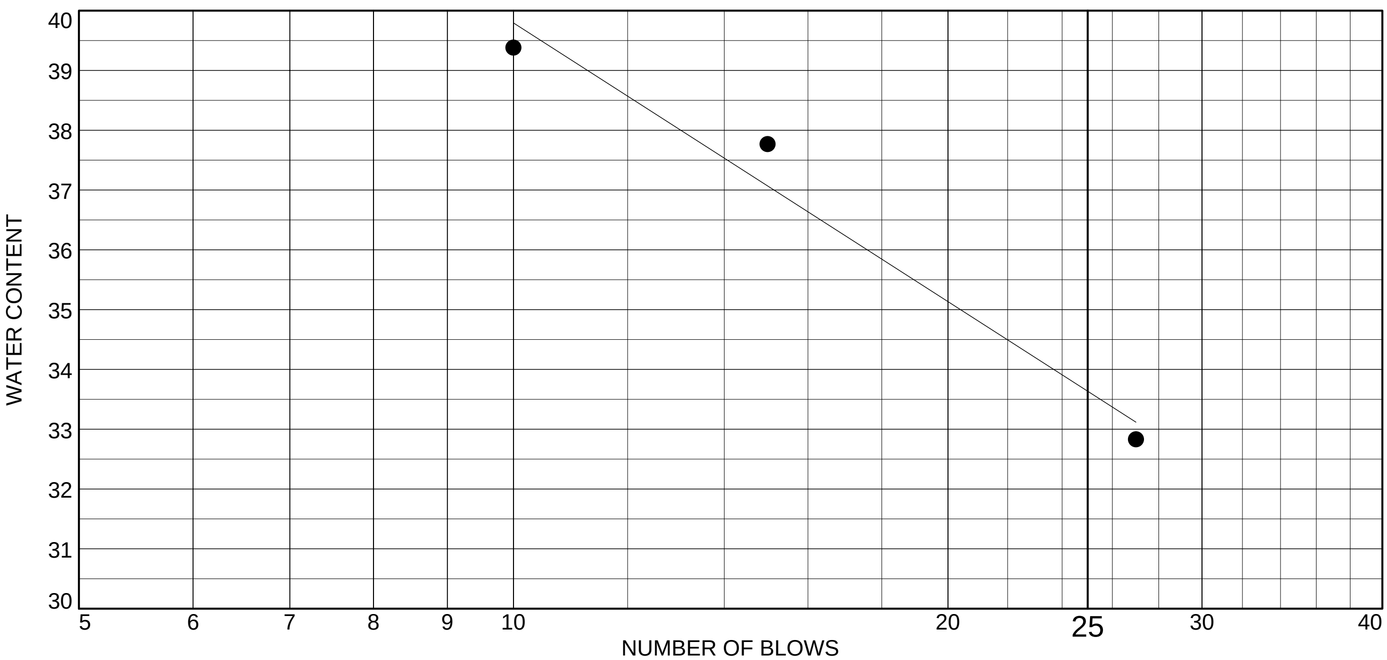
Terracon

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	VERY DARK GRAY ORGANIC SILT WITH SAND - SHELL NOTED	34	26	8			ML

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B019 **Depth:** 25.0'-27.0'
Sample Number: S-7

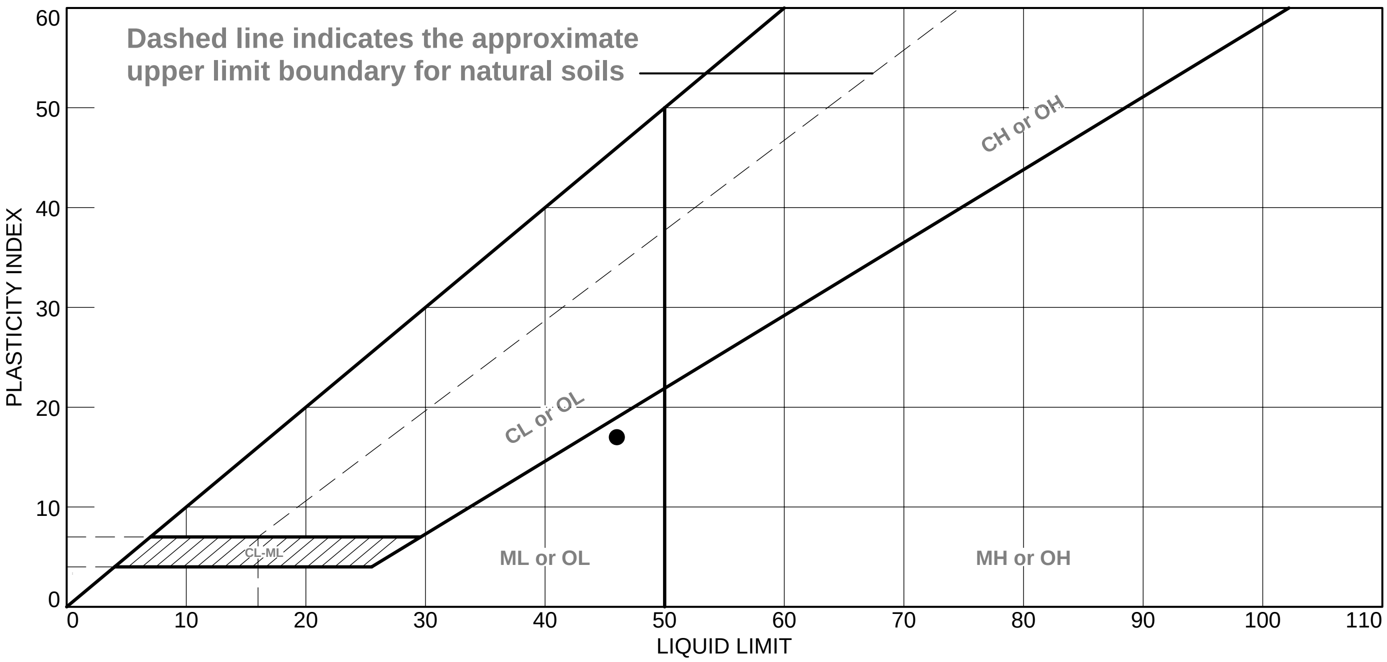
Terracon

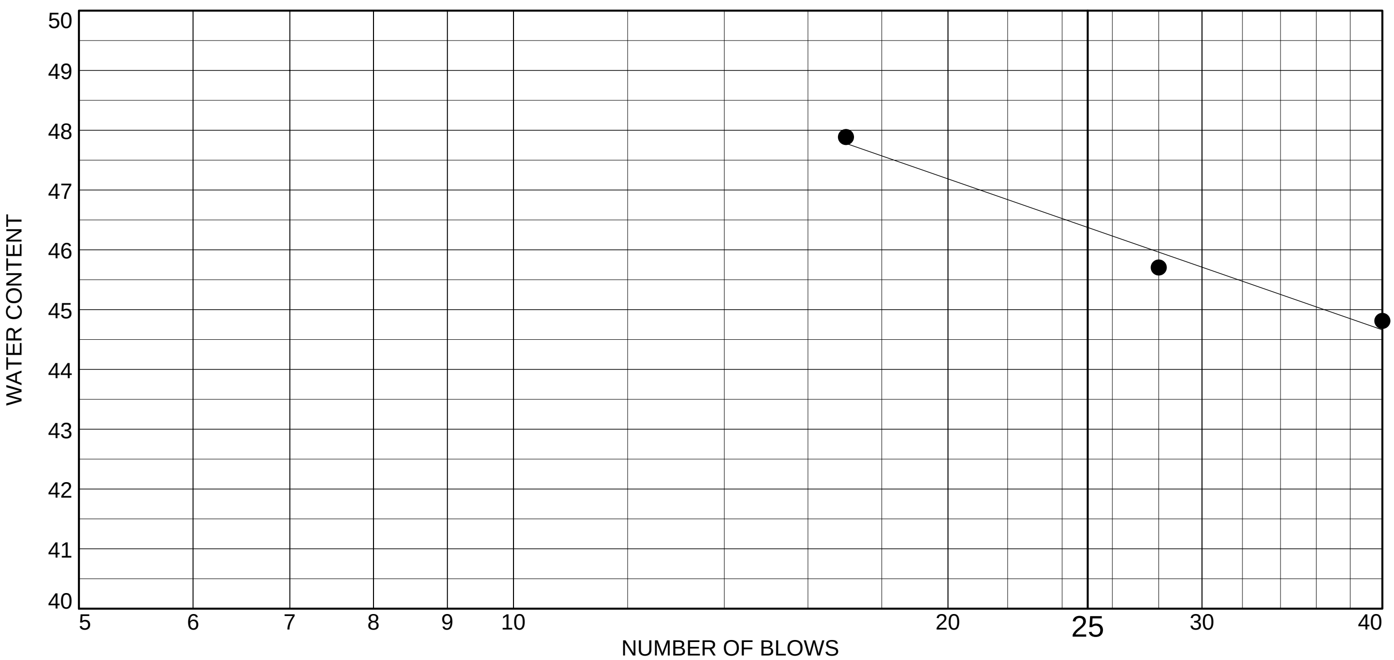
Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY LEAN CLAY WITH SILT	46	29	17			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

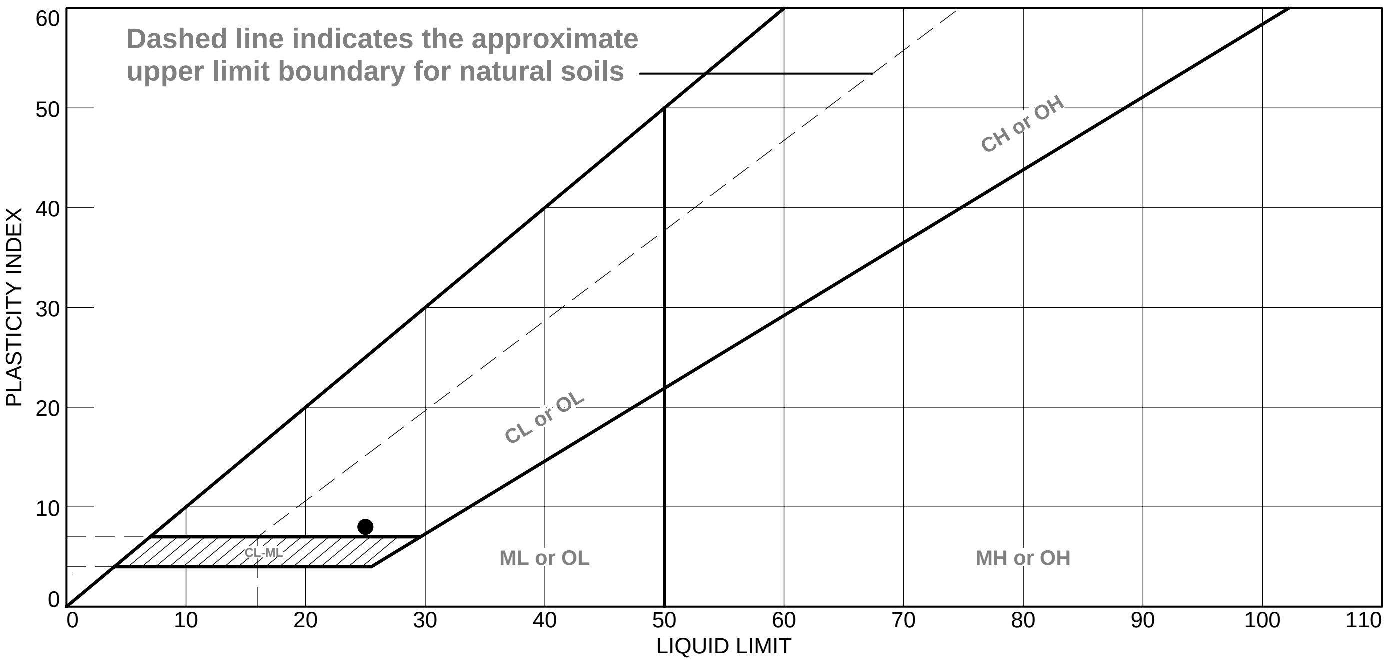
Source of Sample: HEN-B019 **Depth:** 50.0'-51.5'
Sample Number: S-12

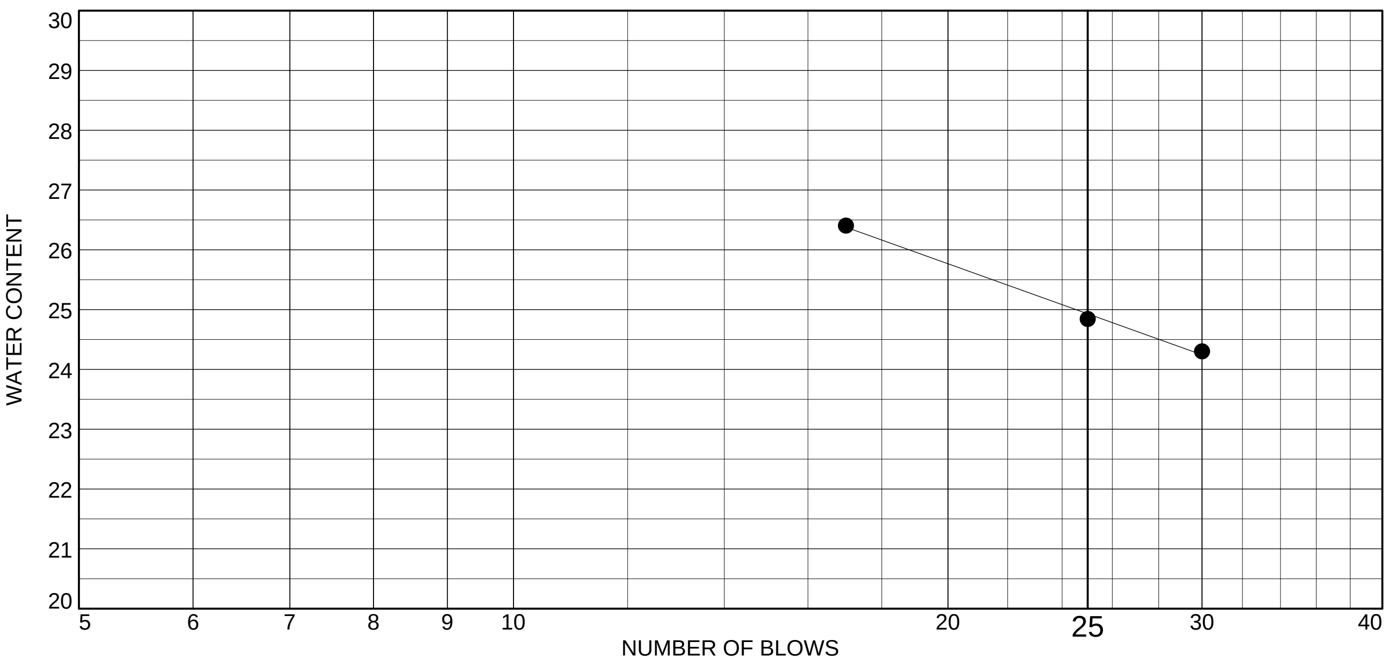
Remarks:

Figure

Tested By: HP **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND DARK BROWN LEAN CLAY WITH SILT AND GRAVEL	25	17	8			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B020 **Depth:** 0.0'-1.5'
Sample Number: S-1

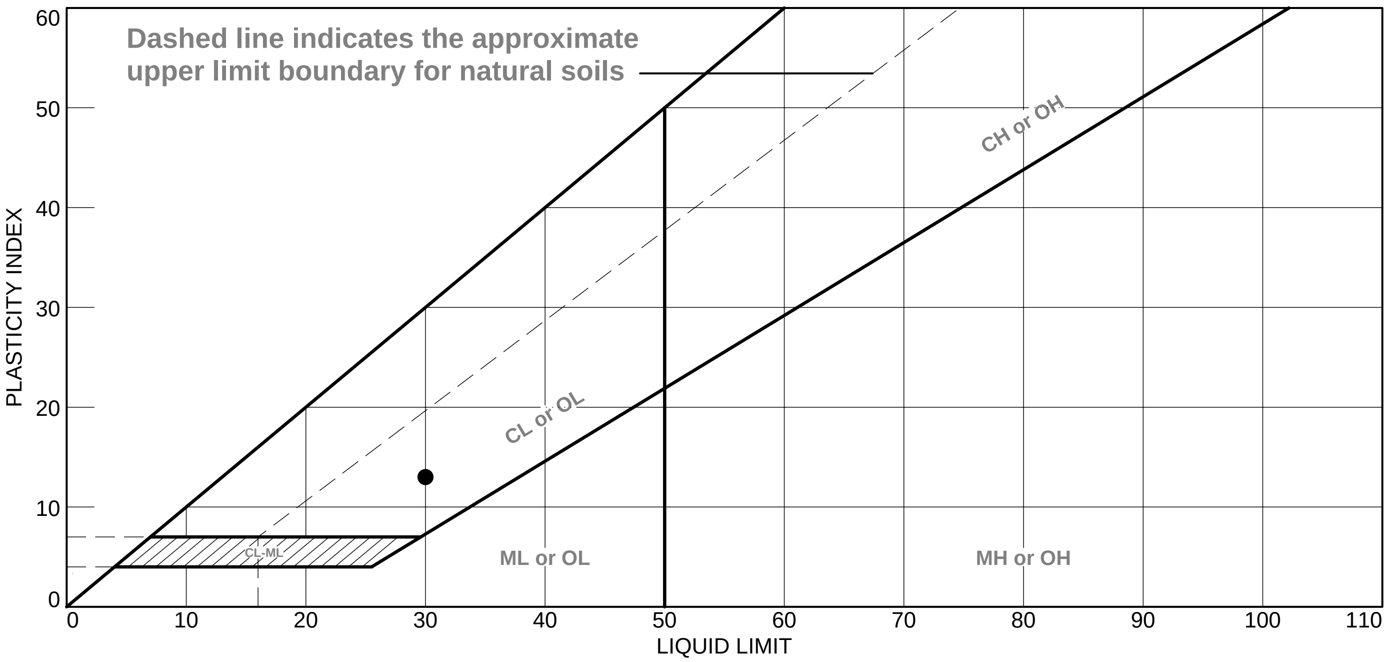
Terracon

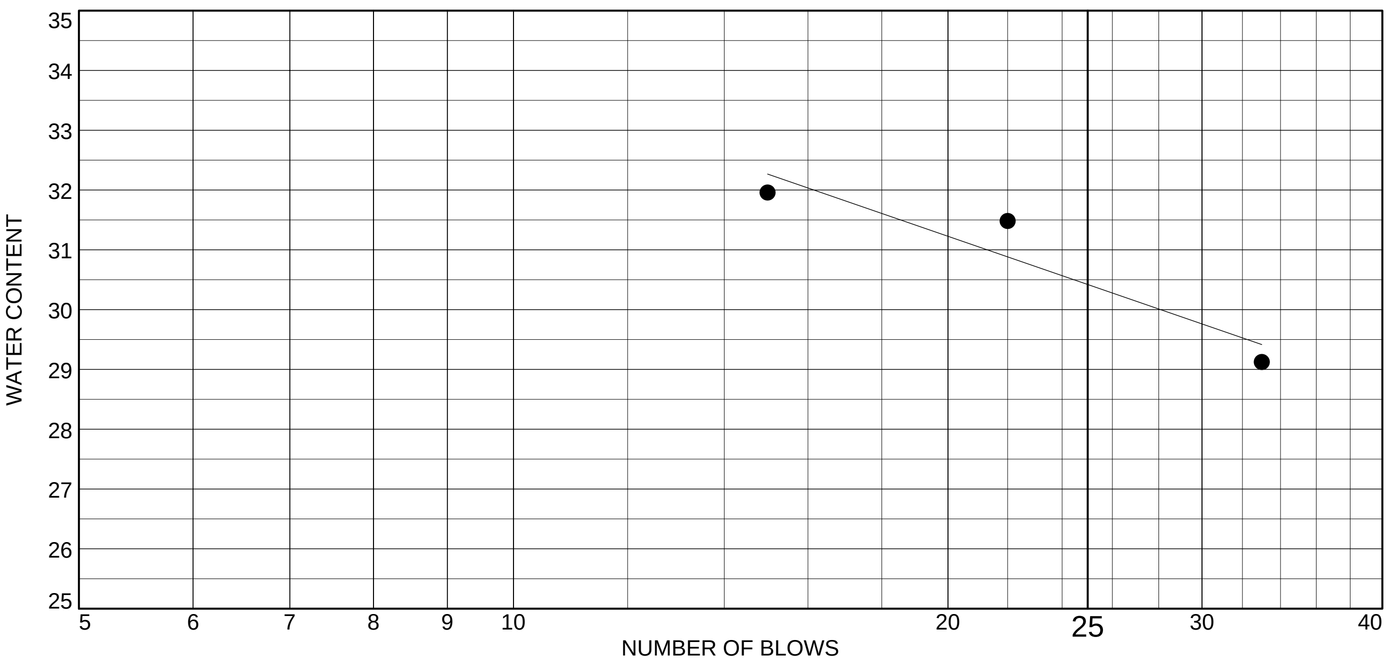
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN SANDY LEAN CLAY WITH GRAVEL	30	17	13			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B020 **Depth:** 9.5'-11.5

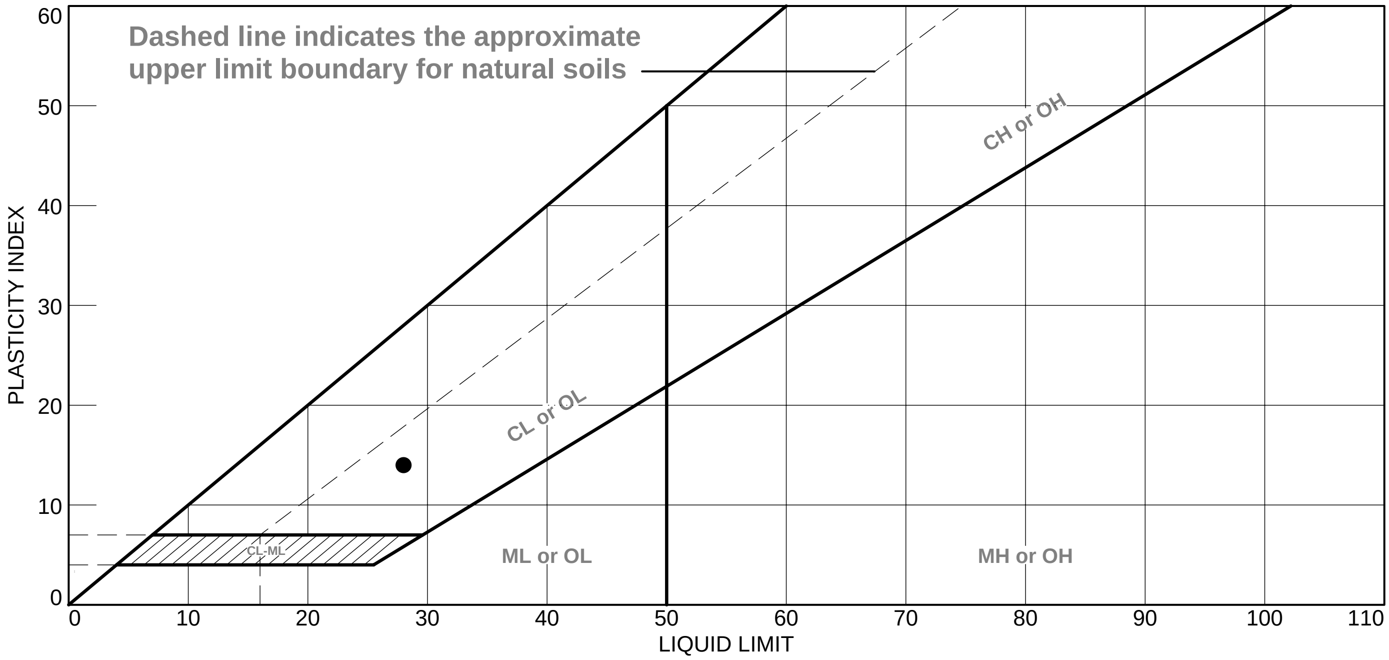
Sample Number: S-5

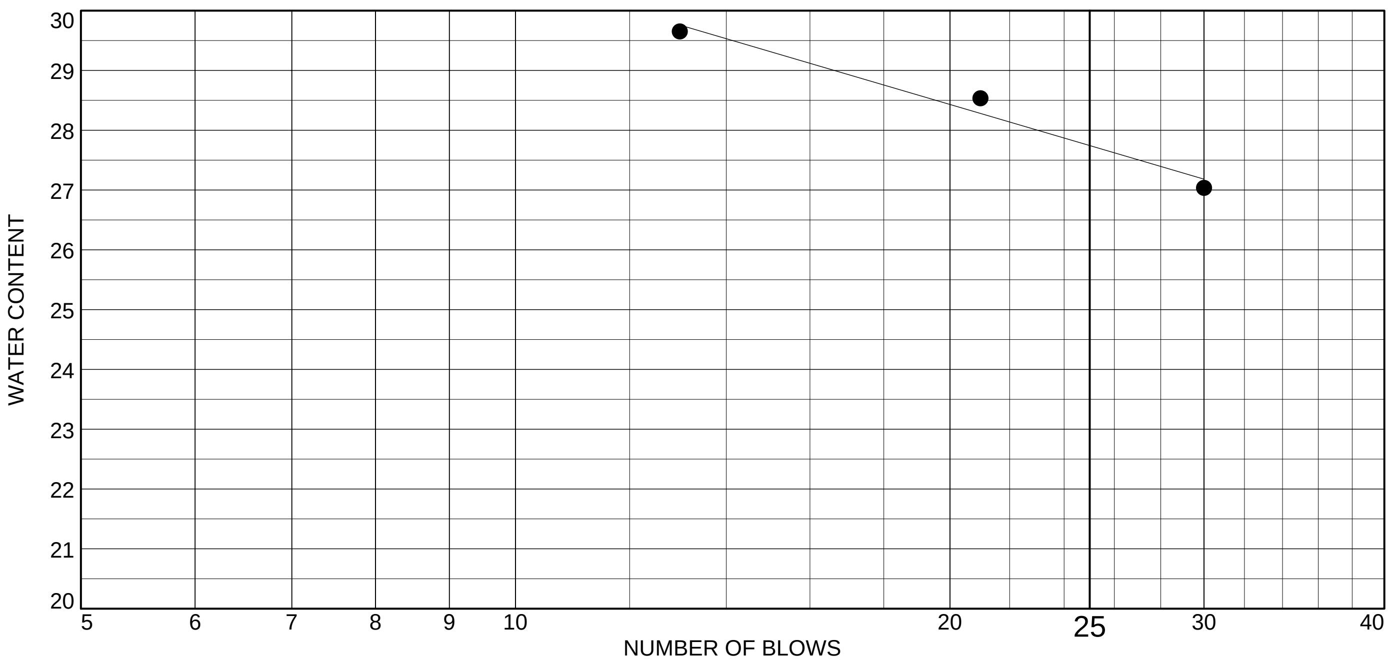
Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN LEAN CLAY WITH SAND AND GRAVEL	28	14	14			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B021 **Depth:** 5.0'-6.0'

Sample Number: S-3

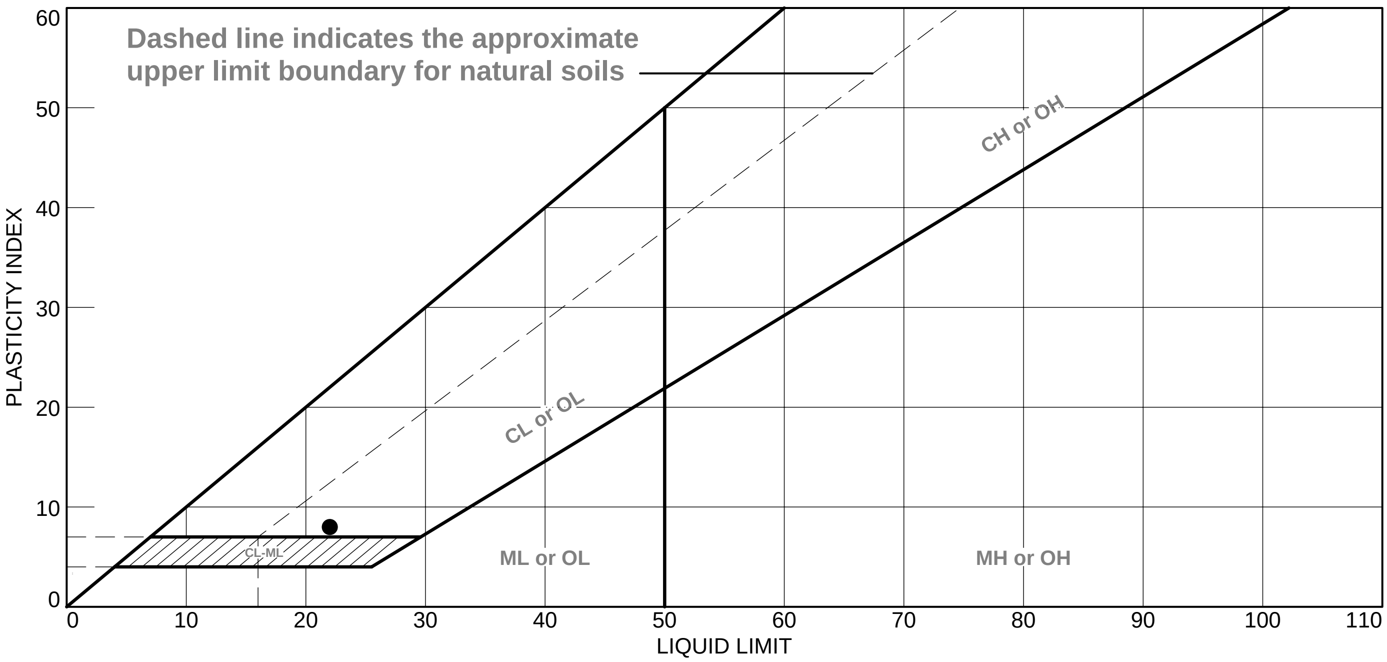
Terracon

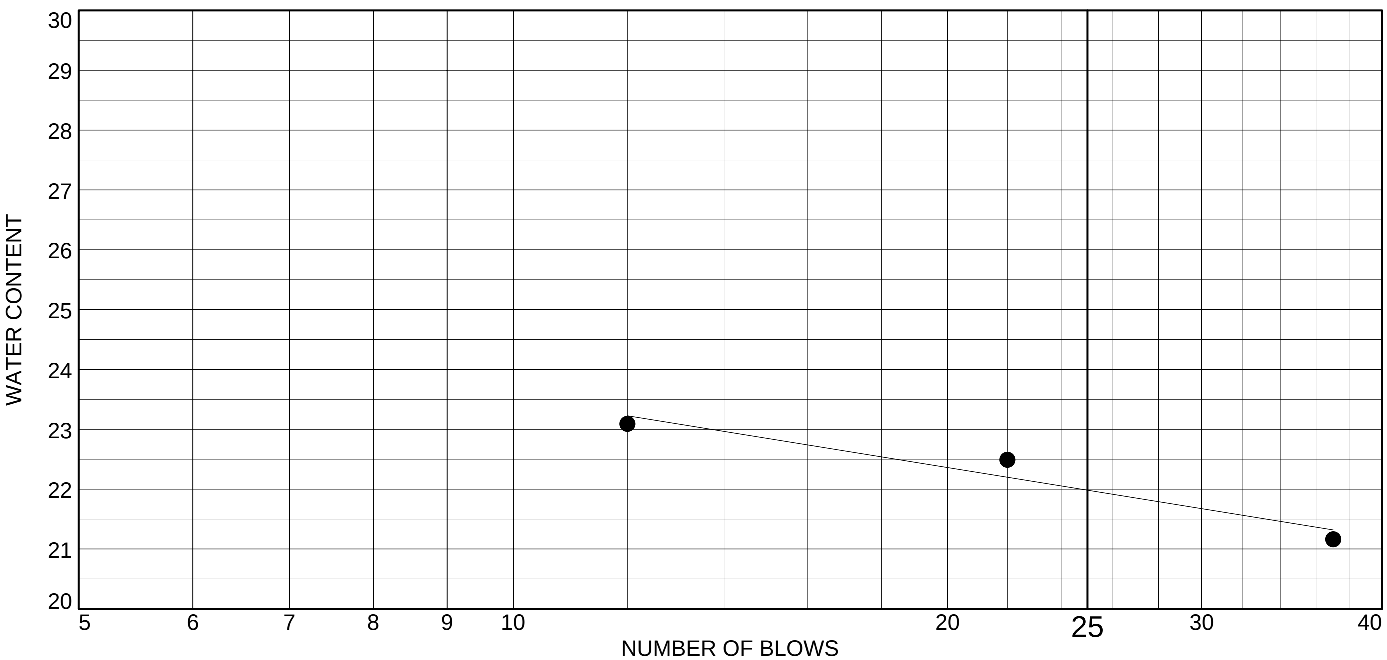
Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN LEAN CLAY WITH SAND - ROOTS NOTED	22	14	8			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B021 **Depth:** 15.0'-16.5'
Sample Number: S-6

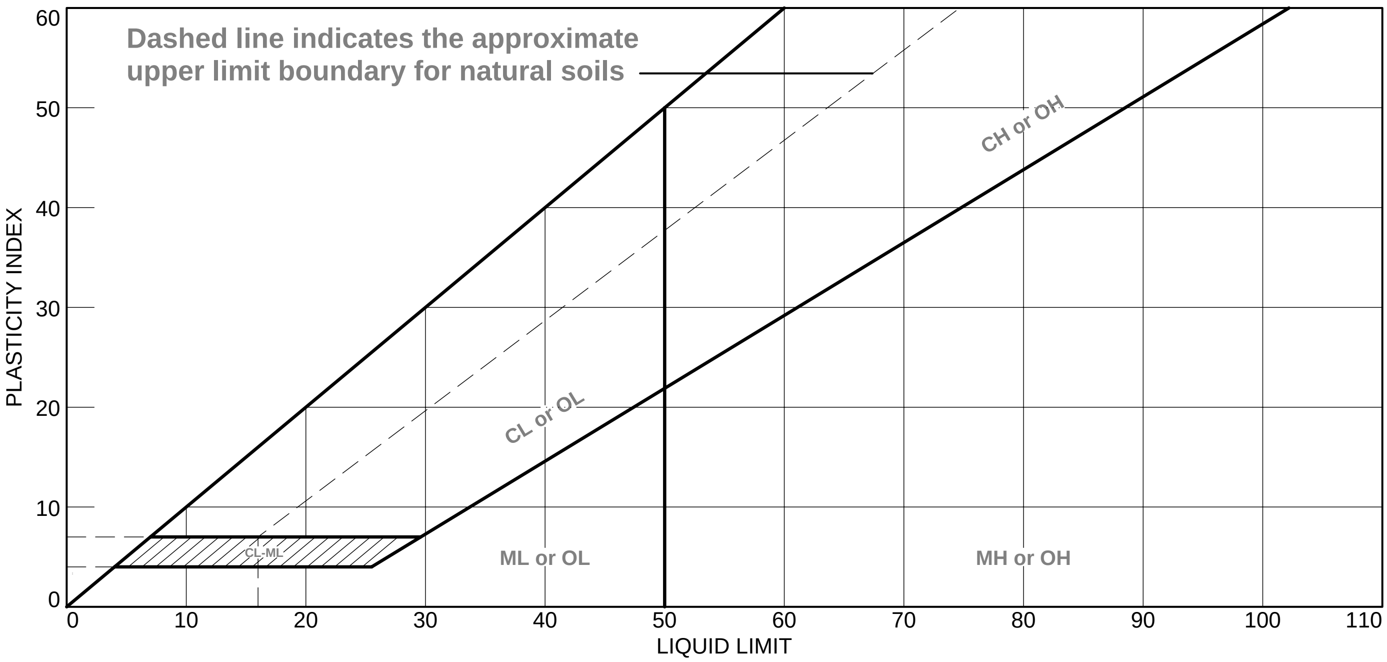
Terracon

Remarks:

Figure

Tested By: HP **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	VERY DARK GRAY VARVED FLY ASH	36	42	NP			

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B022 **Depth:** 2.5'-4.5'

Sample Number: S-2

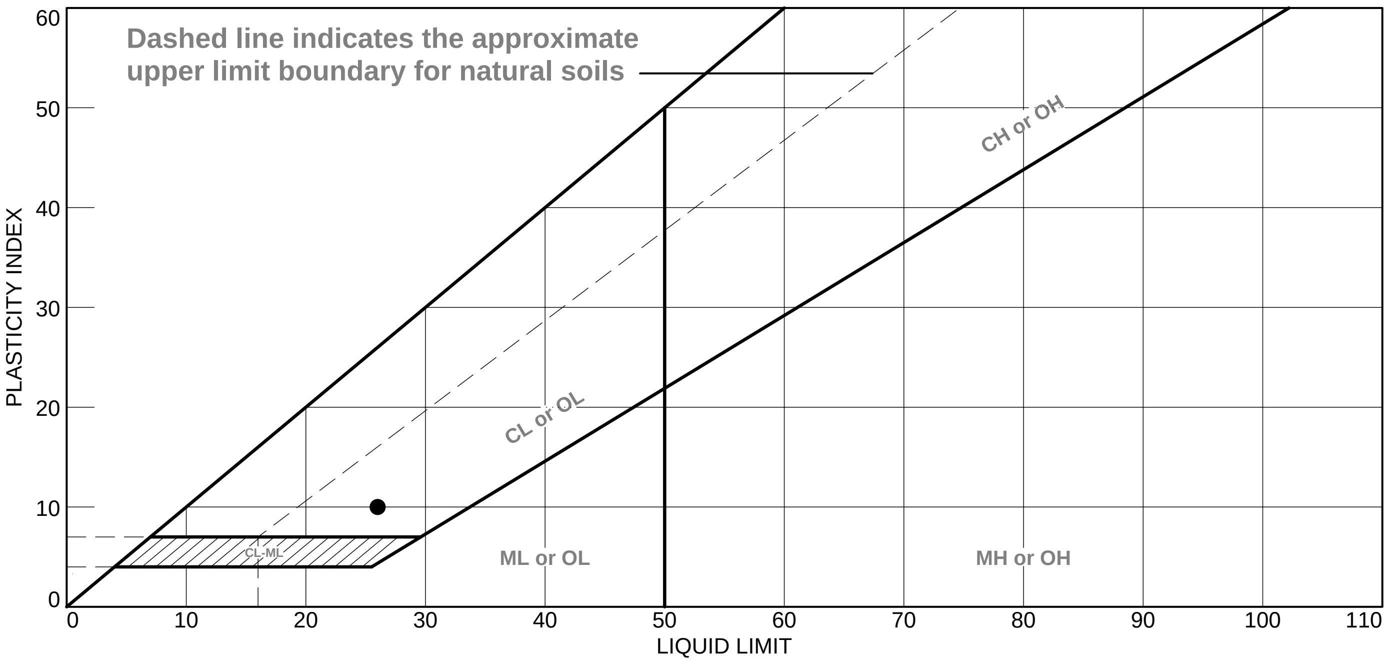
Remarks:

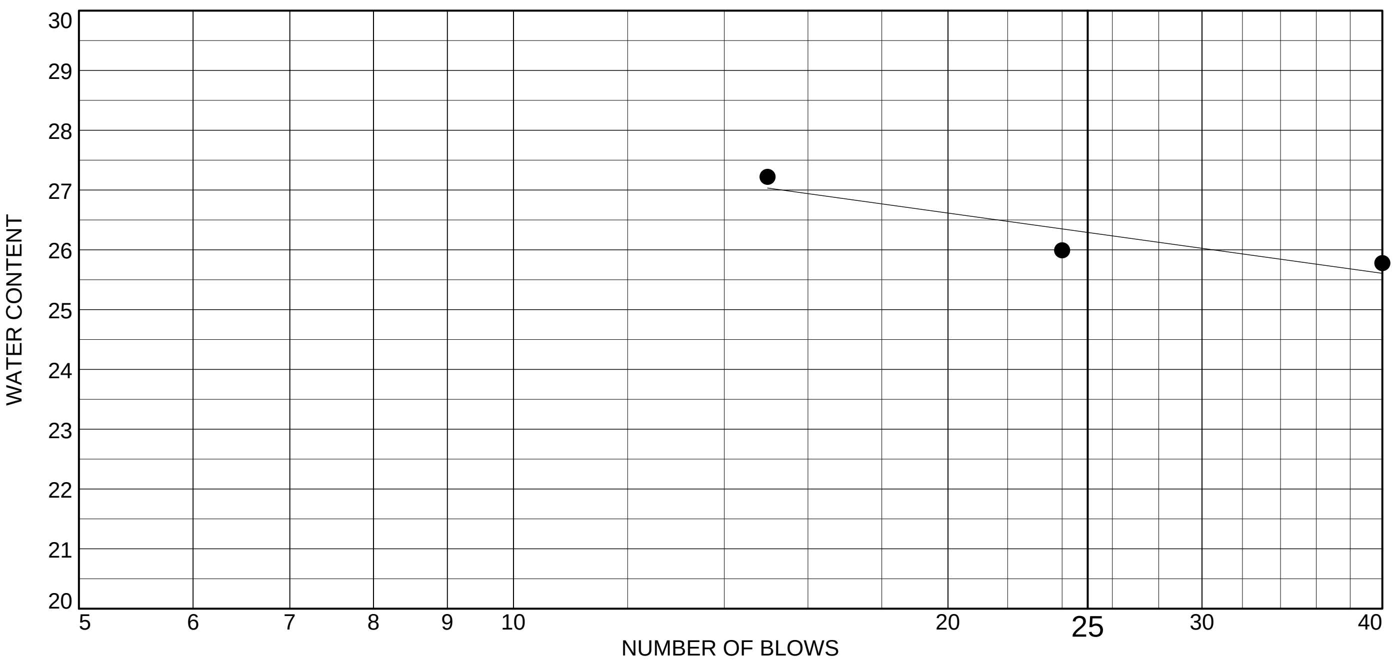
● A single point test was performed because of difficultly obtaining high blow counts due to type of material.

Figure

Tested By: HP **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	REDDISH BROWN SANDY LEAN CLAY	26	16	10			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

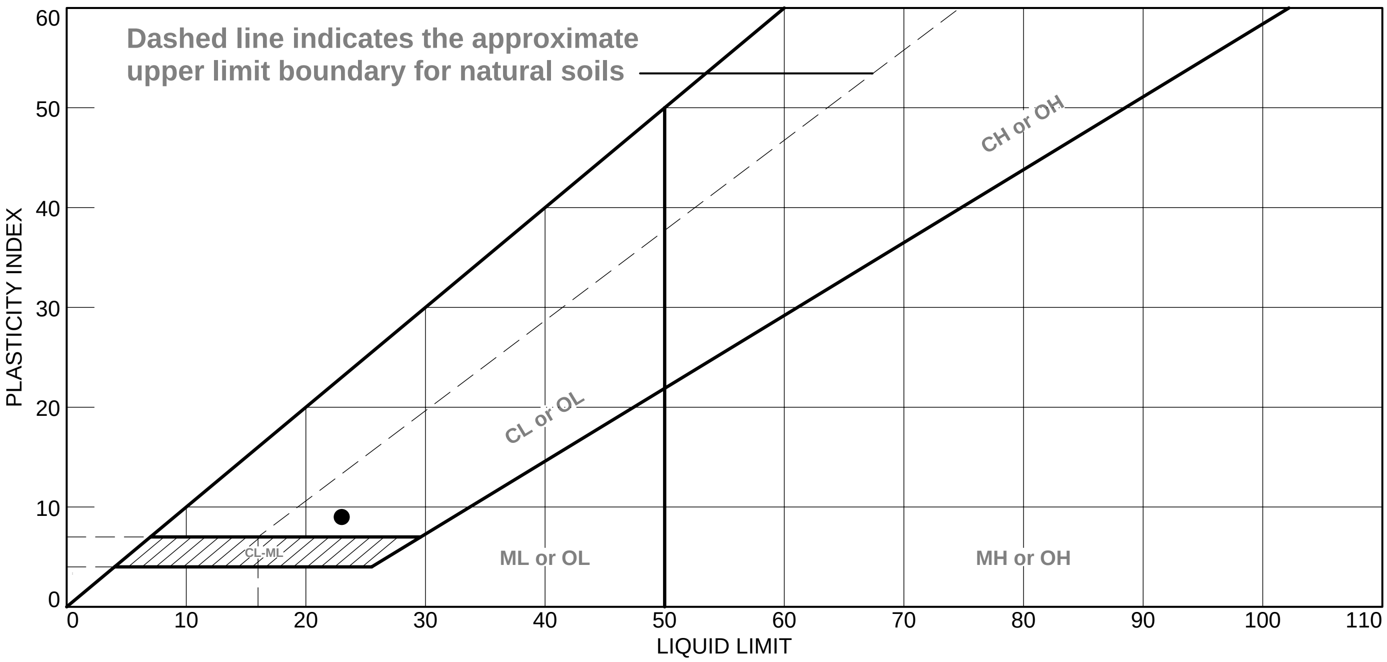
Source of Sample: HEN-B022 **Depth:** 20.0'-21.5'
Sample Number: S-7

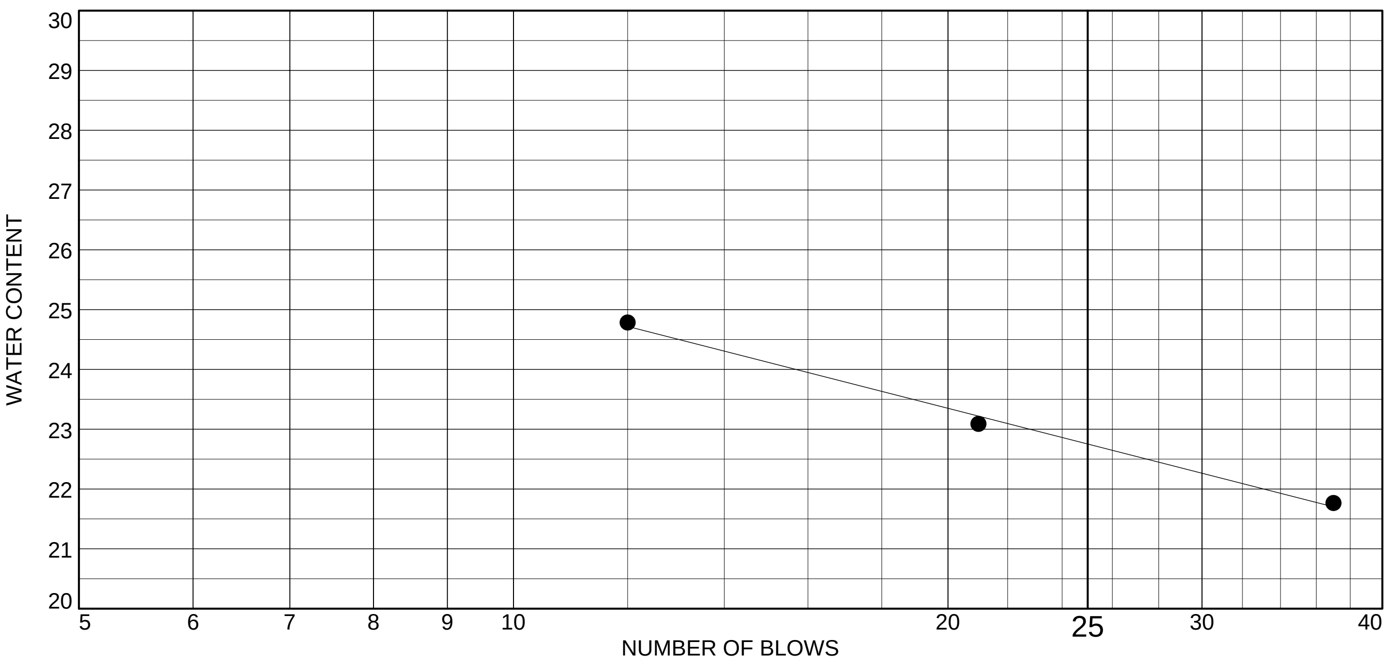
Remarks:

Figure

Tested By: HP **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN LEAN CLAY WITH GRAVEL	23	14	9			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B024 **Depth:** 10.0'-11.5'
Sample Number: S-5

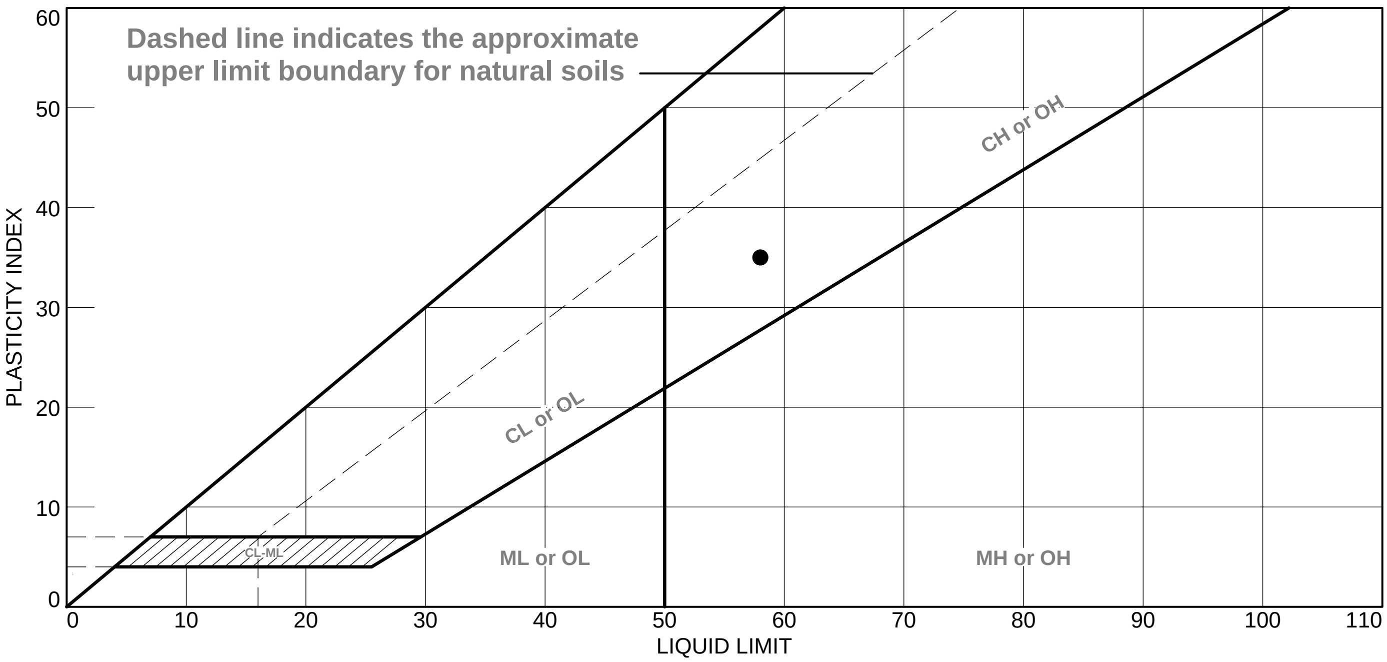
Terracon

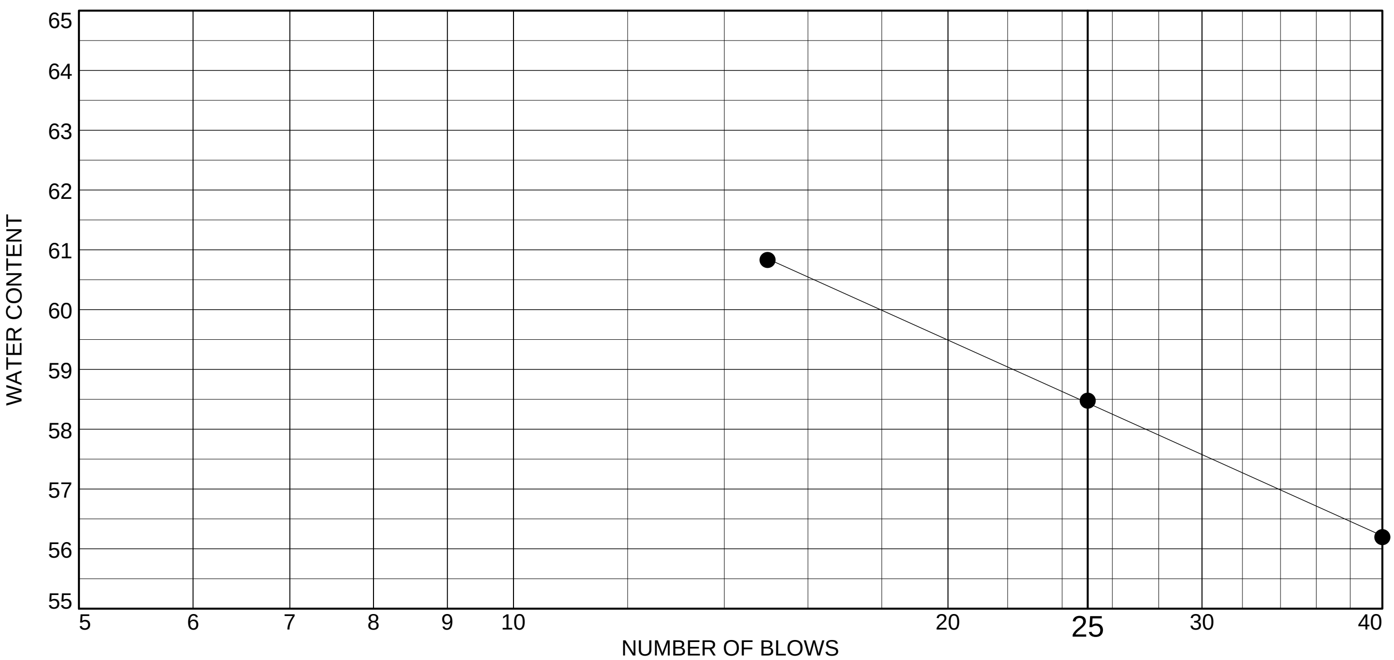
Remarks:

Figure

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY ORGANIC CLAY WITH SAND	58	23	35			0H

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B024 **Depth:** 26.5'-28.5'

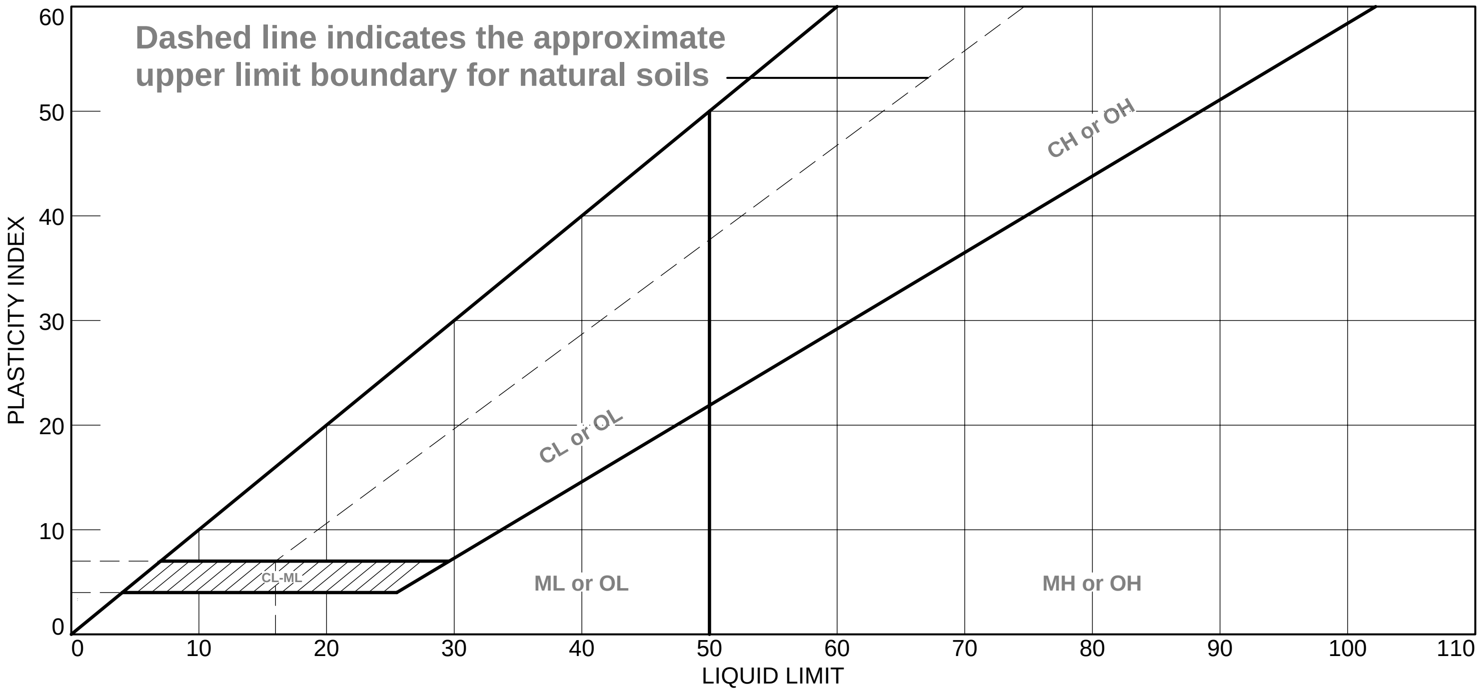
Sample Number: S-9

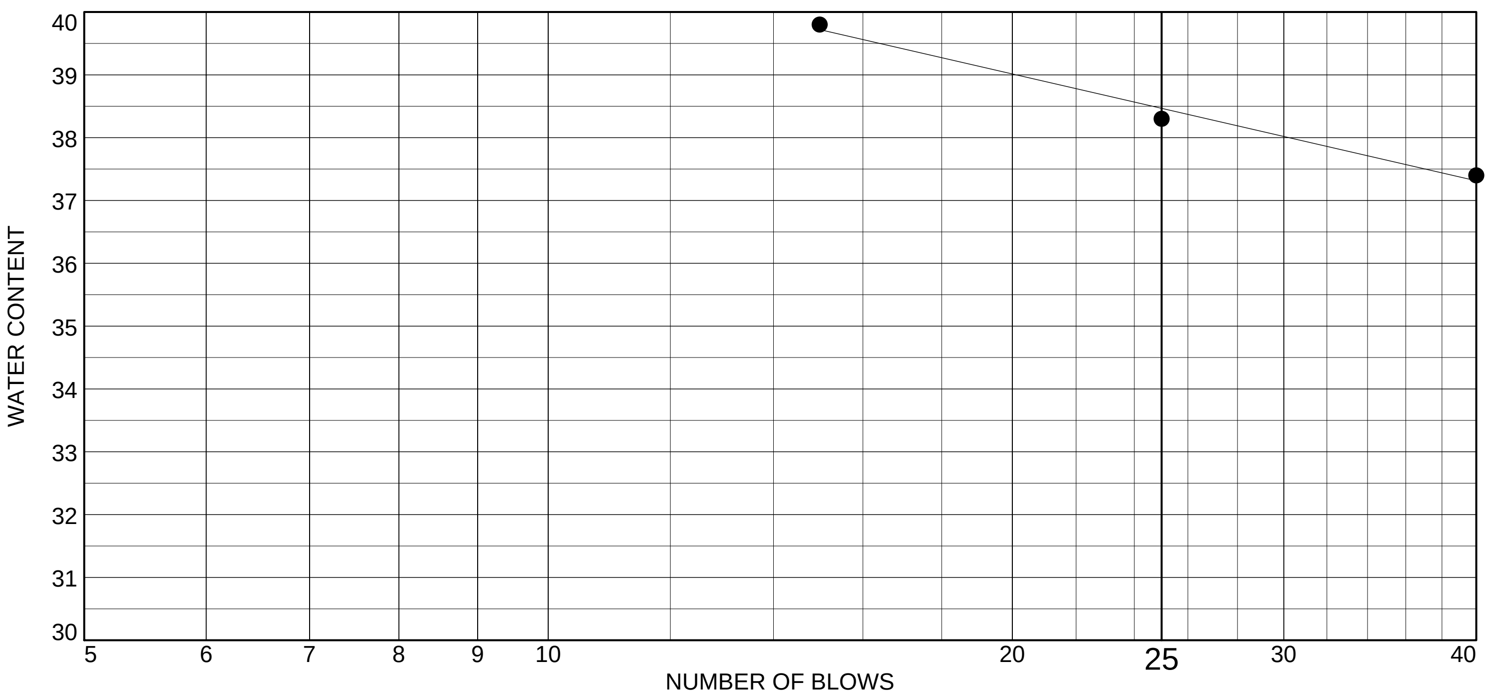
Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	VERY DARK GRAY FLY ASH WITH SAND	38	38	NP	78.0	72.5	ML

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

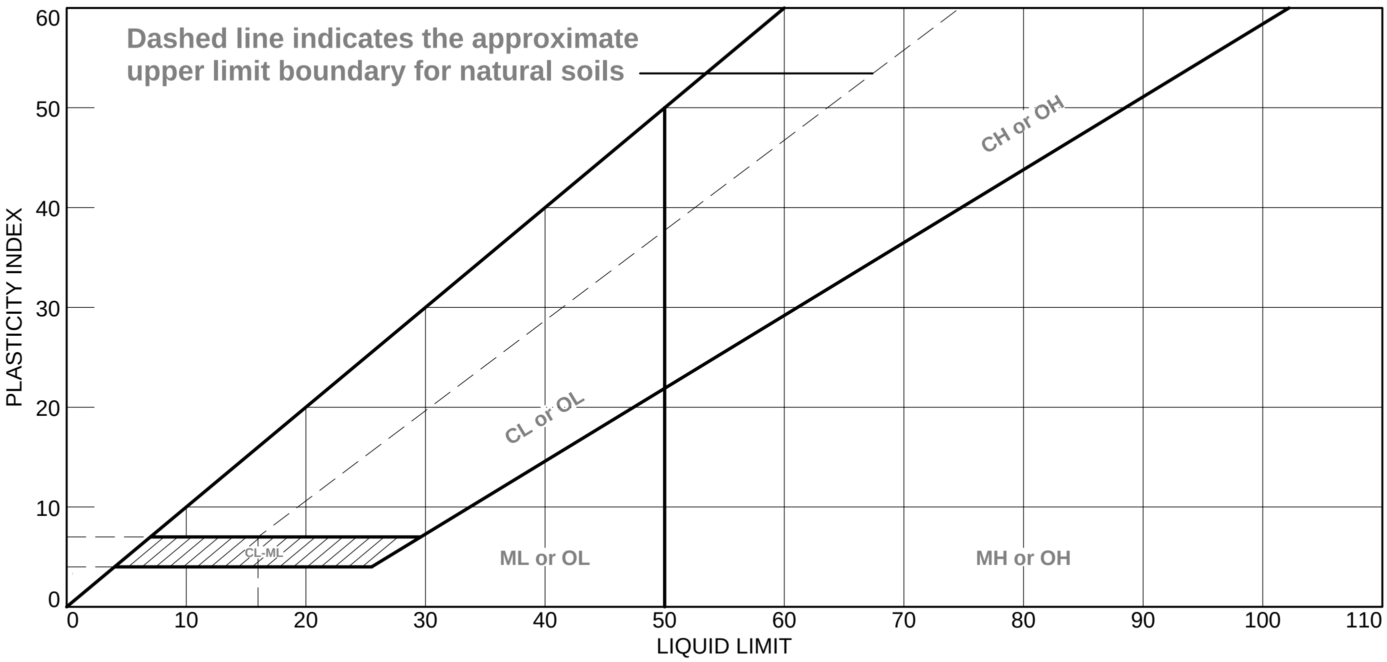
Source of Sample: HEN-B025 **Depth:** 11.5'-14.0'
Sample Number: S-6

Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	VERY DARK GRAY TO GRAY FLY ASH WITH SAND	32	34	NP			

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B025 **Depth:** 25.0'-27.0'
Sample Number: S-9

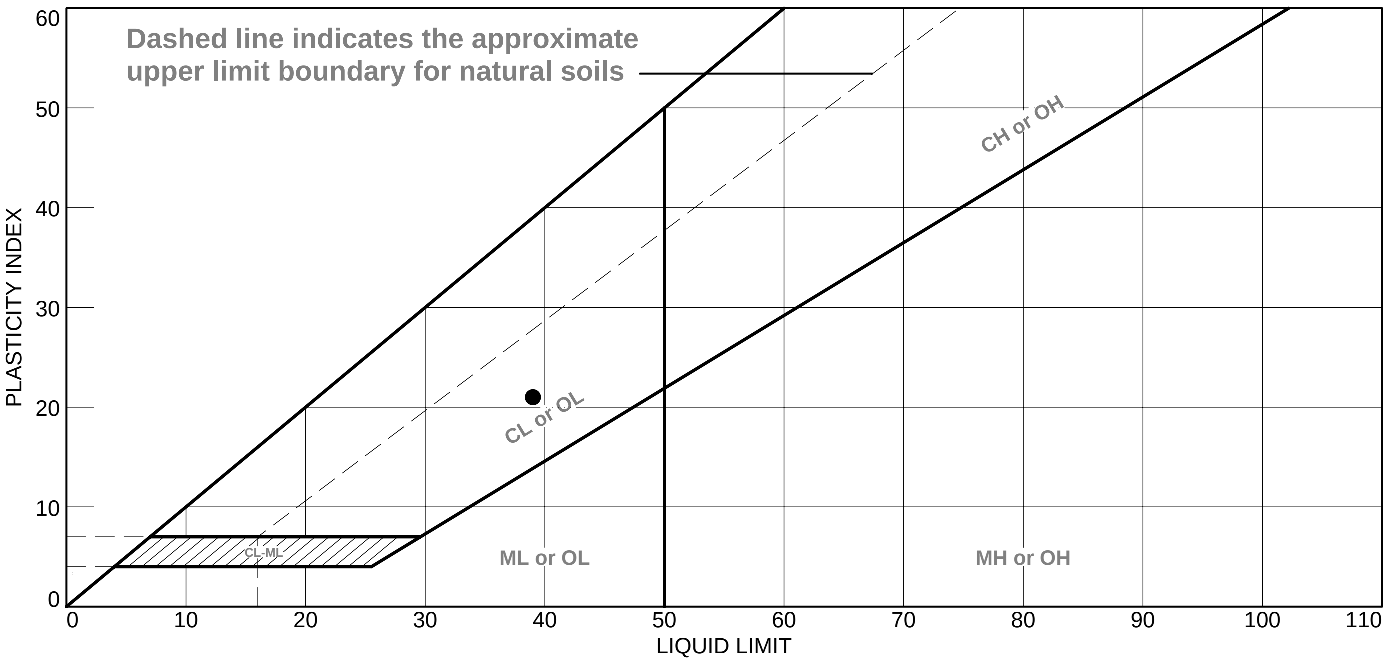
Remarks:

● A single point test was performed because of difficultly obtaining high blow counts due to type of material.

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN LEAN CLAY WITH GRAVEL	39	18	21			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

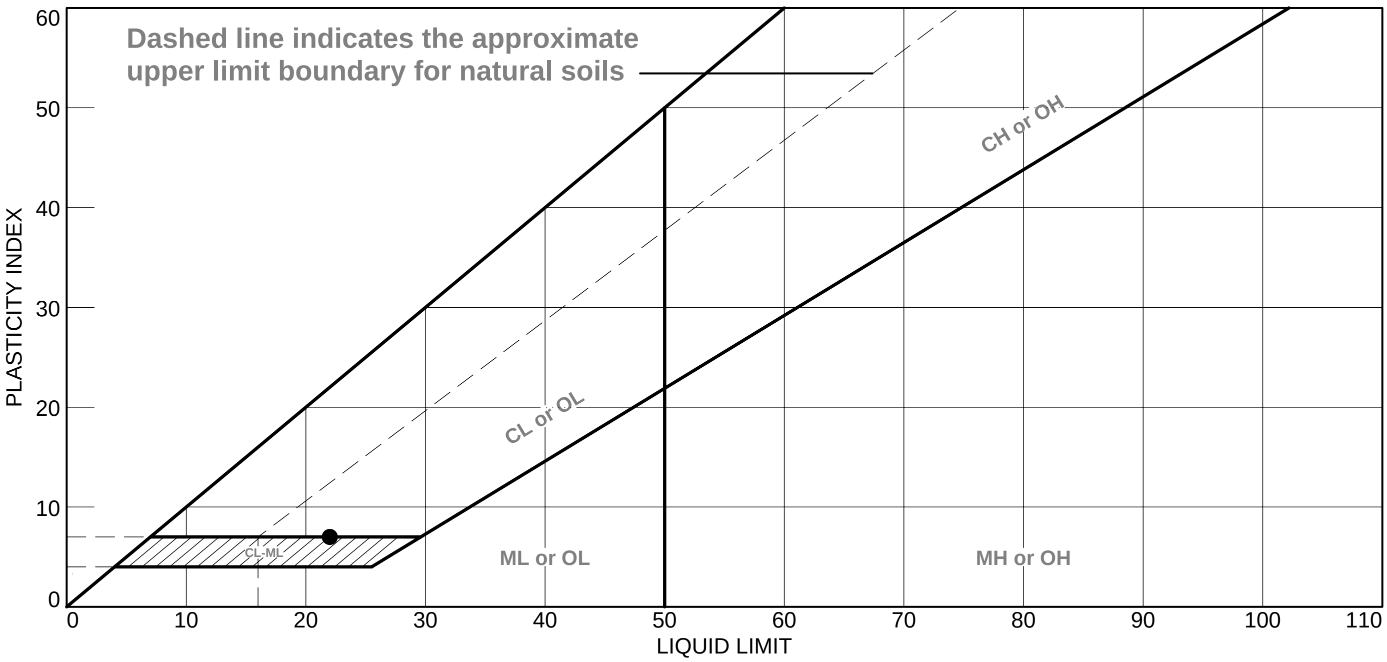
Source of Sample: HEN-B027 **Depth:** 15.0'-16.5'
Sample Number: S-4

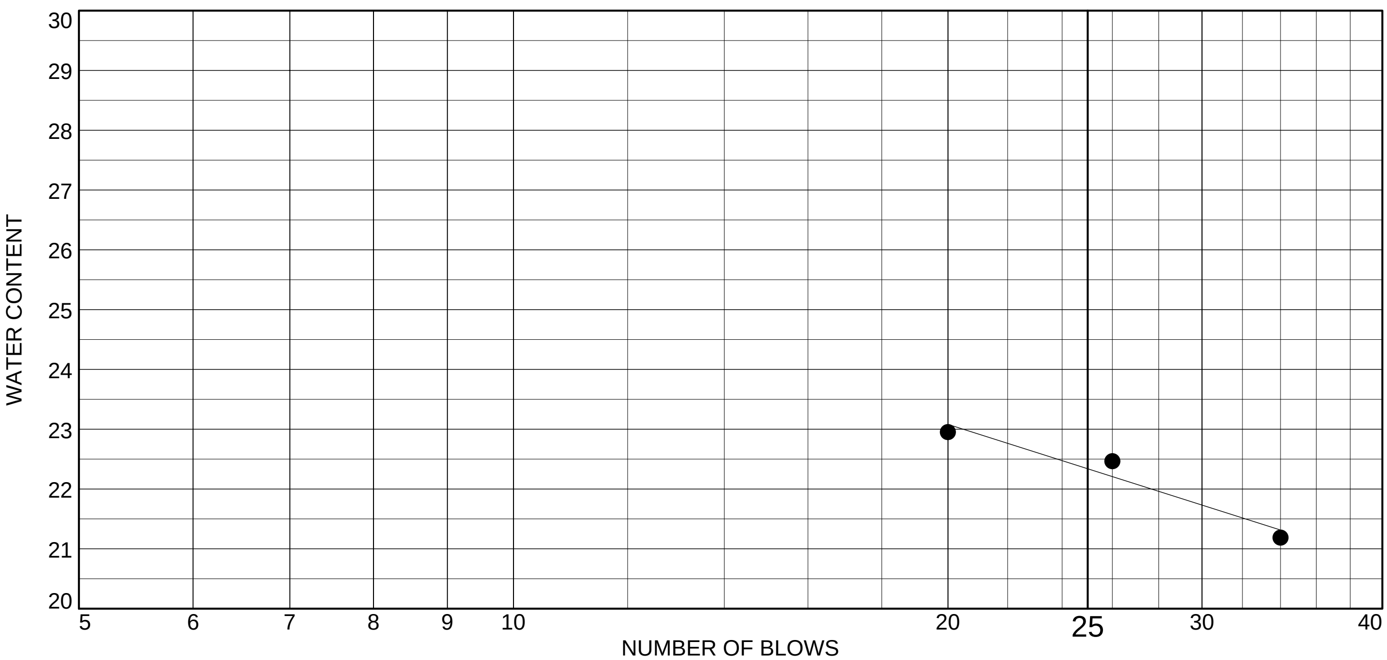
Remarks:

Figure

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN LEAN CLAY WITH SAND AND GRAVEL	22	15	7			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

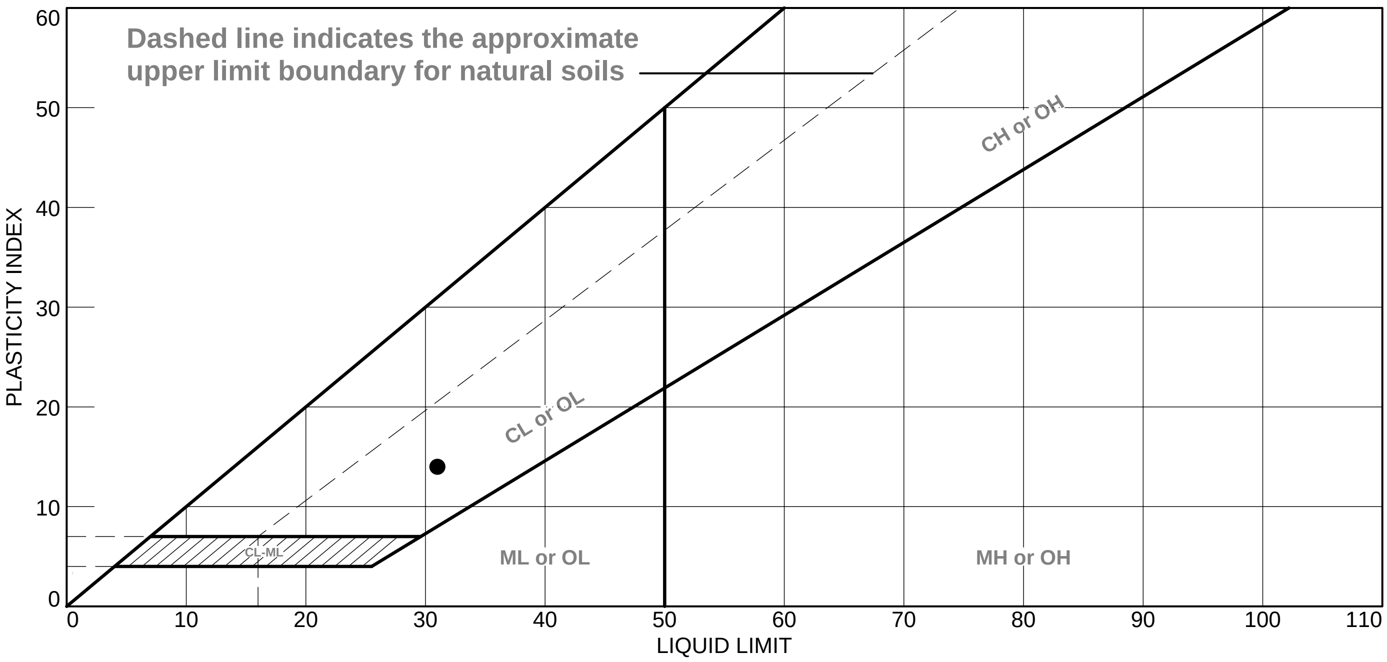
Source of Sample: HEN-B029 **Depth:** 5.0'-7.0'
Sample Number: S-3

Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	VERY DARK BROWN AND GRAY SLIGHTLY ORGANIC LEAN CLAY WITH SAND AND GRAVEL	31	17	14			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B029 **Depth:** 10.0'-12.0'
Sample Number: S-5

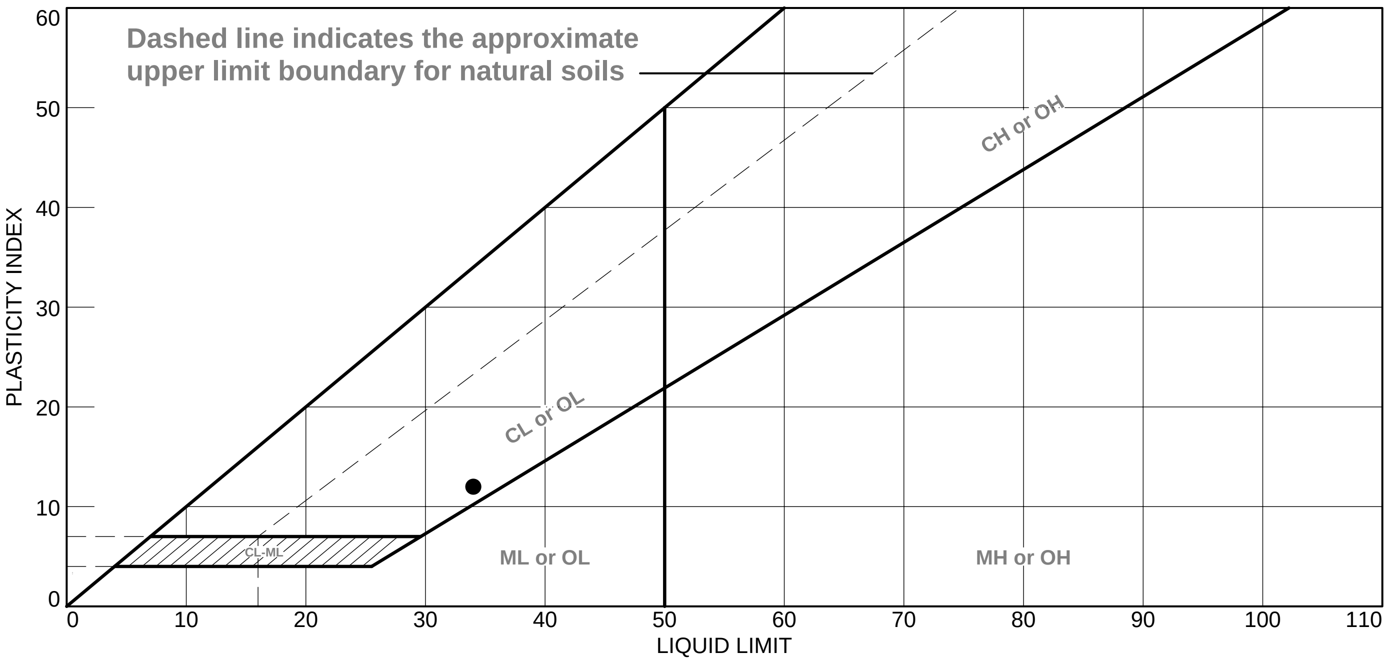
Terracon

Remarks:

Figure

Tested By: BCM **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK BROWN AND BLACK ORGANIC CLAY WITH GRAVEL - WOOD NOTED	34	22	12			OL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B030 **Depth:** 21.5'
Sample Number: S-7

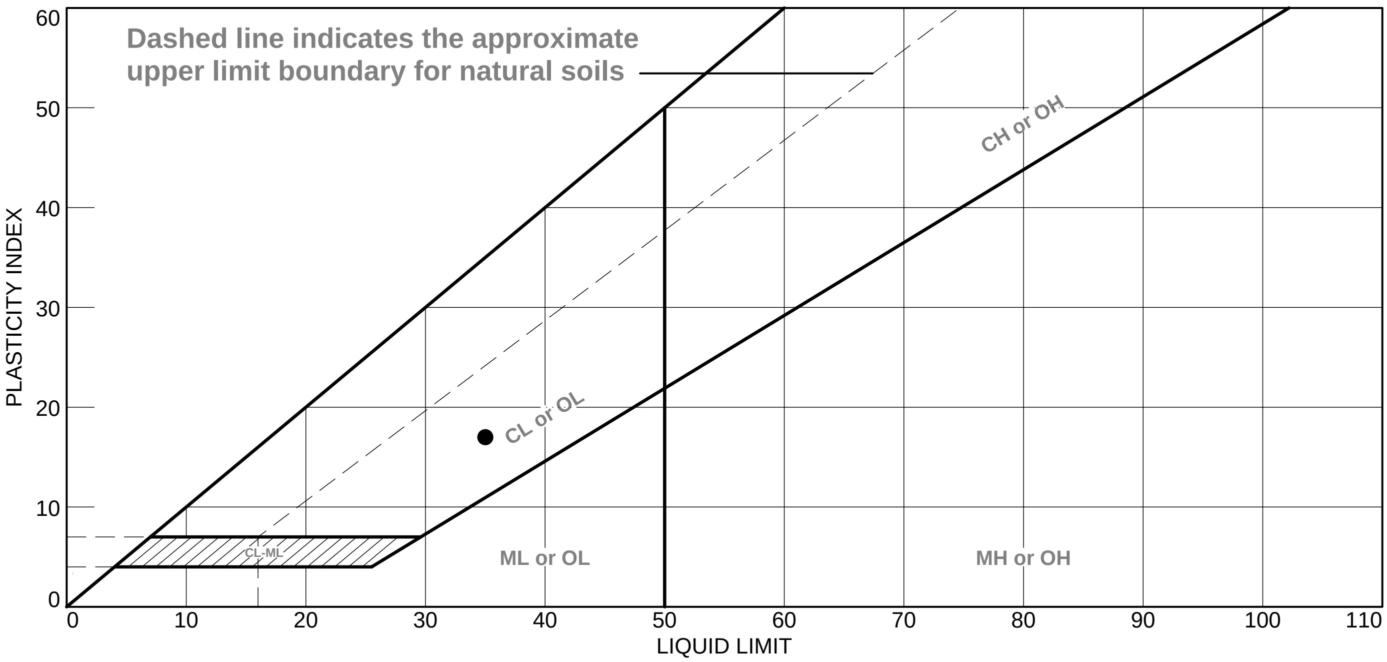
Terracon

Remarks:

Figure

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL	35	18	17			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B032 **Depth:** 5.0'-7.0'
Sample Number: S-3

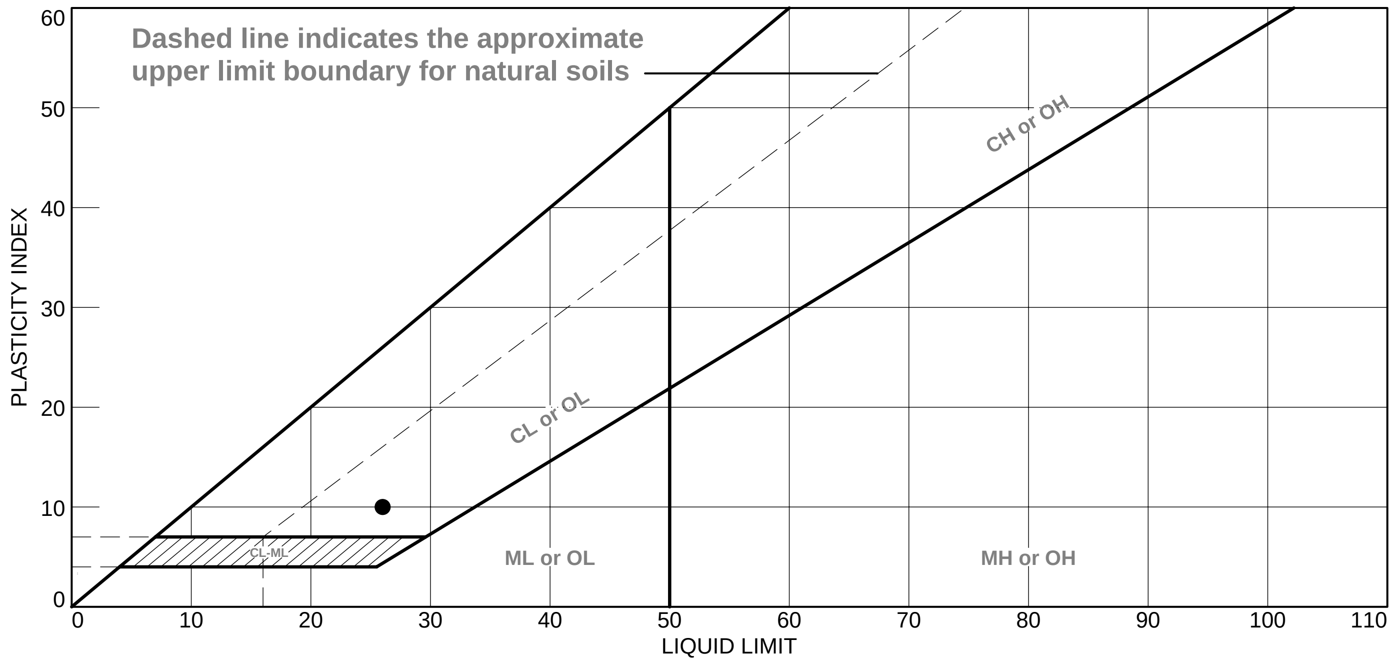
Terracon

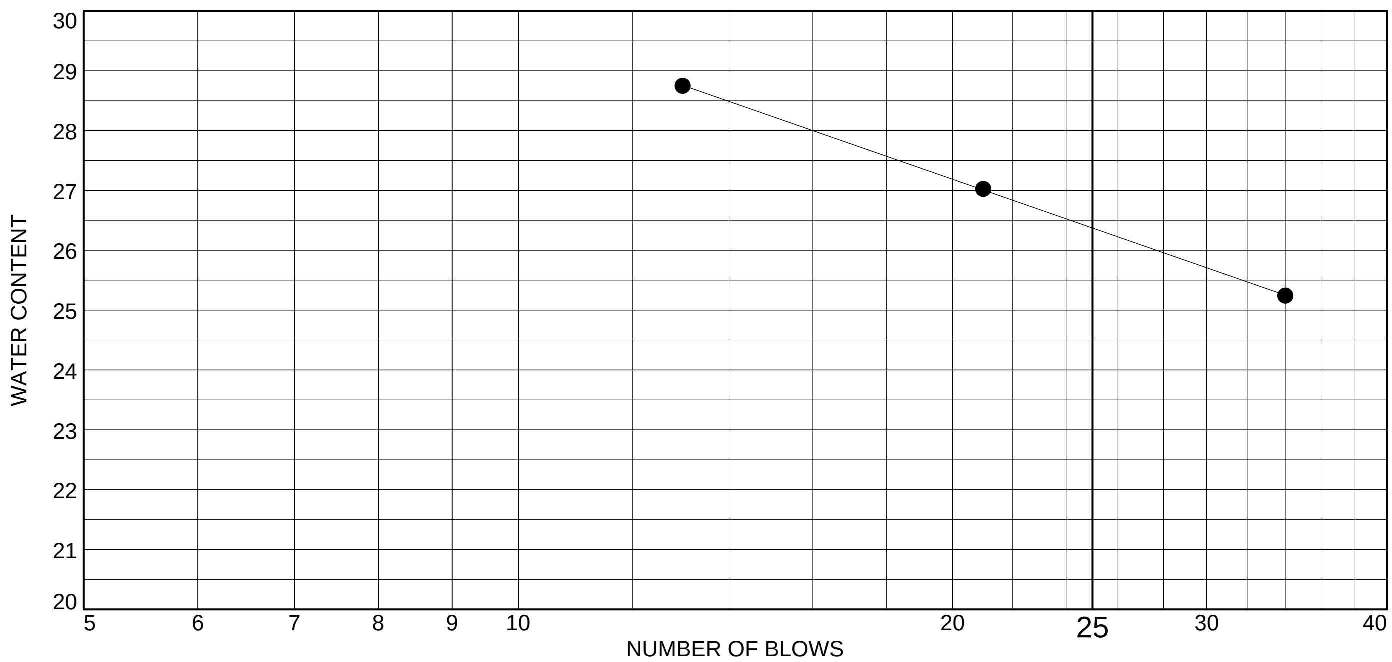
Remarks:

Figure

Tested By: HP **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK BROWN AND DARK GRAY LEAN CLAY WITH GRAVEL	26	16	10			CL

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

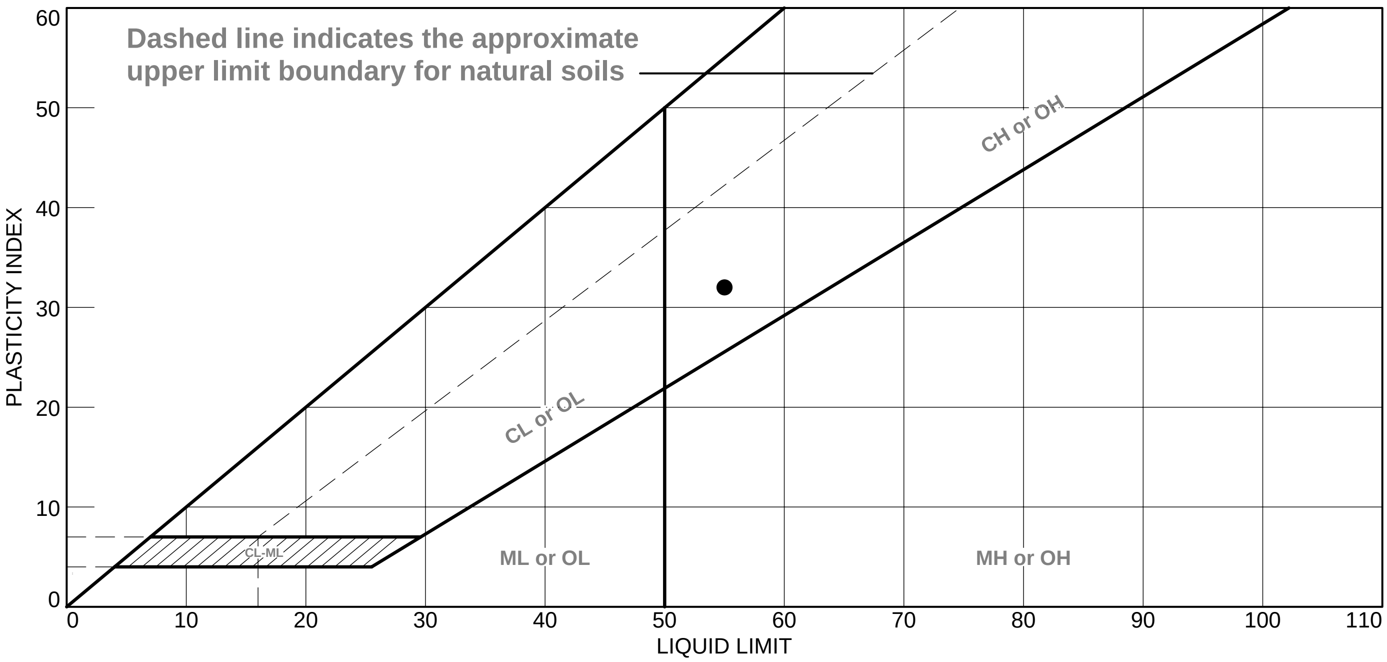
Source of Sample: HEN-B032 **Depth:** 10.0'-11.5'
Sample Number: S-5

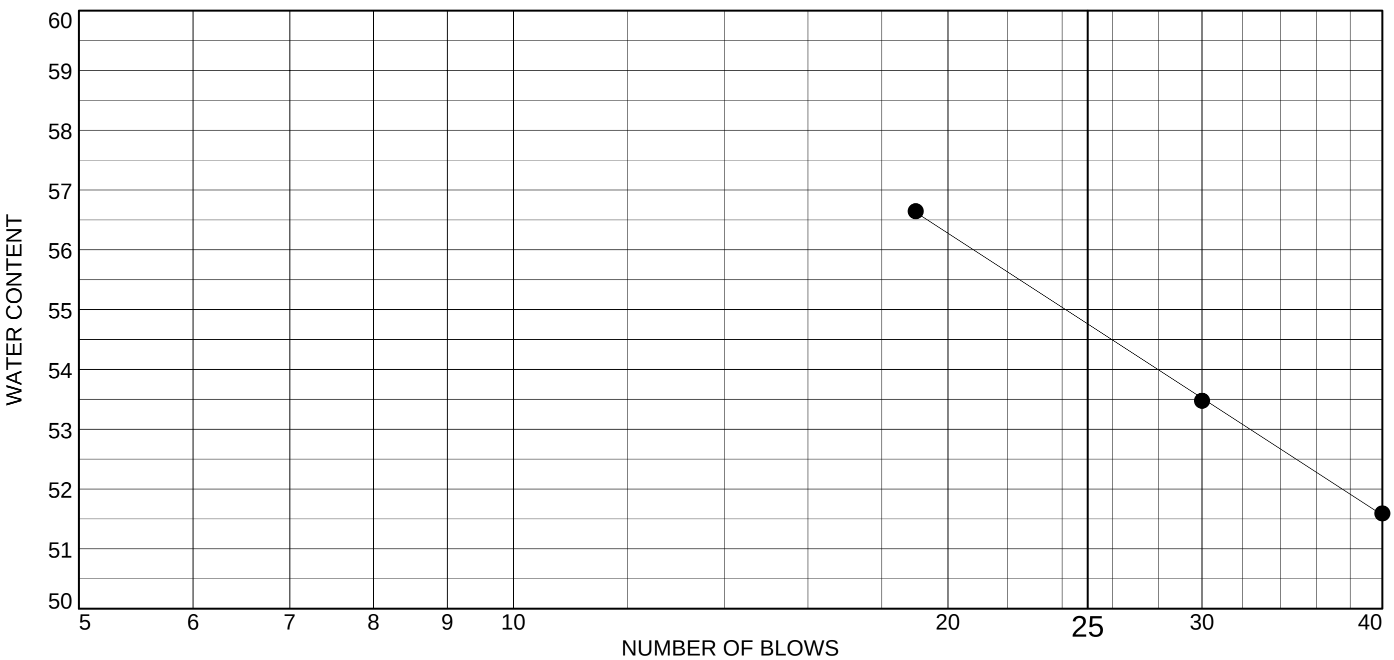
Remarks:

Figure

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GREENISH GRAY FAT CLAY	55	23	32			CH

Project No. MR155233 **Client:** AECOM

Project: DYNERGY - HENNEPIN

Source of Sample: HEN-B038 **Depth:** 10.5-11.5'
Sample Number: S-5B

Terracon

Remarks:

Figure

Tested By: HP **Checked By:** WPQ

Specific Gravity of Soils
ASTM D 854

Terracon
Consulting Engineers & Scientists

SPECIFIC GRAVITY OF SOIL SOLIDS
ASTM D-854

Project Number: MR155233
Project Name: Dynergy Hennepin
Test Date: 12/11/2015

Results Summary

Boring / Sample	Sample Description	USCS	Sample Number	Depth (ft)	Passing #4	Specific Gravity (Gs)
HEN-B002	BROWN SAND WITH CLAY	CL	S-2	2.50'-4.0'	100.00%	2.680
HEN-B004	BROWN, TAN AND GRAY GRAVEL WITH SAND	GP	S-2	2.5'-4.0'	100.00%	2.746
HEN-B006	BROWN AND LIGHT BROWN SAND WITH GRAVEL	SP	S-2	2.5'-4.0'	100.00%	2.665
HEN-B009	DARK BROWN SILT WITH SAND	ML	S-4	8.0'-9.0'	100.00%	2.672
HEN-B010	BROWN AND DARK BROWN SILTY SAND	SM	S-4	7.5'-9.0'	100.00%	2.723
HEN-B011	RUST BROWN SANDY LEAN CLAY	CL	S-2	2.5'-4.0'	100.00%	2.693
HEN-B018	BROWN, TAN AND GRAY SILT WITH CLAY AND GRAVEL	ML	S-3	5.0'-6.5'	100.00%	2.700
HEN-B020	BROWN SILT WITH CLAY, SAND AND GRAVEL	ML	S-3	5.0'-6.5'	100.00%	2.672
HEN-B023	FILL: BROWN AND DARK BROWN SILT WITH CLAY SAND AND GRAVEL	ML	S-3	5.0'-6.5'	100.00%	2.701
HEN-B024	BROWN AND GRAY SAND WITH SILT, CLAY AND GRAVEL	SM	S-2	2.5'-4.5'	100.00%	2.756
HEN-B025	BROWN LEAN CLAY WITH SILT AND SAND	CL	S-2	2.5'-4.5'	100.00%	2.708
HEN-B030	FILL: BROWN AND GRAY LEAN CLAY WITH SILT, SAND AND GRAVEL	CL	S-3	5.0'-6.5'	100.00%	2.746
HEN-B034	DARK BROWN LEAN CLAY WITH SILT AND SAND	CL	S-2	2.5'-4.0'	100.00%	2.704
HEN-B034	BROWN AND LIGHT BROWN GRAVEL WITH CLAY AND SAND	GP-GC	S-6	15.0'-16.5'	100.00%	2.808
HEN-B037	BROWN SAND WITH SILT AND GRAVEL	SP-SM	S-2	2.5'-4.0'	100.00%	2.685
HEN-B038	BROWN GRAVEL WITH CLAY AND SILT	GP-GC	S-6	15.0'-16.5'	100.00%	2.763

Corrosion Series of Tests
ASTM G 51
ASTM G 57
DIPRA Methods

Soil Resistivity	ASTM G 57
Soil pH	ASTM G 51
Soil REDOX	DIPRA
Soil Sulfides	DIPRA
Water Content	ASTM D 2216

Laboratory Services *750 Corporate Woods Parkway* *Vernon Hills, Illinois 60061* *Phone: (224) 352-7000 Fax: (224) 352-7024*

Soil Corrosivity Indication Series

Project No.: **MR155233**
Project Name: Dynegy Hennepin
Client Name: AECOM
Test Date: **12/15/2015**

Boring / Sample No.	Resistivity Natural Soil Box (ohm-cm)	Resistivity Saturated Soil Box (ohm-cm)	pH Soil Water Slurry	REDOX Soil Water Slurry (mV)	Sulfides Reaction (pos/neg)	As Received WC (%)	Saturated WC (%)	Total Points
HEN-B003 Sample 5 10.0'-12.0'	400,000	3680	9.22	70	NEG	2.1	45.7	
Points	-	0	3	3.5	0	-	-	**6.5**
HEN-B009 Sample 2 2.5'-4.0'	16,000	4,400	8.39	65	NEG	11.0	28.5	
Points	-	0	0	3.5	0	-	-	**3.5**
HEN-B023 Sample 4 7.5'-9.0'	13,600	3,940	8.19	80	NEG	8.0	24.7	
Points	-	0	0	3.5	0	-	-	**3.5**
HEN-B025 Sample 2 2.5'-4.0'	10,600	3,680	8.26	85	NEG	9.3	22.5	
Points	-	0	0	3.5	0	-	-	**3.5**

Resistivity:	Points:	pH:	Points:	Redox:	Points:	Sulfides:	Points:	†
<1500 ohms	10	0.0-2.0	5	Negative	5	Positive	3.5	
1500-1800	8	2.0-4.0	3	0 - 50mV	4	Trace	2	
1800-2100	5	4.0-6.5	0	50 - 100mV	3.5	Negative	0	
2100-2500	2	6.5-7.5	0*	100mV+	0			
2500-3000	1	7.5-8.5	0					
3000+	0	8.5 +	3					

*- If Sulfides are present and a low or neg. ReDox, add 3 points

† - THIS SYSTEM IS BASED ON A 25.5 POINT CORROSIVITY RATING SYSTEM DEVELOPED BY THE AMERICAN NATIONAL STANDARDS FOR POLYETHYLENE ENCASEMENT AND DUCTILE-IRON PIPE SYSTEMS. IT SHOULD BE NOTED THAT THESE TEST RESULTS ARE AN INDICATION OF SOIL CHEMISTRY AND SHOULD BE USED AS A INDICATION OF POSSIBLE CORROSIVE CONDITIONS. TERRACON IS NOT LIABLE FOR ANY REMEDIAL MEASURES TAKEN ON THE BASIS OF THESE RESULTS.

Tested by: WPQ Checked By: BCM

Organic Content Test by Loss on Ignition ASTM D 2974 Method C

Terracon
Consulting Engineers & Scientists

ORGANIC CONTENT TEST
ASTM D-2974
Method C

Laboratory Services Group | **750 Corporate Woods Parkway** | **Vernon Hills, Illinois 60061** | **Ph. (224)352-7000** | **fax (224)352-7024**

Project No.: MR155233
Project Name: DYNEGY HENNEPIN
Date Tested: 12/14/15

Sample Information

Boring / Source:	HEN-B019
Sample No.:	S-2
Depth (ft.):	7.5'-8.5'

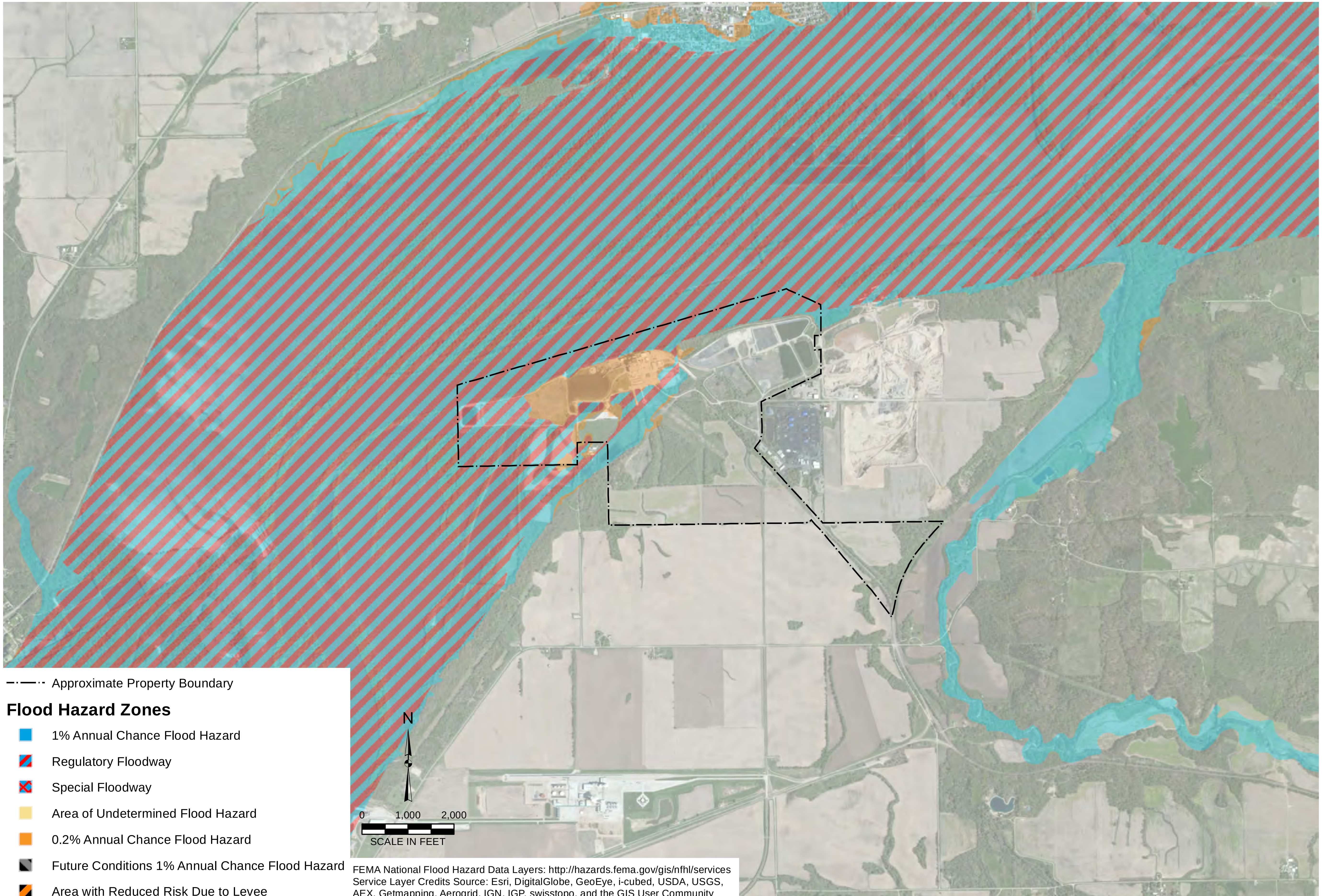
Organic Content Test Data

Tare No.:	F
Tare Wt. (gm): T	19.63
Wet Wt. + Tare (gm): A+T	59.14
Dry Wt. + Tare (gm): B+T	49.34
Moisture Content (%):	**32.99**
Wt. of Ash + Tare (gm): D+T	48.36
Percent Ash: (D-T/B-T)x100 = E	96.70
Organic Content (%):	**3.30**

** Note: Test performed by heating the sample to 440 degrees centigrade for a period of three hours.

Appendix F

FEMA National Flood Hazard Map



FEMA National Flood Hazard Data Layers: http://hazards.fema.gov/gis/nfhl/services
Service Layer Credits Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

DRAWN BY/DATE: TDC 11/11/13
REVIEWED BY/DATE: BRH 11/18/13
APPROVED BY/DATE: SJC 5/14/14

FEMA NATIONAL FLOOD HAZARD MAP

HYDROGEOLOGICAL SUMMARY AND GROUNDWATER QUALITY ASSESSMENT
WEST ASH POND SYSTEM
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

PROJECT NO: 2140

APPENDIX: A

Natural Resource Technology

Y:\Mapping\Projects\21\2140\MXD\Appendix A_FEMA National Flood Hazard Map.mxd Author: mmejac; Date/Time: 5/14/2014, 10:48:38 AM

Appendix G

Water Wells Survey
NRT/Kelron, June 3, 2009

Water Well Survey

Dynegy Midwest Generation
Hennepin Power Station
Hennepin, Illinois

June 3, 2009

Project No: 1957

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

REPORT CERTIFICATION

Certification of document preparation and supervision for the following:

Water Well Survey for Hennepin Power Station
Hennepin, Illinois

June 3, 2009

Professional Geologist Name:	Stuart J. Cravens
License Number:	196-000108
Expiration Date:	March 31, 2011

Illinois Licensed Professional Geologist

Signature: ______________________________

Date: ______________________________ (June 3, 2009)

Seal:

1 OVERVIEW

This report has been prepared for Dynegy Midwest Generation, Inc. (DMG) by Kelron Environmental and Natural Resource Technology, Inc. (NRT) and is intended to meet well survey procedures in relevant Illinois and federal regulations[1], including the "Right to Know" Potable Water Well Survey procedures of 35 Illinois Administrative Code 1600.210(b)(1) and 1600.210(b)(2). The purpose of this survey is to identify all existing water wells located within 2,500 feet of the property boundary of DMG's Hennepin Power Station (HPS or Facility), located within the Village of Hennepin's northern municipal limits in Putnam County, Illinois. The HPS property boundary (Figure 1) is located in:

- The north half of the southeast quarter and the south half of the northeast quarter of Section 27; and
- The north half of the northwest quarter of the southeast quarter; the north half of the northwest quarter of the southwest quarter; and, the north half of the northeast quarter of the southwest quarter of Section 26.

A non-community wellhead protection area (WHPA) has been designated by the Illinois Environmental Protection Agency (Illinois EPA) and Illinois Department of Public Health (IDPH) south of the East Ash Pond System and property boundary (Figures 1 and 2). A total of 11 water supply wells were identified within the search radius outside of the HPS property boundary using Illinois EPA, Illinois State Geological Survey (ISGS), Illinois State Water Survey (ISWS) information, and a visual survey. Additionally, four water wells owned by DMG are located within the HPS property boundary. Within the search radius, one well (Well #4) is located east of the Facility, one well (Well #3) is located west of the Facility, and nine wells are located south of the Facility (Well numbers 5 through 11, 14, and 15). One well (Well #7) is designated as a non-community water supply well (non-CWS). All these wells are either upgradient or side gradient from the active and out-of-service ash pond systems of the HPS.

[1] Leaking Underground Storage Tank regulations (35 Ill. Adm. Code 732); Leaking Underground Storage Tank regulations (35 Ill. Adm. Code 734); Site Remediation Program (35 Ill. Adm. Code 740.425(b)(2)(D)); RCRA Permit regulations (35 Ill. Adm. Code 703.183(s)(9); 35 Ill. Adm. Code 703.184(a)(3)); and the National Contingency Plan (40 CFR 300.430(d)).

2 WATER WELL DATABASE AND ALTERNATE SEARCH RESULTS

The following databases and sources of information were utilized in order to determine community water source and potable water well locations and construction in the vicinity of the HPS property boundary:

- Illinois State Geological Survey -Water Well Database Query;
- Illinois State Water Survey private well database;
- Illinois EPA web-based Geographic Information System (GIS) files;
- Illinois Department of Public Health;
- Putnam County Health Department; and
- Field observation of wells from visual survey.

2.1 Illinois State Geological Survey (ISGS)

The ISGS website provided an ArcIMS Viewer Map as well as a database query. According to the ISGS ArcIMS Viewer Map, 11 water wells are located within a 2,500-foot radius of the HPS property boundary (Figures 1 and 2). The wells are numbered 1, 2, 4 through 9, 12, and 13 on the map. Each map location number represents one well identification, with the exception of map Well #6, which appears to have two listings for the same well (Table 1). The ISGS database information, including any boring log and well construction information, is provided in Appendix A. Four mapped well numbers occur on the Facility property as follows:

- Well #1, located southwest of the main plant near the front entrance gate; and,
- Wells #2, #12, and #13 located south of the main plant and midway between the East and West Ash Pond Systems.

Well #1 was located incorrectly on the original driller's log and this error has been propagated through the ISGS (and ISWS and IEPA) databases. This well is used for irrigation of the coal pile and is not a potable source.

The depths of the wells in the ISGS database ranged from 64 to 128 feet deep. All wells, where lithology information is provided, obtain water from unconsolidated sand and gravel deposits. The ISGS water well database also contained test borings for DMG's Facility; none of these borings were for potable wells and were not included within the search results presented in this report.

2.2 Illinois State Water Survey (ISWS)

The ISWS database of well records included records for the wells identified in the ISGS database, with the exception of well numbers 4 and 12, for which there were no ISWS records. There were also two ISWS Private Well Database records that did not appear in any other databases: well numbers 3 and 14, both of which are very old wells with only approximate locations and unknown ownership. Wells #3 and #14 are dug wells with recorded construction dates of 1844 and 1922, respectively, and were most likely abandoned decades ago.

A number of well records from the ISWS contained minimal information for mapping; therefore, these wells are not included in this report as sufficient information was provided to determine the wells are not within the 2,500 feet search radius. A copy of the ISWS Private Well database records is included in Appendix B.

2.3 Illinois Environmental Protection Agency (Illinois EPA)

The Illinois EPA Database website provided ArcIMS Viewer Maps (Appendix C). The database provides information on community, non-community, and public water supply wells as defined on the Illinois EPA website:

- <u>Community Water Supply</u>: *a public water supply that serves or is intended to serve at least 15 service connections used by residents or regularly serves at least 25 residents.*
- <u>Non-community Water Supply</u>: *a public water supply that is not a community water supply.*
- <u>Public Water Supply</u>: *all mains, pipes and structures through which water is obtained and distributed to the public, including wells and well structures, intakes and cribs, pumping stations, treatment plants, reservoirs, storage tanks and appurtenances, collectively or severally, actually used or intended for use for the purpose of furnishing water for drinking or general domestic use and which serve at least 15 service connections or which regularly serve at least 25 persons at least 60 days per year. A public water supply is either a community water supply or a non-community water supply.*

Based on the Illinois EPA maps, community water systems (CWS) are not present within a 2,500 feet radius of the HPS property boundary. The nearest CWS wells and system details, included in Appendix C, are:

- Village of Depue (Facility Number 0110300) located approximately 1.5 miles north of the Facility;
- Village of Hennepin (Facility Number 1555100) located approximately 3 miles south of the Facility;
- Village of Bureau Junction (Facility Number 0110150) located approximately 3 miles southwest of the Facility; and
- Village of Granville (Facility Number 1550050) located approximately 3.5 miles southeast of the Facility.

According to Illinois EPA records, the HPS property boundary is located greater than 1-mile from the Minimum Setback Zones, Existing or Potential Maximum Setback Zones, and /or Recharge Areas for the CWS systems.

Based on the Illinois EPA maps, there is one non-community supply (non-CWS) well, 6 industrial / commercial wells, and 2 farm/domestic water wells located within the 2,500 feet radius of the HPS property boundary (Figures 1 and 2). All wells identified on Illinois EPA maps were also identified in ISGS and/or ISWS records. The non-CWS water supply system (Appendix C) is identified as the Exolon ESK System #0117408, which consists of one well (Map Well #7). The WHPA for this system lies within the 2,500-foot search radius (Figures 1 and 2) but south of the Hennepin Power Station's property boundary.

A wellhead protection area (WHPA) is the surface and subsurface area surrounding a water well or well field supplying a CWS or non-CWS water system through which contaminants from a source are theoretically likely to move and reach the water well or well field. All CWS and non-CWS systems utilizing groundwater in Illinois have a 1,000-foot wellhead / source water protection radius, also referred to as a Phase I WHPA.

2.4 Illinois Department of Public Health (IDPH)

The IDPH was contacted for confirmation information on the Exolon non-CWS system. J. Scott Bell with the IDPH confirmed the system is the only non-CWS within the search radius. Mr. Bell also stated the system is now identified as the Washington Mills non-CWS (Appendix D).

2.5 Putnam County Health Department

Personnel from the Bureau-Putnam County Health Department were not able to confirm or provide additional data on the non-CWS well system (Appendix D).

2.6 Visual Survey

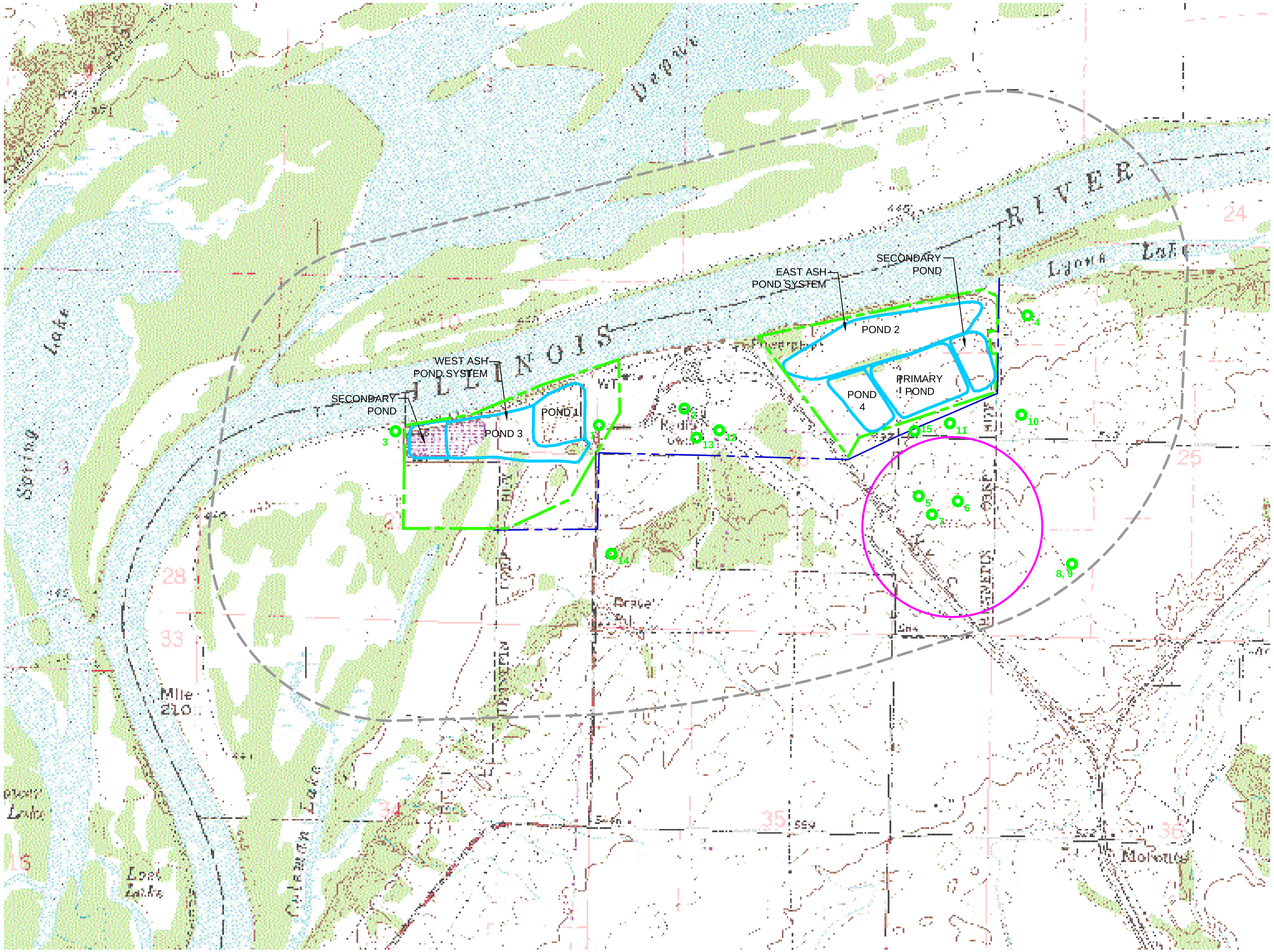
A visual survey, also referred to as a windshield survey, was conducted on April 14, 2009 to verify some well locations listed in the databases and also to locate wells not identified by ISGS, ISWS, Illinois EPA or DMG sources. Three wells were field identified (Table 1; Figures 1 and 2) that did not have corresponding well logs in any of the database sources: Well #10, located on property owned by Tri-Con Materials; and Wells #11 and #15, located on property that appears to be owned by Advanced Asphalt. All three of these wells are industrial-commercial wells with unknown operational status as to whether they are active or inactive.

3 CONCLUSIONS

According to database records of the ISGS, ISWS, and Illinois EPA, there are eight water wells (assumed to be potable) owned by private residences or companies within a 2,500 feet radius of the HPS property boundary and four water wells owned by DMG are located on the HPS property (Table 1). Three additional undocumented industrial-commercial wells were identified at locations south and southeast of the Facility during a visual (windshield) survey. A total of 15 water wells have been identified both on DMG's HPS property and within a 2,500-foot radius of the Facility property boundary.

In addition to the above sources of water well information provided by State agencies, Kelron obtained information from DMG personnel and the IDPH. Personnel with both these entities had no knowledge or information of any additional wells within a 2,500 feet radius of the HPS property boundary beyond those identified within the State databases.

The results of the water well survey are provided in Appendices A through D for each of the sources of information contacted. Based on all of the well information acquired from the listed sources, water supply wells within at least 2,500 feet of the HPS property boundary were placed on a topographic map (Figure 1) and aerial photograph (Figure 2) and shown in relation to the HPS property boundary. The current status of some of these wells (i.e., operational, abandoned, or sealed) is not known.



LEGEND

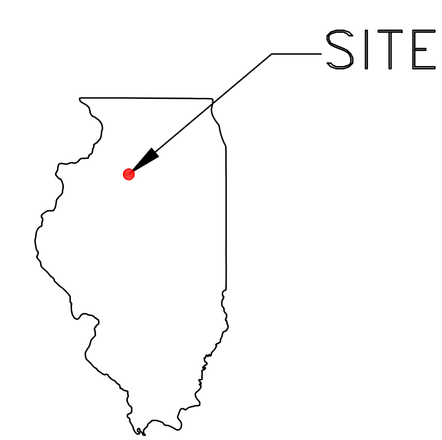
4	WATER WELL LOCATION
	ASH POND
	APPROXIMATE PROPERTY BOUNDARY
	GROUNDWATER MANAGEMENT ZONE
	2,500 FOOT RADIUS FROM PROPERTY BOUNDARY
	NON-CWS WELLHEAD PROTECTION AREA

SOURCE:
USGS DIGITAL RASTER GRAPHICS FILES FROM ILLINOIS NATURAL RESOURCES GEOSPATIAL DATA CLEARINGHOUSE (http://www.isgs.uiuc.edu)

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY SOURCE WATER ASSESSMENT PROGRAM (SWAP) ArcIMS MAPPING TOOL (http://maps.epa.state.il.us/website/swap/intro.html).

ILLINOIS STATE GEOLOGICAL SURVEY, DIGITAL WATER WELL RECORDS INTERACTIVE MAP (http://www.isgs.illinois.edu/maps-data-pub/wwdb/wwdb.shtml).

2009 KELRON/NRT FIELD OBSERVATIONS.
2009 DYNEGY MIDWEST GENERATION PERSONNEL CORRESPONDENCE.



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DRAWN BY: RLH DATE: 06/01/09
CHECKED BY: RJC DATE: 06/01/09
APPROVED BY: RJC DATE: 06/01/09
DRAWING NO: 1957-1-B01C
REFERENCE: o41089c3.tiff

WATER WELL LOCATION MAP

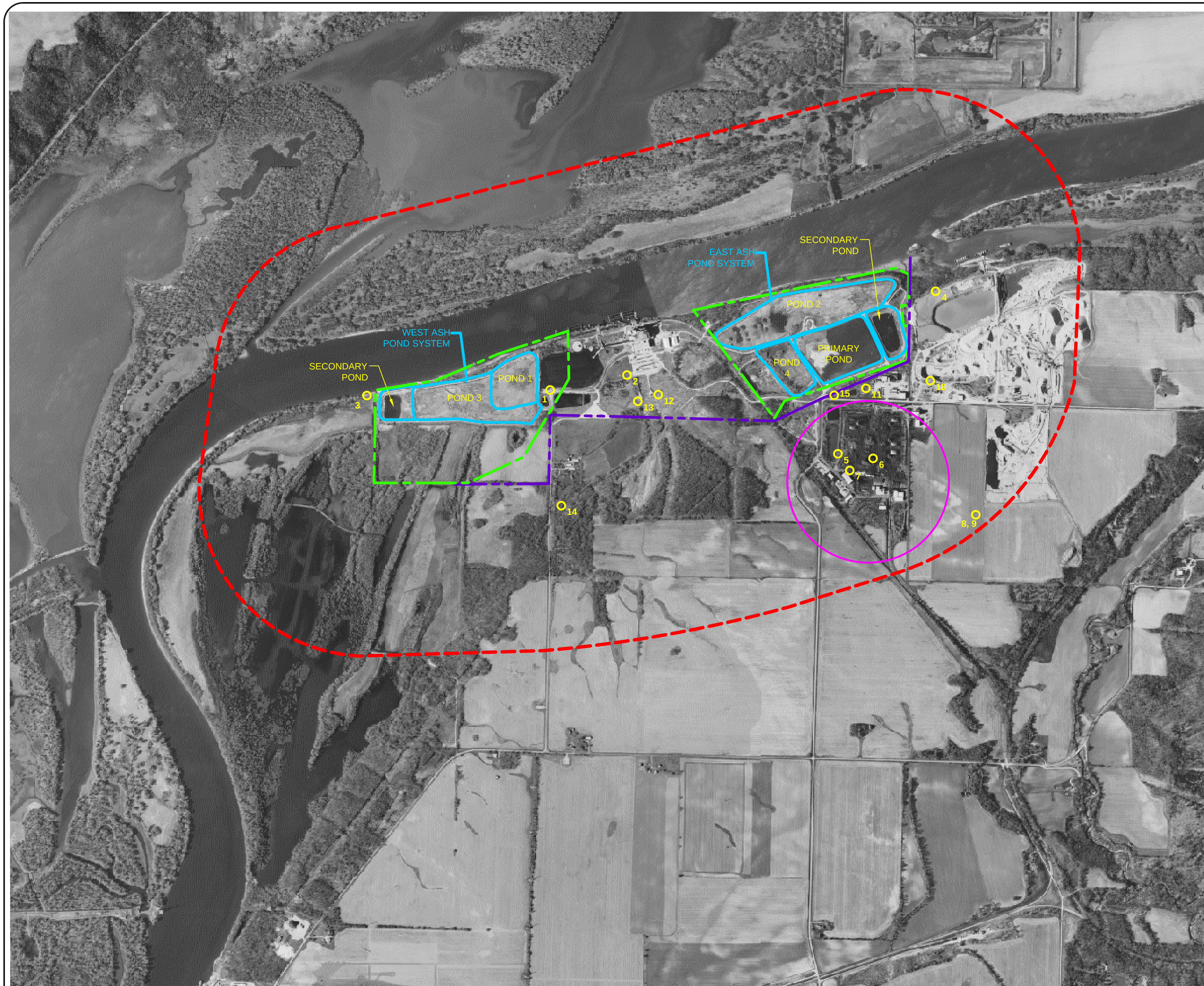
WATER WELL SURVEY
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

NATURAL RESOURCE TECHNOLOGY

PROJECT NO. 1957/1.0

FIGURE NO. 1

KELRON environmental



LEGEND

12	WATER WELL LOCATION
	ASH POND
	APPROXIMATE PROPERTY BOUNDARY
	GROUNDWATER MANAGEMENT ZONE
	2500 FT. RADIUS, FROM PROPERTY BOUNDARY
	NON-CWS WELLHEAD PROTECTION AREA

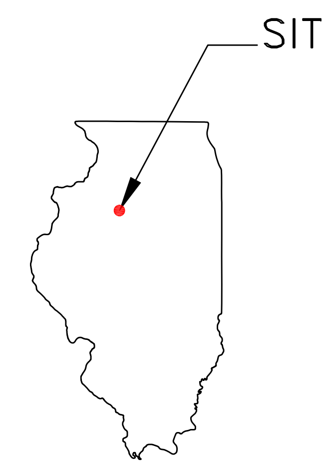
SOURCE NOTES:

2005 DIGITAL ORTHOPHOTO FROM ILLINOIS NATURAL RESOURCES GEOSPATIAL DATA CLEARINGHOUSE (http://www.isgs.uiuc.edu).

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY SOURCE WATER ASSESSMENT PROGRAM (SWAP) ArcIMS MAPPING TOOL (http://maps.epa.state.il.us/website/swap/intro.html).

ILLINOIS STATE GEOLOGICAL SURVEY, DIGITAL WATER WELL RECORDS INTERACTIVE MAP (http://www.isgs.illinois.edu/maps-data-pub/wwdb/wwdb.shtml).

2009 KELRON/NRT FIELD OBSERVATIONS.
2009 DYNEGY MIDWEST GENERATION PERSONNEL CORRESPONDENCE.



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APPROVED BY: RJC DATE: 06/01/09
DRAWING NO: 1957-1-B02C
REFERENCE: 41089c31.sid, 41089c32.sid, 41089c33.sid, 41089c34.sid

AERIAL PHOTOGRAPH WITH WATER WELLS

WATER WELL SURVEY
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

NATURAL RESOURCE TECHNOLOGY

PROJECT NO. 1957/1.0

FIGURE NO. 2

KELRON environmental

Table 1. Water Well Records Within 2,500-Foot Radius of Property Boundary
Hennepin Power Station; Hennepin, Illinois

Map	Source of Well Information				Location Name	Well		Location				Year	Aquifer		Well
Well #	ISGS	ISWS	IEPA	Other	at Time of Well Completion	Depth	County	Township	Range	Section	Subsection	Drilled	Type	Formation	Use
1*	121552070200	155-12-04	20702	DMG	Hennepin Power Station (DMG)	83	Putnam	33N	02W	27	SE/SE/NE	2004	Unconsolidated	Sand and Gravel	IC
2	121550012800	P403409	00128	DMG	Illinois Power Co., No. 5	113	Putnam	33N	02W	26	NE/NE/NW	1968	Unconsolidated	Sand and Gravel	IC
3	- -	125917	- -	- -	- -	30	Putnam	33N	02W	27	NE/NW/SW	1844	- -	- -	FD
4	121552045800	- -	20458	- -	Advanced Asphalt Co.	114	Putnam	33N	02W	25	SW/NW/NW	1995	Unconsolidated	Sand and Gravel	IC
5	121552029200	79101 P403400	20292	- -	Exolon, Well No. 1	109	Putnam	33N	02W	26	SW/NE/SE	1978	Unconsolidated	Sand and Gravel	IC
6	121552049700 121552047700	155-011-96 P405443	20497 20477	- -	Exolon, Well No. 3	124	Putnam	33N	02W	26	SE/NE/SE	1996	Unconsolidated	Sand and Gravel	IC
7	121552025800	76743	20258	SWA	Exolon, Well No. 2 (ID 15500143)	128	Putnam	33N	02W	26	SW/NE/SE	1978	Unconsolidated	Sand and Gravel	NCWS
8	121552051800	314693	20518	- -	Kenneth Brown	72	Putnam	33N	02W	25	NE/SW/SW	1999	Unconsolidated	Sand and Gravel	FD
9	121552068500	359951	20685	- -	Kenneth Brown	64	Putnam	33N	02W	25	NE/SW/SW	2002	Unconsolidated	Sand and Gravel	FD
10	- -	- -	- -	Visual	Tri-Con Materials	--	Putnam	33N	02W	25	SW/SW/NW	- -	- -	- -	IC
11	- -	- -	- -	Visual	Potentially Advanced Asphalt	--	Putnam	33N	02W	26	SE/SW/NE	- -	- -	- -	IC
12	121552043500	- -	20435	DMG	Illinos Power Co., No. 1A/6	125	Putnam	33N	02W	26	NE/NE/NW	1993	Unconsolidated	Sand and Gravel	IC
13	121552059800	176545 P403406	20598	DMG	Illinois Power Co., No. 4	114	Putnam	33N	02W	26	NE/NE/NW	1969	Unconsolidated	Sand and Gravel	IC
14	- -	125916	- -	- -	- -	17	Putnam	33N	02W	26	NW/SW/SW	1922	Unconsolidated	Sand and Gravel	FD
15	- -	- -	- -	Visual	Potentially Advanced Asphalt	--	Putnam	33N	02W	26	SW/SE/NE	- -	- -	- -	IC

Sources of Information

DMG	Dyngey Midwest Generation
IEPA	Illinois Environmental Protection Agency
ISGS	Illinois State Geological Survey
ISWS	Illinois State Water Survey
SWA	IEPA Source Water Assessment

Well Use

FD	Farm and/or Domestic Water Well
IC	Industrial/Commercial Water Well
CWS	Community Water Supply
NCWS	Non-Community Water Supply

Notes

- -	Not applicable or no information available.
*	Used for irrigation of coal pile only.

APPENDIX A

ILLINOIS STATE GEOLOGICAL SURVEY WELL LOCATIONS AND DATA

ILLINOIS STATE GEOLOGICAL SURVEY

MAP # 1

ISWS # 155-12-04
P 411819

Irrigation Well	Top	Bottom
gravel	0	4
gravel & boulders	4	18
12-25 slot sand	18	26
gravel & boulders	26	33
1/8" - 1" gravel, no fines	33	80
20-60 slot sand	80	83
shale at	83	83
Total Depth		83

Casing: 12" STEEL from 0' to 62'
12" STAINLESS STL SCREEN from 62' to 82'
Screen: 20' of 12" diameter 80 slot
Grout: BENTONITE from 0 to 20.
Grout: #2 MUSCATINE from 20 to 82.
Water from sand at 33' to 82'.
Static level 13' below casing top which is 2' above GL
Pumping level 20' when pumping at 50 gpm for 1 hour
Permanent pump installed at 60'

Address of well: same as above

Location source: Location from permit

Permit Date: August 9, 2004 **Permit #:**

COMPANY Harold Dean Albrecht
FARM Dynegy Midwest-Hennepin Power
DATE DRILLED August 11, 2004 **NO.**
ELEVATION 0 **COUNTY NO.** 20702
LOCATION NE NW SW
LATITUDE 41.296294 **LONGITUDE** -89.335163
COUNTY Putnam **API 121552070200** **27 - 33N - 2W**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Total Depth		113
Driller's Log filed		

MAP #2

ISWS # P403409

Permit Date: **Permit #:**

COMPANY Layne Western Co., Inc.

FARM Illinois Power

DATE DRILLED September 1, 1968 **NO.** 5

ELEVATION 0 **COUNTY NO.** 00128

LOCATION NE NE NW

LATITUDE 41.304882 **LONGITUDE** -89.31122

COUNTY **Putnam** **API 121550012800** **26 - 33N - 2W**

ILLINOIS STATE GEOLOGICAL SURVEY

MAP #4

Semi-Private Water Well	Top	Bottom
yellow rocky sand & gravel	0	75
very fine Sankoty sand	75	114
blue shale at	114	114
Total Depth		114

Casing: 6" BLACK STEEL from 3' to 109'
Screen: 4' of 6" diameter 10 slot
Grout: BENTONITE from 0 to 90.
Size hole below casing: 6"

Water from Sankoty at 109' to 113'.
Static level 75' below casing top which is 1' above GL
Pumping level 105' when pumping at 10 gpm for 2 hours

Permanent pump installed at 112' on June 29, 1995, with a capacity of 10 gpm

Address of well: R.R. #1
Hennepin, IL

Location source: Location from permit

Permit Date: May 31, 1995 **Permit #:**

COMPANY Lutes, George W.
FARM Advanced Asphalt Co.
DATE DRILLED June 12, 1995 **NO.**
ELEVATION 0 **COUNTY NO.** 20458
LOCATION SW NW NW
LATITUDE 41.30505 **LONGITUDE** -89.299075
COUNTY **Putnam** **API 121552045800** **25 - 33N - 2W**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Total Depth		109
Driller's Log filed		
Sample set # 61998 (0' - 105') Received: June 15, 1979		

MAP # 5

ISWS # 79101
P403400

Permit Date: **Permit #:**

COMPANY Layne Western Co., Inc.
FARM Esk Corporation
DATE DRILLED September 1, 1978 **NO.** 1
ELEVATION 0 **COUNTY NO.** 20292
LOCATION 1830'S line, 1070'E line of SE
LATITUDE 41.298332 **LONGITUDE** -89.304115
COUNTY **Putnam** **API 121552029200** **26 - 33N - 2W**

ILLINOIS STATE GEOLOGICAL SURVEY

Noncommunity - Public Water Well	Top	Bottom
SS #68792 (0-120')	0	0
fine brown sand	0	4
gray clay	4	5
coarse sand & gravel with boulders	5	79
brown clay with gravel	79	81
fine sand with gravel	81	117
gray shale	117	124
Total Depth		124

Casing: 12" STEEL .375" from 0' to 102'
Screen: 15' of 12" diameter .13 slot
Grout: CEMENT from 0 to 20.
Size hole below casing: 38"

Water from sand & gravel at 102' to 117'.

Sample set # 68792 (0' - 120') Received: March 6, 2000

Location source: Location from permit

Permit Date: September 5, 1996 **Permit #:** 155-011

COMPANY Buffington, G.
FARM Exolon - ESK Company
DATE DRILLED October 1, 1997 **NO.** 3
ELEVATION 0 **COUNTY NO.** 20497
LOCATION 1775'N 550'W SE/c
LATITUDE 41.298186 **LONGITUDE** -89.302211
COUNTY **Putnam** **API 121552049700** **26 - 33N - 2W**

MAP #6
ISWS # 155-011-96
P 403400

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	Top	Bottom
fine brown sand	0	4
gray clay	4	5
coarse sand & gravel	5	79
brown clay with gravel	79	81
fine sand with gravel	81	117
gray shale	117	124
Total Depth		124

Casing: 12" STEEL .375" from 0' to 102'
Screen: 15' of 12" diameter .13 slot
Grout: CEMENT from 0 to 20.
Size hole below casing: 38"

Water from sand & gravel at 102' to 117'.
Permanent pump installed at 80' on , with a capacity of 300 gpm

Location source: Location from permit

MAP #6

Permit Date: September 5, 1996 **Permit #:**

COMPANY Buffington, G.
FARM Exolon - ESK Company #3
DATE DRILLED October 1, 1996 **NO.**
ELEVATION 0 **COUNTY NO.** 20477
LOCATION 1775'N 550'W SE/c SE
LATITUDE 41.298186 **LONGITUDE** -89.302211
COUNTY **Putnam** **API 121552047700** **26 - 33N - 2W**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Total Depth		128
Driller's Log filed		
Sample set # 61999 (0' - 130') Received: June 15, 1979		

MAP # 7

Permit Date: **Permit #:**

COMPANY Layne Western Co., Inc.

FARM Esk Corporation

DATE DRILLED July 1, 1978 **NO.** 2

ELEVATION 0 **COUNTY NO.** 20258

LOCATION 1590'S line, 890'E line of SE

LATITUDE 41.297672 **LONGITUDE** -89.303448

COUNTY **Putnam** **API 121552025800** **26 - 33N - 2W**

ILLINOIS STATE GEOLOGICAL SURVEY

MAP # 8

Private Water Well	Top	Bottom
dirty sand	0	8
gravel	8	18
clay	18	36
yellow gravel (a lot of water loss)	36	50
gray gravel (a lot of water loss)	50	72
shale at	72	72
Total Depth		72

Casing: 4" PVC SCH 40 from -1' to 51'
Screen: 4' of 4" diameter 15 slot
Grout: BENT GROUT MIX from 0 to 46.
Water from sand & gravel at 0' to 0'.
Static level 18' below casing top which is 1' above GL
Pumping level 0' when pumping at 50 gpm for 3 hours

Address of well: R.R. #1
Hennepin, IL

Location source: Location from permit

Permit Date: August 3, 1999 **Permit #:**

COMPANY Jet Hall
FARM Brown, Kenneth
DATE DRILLED August 25, 1999 **NO.**
ELEVATION 0 **COUNTY NO.** 20518
LOCATION NE SW SW
LATITUDE 41.296001 **LONGITUDE** -89.296594
COUNTY **Putnam** **API 121552051800** **25 - 33N - 2W**

ILLINOIS STATE GEOLOGICAL SURVEY

MAP # 9

Private Water Well	Top	Bottom
sandy brown clay	0	12
gravel	12	20
pinkish gray clay	20	28
yellow gravel (lots of water loss)	28	50
fine sand	50	64
Total Depth		64

Casing: 6" PVC from 0' to 42'
6" SS SCREEN 18/20 SLOT from 42' to 50'
Screen: 8' of 6" diameter slot
Grout: BENT CLAY SLRY from 0 to 40.
Grout: MUSCATINE #1 from 40 to 50.
Water from sand & gravel at 28' to 64'.
Static level 5' below casing top which is 1' above GL
Pumping level 7' when pumping at 12 gpm for 2 hours

Address of well: same as above

Location source: Location from permit

Permit Date: October 4, 2002 **Permit #:**

COMPANY Jet Hall/Lutes H2o Well Drlg.
FARM Brown, Kenneth
DATE DRILLED November 15, 2002 **NO.**
ELEVATION 0 **COUNTY NO.** 20685
LOCATION NE SW SW
LATITUDE 41.296001 **LONGITUDE** -89.296594
COUNTY **Putnam** **API 121552068500** **25 - 33N - 2W**

ILLINOIS STATE GEOLOGICAL SURVEY

MAP #12

Noncommunity - Public Water Well	Top	Bottom
SS #68242 (0'-120')	0	0
black topsoil	0	2
brown clay, a little clayey	2	7
yellow-brown coarse gravel & boulders	7	27
brown coarse sand to coarse gravel	27	41
gray & brown soft silty clay	41	43
brn med sand to coarse gravel & boulders	43	50
reddish brown coarse gravel & boulders	50	67
multi-colored boulders	67	73
conglomerate clay & boulders /trace lime	73	82
light gray silty clay	82	84
hard tight coarse gravel	84	86
brn med sand to coarse gravel & boulders	86	96
boulder	96	98
fn brn snd; coarse gravel w/finer layers	98	112
brown fine sand to medium gravel	112	118
firm gray shale	118	125
Total Depth		120

Casing: 36" STEEL from 12' to 62'
18" STEEL 70.59#/FT. from -2' to 90'

Screen: 25' of 18" diameter .1 slot

Grout: CONCRETE from 0 to 20.

Water from sand & gravel at 90' to 115'.

Static level 17' below casing top which is 3' above GL

Pumping level 31' when pumping at 1086 gpm for 8 hours

Permanent pump installed at 50' on October 31, 1993, with a

Permit Date: August 31, 1993 **Permit #:**

COMPANY Buffington, G.

FARM Illinois Power Co.

DATE DRILLED September 30, 1993 **NO.** 1A/5 6 6?

ELEVATION 0 **COUNTY NO.** 20435

LOCATION NE NE NW

LATITUDE 41.304882 **LONGITUDE** -89.31122

COUNTY **Putnam** **API 121552043500** **26 - 33N - 2W**

MAP # 12
PAGE 2

capacity of 500 gpm

Sample set # 68242 (10' - 120') Received: July 14, 1994

Location source: Location from permit

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Total Depth		114
Sample set # 56227 (65' - 114') Received: May 16, 1969		

MAP #13

ISWS#
176545
P403406

Permit Date: **Permit #:**

COMPANY Layne-Western Drlg

FARM Il. Power Co.

DATE DRILLED **NO.** 4

ELEVATION 0GL **COUNTY NO.** 20598

LOCATION NE NE NW

LATITUDE 41.304882 **LONGITUDE** -89.31122

COUNTY **Putnam** **API 121552059800** **26 - 33N - 2W**

APPENDIX B

ILLINOIS STATE WATER SURVEY PRIVATE WELL DATABASE WELL DATA

Illinois Department of Public Health
WATER WELL CONS[illegible]ICTION REPORT

Date 8-31-04

T[illegible]PE OR PRESS FIRMLY WITH BLACK INK PEN. COMPLETE WITHIN 30 DAYS OF WELL COMPLETION AND SEND TO THE APPROPRIATE HEALTH DEPARTMENT.

RECEIVED 10/1/04

(Dynegy Midwest Gen - Hennepin Power

GEOLOGICAL AND WATER SURVEY WELL RECORD

1. Type of Well a. Driven Well Casing diam. ____in. Depth ____ft.
b. Bored Well Buried Slab [ ] Yes [ ] No
Hole Diameter ____in. to ____ft.; ____in. to ____ft.; ____in. to ____ft.
c. Drilled Well PVC casing Formation packer set at depth of ____ft.
Hole Diameter ____in. to ____ft. ____in. to ____ft. ____in. to ____ft.

Type of Grout	# of Bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)

d. Drilled Well Steel Casing- - - Mechanically Driven [ ] Yes [ ] No
Hole Diameter 19 in. to 82 ft. ____in. to ____ft. ____in. to ____ft.

Type of Grout	# of Bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
bentonite			0	20	20

e. Well finished within [X] Unconsolidated Materials [ ] Bedrock

f.

Kind of Gravel Sand Pack	Grain Size/Supplier #	From (ft.)	To (ft.)
#2 Muscatine		20	82

2 Well Use [ ] Domestic [x] Irrigation [ ] Commercial [ ] Livestock [ ] Monitoring [ ] Other
3 Date Well Completed 8-11-04 Well Disinfected [x] Yes [ ] No
Driller's estimated well yield 50 gpm w/air
4 Date Permanent Pump Installed 8-16-04
5 Pump Capacity ____gpm Set at (depth) 60 ft.
6 Pitless Adapter Model and Manufacturer ____
7 Well Cap Type and Manufacturer Weld-on Top Plate
8 Pressure Tank Working Cycle ____gals. Captive Air [ ] Yes [ ] No
9 Pump System Disinfected [x] Yes [ ] No
10 Name of Pump Company Albrecht Well Drilling, Inc.
11 Pump Installer Harold D. Albrecht License # 102-002466
12 Harold D. Albrecht License # 102-002466
Licensed Pump Contractor Signature

PICS 155342260, #7 P# 411819

Illinois Department of Public Health
Division of Environmental Health
525 W. Jefferson St.
Springfield, IL 62761

DO NOT write on these lines

X11819

13. Property Owner Dynegy Midwest Well # 4521
14. Driller Harold D. Albrecht License # 102-002466
15. Name of Drilling Co. Albrecht Well Drilling, Inc.
16. Permit No. 155-12-04 Date Issued 8-9-04
17. Date Drilling Started August 10, 2004
18. Well SITE address R.R.#1 Hennepin, IL
19. Township Name Hennepin Land ID # 01-27-100-OCC
20. Subdivision Name n/a Lot # n/a
21. Location a. County Putnam
b. Township 33N Range 2W Section 27 7d
c. NE Quarter NW Quarter SW Quarter
d. Coordinates ____ Site Elevation ____ ft. (msl)

For Survey Use

22. Casings, Liners* and Screen Information

Diam. (in.)	Material	Joint	Slot Size	From (ft.)	To (ft.)
12	steel			0	62
12"	SS		80	62	82

(*) ____
(List reason for liner, type of upper and lower seals installed)

23. Water from sand at a depth of 33 ft. to 82 ft.
a. Static water level 13 ft. below casing which is 18 in. above ground
b. Pumping level is 20 ft. pumping 50 gpm after pumping for 1/2 hours w/air

24. Earth Materials Passed Through

Earth Materials Passed Through	From (ft.)	To (ft.)
gravel	0	4
gravel & boulders	4	18
12-25 slot sand	18	26
gravel & boulders	26	33
1/8" - 1" gravel [no fines]	33	80
20-60 slot sand	80	83
shale	83	

(If dry hole, fill out log and indicate how hole was sealed.)

Harold D. Albrecht 102-002466
25. Licensed Water Well Contractor Signature License Number

MAP #1

IMPORTANT NOTICE: 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.

ISGS # 121552070200

SEE REVERSE SIDE FOR ADDITIONAL INFORMATION)

ILLINOIS DEPARTMENT OF PUBLIC HEALTH
WELL CONSTRUCTION REPORT

1. Type of Well
   a. Dug____. Bored____. Hole Diam.____in. Depth____ft.
      Curb material____. Buried Slab: Yes____ No____
   b. Driven____. Drive Pipe Diam.____in. Depth____ft.
   c. Drilled ✓. Finished in Drift ✓. In Rock____.
      Tubular____. Gravel Packed ✓.
   d. Grout:

(KIND)	FROM (Ft.)	TO (Ft.)
None		

2. Distance to Nearest:
   Building____Ft. Seepage Tile Field____
   Cess Pool____ Sewer (non Cast iron)____
   Privy____ Sewer (Cast iron)____
   Septic Tank____ Barnyard____
   Leaching Pit____ Manure Pile____
3. Is water from this well to be used for human consumption?
   Yes____ No ✓
4. Date well completed Aug 27, 68
5. Permanent Pump Installed? Yes ✓ No____
   Manufacturer Layne Type Line shaft
   Capacity 1000 gpm. Depth of setting 60 ft.
6. Well Top Sealed? Yes ✓ No____
7. Pitless Adaptor Installed? Yes____ No ✓
8. Well Disinfected? Yes ✓ No____
9. Water Sample Submitted? Yes____ No ✓

REMARKS:

P 403409

GEOLOGICAL WATER SURVEYS WATER WELL RECORD

10. Dept. Mines and Minerals permit No. N-4409 Year 1968
11. Property owner Ill. Power Co. Well No. 5
    Address Hennepin, Ill
    Driller Layne-Western Co. License No. 92-14
12. Water from Drift (Formation) at depth 0 to 112 ft.
13. County Putnam
    Sec. 26.5A
    Twp. 33N
    Rng. 2W
    Elev.
14. Screen: Diam. 18 in.
    Length: 30 ft. Slot 0.080"
15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
30"	3/8" steel	0	63'-6
18"	3/8" steel	0	63'-6'
18"	3/8" steel	73'-6"	73'-6'

SHOW LOCATION IN SECTION PLAT

NE NE NW

16. Size Hole below casing: 30 in.
17. Static level 13'4" ft. below casing top which is 0 ft. above ground level. Pumping level 33 ft. when pumping at 1572 gpm for 6 hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Drift	112	112
Shale	?	?
(CONTINUE ON SEPARATE SHEET IF NECESSARY)		

SIGNED D. L. [illegible] DATE Nov 2, 68

MAP # 2
ISGS # 121550012800

Whi[illegible]py – Ill. Dept. of Public Health
Yellow Copy – Well Contractor
Blue Copy – Well Owner

INSTRUCTION[illegible] TO DRILLERS

FILL IN ALL PERTINENT INFORMATION REQUESTED AND MAIL ORIGINAL TO STATE DEPARTMENT OF PUBLIC HEALTH, ROOM 616, STATE OFFICE BUILDING, SPRINGFIELD, ILLINOIS, 62706. DO NOT DETACH GEOLOGICAL / WATER SURVEYS SECTION. BE SURE TO PROVIDE PROPER WELL LOCATION.

ILLINOIS DEPARTMENT OF PUBLIC HEALTH
WELL CONSTRUCTION REPORT

1. Type of Well
   a. Dug____. Bored____. Hole Diam.____in. Depth 104 ft.
      Curb material____. Buried Slab: Yes____No____
   b. Driven____. Drive Pipe Diam.____in. Depth____ft.
   c. Drilled x. Finished in Drift x. In Rock____.
      Tubular____. Gravel Packed x.
   d. Grout:

(KIND)	FROM (Ft.)	TO (Ft.)
ready mix	7	20

2. Distance to Nearest:
   Building____Ft. Seepage Tile Field____
   Cess Pool____ Sewer (non Cast iron)____
   Privy____ Sewer (Cast iron)____
   Septic Tank____ Barnyard____
   Leaching Pit____ Manure Pile____
3. Is water from this well to be used for human consumption?
   Yes____ No x
4. Date well completed 10/2/78
5. Permanent Pump Installed? Yes____ No x
   Manufacturer____ Type____
   Capacity____gpm. Depth of setting____ft.
6. Well Top Sealed? Yes x No____
7. Pitless Adaptor Installed? Yes____ No x
8. Well Disinfected? Yes x No____
9. Water Sample Submitted? Yes x No____

REMARKS:

County # 20292

ISGS
121552029200

IDPH 4.065
10/68

P403400

PLC, 15534255, #1

GEOLOGICAL AND WATER SURVEYS WELL RECORD
(Industrial)

10. Property owner ESK Corporation Well No. 1
    Address Hennepin IL
    Driller Layne-Western Co. License No. 102-13
11. Permit No. 79101 Date 9/6/78
12. Water from drift (Formation) 13. County Putnam
    at depth 89 to 104 ft. Sec. 26 Uc
14. Screen: Diam. 12 in(Tele) Twp. 33N
    Length: 15 ft. Slot 40 Rge. 2W
    Elev.____

SHOW LOCATION IN SECTION PLAT

1830'N, 1070'W, SE/c, (Industrial)

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
12	steel 0.330"	89	+2

16. Size Hole below casing: 38 in.
17. Static level 72 ft. below casing top which is 2 ft. above ground level. Pumping level 85 ft. when pumping at 530 gpm for 8 hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Fine sand to coarse gravel /boulders	0	6
Fine brown sand	6	8
Fine sand to coarse gravel /boulders	8	64
Fine to coarse sand	64	105
Fine sand to coarse gravel,		
boulders & traces of clay	105	109

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED D. G. Lohmeier DATE 10/3/78
D. G. Lohmeier, P.E.

MAP #5

White & Pink Copies:
Ill. [illegible]t. of Public Health
Yellow [illegible]opy: Well Contractor
Golden Copy: Well Owner

Well Construction Report

1565 #121552049700 MAP #6

THIS FORM MUST BE COMPLETED WITHIN 30 DAYS
OF WELL COMPLETION AND SENT TO
THE ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 WEST JEFFERSON STREET
SPRINGFIELD, ILLINOIS 62761

1. Type of Well
   a. Bored____ Hole Diam.____in. Depth____ft
      Buried Slab: Yes____ No____
   b. Driven____ Drive Pipe Diam.____in. Depth____ft
   c. Drilled X Finished in Drift X In Rock____
   d. Grout:

(KIND)	FROM (Ft.)	TO (Ft.)
cement	0	20

2. Well furnishes water for human consumption? Yes X No____
3. Date well drilled October 1
4. Permanent pump installed? Yes____ Date in future No X
   Manufacturer Layne & Bowler Type VTP
   Location
   Capacity 300 gpm. Depth of setting 80 ft.
5. Well top sealed? Yes X No____ Type steel plate
6. Pitless adapter installed? Yes____ No X
   Manufacturer____ Model No.____
   How attached to casing? -
7. Well disinfected? Yes X No____
8. Pump and equipment disinfected Yes____ No____

IMPORTANT NOTICE

This State Agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act 85-0863. Disclosiure of this information is mandatory. This form has been approved by the Forms Management Center.

PRESS FIRMLY WITH BLACK PEN OR TYPE
P# 405443 Do Not Use Felt Pen

CO#20497

IL482-0126

PICS 15534255, #3

GEOLOGICAL AND WATER SURVEYS WELL RECORD

Project Driller, MIKE RIFE & MARV MICHELS

9. Driller Layne-Western License No. 102-003241
10. Well Site Address HENNEPIN, IL
11. Property Owner Exolon-ESK Well No. 3
12. Permit No. 155-011-96 Date Issued 9/5/96
13. Location: County Putnam
    550'W & 1775'N of S.E. corner
    Sec. 26, 46
    Twp. 33N
    Rge. 2W
    Show location in section plat
    SWNWSE
14. Water from sand & gravel at depth 102 ft to 117 ft
15. Casing and Liner Pipe

Diam.(in)	Kind and Weight	From (ft)	To (ft)
12	steel-.375"	0	102

16. Screen: Diam. 12 in, Length 15' ~~XX~~, Slot Size .130"
17. Size hole below casing 38 in. 18. Ground Elev.____ ft msl.
19. Static level____ft below casing top which is ____ft. above ground level. Pumping level ____ft, pumping gpm for ____ hours.

20. Earth Materials Passed Through	Depth of Top	Depth of Bottom
Fine brown sand	0	4
Gray clay	4	5
Coarse sand & gravel with boulders	5	79
Brown clay with gravel	79	81
Fine sand with gravel	81	117
Gray shale	117	124

Continue on separate sheet if necessary.

Signed GREGORY D. BUFFINGTON, P.E. Date 11/5/96

MAP # 7
ISGS # 20258

White Copy — Ill. Dept. of Public Health
Yellow Copy — Well Contractor
Blue Copy — Well Owner

INSTRUCTIONS TO DRILLERS

FILL IN ALL PERTINENT INFORMATION REQUESTED AND MAIL ORIGINAL TO STATE DEPARTMENT OF PUBLIC HEALTH, ROOM 616, STATE OFFICE BUILDING, SPRINGFIELD, ILLINOIS, 62706. DO NOT DETACH GEOLOGICAL / WATER SURVEYS SECTION. BE SURE TO PROVIDE PROPER WELL LOCATION.

ILLINOIS DEPARTMENT OF PUBLIC HEALTH
WELL CONSTRUCTION REPORT

1. Type of Well
   a. Dug____. Bored____. Hole Diam.____in. Depth 128 ft.
      Curb material ____. Buried Slab: Yes____ No____
   b. Driven____. Drive Pipe Diam.____in. Depth____ft.
   c. Drilled x. Finished in Drift x. In Rock____.
      Tubular____. Gravel Packed x.
   d. Grout:

(KIND)	FROM (Ft.)	TO (Ft.)
Grout	7	20

2. Distance to Nearest:
   Building ____ Ft. Seepage Tile Field ____
   Cess Pool ____ Sewer (non Cast iron) ____
   Privy ____ Sewer (Cast iron) ____
   Septic Tank ____ Barnyard ____
   Leaching Pit ____ Manure Pile ____
3. Is water from this well to be used for human consumption?
   Yes x No____
4. Date well completed 8/15/78
5. Permanent Pump Installed? Yes____ No x
   Manufacturer ____ Type ____
   Capacity ____gpm. Depth of setting ____ft.
6. Well Top Sealed? Yes x No____
7. Pitless Adaptor Installed? Yes____ No x
8. Well Disinfected? Yes x No____
9. Water Sample Submitted? Yes x No____

REMARKS: County # 20258

116
12
128

IDPH 4.065
10/68

GEOLOGICAL AND WATER SURVEYS WELL RECORD
(Potable)

10. Property owner ESK Corporation Well No. 2
    Address Hennepin, Illinois
    Driller Layne-Western Co.Inc. License No. 102-13
11. Permit No. 76743 Date 7/12/78
12. Water from drift (Formation) at depth 116 to 128 ft.
13. County Putnam
    Sec. 26.2c
    Twp. 33N
    Rge. 2W
    Elev. ____
14. Screen: Diam. 12 in (Tele)
    Length: 12 ft. Slot 40
15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
12	steel 0.330"	0	116

SHOW LOCATION IN SECTION PLAT
1590'N 890'W, SE/c, (Industrial)

16. Size Hole below casing: 20 in.
17. Static level 90 ft. below casing top which is 2 ft. above ground level. Pumping level 112 ft. when pumping at 261 gpm for 8 hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Gravel, boulders	0	82
Brown clay	82	88
Med. sand, gravel, fine sand	88	128

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED D. G. Lohmeier DATE 10/3/78
D. G. Lohmeier, P.E.

PICS 15534255 #2 P403401

4Y

MAP # 12

ISGS #121552043500

PAGE 1

WELL INFORMATION – DRIFT WELLS

Layne-Western Company, Inc.

PROFESSIONAL SERVICES FOR WATER SYSTEMS

721 West Illinois Avenue • Aurora, Illinois 60506-2892 • Phone: 708/897-6941

Name of Job: Illinois Power Company   Date: 10/05/93

City or Village: Hennepin   State: IL

Well No.: ~~5~~ 6 (Local 1A)   Drillers: Glidewell, Will, Rife

Well Location: ______ ft. (___) and ______ ft. (___) of the ______ corner of

Section 26 NE, Twp. 33 (N), Range 2 (W) Putnam County.

Otherwise located as: fractional section

Work Began: 8-24-93   Work Completed: 10-07-93   Well Depth: 115'

All measurements made from existing ground level at time well was drilled.

Casing Record:

Amount	Dia.	Wt. or Thickness	Material						
92'	18"	0.375"	Steel	with	Welded	joints from	90'	to	+2'
50'	36"	0.375'	Steel	with	Welded	joints from	12'	to	62'

Screen Record: Type Houston

Amount	Dia.	Opening	Material						
25'	18"	0.100	S.Steel	with	Welded	joints from	115'	to	90'
				with		joints from		to	

Type of Seal at Bottom: Stainless Steel Plate

Hole Record:

38" min. inch from 0 to 118'

______ inch from ______ to ______

Gravel Pack Record:

Amount	Size	Source	From	To
47 Tons	#3	Northern	118"	70'

Cementing Record: Ready Mix Concrete - 20' to 9'

Backfill Record: Bentonite Seat at 62 ft.

Backfill Sand 62 to 20

P404906

MAP #12
PAGE 2

WELL LOG

Feet		Feet	Description
0	to	2	Black topsoil
2	to	7	Brown sand, a little clayey
7	to	27	Yellow brown coarse gravel&boulders
27	to	41	Brown coarse sand to coarse gravel
41	to	43	Gray & brown soft silty clay
43	to	50	Brown medium sand to coarse gravel & boulders
50	to	67	Reddish brown coarse gravel & boulders
67	to	73	Multi-colored boulders
73	to	82	Conglomerate clay & boulders traces of weathered lime
82	to	84	Light gray silty clay
84	to	86	Hard tight coarse gravel
86	to	96	Brown jagged medium sand to coarse gravel & boulders
96	to	98	Boulder
98	to	112	Brown fine sand to coarse gravel with finer layers
112	to	118	Brown fine sand to medium gravel
118	to	125	Firm gray shale
	to		
	to		
	to		
	to		
	to		
	to		
	to		

Well Test Data: Static Level 17 ; pumping level 31' after 8 hours pumping at 1086 g.p.m.

Length of test 8 hrs. See Well Test Data Sheet Dated October 4, 1993

REMARKS:

MAP #12
PAGE 3

WELL TEST DATA SHEET

Layne-Western Company

A Layne Company

PROFESSIONAL SERVICES FOR WATER SYSTEMS

721 West Illinois Avenue • Aurora, Illinois 60506-2892 • Phone: 708/897-6941

Job Illinois Power Company Well No. ~~5~~ 6 Date Tested 10/4/93

Location Hennepin, IL Tested By C. Glidewell

Dia. of Well 18" Driver 671 Engine

Depth of Well 115' from G.L. Pump Used: Column and Shaft 8 x 1-11/16"

Length of Airline 85' Bowls

Non-Pumping Level 17' Manufacturer Layne

Orifice Size 10" x 8" Serial No. Test Pump

Time	Piezometer Reading (in.)	G.P.M.	Air Gauge Reading (feet)	Pumping Level	Drawdown	Disch. Pressure Lbs.	Disch. Pressure Feet	Total Pumping Head	Remarks
9:30		0	68	17'	SWL				
10:00	13.5	1086	56	29	12				Cloudy
10:30	13.5	1086	56	29					Clear
11:00	13.5	1086	56	29					No Sand
11:30	13.5	1086	56	29					
12:00	13.5	1086	54	31	14				
12:30	13.5	1086	54	31					
1:00	13.5	1086	54	31					
1:30	13.5	1086	54	31					
2:00	13.5	1086	54	31					
2:30	13.5	1086	54	31					
3:00	13.5	1086	54	31					
3:30	13.5	1086	54	31					
4:00	13.5	1086	54	31					
4:30	13.5	1086	54	31					
5:00	13.5	1086	54	31					
5:30	13.5	1086	54	31	14				

Final Specific Capacity = 77.6 GAL/FT.

Layne

WELL TEST DATA SHEET

MAP #12
PAGE 4

Layne-Western Company

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PROFESSIONAL SERVICES FOR WATER SYSTEMS

721 West Illinois Avenue • Aurora, Illinois 60506-2892 • Phone: 708/897-6941

Job Illinois Power

Well No. #6 (1A)

Date Tested 10/27/93

Location Hennepin, IL.

Tested By Marvin Michelson

Dia. of Well 18"

Driver 60 HP Westinghouse

Depth of Well 115' (from G.L.)

Pump Used:

Column and Shaft 8"x1 11/16"x2 1/2"

Length of Airline 50'

Bowls 11 stage - 12 RKMC

Non-Pumping Level 29' (Direct)

Manufacturer Layne-Western

Orifice Size IP Tripod - 6 x 5

Serial No. 22200

Time	Piezometer Reading (in.)	G.P.M.	Air Gauge Reading (feet)	Pumping Level	Drawdown	Disch. Pressure Lbs.	Disch. Pressure Feet	Total Pumping Head	Remarks
7:00		0	29						
1:15	14.3	466	35	35	6	120			~~78/78/80~~ cloudy
1:20	17.3	513	35	35	6	115			78/78/79
1:25	19	543	35	35	6	100			clear
	21	570	36	36	7	105			clear
	22.8	597	36	36	7	100			clear
	24.5	616	36	36	7	95			clear
	26.8	641	37	37	8	90			clear
	28.3	659	37	37	8	85			77/77/78
	30.3	682	37	37	8	80			77/77/78
	32.3	704	38	38	9	75			77/77/78
	34	726	38	38	9	70			77/77/78
	36	747	38	38	9	65			77/77/78
	37.3	757	38	38	9	60			77/77/78
	39.3	777	39	39	10	55			77/77/78
	41	797	39	39	10	50			77/77/78
1:40	43	816	40	40	11	45			77/77/78
	44.8	826	40	40	11	40			77/77/78
	46.5	849	40	40	11	35			77/77/78
	48	862	41	41	12	30			77/77/78
	49.8	876	42	42	13	25			Sp Q =67.4

ISGS # 121552059800 #4 MIAF AGET 7/17/65

City Hennepin Industrial section County Putnam

Section 26 S ½ Twp. No. 33N Range 2W

Location (in feet from section corner) NE ¼, NE ¼, NW ¼

Owner Illinois Power Co. Authority

Contractor Layne-Western Co. Address 721 West Illinois Ave., Aurora, Ill. 60507

Date drilled Aug 26, 68 Elev. above sea level top of well

Depth ~~116'~~ 113.5

Log Sand and gravel

Were drill cuttings saved Yes Where filed State of Illinois

Size hole 30" If reduced, where and how much

Casing record 18" to 93'-6" ; 18" stainless screen to 116'

Distance to water when not pumping 13'-4" Distance to water is 24

feet after pumping at 1080 G. P. M. for 8 hours.

Reference point for above measurements Top of casing

Type of pump Test pump Distance to cylinder

Length of cylinder Length of suction pipe below cylinder

Length stroke Speed

Hours used per day Type of power

Rating of motor Rating of pump in G. P. M.

Can following be measured: (1) Static water level

(2) Pumping level (3) Discharge

(4) Influence on other wells

Temperature of water Was water sample collected Yes

Date Effect of water on meters, hot water

coils, etc.

Date of Analysis Analysis No.

Recorder

Date

2807-22617 12

April 1, 1969

WELL PRODUCTION TEST
ILLINOIS POWER COMPANY, WELL NO. 4
PUTNAM COUNTY
by

Layne-Western

MAP #13
PAGE 2

ISGS #
121552059800

Owner:	Illinois Power Company
Location:	NE 1/4, NE 1/4, NW 1/4, Sec. 26, T. 33N., R. 2W.
Date of Test:	8/27/68
Date Completed:	August 1968
Length of Test:	6 hours
Aquifer:	Sand & gravel

WELL DATA

PUMPED WELL

Well No:	4
Driller:	Layne-Western
Depth:	113.5
Hole Record:	48" 0-15'; 42" 15-30'; 34" 30-60'; 30" 60-113.5'
Casing Record:	30" 0-62'; 18" 0-63.5 and 73.5-93.5' (gravel packed, 2-113.5')
Screen Record:	10' of 18" #6 slot S.S. 63.5-73.5'; 20' of 18" #6 slot S. S. 93.5-113.5'
Pump and Power:	Test pump; 100 hp motor
Measuring Point:	18" above GL, top of casing
Measuring Equipment:	10x8" orifice, steel tape
Static Level:	13'4"

R-403404

MAP #13
PAGE 3

MEASUREMENTS

PUMPED WELL

Date 1968	Hour	Time (min)	Alt. gage (ft)	Depth to water (ft)	Draw-down (ft)	Piez. tube (in)	Pump. rate (gpm)	Remarks
8/27	7:50A		13.33					FPNR*
	8:45		17.58					Fire pump running (on at 8:37)
	8:59		13.58					FPNR*
	9:00	0				24.5	1543	Pump on
	9:15	15	31.17	31.17	17.82	25	1557	FPNR*
	9:30	30	33.42	33.42	20.08	25.5	1571	Fire pump running
	10:00	60	33.58	33.58	20.25	25.5	1571	Fire pump running
	10:30	90	33.58	33.58	20.25	25.5	1571	Fire pump running
	11:00	120	31.42	31.42	18.08	25.5	1571	Fire pump running
	11:30	150	33	33	19.67	25.5	1571	Fire pump running
	12:00N	180	33.33	33.33	20	25.5	1571	Fire pump running
	12:30P	210	33.08	33.08	19.75	25.5	1571	Fire pump running
	1:00	240	33.25	33.25	19.75	25.5	1571	Fire pump running
	1:30	270	33.82	33.82	20.50	25.5	1571	Fire pump running
	2:00	300	32.92	32.92	19.58	25.5	1571	Fire pump running
	2:30	330	33	33	19.67	25.5	1571	Fire pump running
	3:00	360	33	33	19.67	25.5	1571	Fire pump running
	3:05	365						Reduced capacity to 1080 gpm
	3:30	390	26.17	26.17	12.67	11	1080	Fire pump running
	4:00	420	24.08	24.08	10.75	11	1080	FPNR* (off at 3:33)
	4:30	450	24.08	24.08	10.75	11	1080	FPNR*
	5:00	480	24.08	24.08	10.75	11	1080	FPNR*
								End of Test

*FPNR=Fire pump not running

MAP #13
PAGE 4

DRILLER'S LOG
WELL NO. 4

Formation	From	To
Brown sandy soil	0'	8"
Brown med. sand to coarse gravel with boulders	8"	22 1/2'
Black silty soil	22 1/2'	23 1/2
Brown med. sand to coarse gravel with trace of clay and silt	23 1/2	26 1/2
Light gray silty clay, soft	26 1/2	28
Brown med. sand	28	29 1/2
Multi-colored clay silt, soft, soft sandstone boulder at 30'	29 1/2	32
Brown med. sand to coarse gravel, trace of rusty colored sandy silt, some boulders	32	49 1/2
Gray sandy clay	49 1/2	50 1/2
Brown and gray med. sand to coarse gravel	50 1/2	58
Light gray silty clay	58	59
Med. sand to coarse gravel, multi-colored	59	67
Light gray silty clay	67	67 1/2
Med. sand to coarse gravel, multi-colored	67 1/2	79
Fine to med. sand, gray	79	87
Limestone boulder	87	88
Brown med. sand to coarse gravel	88	97
Brown fine to med. sand, trace of gravel	97	106 1/2
Brown med. sand to coarse gravel	106 1/2	112 1/2
Gray shale	112 1/2	

Location:

NE 1/4, NE 1/4, NW 1/4, S. 26
T. 33 N., R. 2 W.

P Number:	431044
Data Set Location:	1 OF 9

NEW | SAVE | CANCEL | DELETE | > | >|

Entered By: tbryant 10/31/2007
Last User: tbryant 10/31/2007

SUMMARY | POINT INFO | IWIP INFO | LOCATION VERIFICATION | OBSERVATION | PAPER FILES | QA / QC

Well Type: | Total Depth: 44.00 (ft.) | AQ Code:
Aquifer Type: | Well Use: RE | Date Completed: <1991
Owner: DYNEGY MIDWEST GEN - HENNEPIN POWER
Facility Point Number: 8 | IWIP Facility ID: 15534260
Driller:
Drilling Company:
Permit #: | VALID # | VALID LOCATION
Address:
City: | State: | Zip:
Land ID: | Lot #:
Subdivision:
FIPS: 155 | TWN: 33N | RNG: 02W | SEC: 26 | QQQ: SE NE NW | Plot: 5G | VALID LOC.
PLSS Source: CR | Principal Meridian: 3

	Decimal Degrees		Deg.	Min.	Sec.	Decimal Minutes
Latitude: N	41.3032333	CALC	41	18	11.64	
Longitude: W	39.3162167		39	18	58.38	

Lat-Lon Source: GPS

LS Elevation: (ft.) | Elevation Method: | Elevation Source:
Casing Dia.: (in.) | Variable: | Casing Depth: (ft.) | Slotted:
Screen Length: (ft.)
Water From: | depth of: (ft.) to: (ft.)

Static Level Below Casing Top: (ft.)
Inches Casing Above Ground Level: (in.)
Pumping Level Below Casing Top: | CALC
Static Water Level: | Pumping Level:
Pumping: gpm for hours
General Remarks: USED 1991-1993 AS PART OF A LEAKING UNDERGROUND TANK REMEDIATION PER JOHN AUGSPOLS 10-31-07 TB.
Record Type: | SIC: 4911 | SIC Source: 1
Record Type Remarks:
Previous Owners:
Date Sealed: 08/16/2007 | SGS Number:
Lambert X: 3051710 | Lambert Y: 3011702 | CALC
Lambert Method:
Lambert Method Remarks:
Lambert Accuracy:
Lambert Source:

Database Data
Date Completed:
Date Sealed: 20070816

RECOR[illegible] FILTE[illegible] | FIND [illegible] NUMBE[illegible] | VIEW PUMPA[illegible] | VIEW SC[illegible] | VIEW FACILIT[illegible] | VIEW PERMI[illegible] | PRINT SCREE[illegible]

NO MAP #
TEST WELLS

P431044
Facility 15534260, #8

SCANNED

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Records for **Putnam** county, **33N** township, **01W** range, **30** section.

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125859	1G	119	RG	DO	~~	~~	00173

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
S DEAN ALBRECHT	07/06/1973				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125860	2H	100	RG	DO	~~	~~	00127

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
S DEAN ALBRECHT	10/15/1968				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125861	2H	100	RG	DO	~~	~~	

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
S DEAN ALBRECHT	07/31/1969				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
314745	8A	170	RGCP	DO	DL	UN	20515

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
COUNTRY WELL & PUMP	10/02/1997				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
329423	5B	26	RGP	DO	BD	UN	20541

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
ROY THORNE	03/28/2000	13			

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
348053	3H	65	RGP	DO	BD	UN	20670

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
THORNE WELL DRILLING/MIKE DRYDEN	03/07/2003				

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Records for **Putnam** county, **33N** township, **01W** range, **31** section.

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125862	1A	201	RG	DO	~~	~~	00180

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
S DEAN ALBRECHT	06/12/1973				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125863	1F	200	RG	DO	~~	~~	20256

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
K & K WELL DRILLING	07/11/1977				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125864	2F	4	RG	DO	~~	~~	

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
	03/12/1934				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125865	5F	200	RG	DO	~~	~~	00164

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
S DEAN ALBRECHT	11/17/1972				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
296155	8H	213	RG	DO	DL	UN	

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
KEITH THIERY	04/30/1997	134	136	20	2

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
358239	8H	241	RG	DO	DL	UN	20698

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
COMPLETE WELL DRILLING/DARREL DOBER	06/19/2003	179	189	12	2

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Records for **Putnam** county, **33N** township, **02W** range, **24** section.

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
343982	5D	303	RGP	DO	DL	UN	20622

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
LUTES H2O DRILLING/G.DELHOTEL	07/30/2001	229		30	2

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Records for **Putnam** county, **33N** township, **02W** range, **25** section.

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125915	3F	196	RG	DO	~~	~~	

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
EGART	1922				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
314693	7B	72	RGCP	DO	DL	UN	20518

MAP # 8

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
LUTES DRILLING	09/14/1999	17		50	3

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
359951	7B	64	RG	DO	DL	UN	20685

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
LUTES H2O DRILLING/JET HALL	11/15/2002	4	6	12	2

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
382144	1A	158	RG	DO	DL	UN	20747

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
LUTES H2O DRILLING/KEITH THIERRY	04/10/2006	100		15	1

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Records for **Putnam** county, **33N** township, **02W** range, **26** section.

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125916	8B	17	RG	DO	~~	~~	

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
	1922				

MAP # 14

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Records for **Putnam** county, **33N** township, **02W** range, **27** section.

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125917	5D	30	RG	DO	~~	~~	

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
	1884				

OUT OF RADIUS

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Records for **Putnam** county, **33N** township, **02W** range, **34** section.

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125918	1D	300	RG	DO	~~	~~	

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
	1848				

OUT OF 02 & 4S

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Records for **Putnam** county, **33N** township, **02W** range, **35** section.

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125919	1E	127	RG	DO	~~	~~	

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
BICKERMAN	1909				

OUT OF RADIUS

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125920	3A	75	RG	DO	~~	~~	

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
BICKERMAN	1895				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125921	7D	110	RG	DO	~~	~~	

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
	1904				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125922	8E	160	RG	DO	~~	~~	

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
BICKERMAN	1920				

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Private Well Database

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Records for **Putnam** county, **33N** township, **02W** range, **36** section.

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125160	7A	155	RG	DO	~~	~~	00118

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
S DEAN ALBRECHT	01/12/1968				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125923	1G	186	RG	DO	~~	~~	20286

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
S D ALBRECHT	08/18/1977				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125924	1H	155	RG	DO	~~	~~	00107

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
S DEAN ALBRECHT	1966				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125925	5E	35	RG	DO	~~	~~	

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
	1874				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125926	6D	105	RG	DO	~~	~~	

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
BICKERMAN	1898				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
125927	8E	85	RG	DO	~~	~~	

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
	1874				

Well ID	Plot	Depth	Record Type	Well Use	Well Type	Aquifer Type	ISGS No.
359954	4E	67	RGP	DO	DL	UN	20688

Driller	Date Drilled	Static Level	Pumping Level	Pumping GPM	Pumping Hours
LUTES H2O DRILLING/JET HALL	05/08/2003	19		50	2

View the results in "Table Format" Search for a different Section

If this page does not print correctly, change your browser's layout mode to landscape.

Please view our **Data Disclaimer**, Water Well Records Policies and Procedures, and **Plot Location System**

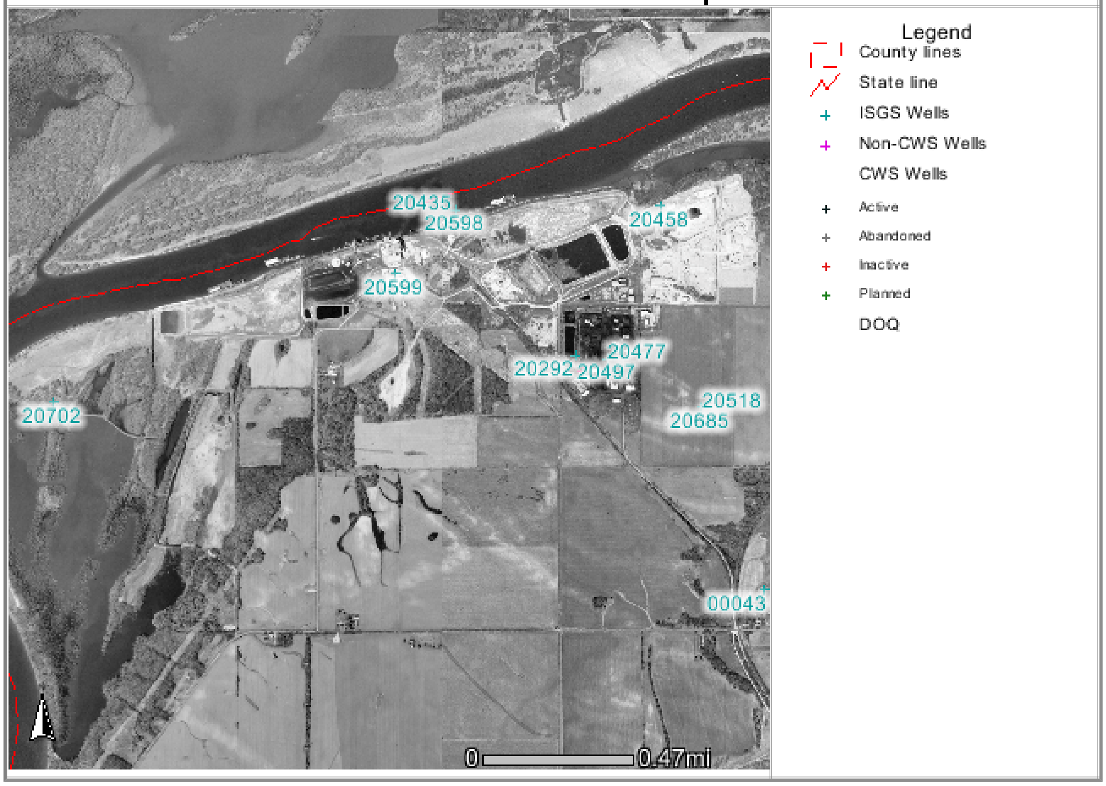
Column headings link to data explanations.

APPENDIX C

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
WEB-BASED GIS FILES

Information and data presented were obtained from various Federal, State, and local agencies and are subject to revision.

ArcIMS HTML Viewer Map

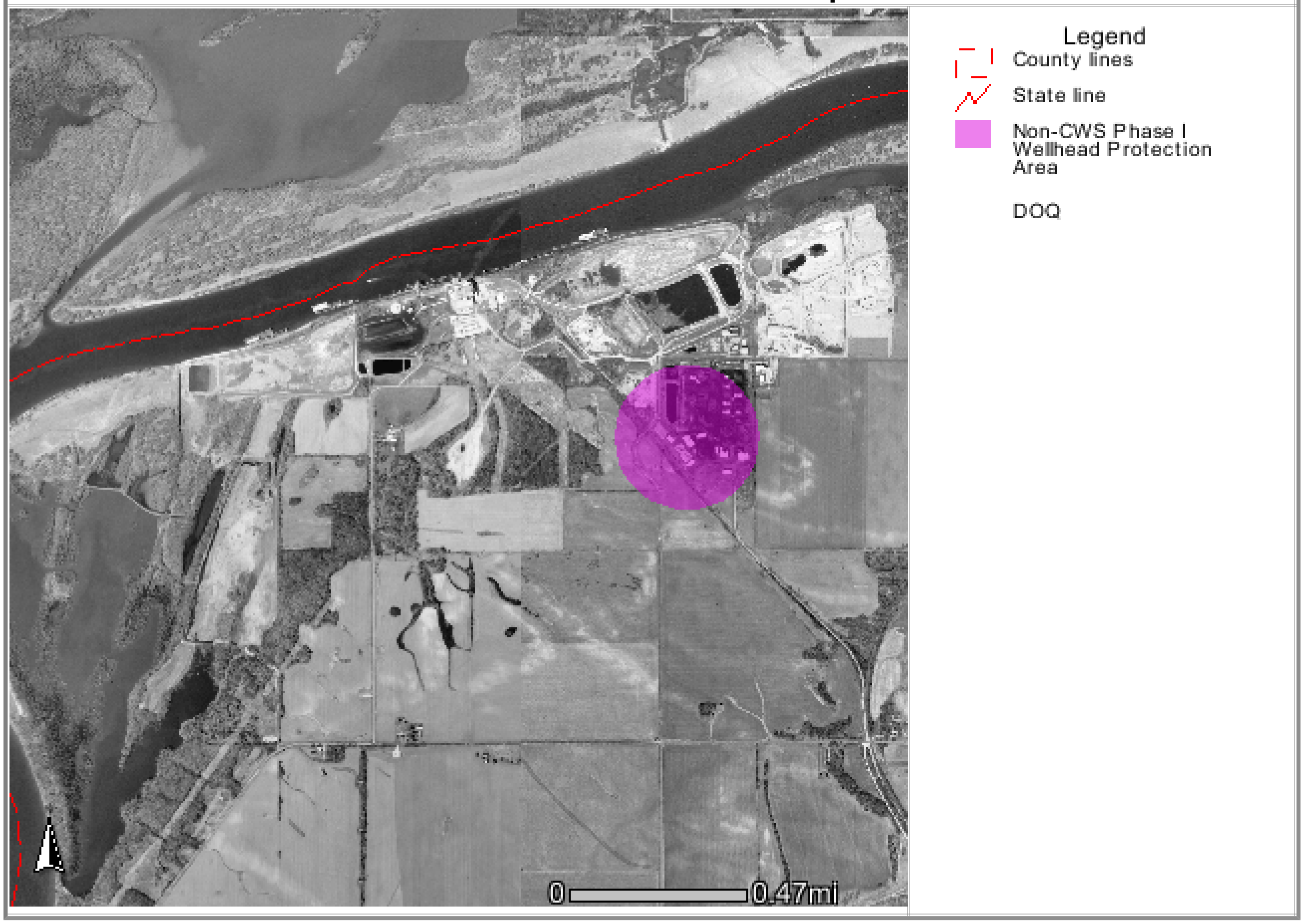


ISGS Wells

Rec	API_NUMBER	TOTAL_DEPT	FARM_NAME	ELEVATION	STATUS	LAM_X	LAM_Y	LATITUDE	LONGITUDE	COUNTY_NO
1	121552070200	83	Dynegy Midwest-Hennepin Power	0	WATER	3045102	3008480	41.296270	89.335096	20702

Information and data presented were obtained from various Federal, State, and local agencies and are subject to revision.

ArcIMS HTML Viewer Map



Non-CWS Phase I Wellhead Protection Area

Rec	area	perimeter	buff1000_	buff1000_i	inside
1	3125482.25000	6275.02881	1420	1419	100

Source Water Assessment Summary

0117408 - EXOLON ESK

Last Updated on 2/3/2006

Source of Groundwater
The Exolon Company water supply system consists of one well. The well draws its water supply from an unconfined aquifer, which consists of sand.

Source Water Quality
The well at the Exolon Company is sampled for bacteria, nitrate/nitrites and lead and copper. In addition the Exolon Company is also required to sample for inorganic compounds (IOC), volatile compounds (VOC), and synthetic compounds (SOC).

On review of the geological composition, land-use practices, and well construction it was found that the well is susceptible to VOC, SOC, IOC, nitrate/nitrites, and bacteria.

Construction/Treatment
The Exolon Company has a 12-inch drilled well with steel casing. The well has an estimated depth of 130 feet. The well has a turbine pump and a 1,000 pressurized storage tank. The well receives no treatment.

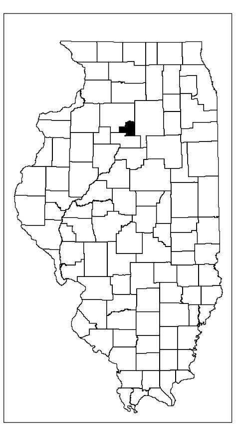
Finished Water Quality
A review of the Exolon Company water supply at this time shows that the system is in compliance with the groundwater quality standards established under 35 Illinois Administrative Code Part 620.

Potential Sources of Contamination
The following sites are listed as potential sources of contamination due to the nature of their activity and their geographic proximity (within a 1,000 foot buffer) to the source water protection area.

See Table on Topographic Map Coverage(Second Map)

Susceptibility to Contamination
The Illinois Department of Public Health has determined that the Exolon Company water supply has a high susceptibility to contamination. This determination is based on a number of criteria including: available geological data, land-use practices, and well depth.

Aerial Photograph Coverage
Exolon Non-Community Well



N

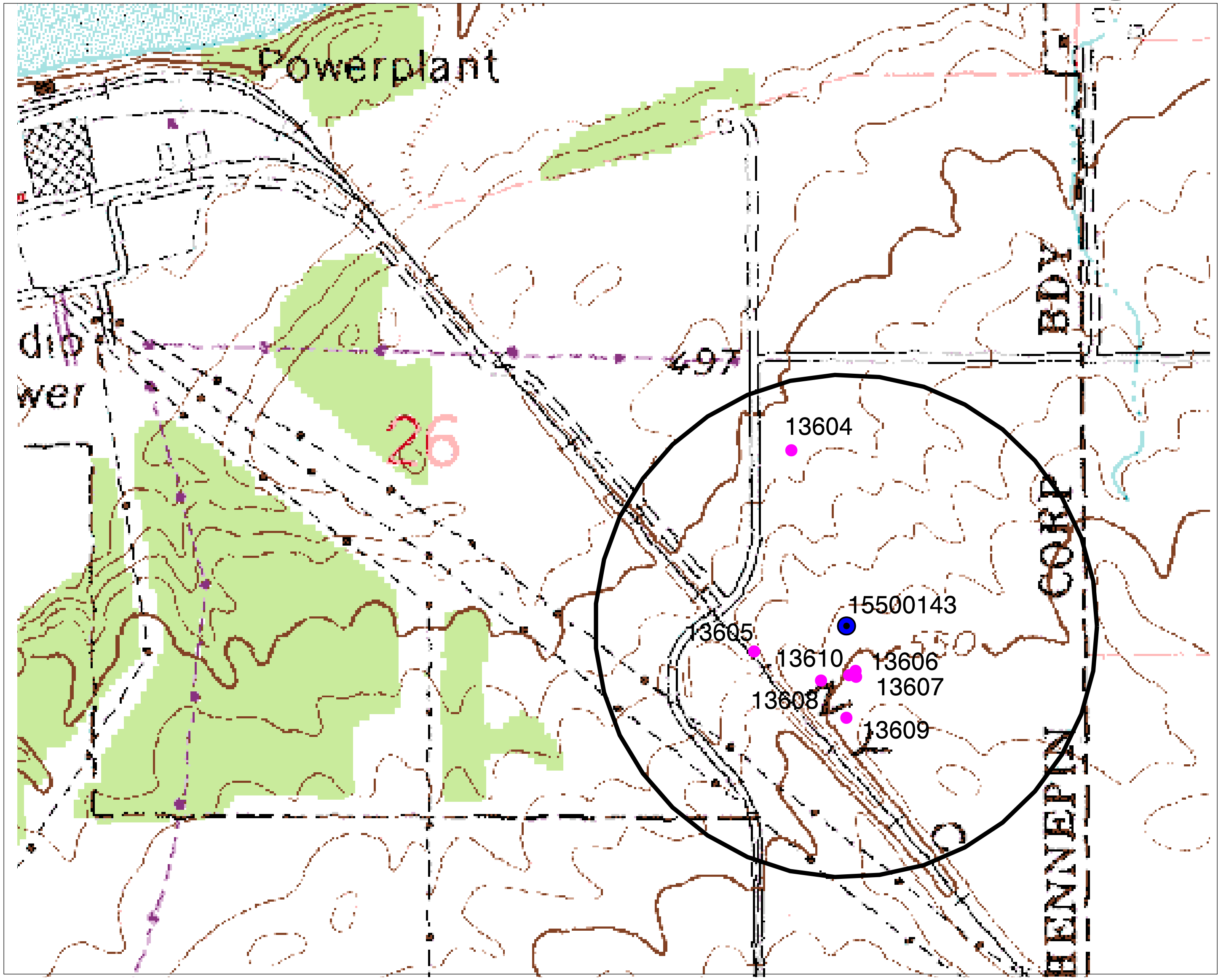
1000 0 1000 Feet

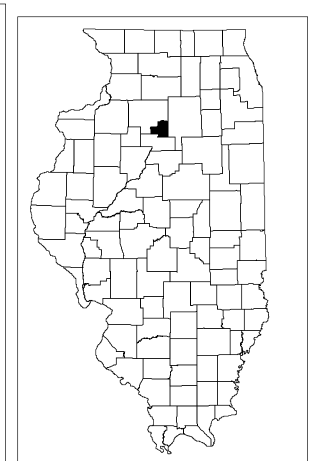
Non-Community Water Supply Wells

Illinois Environmental Protection Agency
Division of Public Water Supplies
Groundwater Section

Illinois Department of Public Health

Topographic Map Coverage
Exolon Non-Community Well





N

Potential_	Potential_	Source_id_
Exolon	Lagoon on-site	13604
Exolon	Single Unit Septic	13605
Exolon	A.G. L.P. < 25000 gal.	13606
Exolon	A.G. Pet Stor < 25000 gal.	13607
Exolon	Electrical Generator/Subs	13608
Exolon	A.G. Pet Stor	13609
Exolon	B.G. Pet Stor > 500 gal	13610

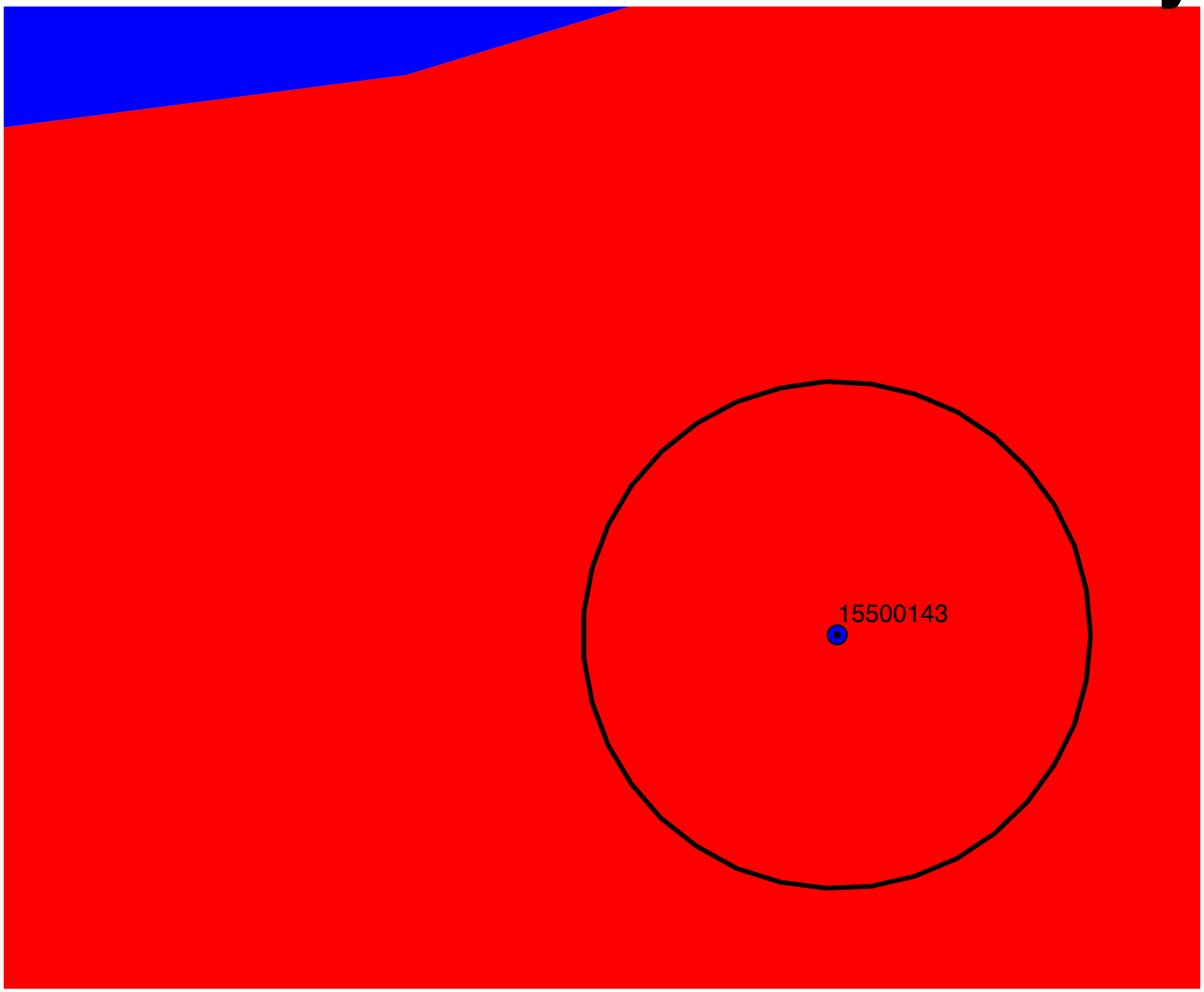
Non-Community Water Supply Wells
Potential Sources of Contamination

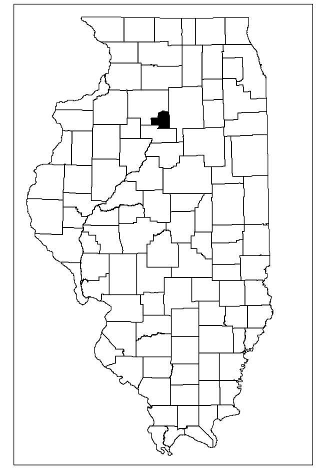
Illinois Environmental Protection Agency
Division of Public Water Supplies
Groundwater Section

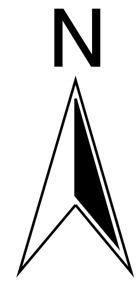
Illinois Department of Public Health

1000 0 1000 2000 3000 4000 Feet

Nitrate Sensitivity
Exolon Non-Community Well







Disclaimer: This nitrate sensitivity data is being used at a scale smaller than at which it was digitized. This may make features look angular or rasterized, or may make them appear to be out of place. This map should be used as a general reference only, and a smaller scale assessment should be performed for further evaluation of this site.

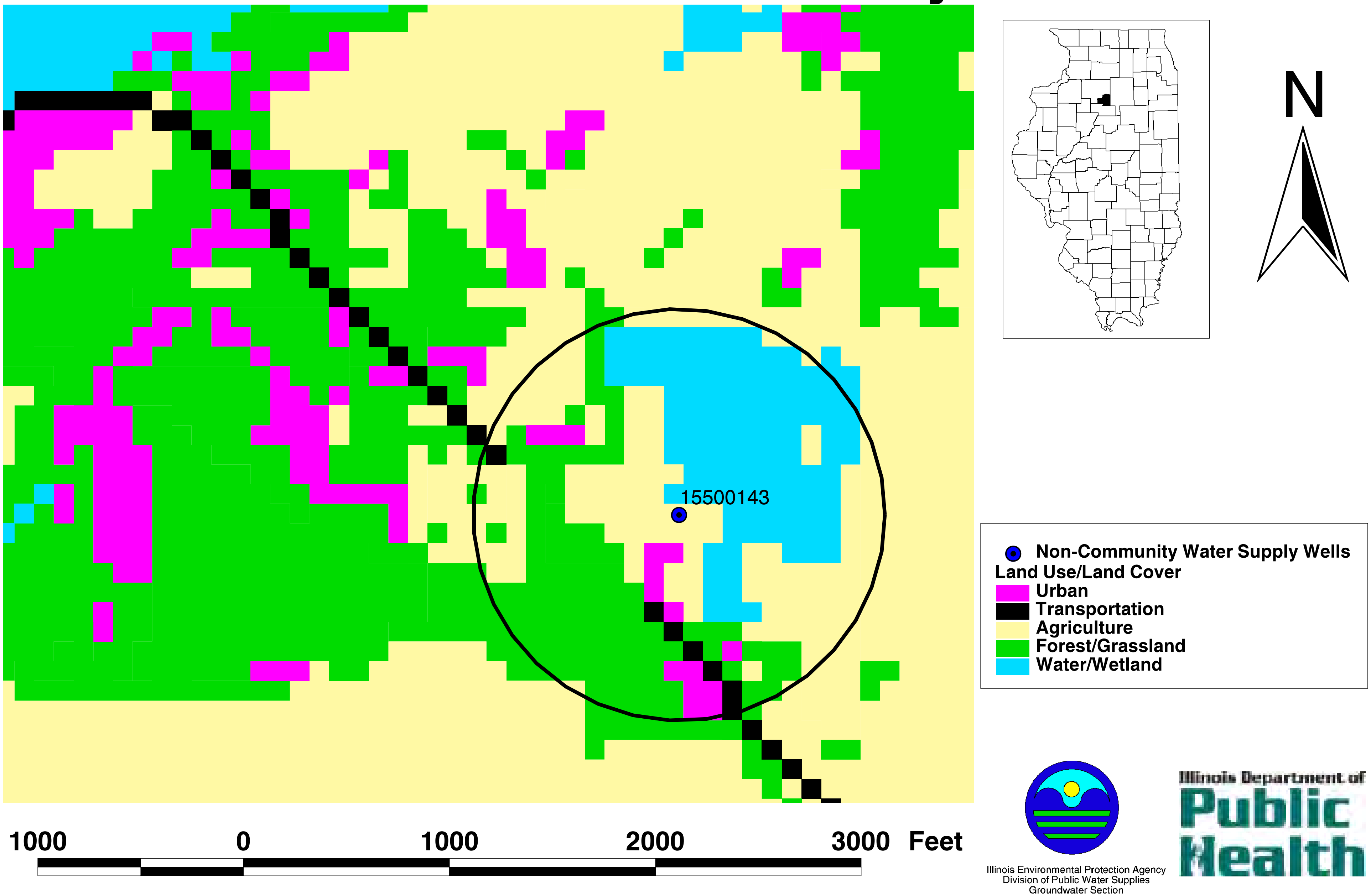
Non-Community Water Supply Wells

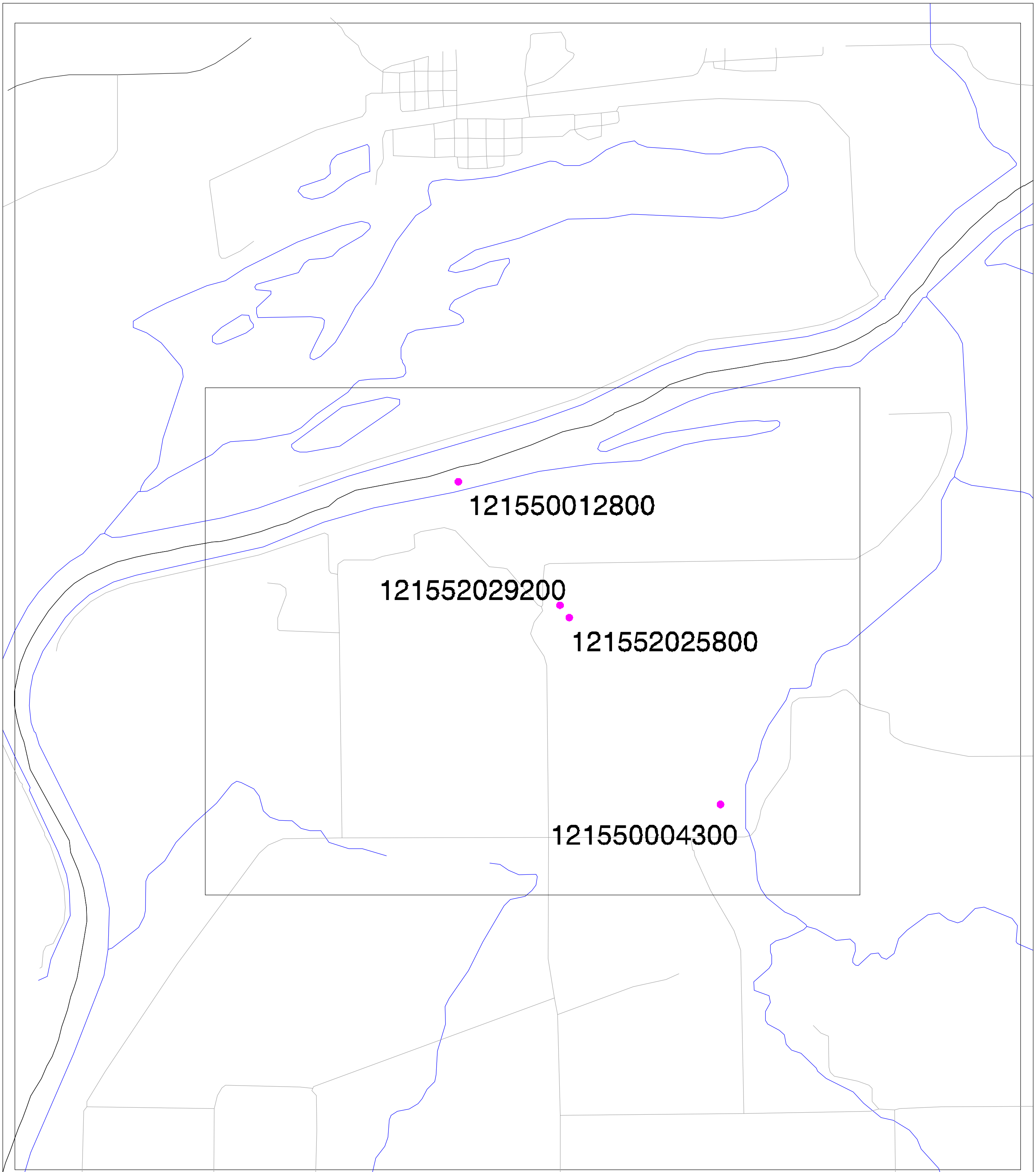
Nitrate Sensitivity
- Excessive
- High
- Moderate
- Somewhat Limited
- Limited
- Very Limited
- Disturbed Land
- Surface Water

Illinois Environmental Protection Agency
Division of Public Water Supplies
Groundwater Section

Illinois Department of Public Health

Land Use/Land Cover
Exolon Non-Community Well





N

Scale

1:30011

Illinois Geographic-Lithologic Analysis Support System

I-GLASS

Illinois EPA
Division of Public Water Supplies
Groundwater Section

Illinois Department of Public Health

Use of this map is restricted to Illinois EPA Staff.
The IEPA is not liable for any misinterpretation of these data by non-IEPA staff.

This map contains information derived from tabular and spatial datasets obtained from the Illinois State Geological Survey, the Illinois State Water Survey, the Illinois Department of Natural Resources, and the United States Geological Survey.

Illinois Environmental Protection Agency

Source Water Assessment Program

FACT SHEET

DE PUE

BUREAU COUNTY

Prepared in cooperation with the U.S. Geological Survey.

Information and data used in the preparation of this Fact Sheet are provided by the Illinois EPA and are subject to revision.

IMPORTANCE OF SOURCE WATER:

The Village of DePue (Facility Number 0110300) has two public water supply wells. Wells #2 and #3 (IEPA #11336 and #11337) produce 176,300 gallons per day on average to an estimated population of 1729 through 710 service connections.

WATER SUPPLIES THAT OBTAIN SOURCE WATER FROM THIS FACILITY:

As of January 2001, no other facilities purchase water from this community water supply.

SOURCE OF WATER SUPPLY:

Wells #2 and #3 are located behind the waterworks on 2nd Street. Wells #2 and #3 pump 220 and 250 gallons per minute, respectively, and have a production capacity of 288,000 gallons per day. Wells #2 and #3 are 1487 and 1490 feet deep, respectively, and utilize a deep bedrock aquifer. The bedrock is overlain by permeable river deposits and impermeable bedrock. The aquifer utilized is considered confined by the Illinois EPA, therefore is not considered geologically sensitive.

WELL DATA FOR THIS FACILITY:

Well ID	Well Description	Status	Depth (Feet)	Min Setback (Feet)	Aquifer Description
11336	WELL 2	A	1487	200	DEEP BEDROCK
11337	WELL 3	A	1490	200	DEEP BEDROCK

SOURCE WATER QUALITY:

The public water supply wells at DePue were sampled as part of a Statewide Groundwater Monitoring Network on March 12, 1987. The well samples were analyzed for volatile organic compounds (VOC) and inorganic chemicals (IOC). The analyses detected no quantifiable levels of VOC in either well. The inorganic analyses performed found the water from both wells to meet all groundwater quality standards established in 35 Illinois Administrative Code Part 620.410.

FINISHED WATER QUALITY:

Finished water quality data tables of monitored parameters, contaminants detected, health advisory information, drinking water standards or maximum contaminant levels are available at http//www.epa.gov/ogwdw. Similar information is also available in the Consumer Confidence Report supplied by the water supply to its customers. A review of this information does not indicate levels of organic or inorganic compounds which exceed the drinking water quality standards. Radium and Alpha emitters were detected in radionuclide analyses done in 1999. Alpha emitters were detect at a level of 15 pCi/l and combined radium was detected at a level of 6.9 pCi/l, the maximum contaminant levels (MCL) are 15 and 5 pCi/l respectively.

POTENTIAL SOURCES OF CONTAMINATION:

The site labeled on the Wellhead Protection Planning Map and described in the following table is considered a "potential" source of contamination. (Maps and tables are not available in the Visually Impaired version. However, the information presented in these maps and tables is summarized within the following text sections of this fact sheet.) The Illinois EPA performed a detailed well Site Survey in 1989 to identify potential sources of contamination to the village's wells. These sources are identified based on the nature of its activity, the availability of data in the electronic data bases, and its geographical proximity to the source water protection area. In addition, the Illinois EPA made use of its information from the its leaking underground storage tank database (http://epadata.epa.state.il.us/land/ust/search.asp) and site remediation program database (http://epadata.epa.state.il.us/land/srp/search.asp) to further assess potential sources of contamination to the community's source water. These databases include information from the Illinois EPA Division of Land Pollution Control (LPC) and the Illinois Emergency Management Agency (IEMA). The following list of facilities contained within these databases. As a result of multiple possible contamination sources, individual sites may be listed on the table more than once in relation to the wells.

IEMA #900361 - LPC #0110300003 - Mobil Chemical Company, Depot & Marquette Streets., Depue 61322

SITE DATA FOR THIS FACILITY:

Well ID	Map Code	Site Name	Site Description	Distance (Feet)
11336	02556	CASEY'S GENERAL STORE	BELOW GROUND STORAGE (PET	975
11337	02556	CASEY'S GENERAL STORE	BELOW GROUND STORAGE (PET	975

OTHER IDENTIFIED POTENTIAL SOURCES:

For this community water supply, no additional potential sources of contamination have been identified beyond those in Illinois EPA databases.

SUSCEPTIBILITY TO CONTAMINATION:

Based on information obtained in a Well Site Survey published in 1989 by the Illinois EPA, one "potential" source is located within 1,000 feet of the wells.

The Illinois EPA has determined that the Depue Community Water Supply's source water is not suspectibile to contamination. This determination is based on a number of including: monitoring conducted at the wells; monitoring conducted at the entry point to the distribution system; available hydrogeologic data on the wells; and land use proximite to the wells.

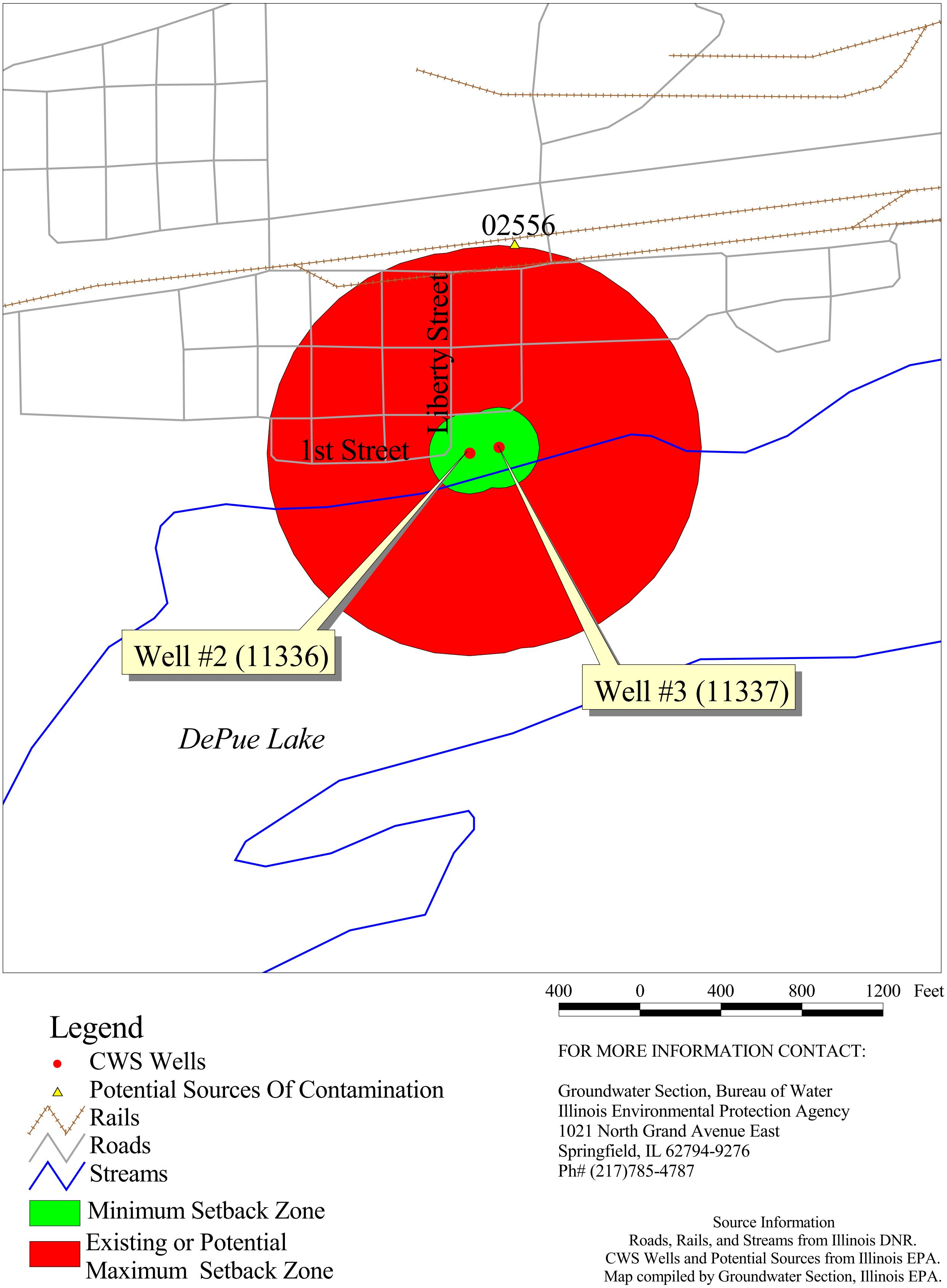
Furthermore, in anticipation of the U.S. EPA's proposed Ground Water Rule, the Illinois EPA has determined that the Depue Community Water Supply is not vulneraible to viral contamination. This determination is based upon the evaluation of the following criteria during the Vulnerability Waiver Process: the community's wells are properly constructed with sound integrity and proper siting conditions; a hydrogeologic barrier exists which should prevent pathogen movement; all potential routes and sanitary defects have been mitigated such that the source water is adequately protected; monitoring data did not indicate a history of disease outbreak; and the sanitary survey of the water supply did not indicate a viral contamination threat. Because the community's wells are constructed in a confined aquifer, which should prevent the movement of pathogens into the wells, well hydraulics was not considered to be a significant factor in the susceptibility determination.

SOURCE WATER PROTECTION EFFORTS:

The Ilinois Environmental Protection Act provides minimum protection zones of 200 feet for your wells. These minimum protection zones are regulated by the Illinois EPA. To further reduce the risk to source water, the water supply has implemented a wellhead protection program which includes the proper abandonment of potential routes of groundwater contamination and correction of sanitary defects at the water treatment facility. This effort resulted in the community water supply receiving a special exception permit from the Illinois EPA which allows a reduction in monitoring. The outcome of this monitoring reduction has saved the community considerable laboratory analysis costs.

To further minimize the risk to the community's groundwater supply, the Illinois EPA recommends that three additional activities be assessed. First, the facility may wish to enact a "maximum setback zone" ordinance. These ordinances are authorized by the Illinois Environmental Protection Act and allow county and municipal officials the opportunity to provide additional protection up to a fixed distance, normally 1,000 feet from their wells. Second, the water supply staff may wish to revisit their contingency planning documents. Contingency planning documents are a primary means to ensure that, through emergency preparedness, a community will minimize their risk of being without safe and adequate water. Finally, the water supply staff is encouraged to review their cross connection control program to ensure that it remains current and viable. Cross connections to either the water treatment plant (for example, at bulk water loading stations) or in the distribution system may negate all source water protection initatives provided by the community.

WELLHEAD PROTECTION PLANNING MAP FOR DEPUE (FACILITY #0110300)



FOR MORE INFORMATION CONTACT:

Groundwater Section, Bureau of Water
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, IL 62794-9276
Ph# (217)785-4787

Source Information
Roads, Rails, and Streams from Illinois DNR.
CWS Wells and Potential Sources from Illinois EPA.
Map compiled by Groundwater Section, Illinois EPA.

Illinois Environmental Protection Agency

Source Water Assessment Program

FACT SHEET

HENNEPIN PWD

PUTNAM COUNTY

Prepared in cooperation with the U.S. Geological Survey.

Information and data used in the preparation of this Fact Sheet are provided by the Illinois EPA and are subject to revision.

IMPORTANCE OF SOURCE WATER:

The Village of Hennepin (Facility Number 1555100) obtains its water from three active community water supply wells. Wells #3, #4, and #5 (Illinois EPA #11602, 11603, and 11604, respectively) supply an average of 149,600 gallons per day (gpd) to 312 services or a population of 750.

WATER SUPPLIES THAT OBTAIN SOURCE WATER FROM THIS FACILITY:

No connected water supplies existed at the time this Source Water Assessment fact sheet was completed.

SOURCE OF WATER SUPPLY:

Wells #3 and #4 are located at the central and southern end of Hennepin, respectively, and well #5 is located north of Hennepin. They produce 250, 400, and 650 gallons per minute (gpm), respectively and are operated for a combined maximum output of roughly 341,900 gpd. Wells #3, #4, and #5 are 100, 107, and 135 feet in depth, respectively. All three wells obtain their source water from a shallow, permeable sand and gravel aquifer overlain by materials of variable permeability. Permeability is a measure of the capability of a soil or sediment to transmit fluids. The Illinois EPA considers these wells to be geologically sensitive.

WELL DATA FOR THIS FACILITY:

Well ID	Well Description	Status	Depth (Feet)	Min Setback (Feet)	Aquifer Description
11602	WELL 3	A	100	400	Sand & Gravel
11603	WELL 4	A	107	400	Sand & Gravel
11604	WELL 5	A	135	400	Sand & Gravel

SOURCE WATER QUALITY:

Hennepin's wells have been sampled since January 20, 1981 for inorganic chemicals (IOC), volatile organic compounds (VOC), and synthetic organic compounds (SOC) as part of a Statewide Groundwater Monitoring Program. The VOC and SOC analyses did not detect quantifiable levels of any organic compounds. IOC analyses indicate that concentrations of these chemicals are consistent with other sand and gravel aquifers of similar character in Illinois. It is important to note that the IOC results were below the groundwater quality standards established under 35 Illinois Administrative Code Part 620.410, with the exception of manganese concentrations. Manganese concentrations range from 15 to 339 parts per billion (ppb). The groundwater quality standard for manganese, as established under Part 620.410, is 150 ppb. However, the Illinois EPA considers the elevated level of manganese to be the result of natural mineralization of the aquifer. Hence, the level of manganese is not considered a violation due to the stipulation in Part 620.410 that no violation occurs as a result of a natural occurrence of an IOC.

FINISHED WATER QUALITY:

As referenced in the Source Water Quality Section of this report, Hennepin has mineralized groundwater. Sampling performed after treatment indicates that levels of manganese in the source water have been reduced to below the drinking water standards. Further information on finished water quality data tables of monitored parameters, contaminants detected, health advisory information, drinking water standards and maximum contaminant levels are available at http://www.epa.gov/ogwdw/. Similar information is also available in the Consumer Confidence Report supplied by the Village of Hennepin to their customers.

POTENTIAL SOURCES OF CONTAMINATION:

The sites labeled on the Wellhead Protection Planning Map and described in the following tables are considered "potential" sources of contamination. (Maps and tables are not available in the Visually Impaired Accessible version. However, the information presented in the maps and tables is summarized within the following text sections of this fact sheet.) These sites are predominantly identified through the Illinois EPA's Well Site Survey program based on the nature of their activity, the availability of data in electronic databases, and their geographic proximity to the source water protection area. In addition, the Illinois EPA made use of the information from its leaking underground storage tank database (http://epadata.epa.state.il.us/land/ust/search.asp) and site remediation program database (http://epadata.epa.state.il.us/land/srp/search.asp) to further assess potential sources of contamination to the village's source water. These databases include information from the Illinois EPA Division of Land Pollution Control (LPC) and the Illinois Emergency Management Agency (IEMA). The following is a list of facilities contained within these databases. As a result of multiple possible contamination sources, individual sites may be listed in the table more than once in relation to a well.

IEMA # Site Name Street City ZIP Code
902789 Illinois Power Co. Power Station, 2 miles north of Hennepin 61327
921595 Putnam County C.U.S.D. #535 South 5th St., Elemetary School Hennepin 61327
923676 Illinois Power Co. Power Plant Rd. Hennepin 61327

SITE DATA FOR THIS FACILITY:

Well ID	Map Code	Site Name	Site Description	Distance (Feet)
11602	23251	PUTNAM COUNTY SHERIFF'S OF	ABOVE GROUND STORAGE (PET	350
11602	23250	JUDD CONSTRUCTION COMPAN	ABOVE GROUND STORAGE (PET	1800
11602	23252	HENNEPIN MARINE	BOAT YARD	800
11602	23253	HENNEPIN HARDWARE	STORE/SALES	900
11602	23254	HENNEPIN BOAT MARKET	ABOVE GROUND STORAGE (PET	750
11603	23250	JUDD CONSTRUCTION COMPAN	ABOVE GROUND STORAGE (PET	1300
11603	23254	HENNEPIN BOAT MARKET	ABOVE GROUND STORAGE (PET	1650
11603	23251	PUTNAM COUNTY SHERIFF'S OF	ABOVE GROUND STORAGE (PET	800
11603	23252	HENNEPIN MARINE	BOAT YARD	1450
11603	23253	HENNEPIN HARDWARE	STORE/SALES	1750
11604	23255	MODERN HARD CHROME	MANUFACTURING PROCESS (e.g.	500
11604	23256	AIR PRODUCTS	CHEMICAL HANDLING (i.e. MANU	1400
11604	23249	INTERNATIONAL STEEL GROUP	WATER TREATMENT PLANT	1600
11604	23248	INTERNATIONAL STEEL GROUP	INJECTION WELL (ROUTE)	1200
11604	23247	INTERNATIONAL STREEL GROU	SLUDGE DISPOSAL ON-SITE	650
11604	01434	LTV STEEL CO	SLUDGE DISPOSAL ON-SITE	650
11604	01435	LTV STEEL CO	INJECTION WELL (ROUTE)	1200
11604	22477	LTV STEEL WWTP	WATER TREATMENT PLANT	1600

OTHER IDENTIFIED POTENTIAL SOURCES:

For this community water supply, no additional potential sources of contamination have been identified beyond those in Illinois EPA databases.

SUSCEPTIBILITY TO CONTAMINATION:

To determine Hennepin's susceptibility to groundwater contamination, the Illinois Rural Water Association conducted a well site survey in October, 2002. Based on the information obtained in this document, there are 13 potential sources of groundwater contamination that could pose a hazard to groundwater utilized by Hennepin's community water supply. These include 1 chemical handling facility, 1 manufacturing process, 1 boat yard, 1 sales store, 2 onsite sludge disposals, 2 injection wells, 2 water treatment plants, and 3 above ground fuel storage tanks. In addition, information provided by the Leaking Underground Storage Tank and Remedial Project Management Sections of the Illinois EPA indicated sites with on-going remediation that might be of concern.

According to the Hennepin PWD facility, LTV Steel Co. and the associated injection well and water treatment plant have been sold to the International Steel Group. However, the sludge disposal associated with this site is no longer active.

Based upon this information, the Illinois EPA has determined that the Hennepin Community Water Supply's source water is susceptible to contamination. As such, the Illinois EPA has provided 5-year recharge area calculations for the wells. The land use within the recharge areas of the wells was analyzed as part of this susceptibility determination. This land use includes residential, commercial and agricultural properties.

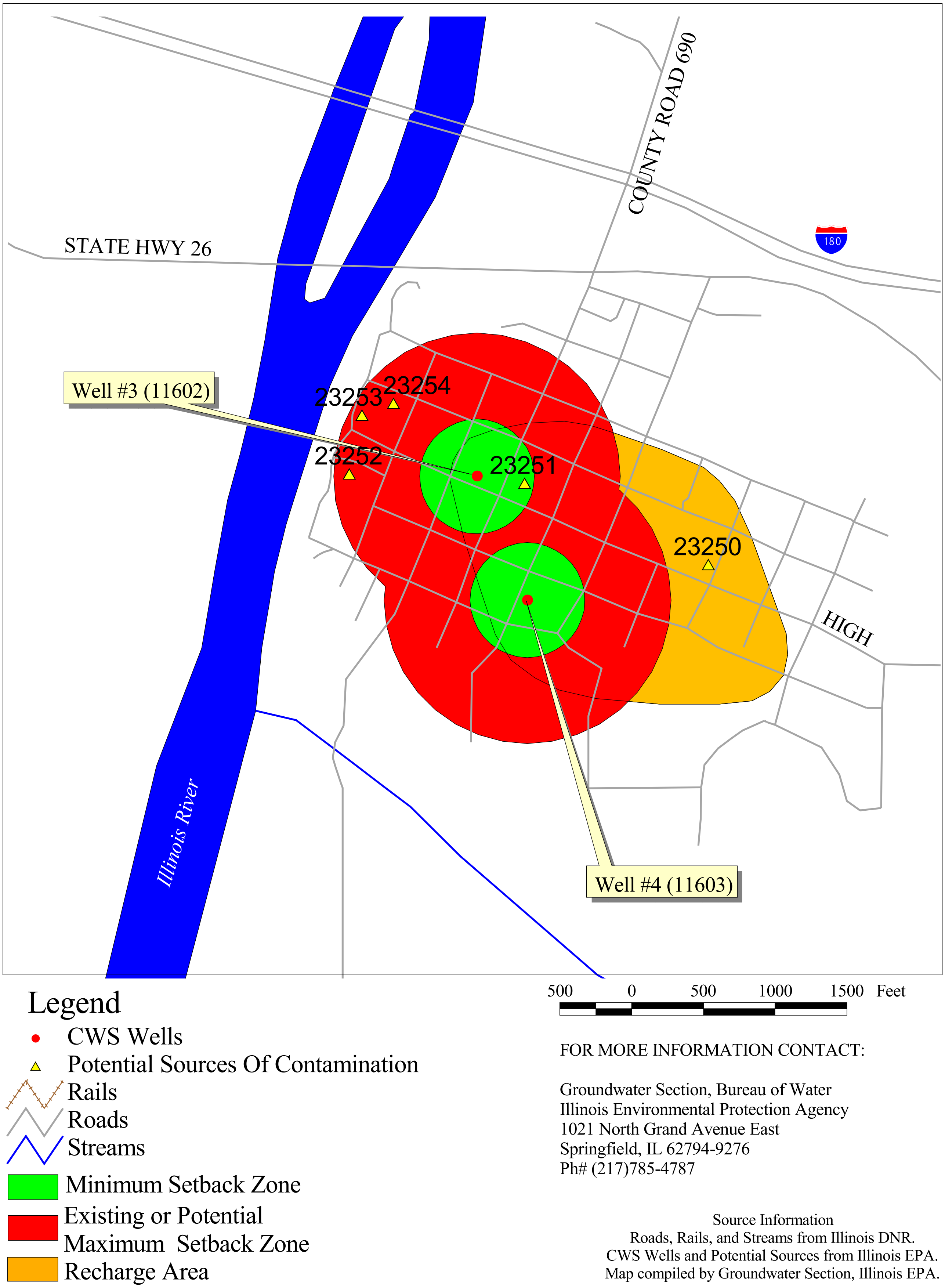
SOURCE WATER PROTECTION EFFORTS:

The Illinois Environmental Protection Act provides minimum protection zones of 400 feet for Hennepin's wells. These minimum protection zones are regulated by the Illinois EPA. To further reduce the risk to the source water, a maximum protection zone may be established, which is authorized by the Illinois Environmental Protection Act and allows county and municipal officials the opportunity to provide additional potential source prohibitions up to 1,000 feet from their wells.

To further minimize the risk to the village's groundwater supply, the Illinois EPA recommends the following additional activities be considered. First, the water supply staff may wish to conduct contingency planning. Contingency planning documents are a primary means to ensure that, through emergency preparedness, a community will minimize their risk of being without safe or adequate water. Second, the water supply staff is encouraged to conduct a biennial cross connection survey of the distribution system as outlined in the cross connection control ordinance [Section 18 of the Environmental Protection Act 415 ILCS 5/1 et seq. (Act); 35 Illinois Act Code, Sections 607.104d, 653.801c] and to review their cross connection control ordinance to ensure that it remains current and viable. Cross connections to either the water treatment plant (for example, at bulk water loading stations) or in the distribution system may negate all source water protection initiatives. Finally, the Illinois EPA recommends that the village investigate additional source water protection management options to address the land use activities within the wells' recharge area. Specifically, these management options should address potential impacts from non-point sources related to agricultural land uses.

To further reduce the risk to source water, Hennepin may wish to implement a wellhead protection program, which includes the proper abandonment of potential routes of groundwater contamination within the recharge area, management of potential sources of contamination and correction of any sanitary defects that might be present at the water treatment facility. This effort may result in the community water supply receiving a special exception permit from the Illinois EPA, which allows a reduction in monitoring and laboratory analysis costs.

FIGURE 1: WELLHEAD PROTECTION PLANNING MAP FOR HENNEPIN (FACILITY #1555100)

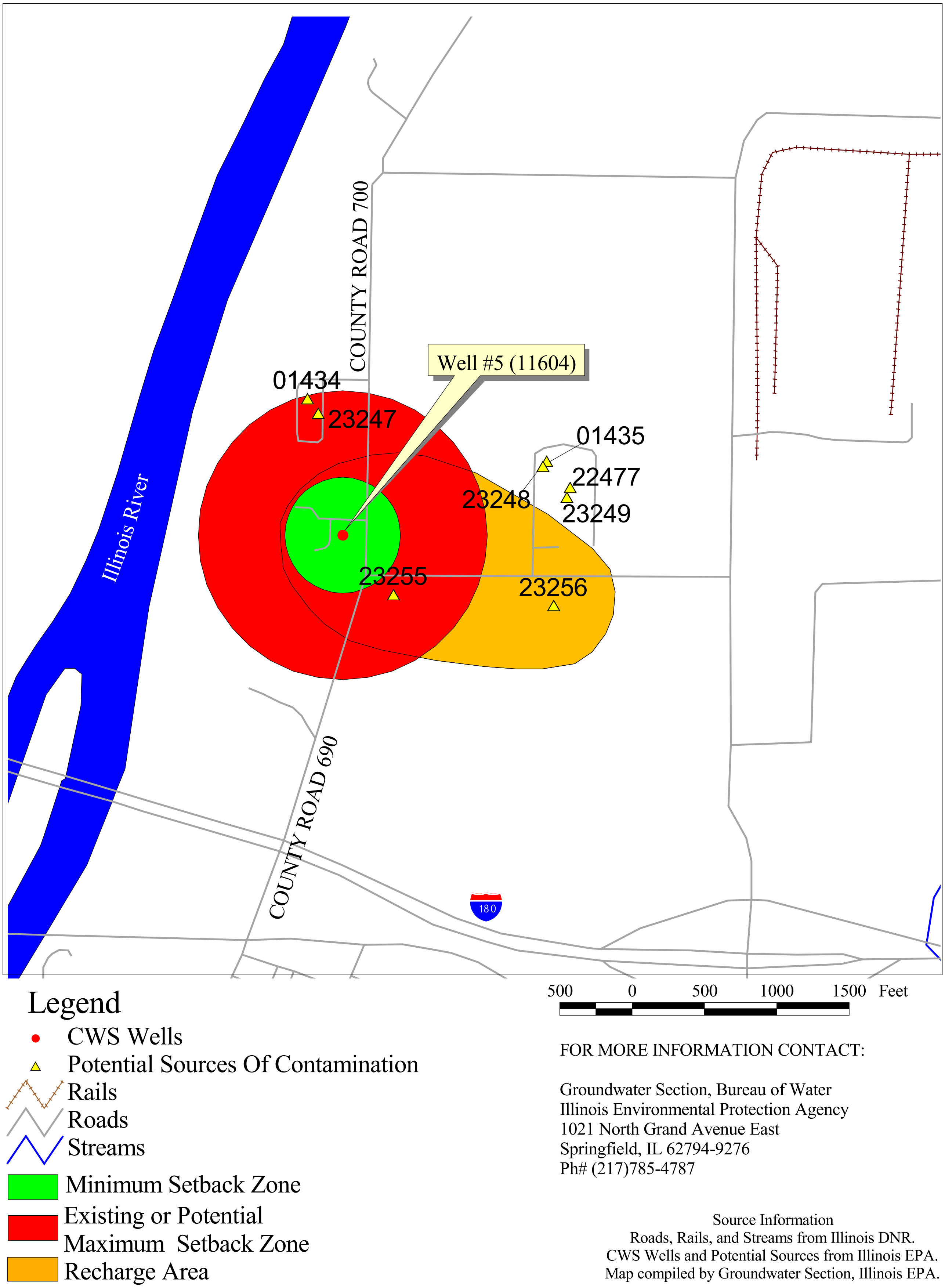


FOR MORE INFORMATION CONTACT:

Groundwater Section, Bureau of Water
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, IL 62794-9276
Ph# (217)785-4787

Source Information
Roads, Rails, and Streams from Illinois DNR.
CWS Wells and Potential Sources from Illinois EPA.
Map compiled by Groundwater Section, Illinois EPA.

FIGURE 2: WELLHEAD PROTECTION PLANNING MAP FOR HENNEPIN (FACILITY #1555100)



FOR MORE INFORMATION CONTACT:

Groundwater Section, Bureau of Water
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, IL 62794-9276
Ph# (217)785-4787

Source Information
Roads, Rails, and Streams from Illinois DNR.
CWS Wells and Potential Sources from Illinois EPA.
Map compiled by Groundwater Section, Illinois EPA.

Illinois Environmental Protection Agency

Source Water Assessment Program

FACT SHEET

BUREAU JUNCTION

BUREAU COUNTY

Prepared in cooperation with the U.S. Geological Survey.

Information and data used in the preparation of this Fact Sheet are provided by the Illinois EPA and are subject to revision.

IMPORTANCE OF SOURCE WATER:

The Village of Bureau Junction (Facility Number 0110150) has two public water supply wells. Wells #4 (Illinois EPA #11327) and #5 (Illinois EPA #00729) produce 32,088 gallons per day on average to an estimated population of 340 through 131 service connections.

WATER SUPPLIES THAT OBTAIN SOURCE WATER FROM THIS FACILITY:

No connected water supplies existed at the time this Source Water Assessment fact sheet was completed.

SOURCE OF WATER SUPPLY:

Well #4 is located on Kansas Street between Miller and North Streets. Well #5 is located 300 feet northeast of Well #4. The water from both wells is blended and treated before distribution. Wells #4 and #5 pump 50 and 190 gallons per minute, respectively and the facility has a production capacity of 345,600 gallons per day. Well #4 is 334 feet deep and utilizes a shallow bedrock aquifer and Well #5 is 1,545 feet deep and utilizes a deep bedrock aquifer which are overlain by permeable alluvial deposits and bedrock formations of variable permeability. Permeability is the ability of a soil or sediment to transmit fluids. Permeability is a measure of the ability of a soil or sediment to transmit fluids. Both aquifers utilized are considered confined by the Illinois EPA, therefore are not considered geologically sensitive.

WELL DATA FOR THIS FACILITY:

Well ID	Well Description	Status	Depth (Feet)	Min Setback (Feet)	Aquifer Description
00729	WELL 5	A	1545	200	Cambrian/Ordovician
11326	WELL 2	B	305	400	Devonian/Silurian
11327	WELL 4	A	334	200	Devonian/Silurian

SOURCE WATER QUALITY:

The Well #4 at Bureau Junction has been sampled regularly as part of a Statewide Ambient Groundwater Monitoring Program since March 1, 1994. Well #5 was sampled in 1997. The samples were analyzed for volatile organic compounds (VOC) and inorganic chemicals (IOC). Well #4 has been sampled for synthetic organic chemical and pesticides (SOC). The VOC analyses detected no contaminants. The IOC analyses have indicated a elevated level of chlorides, which is naturally occurring. The IOC results show levels up to 796 part per billion (ppb) in Well #4, and 201 in Well #5, which is above the groundwater standard of 200 ppb. At this time there is no drinking water standard for chlorides established in 35 Illinois Administrative Code Part 620.410. The Illinois EPA considers these chlorides concentrations the result of natural mineralization in the aquifer.

FINISHED WATER QUALITY:

Further information on finished water quality, including data tables of monitored parameters, contaminants detected, health advisory information, drinking water standards and maximum contaminant levels is available at http//www.epa.gov/ogwdw. Similar information is also available in the Consumer Confidence Report supplied by the water supply to its customers. A review of this information does not indicate levels of organic compounds or inorganic chemicals which exceed the drinking water quality standards. Radium were detected in radio nuclide analyses done in 1999. Alpha emitters were detected at a levels ranging from 20 to 23 picoCuries per liter (pCi/l), the maximum contaminant levels (MCL) for combined Alpha emitters is 15 pCi/l. Combined radium was detected at a levels ranging from 4.7 to 8.8 picoCuries per liter (pCi/l), the maximum contaminant levels (MCL) for combined Radium is 5 pCi/l.

POTENTIAL SOURCES OF CONTAMINATION:

The sites labeled on the Wellhead Protection Planning Map and described in the following tables are considered "potential" sources of contamination. (Maps and tables are not available in the Visually Impaired Accessible version. However, the information presented in the maps and tables is summarized within the following text sections of this fact sheet.) The Illinois EPA performed a detailed Well Site Survey in 1994 to identify potential sources of contamination to the water supply's wells. These sources are identified based on the nature of their activity, the availability of data in electronic databases, and their geographic proximity to the source water protection area. In addition, the Illinois EPA made use of information from its leaking underground storage tank database (http://epadata.epa.state.il.us/land/ust/search.asp) and site remediation program database (http://epadata.epa.state.il.us/land/srp/search.asp) to further assess potential sources of contamination to the water supply's source water. These databases include information from the Illinois EPA Division of Land Pollution Control (LPC) and the Illinois Emergency Management Agency (IEMA). The following is a list of facilities contained within these databases. As a result of multiple possible contamination sources, individual sites may be listed in the table more than once in relation to a well.

IEMA # LPC # Site Name Address City ZIP Code
920807 0118995005 Bureau, Village of 101 East Nebraska St. Bureau 61315
992314 0118995011 Bureau Service Co. 107 North Main Bureau 61315

SITE DATA FOR THIS FACILITY:

Well ID	Map Code	Site Name	Site Description	Distance (Feet)
00729	02912	BILL'S GAS & GENERAL STORE	BELOW GROUND STORAGE (PET	650
00729	02913	VILLAGE OF BUREAU VILLAGE H	BELOW GROUND STORAGE (PET	550
00729	02914	UNKNOWN ABANDONED GAS ST	BELOW GROUND STORAGE (PET	750
11327	02913	VILLAGE OF BUREAU VILLAGE H	BELOW GROUND STORAGE (PET	700
11327	02914	UNKNOWN ABANDONED GAS ST	BELOW GROUND STORAGE (PET	850
11327	02912	BILL'S GAS & GENERAL STORE	BELOW GROUND STORAGE (PET	600

OTHER IDENTIFIED POTENTIAL SOURCES:

For this community water supply, no additional potential sources of contamination have been identified beyond those in Illinois EPA databases.

SUSCEPTIBILITY TO CONTAMINATION:

Based on information obtained in a Well Site Survey published in 1994 by the Illinois EPA, several potential secondary sources are located within 1,000 feet of the wells.

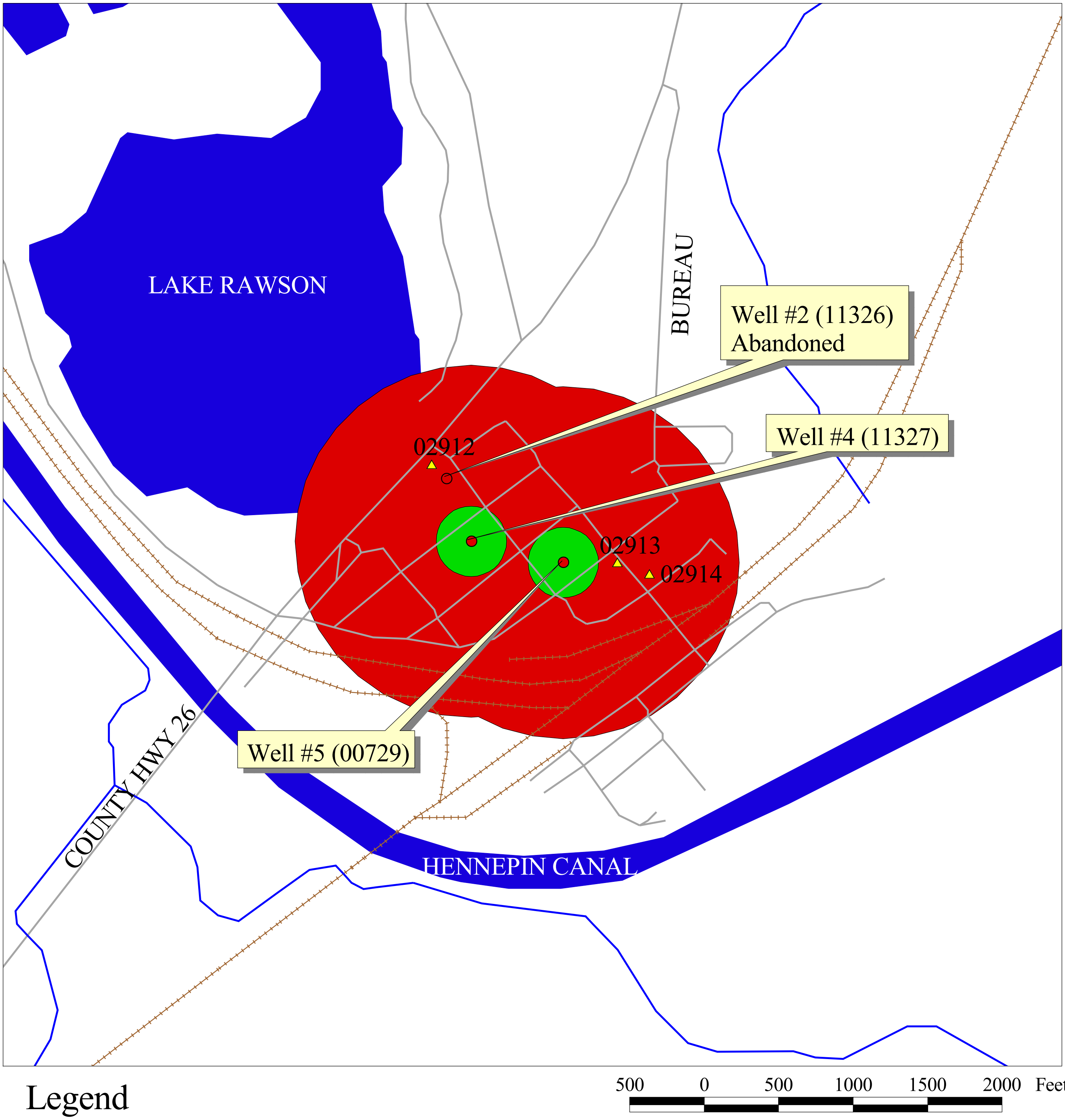
The Illinois EPA has determined that the Bureau Junction Community Water Supply's source water is not susceptible to contamination. This determination is based on a number of criteria including; monitoring conducted at the wells; monitoring conducted at the entry point to the distribution system; and available hydro geologic data on the wells.

SOURCE WATER PROTECTION EFFORTS:

The Illinois Environmental Protection Act provides minimum protection zones of 200 feet for Wells #4 and #5. These minimum protection zones are regulated by the Illinois EPA.

To further minimize the risk to the facility's groundwater supply, the Illinois EPA recommends that three additional activities be assessed. First, the water supply may wish to work with village officials to enact a "maximum setback zone" ordinance. These ordinances are authorized by the Illinois Environmental Protection Act and allow county and municipal officials the opportunity to provide additional protection up to a fixed distance, normally 1,000 feet from their wells. Second, the water supply staff may wish to revisit their contingency planning documents. Contingency planning documents are a primary means to ensure that, through emergency preparedness, a community will minimize their risk of being without safe and adequate water. Finally, the water supply staff is encouraged to review their cross connection control program to ensure that it remains current and viable. Cross connections to either the water treatment plant (for example, at bulk water loading stations) or in the distribution system may negate all source water protection initiatives provided by the community..

FIGURE 1: WELLHEAD PROTECTION PLANNING MAP FOR BUREAU JUNCTION (FACILITY #0110150)



Legend

- CWS Wells
- Potential Sources Of Contamination
- Rails
- Roads
- Streams
- Minimum Setback Zone
- Existing or Potential Maximum Setback Zone
- Recharge Area

FOR MORE INFORMATION CONTACT:

Groundwater Section, Bureau of Water
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, IL 62794-9276
Ph# (217)785-4787

Source Information
Roads, Rails, and Streams from Illinois DNR.
CWS Wells and Potential Sources from Illinois EPA.
Map compiled by Groundwater Section, Illinois EPA.

Illinois Environmental Protection Agency

Source Water Assessment Program

FACT SHEET

GRANVILLE

PUTNAM COUNTY

Prepared in cooperation with the U.S. Geological Survey.

Information and data used in the preparation of this Fact Sheet are provided by the Illinois EPA and are subject to revision.

IMPORTANCE OF SOURCE WATER:

The Viallage of Granville (Facility #1550050) has two public water supply wells. Well #1 (IEPA #11590) and Well #2 (IEPA #11591) produce 186,500 gallons per day to an estimated population of 1,402 through 644 service connections. The facility provides water to the Village of Mark and Oak Park Estates MHP.

WATER SUPPLIES THAT OBTAIN SOURCE WATER FROM THIS FACILITY:

Facility Number	Facility Name	Status	Population
1550010	OAK PARK ESTATES	A	150
1550250	MARK	A	500

SOURCE OF WATER SUPPLY:

Well #1 is located at the village garage at the southeast corner of Main and High Streets. Well #2 is located on the south of the intersection of Tomlinson and Colby Streets. Wells #1 and #2 pump 135 and 170 gallons per minute and have a production capacity of 439,200 gallons per day. The wells are 1,742 and 1,782 feet deep and utilize deep bedrock aquifer, which are overlain by relatively impermeable till interbedded within sand and gravel. Permeability is the ability of a soil or sediment to transmit fluids. The aquifer utilized is considered confined by the Illinois EPA, therefore is not considered geologically sensitive.

WELL DATA FOR THIS FACILITY:

Well ID	Well Description	Status	Depth (Feet)	Min Setback (Feet)	Aquifer Description
11590	WELL NO 1 IN CITY GARAGE	A	1742	200	DEEP BEDROCK
11591	WELL NO 2	A	1782	200	DEEP BEDROCK

SOURCE WATER QUALITY:

The public water supply wells at Granville were sampled as part of the Statewide Groundwater Monitoring Network on June 9, 1987. The well samples were analyzed for volatile organic compounds (VOC) and inorganic chemicals (IOC). The VOC analyses performed detected no quantifiable levels of organic chemicals in either well. The IOC analyses performed found the water from both wells to have an elevated level of total chlorides, which is naturally occurring. Total Chloride was detected at a level of 304 and 308 parts per billion (ppb), in Wells #1 and #2, respectively which is above the Groundwater Quality Standards of 200 ppb for chloride established in 35 Illinois Administrative Code Part 620.410.

FINISHED WATER QUALITY:

Finished water quality data tables of monitored parameters, contaminants detected, health advisory information, drinking water standards or maximum contaminant levels are available at http//www.epa.gov/ogwdw. Similar information is also available in the Consumer Confidence Report supplied by the water supply to its customers. A review of this information does not indicate levels of organic or inorganic compounds which exceed the drinking water quality standards. Radium and Alpha emitters were detected in radionuclide analyses done in 1999. Alpha emitters were detect at a level of 39 picoCuries per liter (pCi/l) and combined radium was detected at a level of 12.2 pCi/l, the maximum contaminant levels (MCL) are 15 and 5 pCi/l respectively.

POTENTIAL SOURCES OF CONTAMINATION:

The sites labeled on the Wellhead Protection Planning Map and described in the following tables are considered "potential" sources of contamination. (Maps and tables are not available in the Visually Impaired Accessible version. However, the information presented in the maps and tables is summarized within the following text sections of this fact sheet.) The Illinois EPA performed a detailed Well Site Survey in 1992 to identify potential sources of contamination to the community's wells. These sources are identified based on the nature of their activity, the availability of data in electronic databases, and their geographic proximity to the source water protection area. In addition, the Illinois EPA made use of information from its leaking underground storage tank database (http://epadata.epa.state.il.us/land/ust/search.asp) and site remediation program database (http://epadata.epa.state.il.us/land/srp/search.asp) to further assess potential sources of contamination to the community's source water. These databases include information from the Illinois EPA Division of Land Pollution Control (LPC) and the Illinois Emergency Management Agency (IEMA). The following is a list of facilities contained within these databases. As a result of multiple possible contamination sources, individual sites may be listed in the table more than once in relation to a well.

IEMA # - LPC # - Site Name Address City ZIP Code
20002181 - 1550055009 - Maupin Trucking & Excavating Rt. 71 Granville 61326
901786 - 1550050001 - Salsman, Coy 102 McCoy St. Granville 61326
921597 - 1550055002 - Putnam County C.U.S.D. #535 400 East Silverspoon St. Granville 61326
930911 - 1550050001 - Salsman, Coy 101 South McCoy St. Granville 61326
932022 - 1550055003 - Petro-Line Rt. 89, R.R. 1, Box 36 Granville 61326
941345 - 1550055001 - Mid-American Growers Inc. R.R. 1, Rt. 89 Granville 61326
972212 - 1550055007 - Toedter Oil Co. RFD Rt. 89 1 1/4 Mile South Spring Valley Granville 61326

SITE DATA FOR THIS FACILITY:

Well ID	Map Code	Site Name	Site Description	Distance (Feet)
11590	07317	COYE'S SUNOCO SERVICE	BELOW GROUND STORAGE (PET	350
11590	07318	DONALDSON BUSINESS FORMS	PRINTING	800
11590	07321	OSSOLA CONSTRUCTION CO.	PILES OF MATERIAL (e.g. SAND A	2300
11590	07320	UNKNOWN FORMER GAS STATI	BELOW GROUND STORAGE (PET	2100
11590	07319	UNKNOWN FORMER GAS STATI	BELOW GROUND STORAGE (PET	1000
11591	07318	DONALDSON BUSINESS FORMS	PRINTING	1500
11591	07321	OSSOLA CONSTRUCTION CO.	PILES OF MATERIAL (e.g. SAND A	300
11591	07320	UNKNOWN FORMER GAS STATI	BELOW GROUND STORAGE (PET	775
11591	07319	UNKNOWN FORMER GAS STATI	BELOW GROUND STORAGE (PET	1580
11591	07317	COYE'S SUNOCO SERVICE	BELOW GROUND STORAGE (PET	2000

OTHER IDENTIFIED POTENTIAL SOURCES:

For this community water supply, no additional potential sources of contamination have been identified beyond those in Illinois EPA databases.

SUSCEPTIBILITY TO CONTAMINATION:

Based on information obtained in a Well Site Survey published in 1992 by the Illinois EPA, several potential sources are located within 1,000 feet of the wells.

The Illinois EPA has determined that the Granville Community Water Supply's source water is not suspectibile to contamination. This determination is based on a number of criteria including; monitoring conducted at the wells; monitoring conducted at the entry point to the distribution system; and available hydrogeologic data on the wells.

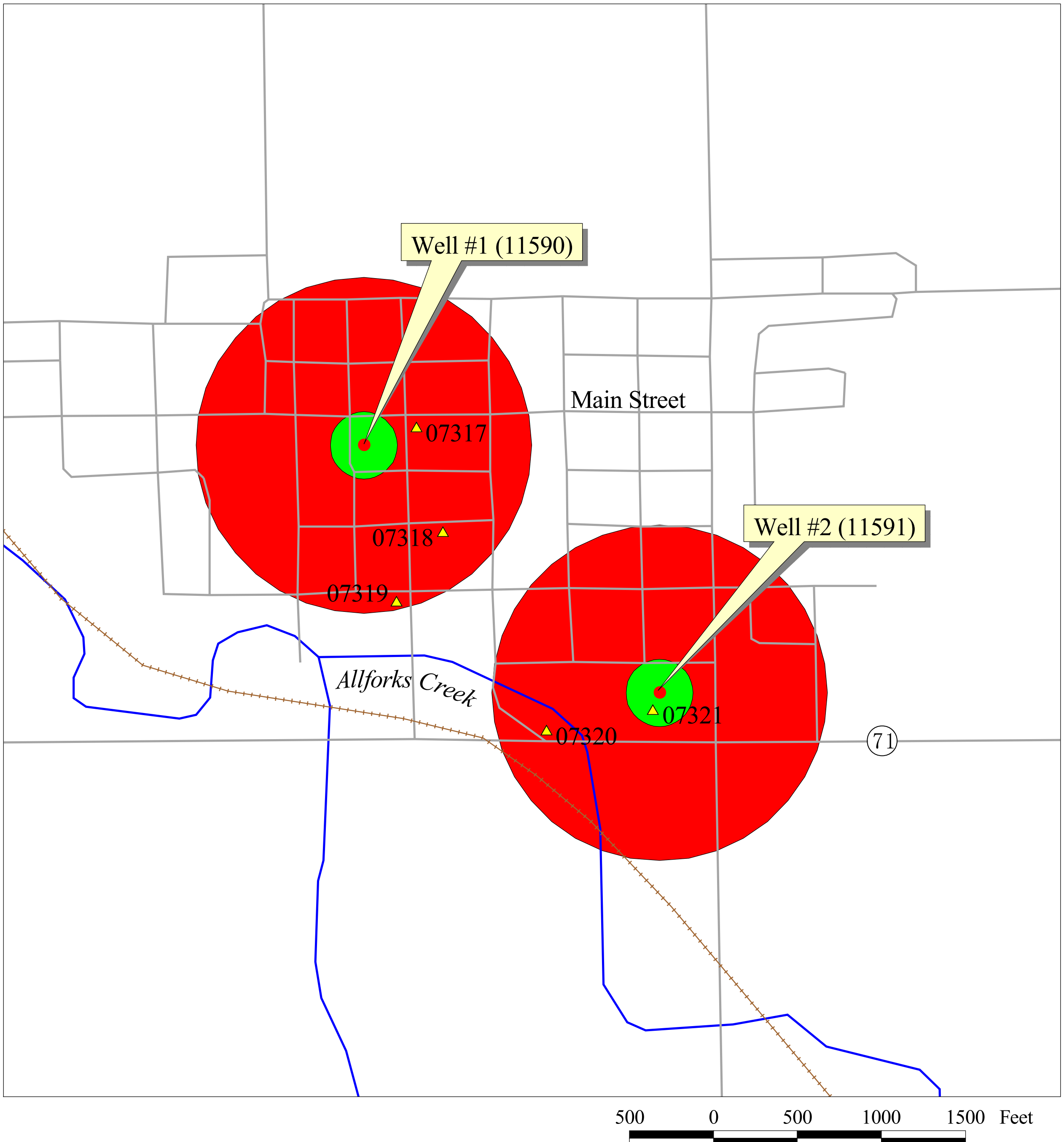
Furthermore, in anticipation of the U.S. EPA's proposed Ground Water Rule, the Illinois EPA has determined that the Granville Community Water Supply is not vulnerable to viral contamination. This determination is based upon the evaluation of the following criteria during the Vulnerability Waiver Process: the community's wells are properly constructed with sound integrity and proper siting conditions; a hydraulic barrier exists which should prevent pathogen movement; all potential routes and sanitary defects have been mitigated such that the source water is adequately protected; monitoring data did not indicate a history of disease outbreak; and the sanitary survey of the water supply did not indicate a viral contamination threat. Because the community's wells are constructed in a confined aquifer, which should prevent the movement of pathogens into the wells, well hydraulics were not considered to be a significant factor in the susceptibility determination. Hence, well hydraulics were not evaluated for this system ground water supply.

SOURCE WATER PROTECTION EFFORTS:

The Illinois Environmental Protection Act provides minimum protection zones of 200 feet for your wells. These minimum protection zones are regulated by the Illinois EPA. To further reduce the risk to source water, the Facility has implemented a wellhead protection program which includes the proper abandonment of potential routes of groundwater contamination and correction of sanitary defects at the water treatment facility. This effort resulted in the community water supply receiving a special exception permit from the Illinois EPA which allows a reduction in monitoring. The outcome of this monitoring reduction has saved the community considerable laboratory analysis costs.

To further minimize the risk to the facility's groundwater supply, the Illinois EPA recommends that three additional activities be assessed. First, the water supply may wish to enact a "maximum setback zone" ordinance. These ordinances are authorized by the Illinois Environmental Protection Act and allow county and municipal officials the opportunity to provide additional protection up to a fixed distance, normally 1,000 feet from their wells. Second, the water supply staff may wish to revisit their contingency planning documents. Contingency planning documents are a primary means to ensure that, through emergency preparedness, a community will minimize their risk of being without safe and adequate water. Finally, the water supply staff is encouraged to review their cross connection control program to ensure that it remains current and viable. Cross connections to either the water treatment plant (for example, at bulk water loading stations) or in the distribution system may negate all source water protection initatives provided by the community.

WELLHEAD PROTECTION PLANNING MAP FOR GRANVILLE (FACILITY #1550050)



Legend

- CWS Wells
- Potential Sources Of Contamination
- Rails
- Roads
- Streams
- Minimum Setback Zone
- Existing or Potential Maximum Setback Zone

FOR MORE INFORMATION CONTACT:

Groundwater Section, Bureau of Water
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, IL 62794-9276
Ph# (217)785-4787

Source Information
Roads, Rails, and Streams from Illinois DNR.
CWS Wells and Potential Sources from Illinois EPA.
Map compiled by Groundwater Section, Illinois EPA.

Illinois Environmental Protection Agency

Source Water Assessment Program

FACT SHEET

MARK

PUTNAM COUNTY

Prepared in cooperation with the U.S. Geological Survey.

Information and data used in the preparation of this Fact Sheet are provided by the Illinois EPA and are subject to revision.

Illinois EPA PWS Number: **1550250**

For the purpose of the Source Water Assessment Program (SWAP), this community water supply (CWS) purchases water from another CWS. The current procedure for a purchasing water supply indicates that the source water information for this CWS is presented in the SWAP Fact Sheet of the parent supply (the water supply from which the water originates). Therefore, please refer to the parent supply's SWAP Fact Sheet for an assessment of this CWS's source water. The parent CWS for the supply you requested is listed below with its source water type and county. Some CWSs that purchase their water have wells as back-up supplies; however, these wells are not the primary source of water supply and are not considered as part of this assessment program.

INFORMATION FOR THE SOURCE OF THIS FACILITY'S WATER

Parent IEPA Number:	**1550050**
Parent Name:	**GRANVILLE**
Parent Water Type:	**GROUND**
Parent Supply County:	**PUTNAM**

APPENDIX D

RECORD OF COMMUNICATIONS

Stuart Cravens

From: "Bell, Scott S." <Scott.S.Bell@Illinois.gov>
To: <kelron@egix.net>
Cc: "Smet, John" <John.Smet@Illinois.gov>
Sent: Wednesday, March 18, 2009 12:18 PM
Subject: attn Stuart Cravens

According to our records, the only active NCPWS within one mile of Dynegy Hennepin Power Station is Washington Mills (fka Exolon, Esk).

J. Scott Bell, LEHP
Illinois Department of Public Health
Peoria Regional Office
5415 N. University
Peoria, IL 61614
309 693 5373
fax 309 693 5118
scott.s.bell@illinois.gov

Stuart Cravens

From: "Andrea Gress" <agress@bchealthdepartment.org>
To: "Stuart Cravens" <kelron@egix.net>
Sent: Tuesday, March 17, 2009 2:26 PM
Subject: RE: Community and Non-Community Water Supplies - Putnam Counry

Dear Stu,

As far as the non-communities we are responsible for at the local level, none of them are located in that area. However, the state also covers non-community wells in our area because they fall in a different category so I am forwarding this email to our Regional State Health Department in Peoria, IL. The contact is John Smet. Email: john.smet@illinois.gov. Hopefully he will get back to you regarding the non-community wells the state is responsible for.

Sincerely,

Andrea Gress

Andrea Gress, BS, LEHP, REHS/RS
Environmental Health Sanitarian
Bureau-Putnam County Health Department
526 Bureau Valley Parkway
Princeton, IL 61356
Phone: 815-872-5091
Fax: 815-872-5092

From: Stuart Cravens [mailto:kelron@egix.net]
Sent: Thursday, March 12, 2009 9:05 AM
To: Andrea Gress
Subject: Community and Non-Community Water Supplies - Putnam Counry

To: Bureau and Putnam County Health Department

As required by the IEPA, and on behalf of the Hennepin Power Station, located in Putnam County, Illinois (Township 33 North, Range, 2 West, Section 26) Kelron Environmental is conducting a water well survey of potable wells within 1 mile of the property.

I have done the web database searches and obtained information from the IEPA, ISGS, and ISWS and wanted to confirm that there are no community water supply wells within 1 mile of the Hennepin Power Station and the only non-community water supply well(s) are located at the Exolon Corporation in the southeast quarter of Section 26. The IEPA website showed there to be one non-community water supply well on Exolon property used for potable purposes, although there are apparently at least two other wells which may be active or inactive for industrial (non-potable) use.

I would appreciate it if you could confirm this information or provide me with a contact person in your office with whom I can communicate via mail or phone.

Thank you very much.

Stu Cravens, Senior Hydrogeologist

Stuart J. Cravens
Kelron Environmental
kelron@egix.net
217-390-1503 phone

Stuart Cravens

From: "Stuart Cravens" <kelron@egix.net>
To: "John P Augspols" <john_augspols@dynegy.com>
Sent: Tuesday, February 03, 2009 3:12 PM
Attach: Hen Power Plant 2.jpg
Subject: Industrial Well locations

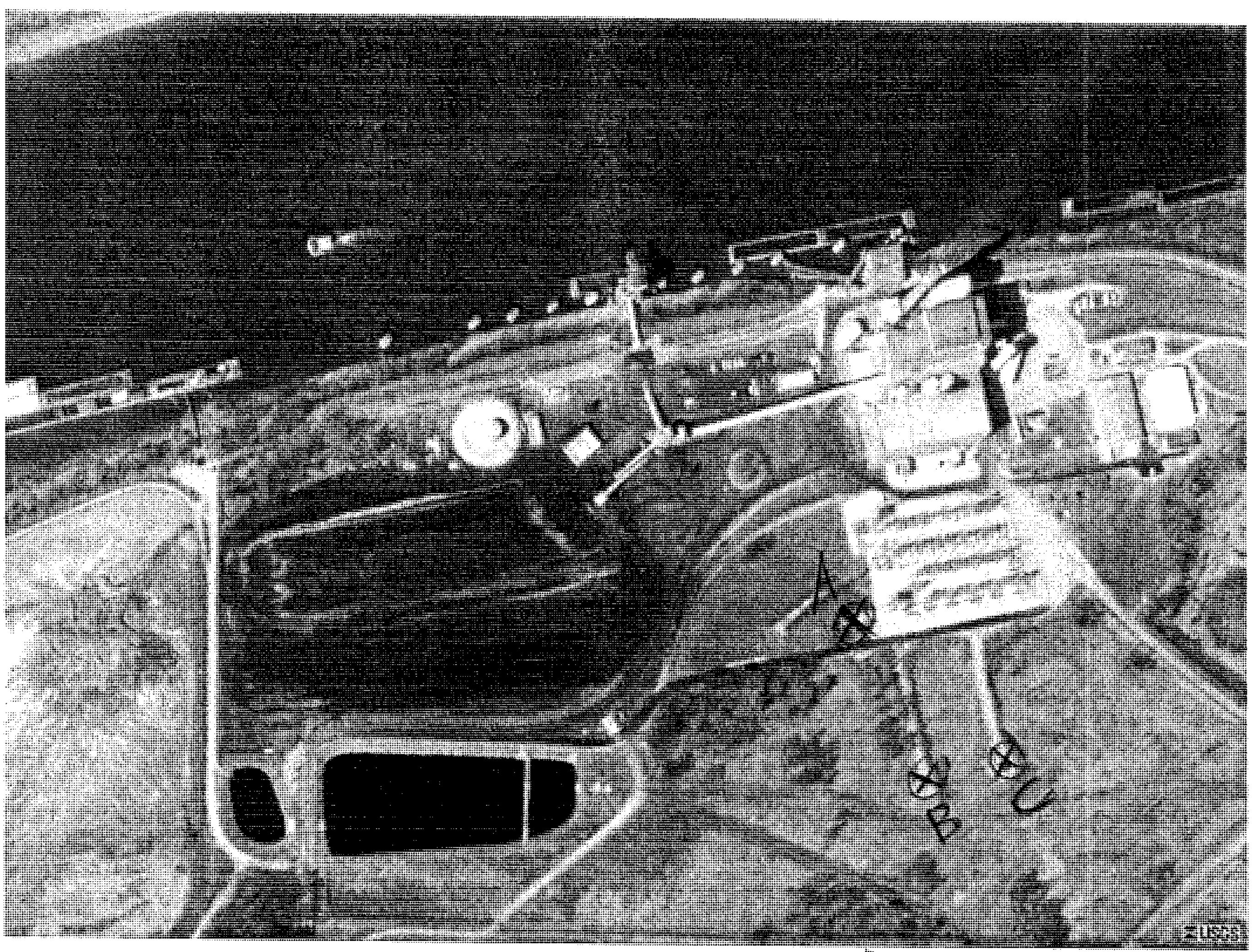
In process

John,

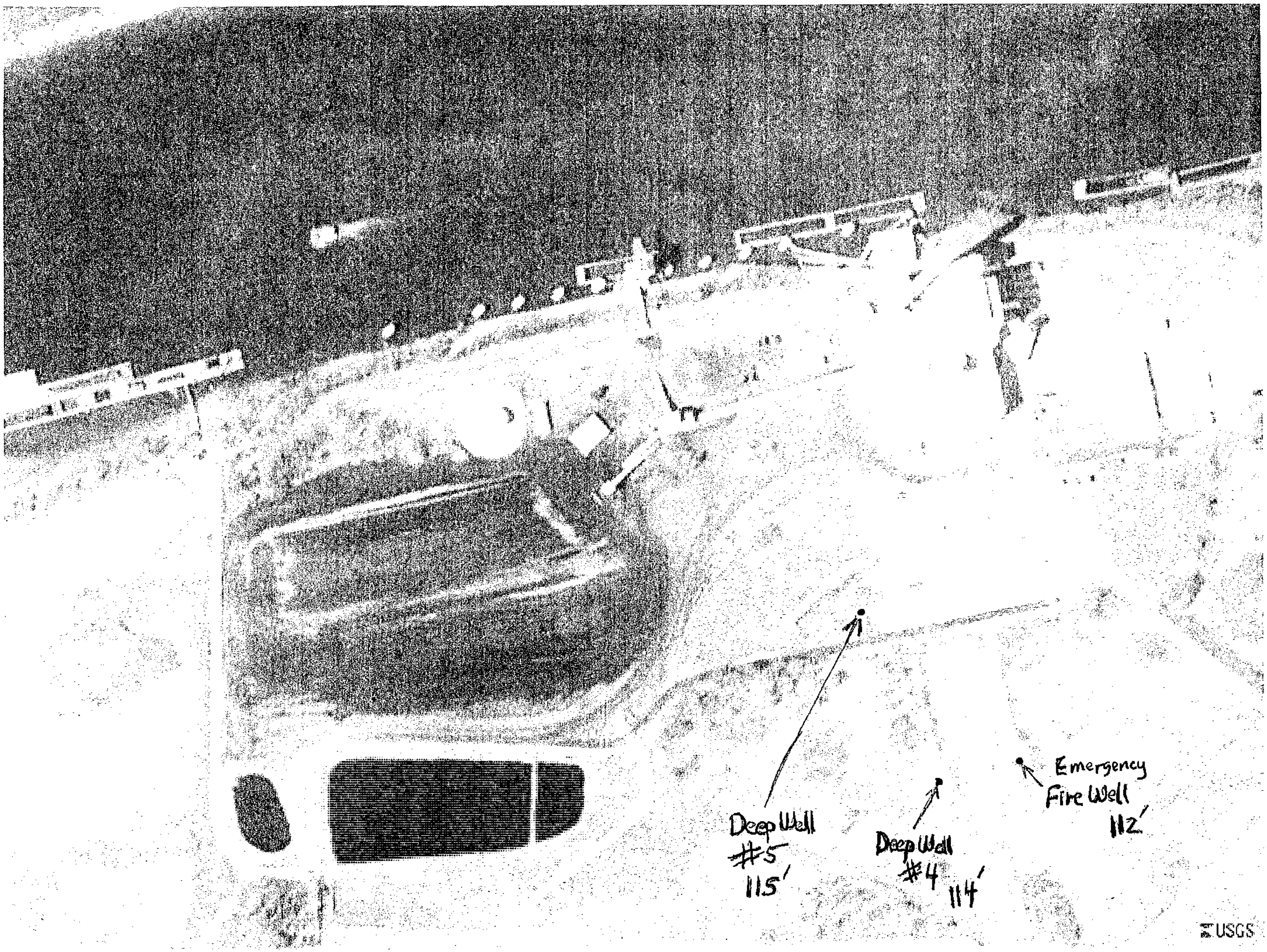
Are any of your industrial water wells at Hennepin active? Can you show on the attached jpeg map the locations of those wells and their designations? Call if this is a problem or any questions.

Thanks. Stu

Stuart J. Cravens
Kelron Environmental
kelron@egix.net
217-390-1503 phone



A = Dry well #5 (115') #28
B = Dry well #4 (114') #26
C = Firewell (112') ?#29?


Deep Well
#5
115'
Deep Well
#4
114'
Emergency
Fire Well
112'
USGS

Appendix H

Groundwater Quality Monitoring Results

Appendix H1

Illinois EPA Program Monitoring Results

Appendix H1: Illinois EPA Program Monitoring Results
Inorganic Parameters - Downgradient Wells
Hydrogeologic Site Characterization Report
Ash Pond No. 2, Hennepin Power Station

Legend:
- Value exceeds 35 IAC 620 Class I groundwater standard
- Value below detection limit

Well No	sample date	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Chloride, total (mg/L)	Chloride, dissolved (mg/L)	Sulfate, total (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Fluoride, total (mg/L)	Boron, dissolved (mg/L)	Boron, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	pH (field) (SU)	Residue, total filtrable (mg/L)
3	3/26/2008									1.1						7.15	
3	5/15/2008									0.93						7	
3	8/25/2008									1.5						6.9	
3	10/27/2008									1.2						6.85	
3	12/29/2008	9.94	0.056							0.935	0.956	0.388	0.044	0.01	0.013		633
3	12/29/2008			88	97	79	80	0.148	0.152							7.12	
3	3/25/2009	7.49	0.07							0.822	0.872	0.109	0.035	0.008	0.006		
3	3/25/2009			80	75	90	90.3	0.12	0.11							6.91	635
3	6/18/2009	14.70	0.098							0.766	0.804	8.9	0.052	0.3	0.009		
3	6/18/2009			92	92.6	109	117.2	0.133	0.105							6.72	735
3	9/29/2009	8.84	0.044							1.23	1.31	0.158	0.025	0.012	0.005		
3	9/29/2009			62	89	109	109.1	0.162	0.194							7.15	627
3	12/22/2009	8.86	0.056							0.706	0.724	0.034	0.02	0.007	0.006		
3	12/22/2009			82	83	95	94.7	0.099	0.089							6.5	596
3	3/16/2010	9.62	0.043							0.725	0.769	0.129	0.028	0.007	0.006		
3	3/16/2010			103	99.2	86	93.6	0.081	0.098							7.23	568
3	6/7/2010		0.124														
3	8/31/2010	11.00	0.052	89		130		0.14		1.1			0.025		0.006	7.11	690
3	12/28/2010	10.00	0.1	100		100		0.16		0.73			0.045		0.01	7.11	710
3	3/16/2011									0.73						7.13	
3	6/29/2011	13.00	0.06		97		100	0.138		0.58			0.025		0.01	7.02	710
3	8/23/2011	13.00	0.048		79		140	0.141		0.99			0.028		0.01	6.79	700
3	10/18/2011	9.10	0.045		77		130	0.106		1.1			0.025		0.009	6.92	690
3	3/1/2012	11.00	0.069		120		110	0.124		0.54			0.036		0.012	7.23	730
3	5/30/2012	8.60	0.058		110		100	0.128		0.67			0.028		0.011	6.73	730
3	8/29/2012	7.10	0.063		110		120	0.138		0.93			0.03		0.009	7.13	730
3	11/27/2012	9.16	0.075		94		109	0.14		0.826			0.046		0.014	7.26	714
3	3/7/2013	10.80	0.072		104		110	0.14		0.561			0.049		0.016	7.13	734
3	6/6/2013	9.23	0.045		88		78	0.15		0.632			0.053		0.009	7.23	628
3	9/3/2013	6.96	0.045		73		188	0.16		1.26			0.039		0.009	7.2	758
3	12/11/2013	10.30	0.034		78		65	0.14		1.04			0.033		0.009	7.2	744
3	3/26/2014	8.32	0.027		69		87	0.11		0.863			0.034		0.008	7.11	632
3	6/17/2014	6.90	0.032		88		108	0.18		0.721			0.029		0.01	7.98	728
3	8/20/2014	9.71	0.021		75		142	0.19		1.16			0.024		0.009	7.17	644
03R	3/18/2015	2.78	0.007		77		93	0.23		0.947			0.02		0.017	7.29	556
03R	6/23/2015	3.07	0.007		69		113	0.26		0.866			0.02		0.01	7.28	518
03R	9/16/2015	4.61	0.007		77		131	0.27		1.56			0.02		0.006	7.23	560
03R	12/9/2015	3.50	0.007		71		84	0.25		1.18			0.02		0.005	7.23	572
03R	3/9/2016	1.83	0.007		72		122	0.26		1.3			0.02		0.005	7.26	476
03R	6/8/2016	3.42	0.005		77		108	0.3		1.33			0.02		0.005	7.27	562
03R	8/31/2016	3.66	0.005		89		100	0.26		0.938			0.02		0.005	7.5	476
03R	12/8/2016	2.31	0.005		67		95	0.29		1.24			0.02		0.005	7.25	464
6	3/26/2008									0.69						6.98	
6	5/15/2008									0.59						6.91	
6	8/25/2008									1.1						6.77	
6	10/27/2008									0.71						6.41	
6	12/29/2008	13.30	0.102							1.02	1.05	0.081	0.053	0.005	0.005	6.66	
6	12/29/2008			77	77	126	139	0.159	0.167								736
6	3/25/2009	9.33	0.098							0.724	0.736	0.058	0.046	0.005	0.005		
6	3/25/2009			101	96	103	98.8		0.142							6.74	692
6	6/18/2009	18.00	0.121							0.644	0.672	0.158	0.055	0.005	0.005		
6	6/18/2009			118	119.1	138	144.4	0.18	0.161							6.57	794
6	9/29/2009	9.91	0.065							1.17	1.24	0.066	0.036	0.005	0.005		
6	9/29/2009			73	94.7	128	124.4	0.199	0.224							6.98	674
6	12/22/2009	10.20	0.101							0.761	0.796	0.078	0.037	0.005	0.005		
6	12/22/2009			116	113	110	109	0.119	0.119							6.86	699
6	3/16/2010	12.00	0.108							0.653	0.739	0.076	0.042	0.005	0.005		
6	3/16/2010			121	118.9	122	120.5	0.11	0.124							6.99	735
6	6/7/2010		0.051														
6	8/31/2010	16.00	0.061	100		160		0.18		0.75			0.025		0.005	6.89	750
6	12/28/2010	11.00	0.093	110		120		0.2		0.72			0.046		0.005	6.97	760
6	3/16/2011									0.63						6.98	
6	6/29/2011	13.00	0.064		109		120	0.193		0.55			0.031		0.005	6.79	740
6	8/23/2011	13.00	0.054		79		150	0.195		0.72			0.03		0.005	6.61	730
6	10/18/2011	13.00	0.059		91		130	0.143		0.9			0.028		0.005	6.61	730
6	3/1/2012	7.40	0.067		130		120	0.171		0.57			0.03		0.005	7.3	760
6	5/30/2012	7.80	0.077		120		120	0.195		0.58			0.033		0.005	6.66	770

Natural Resource Technology

Appendix H1: Illinois EPA Program Monitoring Results
Inorganic Parameters - Downgradient Wells
Hydrogeologic Site Characterization Report
Ash Pond No. 2, Hennepin Power Station

Legend:
Value exceeds 35 IAC 620 Class I groundwater standard
Value below detection limit

Well No	sample date	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Chloride, total (mg/L)	Chloride, dissolved (mg/L)	Sulfate, total (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Fluoride, total (mg/L)	Boron, dissolved (mg/L)	Boron, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	pH (field) (SU)	Residue, total filtrable (mg/L)
6	8/29/2012	8.50	0.083		120		120	0.168		0.6			0.037		0.005	6.96	760
6	11/27/2012	9.79	0.076		115		112	0.21		0.62			0.05		0.005	7.19	752
6	3/7/2013	11.20	0.066		108		118	0.22		0.508			0.058		0.005	7.1	750
6	6/6/2013	9.94	0.067		108		88	0.21		0.41			0.05		0.005	7.15	754
6	9/3/2013	11.60	0.053		84		154	0.24		0.812			0.039		0.005	7.07	876
6	12/11/2013	10.60	0.031		76		110	0.21		0.884			0.026		0.005	7.18	688
6	3/26/2014	9.15	0.039		93		94	0.18		0.685			0.03		0.005	6.97	680
6	6/17/2014	7.84	0.045		112		125	0.26		0.552			0.034		0.005	7.39	802
6	8/20/2014	9.03	0.031		92		184	0.23		0.84			0.027		0.005	7.01	748
6	12/9/2014	3.99	0.007		85		86	0.27		0.418			0.02		0.005	7.09	562
6	3/18/2015	4.27	0.007		80		79	0.28		0.428			0.02		0.005	7.27	480
6	3/19/2015	11.00	0.007		46		61	0.1		0.059			0.02		0.005	7.26	564
6	6/22/2015	5.23	0.007		52		46	0.32		0.292			0.02		0.005	7.19	364
6	9/16/2015	5.97	0.007		82		103	0.31		0.639			0.02		0.005	7.32	546
6	12/9/2015	3.79	0.007		73		69	0.32		0.47			0.02		0.005	7.03	510
6	3/9/2016	4.35	0.007		80		93	0.32		0.551			0.02		0.005	7.2	512
6	6/8/2016	4.79	0.015		99		103	0.37		0.458			0.02		0.005	7.32	610
6	8/31/2016	5.20	0.006		93		89	0.34		0.417			0.02		0.005	7.2	526
6	12/8/2016	3.25	0.005		64		66	0.39		0.354			0.02		0.005	6.88	482
18D	6/18/2009	10.60	0.167							3.51	3.76	7.49	0.082	0.827	0.659		
18D	6/18/2009			93	94.9	169	180.2	0.152	0.141							6.79	737
18D	9/29/2009	7.95	0.161							3.5	4.03	0.644	0.064	0.313	0.281		
18D	9/29/2009			81	97.4	164	162	0.182	0.207							7.15	756
18D	12/22/2009	7.52	0.165							3.37	3.69	0.208	0.058	0.299	0.255		
18D	12/22/2009			98	97	152	154	0.099	0.103							6.5	696
18D	3/16/2010	3.37	0.053							1.38	1.11	0.561	0.025	0.082	0.079		
18D	3/16/2010			31	48.4	63	83.5	0.088	0.093							7.26	474
18D	6/7/2010		0.078														
18D	8/31/2010	4.70	0.112	79		150		0.16		3.2			0.043		0.18	7.04	730
18D	12/28/2010	5.90	0.09	98		160		0.17		3.5			0.055		0.21	7.19	640
18D	6/29/2011	1.50	0.008		20		68	0.126		1.3			0.069		0.12	7.22	400
18D	8/23/2011	4.20	0.059		57		150	0.187		2.8			0.044		0.16	7.09	610
18D	10/18/2011	5.80	0.072		71		160	0.138		2.9			0.045		0.23	6.98	680
18D	3/1/2012	5.00	0.007		83		160	0.158		2.9			0.027		0.19	7.27	640
18D	5/30/2012	4.50	0.046		72		130	0.171		2.3			0.025		0.13	6.84	600
18D	8/29/2012	4.60	0.044		80		150	0.16		2.7			0.046		0.2	7.1	670
18D	11/27/2012	6.50	0.068		81		134	0.15		2.17			0.038		0.171	7.2	720
18D	3/7/2013	5.54	0.06		74		139	0.16		1.75			0.047		0.09	7.13	592
18D	6/6/2013	5.30	0.076		75		105	0.16		1.69			0.032		0.149	7.16	696
18D	9/3/2013	4.02	0.038		72		135	0.2		2.23			0.033		0.186	7.38	718
18D	12/11/2013	5.77	0.049		68		162	0.16		2.6			0.023		0.181	7.28	618
18D	3/26/2014	0.27	0.007		11		40	0.1		1.96			0.025		0.011	7.18	252
18D	6/17/2014	2.76	0.046		66		123	0.17		2.2			0.079		0.291	7.58	750
18D	8/20/2014	5.30	0.053		74		140	0.16		2.18			0.092		0.212	7.12	728
18D	3/18/2015	3.65	0.011		83		134	0.16		1.86			0.024		0.124	7.16	702
18D	6/23/2015	4.06	0.039		84		115	0.14		1.58			0.026		0.077	7.1	640
18D	9/16/2015	4.71	0.039		80		138	0.15		1.94			0.038		0.156	7.19	648
18D	12/9/2015	4.23	0.037		82		132	0.14		1.73			0.022		0.107	7.2	650
18D	3/9/2016	3.88	0.03		84		134	0.14		1.79			0.025		0.131	7.17	622
18D	6/8/2016	3.46	0.027		82		141	0.16		1.95			0.028		0.164	7.17	672
18D	8/31/2016	2.89	0.027		86		136	0.14		1.76			0.02		0.103	7.43	654
18D	12/8/2016	2.41	0.026		85		143	0.17		1.9			0.025		0.158	7.16	592
18S	6/18/2009	11.50	0.101							2.33	2.51	1.19	0.059	0.101	0.054		
18S	6/18/2009			95	93.3	170	164.1	0.109	0.097							6.73	770
18S	9/29/2009	8.17	0.067							2.97	3.17	0.955	0.039	0.072	0.037		
18S	9/29/2009			77	92.4	178	170.8	0.142	0.15							7.15	719
18S	12/22/2009	8.30	0.066							2.99	3.19	0.233	0.022	0.047	0.033		
18S	12/22/2009			89	89	169	166	0.077	0.079							6.8	679
18S	3/16/2010	7.46	0.038							2.43	2.59	0.199	0.021	0.029	0.021		
18S	3/16/2010			103	103.4	113	105.8	0.079	0.08							7.23	586
18S	6/7/2010		0.048														
18S	8/31/2010	10.00	0.039	89		220		0.12		3.6			0.025		0.017	7.18	840
18S	12/28/2010	8.60	0.082	110		150		0.13		2.2			0.036		0.027	7.08	740
18S	6/29/2011	9.60	0.055		98		190	0.1		2.5			0.03		0.025	6.98	760
18S	8/23/2011	8.90	0.048		79		210	0.139		3.4			0.046		0.13	6.93	780
18S	10/18/2011	9.50	0.049		83		190	0.104		2.9			0.031		0.024	6.83	770
18S	3/1/2012	7.00	0.062		110		130	0.116		1.6			0.029		0.023	7.22	740

Appendix H1: Illinois EPA Program Monitoring Results
Inorganic Parameters - Downgradient Wells
Hydrogeologic Site Characterization Report
Ash Pond No. 2, Hennepin Power Station

Legend:
- (pink) Value exceeds 35 IAC 620 Class I groundwater standard
- (blue) Value below detection limit

Well No	sample date	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Chloride, total (mg/L)	Chloride, dissolved (mg/L)	Sulfate, total (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Fluoride, total (mg/L)	Boron, dissolved (mg/L)	Boron, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	pH (field) (SU)	Residue, total filtrable (mg/L)
18S	5/30/2012	7.20	0.05		110		170	0.135		2.4			0.025		0.021	6.78	750
18S	8/29/2012	7.00	0.056		100		130	0.124		1.9			0.025		0.024	7.04	740
18S	11/27/2012	8.71	0.06		93		136	0.13		2.03			0.031		0.024	7.23	762
18S	3/7/2013	9.94	0.074		98		141	0.15		1.45			0.079		0.027	7.14	738
18S	6/6/2013	7.33	0.025		61		129	0.15		2.92			0.036		0.012	7.3	648
18S	9/3/2013	8.71	0.048		77		224	0.16		4.38			0.029		0.017	7.1	930
18S	12/11/2013	8.08	0.041		77		188	0.15		2.97			0.03		0.016	7.23	750
18S	3/26/2014	8.26	0.031		76		134	0.1		2.39			0.043		0.016	7.12	702
18S	6/17/2014	8.43	0.028		77		186	0.15		2.81			0.03		0.016	7.45	858
18S	8/20/2014	9.63	0.025		77		192	0.14		3.24			0.023		0.014	7.17	790
18S	3/18/2015	4.77	0.026		74		161	0.13		2.87			0.02		0.009	7.31	644
18S	6/23/2015	3.84	0.007		72		159	0.13		3.01			0.02		0.009	7.33	634
18S	9/16/2015	4.71	0.007		64		238	0.14		5.34			0.02		0.007	7.4	640
18S	12/9/2015	4.40	0.007		74		163	0.15		3.46			0.02		0.007	7.47	538
18S	3/9/2016	4.23	0.007		71		206	0.14		4.44			0.02		0.007	7.37	628
18S	6/8/2016	3.80	0.005		67		213	0.15		4.56			0.02		0.006	7.58	660
18S	8/31/2016	3.92	0.005		69		188	0.12		4.57			0.02		0.005	7.5	668
18S	12/8/2016	3.11	0.005		71		180	0.15		3.49			0.02		0.008	7.28	546
Class I Standard	--	10.00	2	200	200	400	400	4	4	2	2	5	5	0.15	0.15	9	1200
Class I Standard (pH Lower Limit)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.5	--
# of Exceedances	--	22	0	0	0	0	0	0	0	40	7	2	0	4	17	0	0
# of Exceedances (pH Lower Limit)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--
Minimum Value	--	0.27	0.005	31	11	63	40	0.077	0.079	0.059	0.67	0.034	0.02	0.005	0.005	6.41	252
Maximum Value	--	18.00	0.17	121	130	220	238	0.39	0.22	5.34	4.03	8.90	0.09	0.83	0.66	7.98	930
# of Samples Analyzed	--	118	122	28	110	28	110	117	20	128	20	20	118	20	118	128	118

Appendix H1: Illinois EPA Program Monitoring Results
Inorganic Parameters - Upgradient Wells
Hydrogeologic Site Characterization Report
Ash Pond No. 2, Hennepin Power Station

Legend:
Value exceeds 35 IAC 620 Class I groundwater standard
Value below detection limit

Well No.	sample date	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Chloride, total (mg/L)	Chloride, dissolved (mg/L)	Sulfate, total (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Fluoride, total (mg/L)	Boron, dissolved (mg/L)	Boron, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	pH (field) (SU)	Residue, total filtrable (mg/L)
7	3/27/2008									0.05						6.89	
7	5/15/2008									0.05						6.7	
7	8/25/2008									0.05						6.54	
7	10/27/2008									0.052						6.51	
7	12/29/2008	9.54	0.007							0.04	0.04	0.026	0.02	0.005	0.01		615
7	12/29/2008			30	33	67	71	0.113	0.115							6.52	
7	3/25/2009	9.21	0.007							0.041	0.046	0.02	0.02	0.005	0.005		
7	3/25/2009			33	31	61	63.6	0.091	0.086							6.74	638
7	6/18/2009	9.70	0.007							0.036	0.037	0.658	0.02	0.031	0.005		
7	6/18/2009			35	36.8	64	62	0.101	0.089							6.3	680
7	9/29/2009	9.63	0.007							0.035	0.038	0.063	0.02	0.005	0.005		
7	9/29/2009			33	46.3	75	72.2	0.121	0.147							6.66	628
7	12/29/2009	10.40	0.007							0.048	0.051	0.046	0.02	0.005	0.005		
7	12/29/2009			42	42	75	76.5	0.078	0.073							7	624
7	3/16/2010	10.50	0.007							0.052	0.058	0.021	0.02	0.005	0.005		
7	3/16/2010			43	41.4	76	71.5	0.07	0.081							6.82	587
7	6/7/2010		0.007														
7	8/31/2010	11.00	0.007	29		85		0.1		0.05			0.025		0.005	6.57	660
7	12/29/2010	6.80	0.007	46		80		0.13		0.05			0.025		0.005	6.98	790
7	3/16/2011									0.054						6.92	
7	6/29/2011	7.50	0.007		37		94	0.1		0.05			0.025		0.005	6.85	660
7	8/24/2011	14.00	0.007		29		94	0.128		0.05			0.025		0.005	6.58	660
7	10/19/2011	8.10	0.007		27		170	0.088		0.05			0.025		0.005	6.61	700
7	3/1/2012	13.00	0.007		41		89	0.106		0.05			0.025		0.005	6.9	560
7	5/31/2012	12.00	0.007		39		78	0.122		0.05			0.025		0.005	7.16	610
7	8/29/2012	12.00	0.007		35		80	0.107		0.05			0.025		0.005	6.84	650
7	11/27/2012	12.20	0.007		34		101	0.12		0.052			0.02		0.005	7.15	672
7	3/7/2013	9.62	0.007		30		118	0.12		0.045			0.02		0.005	7.02	588
7	6/6/2013	10.30	0.009		36		63	0.13		0.026			0.02		0.005	7.04	576
7	9/4/2013	6.15	0.007		18		61	0.13		0.034			0.02		0.005	7.19	692
7	12/11/2013	8.23	0.008		25		56	0.1		0.037			0.02		0.005	7.24	592
7	3/26/2014	7.51	0.007		22		49	0.1		0.043			0.02		0.005	6.96	576
7	6/18/2014	6.48	0.007		21		57	0.12		0.037			0.02		0.005	7.22	674
7	8/20/2014	11.00	0.007		38		63	0.1		0.037			0.02		0.005	6.81	670
7	12/9/2014	10.20	0.007		48		67	0.1		0.052			0.02		0.005	6.89	718
7	3/19/2015	7.44	0.007		47		68	0.1		0.056			0.02		0.005	7.06	638
7	6/23/2015	7.35	0.007		53		69	0.11		0.067			0.02		0.005	6.78	552
7	9/17/2015	7.92	0.007		43		69	0.12		0.059			0.02		0.005	7.06	560
7	12/9/2015	7.89	0.007		44		76	0.11		0.068			0.02		0.005	6.99	662
7	3/10/2016	9.21	0.007		47		69	0.1		0.055			0.02		0.005	6.9	504
7	6/8/2016	14.20	0.005		57		77	0.11		0.07			0.02		0.005	6.64	728
7	9/1/2016	9.65	0.005		49		71	0.1		0.066			0.02		0.005	6.94	572
7	12/9/2016	14.80	0.005		62		89	0.1		0.067			0.02		0.005	6.75	682
8	3/26/2008									0.14						6.83	
8	5/15/2008									0.095						6.68	
8	8/25/2008									0.099						6.49	
8	10/27/2008									0.083						6.53	
8	12/29/2008	8.31	0.007							0.078	0.079	0.02	0.02	0.005	0.005		779
8	12/29/2008			80	83	83	79	0.114	0.117							6.64	
8	3/25/2009	6.92	0.007							0.081	0.087	0.02	0.02	0.005	0.005		
8	3/25/2009			109	107	84	82.2	0.094	0.09							6.5	800
8	6/18/2009	4.24	0.01							0.054	0.055	0.169	0.02	0.005	0.005		
8	6/18/2009			32	32.2	82	88.6	0.107	0.098							6.27	718
8	9/29/2009	6.81	0.009							0.071	0.075	0.033	0.02	0.005	0.005		
8	9/29/2009			66	82.7	117	117.5	0.123	0.146							6.6	822
8	12/29/2009	9.58	0.023							0.113	0.116	0.021	0.02	0.005	0.005		
8	12/29/2009			140	140	140	134	0.078	0.074							7.07	945
8	3/16/2010	7.91	0.022							0.086	0.096	0.024	0.02	0.005	0.005		
8	3/16/2010			131	130.6	113	116.1	0.071	0.079							6.74	856
8	6/7/2010		0.029														
8	8/31/2010	7.20	0.011	65		110		0.11		0.055			0.025		0.005	6.49	750
8	12/29/2010	7.40	0.007	170		130		0.12		0.097			0.025		0.005	6.72	860
8	3/16/2011	8.90	0.008			110		0.13		0.14						6.83	1100
8	6/29/2011	2.60	0.026	120	130	110	130	0.1	0.1	0.11	0.1	0.025	0.025		0.005	6.76	980
8	8/24/2011	6.30	0.017		100		110	0.126		0.077			0.025		0.005	6.98	860
8	10/19/2011	8.10	0.007		170		130	0.09		0.087			0.025		0.005	6.56	950
8	3/1/2012	7.70	0.009		210		120	0.106		0.11			0.025		0.005	6.95	960
8	5/30/2012	8.30	0.007	190	220	130	120	0.121	0.134	0.11	0.12	0.025	0.025		0.005	6.68	1100

Appendix H1: Illinois EPA Program Monitoring Results
Inorganic Parameters - Upgradient Wells
Hydrogeologic Site Characterization Report
Ash Pond No. 2, Hennepin Power Station

Legend:
Value exceeds 35 IAC 620 Class I groundwater standard
Value below detection limit

Well No.	sample date	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Chloride, total (mg/L)	Chloride, dissolved (mg/L)	Sulfate, total (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Fluoride, total (mg/L)	Boron, dissolved (mg/L)	Boron, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	pH (field) (SU)	Residue, total filtrable (mg/L)
8	8/29/2012	9.60	0.008		280		120	0.107		0.12			0.025		0.005	6.71	1100
8	11/27/2012	10.60	0.012		321		155	0.1		0.13			0.02		0.005	6.99	1230
8	3/7/2013	12.20	0.008		351		149	0.11		0.148			0.02		0.005	7.02	1200
8	6/6/2013	3.26	0.007	92	89	73	67	0.16	0.15	0.113	0.126	0.025	0.02		0.005	7.75	832
8	9/3/2013	7.41	0.007		186		127	0.12		0.087			0.02		0.005	7.05	1100
8	12/11/2013	9.66	0.015		220		118	0.12		0.111			0.02		0.005	7.06	996
8	3/26/2014	9.70	0.008		173		105	0.1		0.139			0.02		0.005	7.15	968
8	6/18/2014	7.04	0.008	127	129	137	120	0.12	0.11	0.095	0.09	0.031	0.02		0.005	7.08	958
8	8/20/2014	7.34	0.017		146		164	0.1		0.096			0.02		0.005	6.8	1010
8	12/9/2014	15.90	0.08		228		218	0.1		0.095			0.026		0.005	6.78	1230
8	3/19/2015	9.01	0.011		216		120	0.1		0.113			0.02		0.005	6.9	1110
8	6/22/2015	7.20	0.024	269	245	108	107	0.1	0.1	0.124	0.141	0.034	0.02		0.003	6.74	1080
8	9/16/2015	8.56	0.021		162		145	0.1		0.093			0.02		0.005	6.84	978
8	12/8/2015	14.60	0.066		220		177	0.1		0.116			0.023		0.005	6.82	1080
8	3/10/2016	10.20	0.04		142		141	0.1		0.077			0.02		0.005	6.73	896
8	6/7/2016	6.68	0.034	170	178	129	142	0.1	0.1	0.081	0.089	0.044	0.02		0.003	6.6	1030
8	9/1/2016	17.30	0.1		304		196	0.1		0.117			0.034		0.005	6.69	1420
8	12/9/2016	14.60	0.08		242		198	0.1		0.099			0.027		0.005	6.63	1230
08D	6/18/2009	11.50	0.025							0.141	0.15	5.48	0.02	0.396	0.206		
08D	6/18/2009			159	162.1	133	129.5	0.158	0.143							6.27	1004
08D	9/29/2009	6.74	0.016							0.132	0.135	0.301	0.02	0.154	0.107		
08D	9/29/2009			130	182.2	118	126.2	0.142	0.164							6.7	978
08D	12/29/2009	8.16	0.02							0.16	0.178	0.051	0.02	0.108	0.11		
08D	12/29/2009			166	169	120	118	0.094	0.096							6.76	1008
08D	3/16/2010	8.65	0.019							0.154	0.161	0.02	0.02	0.09	0.092		
08D	3/16/2010			184	182.1	113	104	0.094	0.106							6.69	1001
08D	6/7/2010		0.034														
08D	8/31/2010	6.70	0.009	180		120		0.15		0.12			0.025		0.043	6.57	1000
08D	12/29/2010	8.30	0.013	170		130		0.15		0.12			0.025		0.033	6.6	970
08D	3/16/2011	7.60	0.014			110		0.16		0.14						6.68	1000
08D	6/29/2011	9.90	0.022	210	230	120	130	0.1	0.112	0.12	0.12	0.26	0.025		0.044	6.67	1100
08D	8/23/2011	8.60	0.007		240		120	0.158		0.13			0.025		0.028	6.51	1100
08D	10/19/2011	8.60	0.007		190		130	0.111		0.13			0.025		0.029	6.6	1100
08D	3/1/2012	7.50	0.007		270		120	0.114		0.084			0.025		0.023	7.02	930
08D	5/30/2012	8.30	0.01	240	290	130	130	0.122	0.135	0.084	0.092	0.31	0.025		0.016	6.69	1000
08D	8/29/2012	9.00	0.007		340		120	0.115		0.082			0.025		0.009	6.86	1100
08D	11/27/2012	6.22	0.007		296		146	0.11		0.094			0.02		0.011	7.01	1080
08D	3/7/2013	10.80	0.01		245		147	0.12		0.098			0.02		0.022	7.05	1020
08D	6/6/2013	8.44	0.075	250	262	126	127	0.16	0.17	0.124	0.136	0.5	0.045		0.053	6.95	1130
08D	9/4/2013	5.88	0.007		180		130	0.14		0.105			0.071		0.054	7.15	1040
08D	12/11/2013	7.05	0.014		154		118	0.14		0.11			0.032		0.032	7.33	948
08D	3/26/2014	8.71	0.029		140		99	0.1		0.119			0.02		0.012	6.96	1010
08D	6/18/2014	10.70	0.026	189	206	143	168	0.14	0.13	0.113	0.128	0.965	0.02		0.015	7.61	1200
08D	8/20/2014	8.83	0.021		215		173	0.12		0.105			0.02		0.017	6.69	1190
08D	12/10/2014	9.31	0.081		204		142	0.12		0.142			0.047		0.066	6.69	1060
08D	3/19/2015	8.95	0.079		223		143	0.1		0.186			0.047		0.053	6.87	1190
08D	6/22/2015	9.62	0.034	236	238	142	155	0.12	0.11	0.133	0.13	0.25	0.03		0.012	6.71	1090
08D	9/16/2015	8.17	0.011		114		103	0.11		0.102			0.02		0.018	6.82	1040
08D	12/8/2015	7.84	0.03		211		124	0.11		0.124			0.02		0.021	6.89	1090
08D	3/10/2016	8.48	0.019		238		128	0.11		0.11			0.02		0.013	6.73	1040
08D	6/7/2016	7.78	0.016	231	228	118	129	0.11	0.11	0.107	0.106	0.02	0.02		0.027	6.64	1020
08D	9/1/2016	13.00	0.058		317		155	0.11		0.123			0.029		0.01	6.63	1380
08D	12/9/2016	9.87	0.031		325		171	0.1		0.103			0.02		0.005	6.59	1340
Class I Standard	--	10.00	2	200	200	400	400	4	4	2	2	5	5	0.15	0.15	9	1200
Class I Standard (pH Lower Limit)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.5	--
# of Exceedances	--	24	0	6	30	0	0	0	0	0	0	1	0	2	1	0	6
# of Exceedances (pH Lower Limit)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	--
Minimum Value	--	2.60	0.005	29.00	18.00	61.00	49.00	0.070	0.073	0.026	0.037	0.02	0.02	0.005	0.003	6.270	504
Maximum Value	--	17.30	0.10	269.00	351.00	####	#####	0.16	0.17	0.19	0.18	5.48	0.07	0.40	0.21	7.75	1420
# of Samples Analyzed	--	93	96	34	85	36	85	93	28	102	28	28	91	16	91	102	93

Appendix H1: Illinois EPA Program Monitoring Results
Trace Metal Parameters - Downgradient Wells
Hydrogeologic Site Characterization Report
Ash Pond No. 2, Hennepin Power Station

Legend:
Value exceeds 35 IAC 620 Class I groundwater standard
Value below detection limit

Well No.	sample date	Antimony, dissolved (mg/L)	Antimony, total (mg/L)	Arsenic, dissolved (mg/L)	Arsenic, total (mg/L)	Barium, dissolved (mg/L)	Barium, total (mg/L)	Beryllium, dissolved (mg/L)	Beryllium, total (mg/L)	Cadmium, dissolved (mg/L)	Cadmium,total (mg/L)	Chromium, dissolved (mg/L)	Chromium, total (mg/L)	Cobalt, dissolved (mg/L)	Cobalt, total (mg/L)	Copper, dissolved (mg/L)	Copper, total (mg/L)	Lead, dissolved (mg/L)	Lead, total (mg/L)	Mercury, dissolved (mg/L)	Mercury, total (mg/L)	Nickel, dissolved (mg/L)	Nickel, total (mg/L)	Selenium, dissolved (mg/L)	Selenium, total (mg/L)	Silver, dissolved (mg/L)	Silver, total (mg/L)	Thallium, dissolved (mg/L)	Thallium, total (mg/L)	Vanadium, dissolved (mg/L)	Vanadium, total (mg/L)	Zinc, dissolved (mg/L)	Zinc, total (mg/L)
3	12/29/2008	0.005	0.005	0.003	0.003	0.077	0.082	0.001	0.001	0.004	0.005	0.01	0.01	0.0164	0.013	0.016	0.018	0.002	0.002	0.0002	0.0002	0.039	0.039	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.016	0.017
3	3/25/2009	0.005	0.005	0.003	0.003	0.085	0.09	0.001	0.001	0.007	0.006	0.01	0.01	0.0126	0.013	0.024	0.024	0.002	0.002	0.0002	0.0002	0.049	0.051	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.016	0.018
3	6/18/2009	0.005	0.005	0.003	0.004	0.098	0.133	0.001	0.001	0.006	0.007	0.01	0.014	0.0186	0.022	0.024	0.038	0.002	0.008	0.0002	0.0002	0.073	0.087	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.012	0.018	0.064
3	9/29/2009	0.005	0.005	0.003	0.003	0.084	0.089	0.001	0.001	0.006	0.006	0.01	0.01	0.0129	0.012	0.023	0.026	0.002	0.002	0.0002	0.0002	0.043	0.045	0.007	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.018	0.02
3	12/22/2009	0.005	0.005	0.003	0.003	0.083	0.085	0.001	0.001	0.005	0.006	0.01	0.01	0.0117	0.013	0.019	0.021	0.002	0.002	0.0002	0.0002	0.039	0.038	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.015	0.017
3	3/16/2010	0.005	0.005	0.003	0.003	0.084	0.086	0.001	0.001	0.005	0.005	0.01	0.01	0.0115	0.012	0.024	0.023	0.002	0.002	0.0002	0.0002	0.052	0.05	0.006	0.008	0.01	0.01	0.002	0.002	0.01	0.01	0.016	0.018
3	8/31/2010	0.005		0.005		0.074		0.002		0.002		0.01		0.005		0.029		0.005		0.0002		0.051		0.016		0.002				0.002		0.021	
3	12/28/2010	0.005		0.007		0.096		0.002		0.009		0.01		0.011		0.046		0.005		0.0002		0.059		0.01		0.002				0.002		0.031	
3	6/29/2011	0.005		0.01		0.076		0.004		0.005		0.005		0.005		0.005		0.005		0.002		0.054		0.014		0.002		0.002				0.026	
3	8/23/2011	0.005		0.01		0.08		0.004		0.006		0.005		0.01		0.033		0.005		0.0002		0.054		0.012		0.002		0.002				0.025	
3	10/18/2011	0.005		0.003		0.085		0.004		0.007		0.005		0.01		0.031		0.004		0.0002		0.046		0.013		0.002		0.002				0.023	
3	3/1/2012	0.005		0.003		0.086		0.004		0.007		0.005		0.01		0.034		0.004		0.0002		0.062		0.011		0.002		0.002				0.023	
3	5/30/2012	0.005		0.003		0.089		0.004		0.007		0.005		0.01		0.037		0.004		0.0002		0.058		0.015		0.002		0.002				0.023	
3	8/29/2012	0.005		0.003		0.083		0.004		0.009		0.005		0.012		0.043		0.004		0.0002		0.062		0.014		0.002		0.002				0.032	
3	11/27/2012	0.005		0.003		0.093		0.001		0.01		0.005		0.0112		0.052		0.002		0.0002		0.066		0.006		0.002		0.002				0.036	
3	3/7/2013	0.005		0.003		0.104		0.001		0.011		0.005		0.014		0.058		0.002		0.0002		0.086		0.006		0.002		0.002				0.036	
3	6/6/2013	0.005		0.003		0.072		0.001		0.006		0.005		0.0102		0.027		0.002		0.0002		0.06		0.006		0.002		0.002				0.021	
3	9/3/2013	0.005		0.003		0.093		0.001		0.009		0.005		0.011		0.042		0.002		0.0002		0.07		0.011		0.002		0.002				0.033	
3	12/11/2013	0.005		0.003		0.096		0.001		0.007		0.005		0.0081		0.035		0.002		0.0002		0.057		0.006		0.002		0.002				0.027	
3	3/26/2014	0.005		0.003		0.093		0.001		0.006		0.005		0.0093		0.034		0.002		0.0002		0.051		0.006		0.002		0.002				0.024	
3	6/17/2014	0.005		0.003		0.094		0.001		0.007		0.005		0.0106		0.035		0.002		0.0002		0.06		0.006		0.002		0.002				0.026	
3	8/20/2014	0.001		0.001		0.084		0.001		0.006		0.005		0.0067		0.029		0.001		0.0002		0.041		0.004		0.002		0.001				0.026	
03R	3/18/2015	0.001		0.001		0.063		0.001		0.003		0.005		0.005		0.012		0.001		0.0002		0.007		0.003		0.002		0.001				0.013	
03R	6/23/2015	0.001		0.001		0.072		0.001		0.002		0.005		0.005		0.012		0.001		0.0002		0.011		0.006		0.002		0.001				0.011	
03R	9/16/2015	0.001		0.001		0.073		0.001		0.002		0.005		0.005		0.007		0.001		0.0002		0.009		0.005		0.002		0.001				0.008	
03R	12/9/2015	0.001		0.001		0.063		0.001		0.002		0.005		0.005		0.008		0.001		0.0002		0.004		0.005		0.002		0.001				0.007	
03R	3/9/2016	0.001		0.001		0.062		0.001		0.002		0.005		0.005		0.006		0.001		0.0002		0.005		0.005		0.002		0.001				0.006	
03R	6/8/2016	0.001		0.001		0.064		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.008		0.007		0.002		0.001				0.005	
03R	8/31/2016	0.001		0.001		0.061		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.005		0.006		0.002		0.001				0.005	
03R	12/8/2016	0.001		0.001		0.056		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.005		0.002		0.001				0.005	
6	12/29/2008	0.005	0.005	0.003	0.003	0.083	0.089	0.001	0.001	0.005	0.006	0.01	0.01	0.0181	0.018	0.028	0.029	0.002	0.002	0.0002	0.0002	0.059	0.064	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.032	0.033
6	3/25/2009	0.005	0.005	0.003	0.003	0.078	0.085	0.001	0.001	0.004	0.004	0.01	0.01	0.0177	0.018	0.019	0.018	0.002	0.002	0.0002	0.0002	0.064	0.064	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.03	0.033
6	6/18/2009	0.005	0.005	0.003	0.003	0.085	0.087	0.001	0.001	0.005	0.005	0.01	0.01	0.0238	0.024	0.022	0.028	0.002	0.002	0.0002	0.0002	0.086	0.088	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.034	0.034
6	9/29/2009	0.005	0.005	0.003	0.003	0.069	0.073	0.001	0.001	0.005	0.005	0.01	0.01	0.0205	0.022	0.026	0.029	0.002	0.002	0.0002	0.0002	0.065	0.061	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.036	0.031
6	12/22/2009	0.005	0.005	0.003	0.003	0.073	0.078	0.001	0.001	0.006	0.006	0.01	0.01	0.029	0.031	0.03	0.029	0.002	0.002	0.0002	0.0002	0.082	0.085	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.04	0.044
6	3/16/2010	0.005	0.005	0.003	0.003	0.079	0.087	0.001	0.001	0.007	0.008	0.01	0.01	0.0282	0.032	0.036	0.041	0.002	0.002	0.0002	0.0002	0.101	0.114	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.047	0.051
6	8/31/2010	0.005		0.005		0.065		0.002		0.006		0.01		0.016		0.033		0.005		0.0002		0.06		0.005		0.002				0.002		0.044	
6	12/28/2010	0.005		0.005		0.079		0.002		0.009		0.01		0.018		0.05		0.005		0.0002		0.074		0.005		0.002				0.002		0.063	
6	6/29/2011	0.005		0.01		0.063		0.004		0.006		0.005		0.014		0.036		0.005		0.002		0.061		0.01		0.002		0.002				0.05	
6	8/23/2011	0.005		0.01		0.066		0.004		0.005		0.005		0.012		0.031		0.005		0.0002		0.054		0.01		0.002		0.002				0.042	
6	10/18/2011	0.005		0.003		0.067		0.004		0.005		0.005		0.01		0.032		0.004		0.0002		0.053		0.01		0.002		0.002				0.041	
6	3/1/2012	0.005		0.003		0.064		0.004		0.005		0.005		0.011		0.033		0.004		0.0002		0.066		0.01		0.002		0.002				0.041	
6	5/30/2012	0.005		0.003		0.069		0.004		0.006		0.005		0.013		0.036		0.004		0.0002		0.078		0.01		0.002		0.002				0.043	
6	8/29/2012	0.005		0.003		0.063		0.004		0.007		0.005		0.014		0.04		0.004		0.0002		0.071		0.01		0.002		0.002				0.052	
6	11/27/2012	0.005		0.003		0.071		0.001		0.011		0.005		0.0145		0.063		0.002		0.0002		0.078		0.006		0.002		0.002				0.075	
6	3/7/2013	0.005		0.003		0.076		0.001		0.011		0.005		0.0157		0.061		0.002		0.0002		0.085		0.006		0.002		0.002				0.071	
6	6/6/2013	0.005		0.003		0.073		0.001		0.009		0.005		0.0177		0.043		0.002		0.0002		0.089		0.006		0.002		0.002				0.054	
6	9/3/2013	0.005		0.003		0.078		0.001		0.009		0.005		0.0128		0.044		0.002		0.0002		0.076		0.006		0.002		0.002				0.059	
6	12/11/2013	0.005		0.003		0.072		0.001		0.007		0.005		0.0093		0.039		0.002		0.0002		0.051		0.006		0.002		0.002				0.05	
6	3/26/2014	0.005		0.003		0.074		0.001		0.007		0.005		0.0123		0.038		0.002		0.0002		0.059		0.006		0.002		0.002				0.048	
6	6/17/2014	0.005		0.003		0.076		0.001		0.008		0.005		0.0142		0.04		0.002		0.0002		0.075		0.006		0.002		0.002				0.055	
6	8/20/2014	0.001		0.001		0.073		0.001		0.007		0.005		0.0112		0.036		0.001		0.0002		0.06		0.002		0.002		0.001				0.051	
6	12/9/2014	0.001		0.001		0.054		0.001		0.004		0.005		0.005		0.018		0.001		0.0002		0.007		0.001		0.002		0.001				0.032	
6	3/18/2015	0.001		0.001		0.053		0.001		0.004		0.005		0.005		0.016		0.001		0.0002		0.009		0.001		0.002		0.001				0.026	
6	3/19/2015	0.001		0.001		0.066		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.001		0.002		0.001				0.005	
6	6/22/2015	0.001		0.001		0.04		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.006		0.001		0.002		0.001				0.01	
6	9/16/2015	0.001		0.001		0.066		0.001		0.003		0.005		0.005		0.012		0.001		0.0002		0.013		0.003		0.002		0.001				0.019	
6	12/9/2015	0.001		0.001		0.057		0.001		0.002		0.005		0.005		0.009		0.001		0.0002		0.005		0.001		0.002		0.001				0.016	
6	3/9/2016	0.001		0.001		0.064		0.001		0.002		0.005		0.005		0.008		0.001		0.0002		0.007		0.003		0.002		0.001				0.013	
6	6/8/2016	0.001		0.001		0.068		0.001		0.002		0.005		0.0066		0.008		0.001		0.0002		0.026		0.001		0.002		0.001				0.014	
6	8/31/2016	0.001		0.001		0.058		0.001		0.002		0.005		0.005		0.007		0.001		0.0002		0.01		0.001		0.002		0.001				0.01	
6	12/8/2016	0.001		0.001		0.052		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.003		0.001		0.002		0.001				0.007	

Appendix H1: Illinois EPA Program Monitoring Results
Trace Metal Parameters - Downgradient Wells
Hydrogeologic Site Characterization Report
Ash Pond No. 2, Hennepin Power Station

Legend:
- Value exceeds 35 IAC 620 Class I groundwater standard (pink shading)
- Value below detection limit (blue shading)

Well No.	sample date	Antimony, dissolved (mg/L)	Antimony, total (mg/L)	Arsenic, dissolved (mg/L)	Arsenic, total (mg/L)	Barium, dissolved (mg/L)	Barium, total (mg/L)	Beryllium, dissolved (mg/L)	Beryllium, total (mg/L)	Cadmium, dissolved (mg/L)	Cadmium,total (mg/L)	Chromium, dissolved (mg/L)	Chromium, total (mg/L)	Cobalt, dissolved (mg/L)	Cobalt, total (mg/L)	Copper, dissolved (mg/L)	Copper, total (mg/L)	Lead, dissolved (mg/L)	Lead, total (mg/L)	Mercury, dissolved (mg/L)	Mercury, total (mg/L)	Nickel, dissolved (mg/L)	Nickel, total (mg/L)	Selenium, dissolved (mg/L)	Selenium, total (mg/L)	Silver, dissolved (mg/L)	Silver, total (mg/L)	Thallium, dissolved (mg/L)	Thallium, total (mg/L)	Vanadium, dissolved (mg/L)	Vanadium, total (mg/L)	Zinc, dissolved (mg/L)	Zinc, total (mg/L)
18D	6/18/2009	0.005	0.005	0.003	0.004	0.103	0.127	0.001	0.001	0.002	0.002	0.01	0.012	0.0139	0.016	0.01	0.014	0.002	0.007	0.0002	0.0002	0.078	0.088	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.039
18D	9/29/2009	0.005	0.005	0.003	0.003	0.08	0.087	0.001	0.001	0.002	0.002	0.01	0.01	0.0125	0.014	0.01	0.01	0.002	0.002	0.0002	0.0002	0.071	0.08	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
18D	12/22/2009	0.005	0.005	0.003	0.003	0.095	0.1	0.001	0.001	0.002	0.002	0.01	0.01	0.0129	0.015	0.01	0.01	0.002	0.002	0.0002	0.0002	0.063	0.067	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
18D	3/16/2010	0.005	0.005	0.003	0.003	0.088	0.086	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.032	0.025	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
18D	8/31/2010	0.005		0.005		0.092		0.002		0.002		0.01		0.0096		0.01		0.005		0.0002		0.049		0.005		0.002				0.002		0.005	
18D	12/28/2010	0.005		0.005		0.076		0.002		0.002		0.01		0.012		0.004		0.005		0.0002		0.056		0.009		0.002				0.002		0.006	
18D	6/29/2011	0.005		0.01		0.066		0.004		0.005		0.005		0.005		0.005		0.005		0.002		0.016		0.01		0.002		0.002				0.005	
18D	8/23/2011	0.005		0.01		0.08		0.004		0.005		0.005		0.0094		0.005		0.005		0.0002		0.046		0.013		0.002		0.002				0.005	
18D	10/18/2011	0.005		0.003		0.091		0.004		0.005		0.005		0.012		0.005		0.004		0.0002		0.055		0.01		0.002		0.002				0.006	
18D	3/1/2012	0.005		0.003		0.071		0.004		0.005		0.005		0.0094		0.005		0.004		0.0002		0.045		0.01		0.002		0.002				0.005	
18D	5/30/2012	0.005		0.003		0.091		0.004		0.005		0.005		0.0094		0.005		0.004		0.0002		0.046		0.01		0.002		0.002				0.005	
18D	8/29/2012	0.005		0.003		0.089		0.004		0.005		0.005		0.01		0.005		0.004		0.0002		0.05		0.01		0.002		0.002				0.005	
18D	11/27/2012	0.005		0.003		0.094		0.001		0.002		0.005		0.0129		0.006		0.002		0.0002		0.059		0.006		0.002		0.002				0.012	
18D	3/7/2013	0.005		0.003		0.094		0.001		0.002		0.005		0.0117		0.007		0.002		0.0002		0.057		0.006		0.002		0.002				0.01	
18D	6/6/2013	0.005		0.003		0.104		0.001		0.002		0.005		0.0114		0.008		0.002		0.0002		0.064		0.006		0.002		0.002				0.011	
18D	9/3/2013	0.005		0.003		0.097		0.001		0.002		0.005		0.0134		0.007		0.002		0.0002		0.061		0.006		0.002		0.002				0.009	
18D	12/11/2013	0.005		0.003		0.096		0.001		0.002		0.005		0.0093		0.005		0.002		0.0002		0.042		0.006		0.002		0.002				0.005	
18D	3/26/2014	0.005		0.003		0.086		0.001		0.002		0.005		0.0118		0.005		0.002		0.0002		0.044		0.006		0.002		0.002				0.005	
18D	6/17/2014	0.005		0.003		0.106		0.001		0.002		0.005		0.0149		0.005		0.002		0.0002		0.064		0.006		0.002		0.002				0.007	
18D	8/20/2014	0.001		0.001		0.099		0.001		0.002		0.005		0.016		0.005		0.001		0.0002		0.059		0.001		0.002		0.001				0.01	
18D	3/18/2015	0.001		0.001		0.091		0.001		0.002		0.005		0.0103		0.006		0.001		0.0002		0.056		0.001		0.002		0.001				0.011	
18D	6/23/2015	0.001		0.001		0.093		0.001		0.002		0.005		0.008		0.007		0.001		0.0002		0.049		0.001		0.002		0.001				0.011	
18D	9/16/2015	0.001		0.001		0.091		0.001		0.002		0.005		0.0126		0.005		0.001		0.0002		0.05		0.001		0.002		0.001				0.008	
18D	12/9/2015	0.001		0.001		0.082		0.001		0.002		0.005		0.0087		0.005		0.001		0.0002		0.043		0.001		0.002		0.001				0.008	
18D	3/9/2016	0.001		0.001		0.085		0.001		0.002		0.005		0.0091		0.005		0.001		0.0002		0.043		0.001		0.002		0.001				0.006	
18D	6/8/2016	0.001		0.001		0.088		0.001		0.002		0.005		0.0112		0.005		0.001		0.0002		0.045		0.001		0.002		0.001				0.006	
18D	8/31/2016	0.001		0.001		0.084		0.001		0.002		0.005		0.0078		0.005		0.001		0.0002		0.039		0.001		0.002		0.001				0.005	
18D	12/8/2016	0.001		0.001		0.083		0.001		0.002		0.005		0.0089		0.005		0.001		0.0002		0.039		0.001		0.002		0.001				0.005	
18S	6/18/2009	0.005	0.005	0.003	0.003	0.108	0.121	0.001	0.001	0.005	0.005	0.01	0.01	0.0192	0.021	0.024	0.033	0.002	0.002	0.0002	0.0002	0.081	0.089	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.012	0.015	0.021
18S	9/29/2009	0.005	0.005	0.003	0.003	0.098	0.111	0.001	0.001	0.004	0.005	0.01	0.01	0.0112	0.012	0.018	0.022	0.002	0.002	0.0002	0.0002	0.059	0.06	0.008	0.009	0.01	0.01	0.002	0.002	0.01	0.012	0.011	0.016
18S	12/22/2009	0.005	0.005	0.003	0.003	0.095	0.106	0.001	0.001	0.004	0.004	0.01	0.01	0.0118	0.014	0.02	0.02	0.002	0.002	0.0002	0.0002	0.046	0.05	0.009	0.01	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.017
18S	3/16/2010	0.005	0.005	0.003	0.003	0.081	0.087	0.001	0.001	0.003	0.003	0.01	0.01	0.01	0.01	0.012	0.013	0.002	0.002	0.0002	0.0002	0.033	0.033	0.006	0.008	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
18S	8/31/2010	0.005		0.005		0.089		0.002		0.004		0.01		0.0093		0.024		0.005		0.0002		0.046		0.029		0.002				0.009		0.013	
18S	12/28/2010	0.005		0.005		0.085		0.002		0.006		0.01		0.01		0.041		0.005		0.0002		0.06		0.014		0.002				0.008		0.021	
18S	6/29/2011	0.005		0.01		0.077		0.004		0.005		0.005		0.0093		0.034		0.005		0.002		0.006		0.024		0.002		0.002				0.02	
18S	8/23/2011	0.005		0.01		0.098		0.004		0.005		0.005		0.0081		0.026		0.005		0.0002		0.053		0.045		0.002		0.002				0.015	
18S	10/18/2011	0.005		0.003		0.099		0.004		0.005		0.005		0.0092		0.029		0.004		0.0002		0.057		0.026		0.002		0.002				0.016	
18S	3/1/2012	0.005		0.003		0.087		0.004		0.005		0.005		0.0084		0.035		0.004		0.0002		0.054		0.017		0.002		0.002				0.019	
18S	5/30/2012	0.005		0.003		0.098		0.004		0.005		0.005		0.008		0.032		0.004		0.0002		0.056		0.041		0.002		0.002				0.016	
18S	8/29/2012	0.005		0.003		0.092		0.004		0.005		0.005		0.01		0.036		0.004		0.0002		0.063		0.031		0.002		0.002				0.021	
18S	11/27/2012	0.005		0.003		0.1		0.001		0.006		0.005		0.0105		0.041		0.002		0.0002		0.069		0.018		0.002		0.002				0.023	
18S	3/7/2013	0.005		0.003		0.11		0.001		0.007		0.005		0.013		0.053		0.002		0.0002		0.087		0.01		0.002		0.002				0.028	
18S	6/6/2013	0.005		0.003		0.072		0.001		0.003		0.005		0.0069		0.014		0.002		0.0002		0.035		0.02		0.002		0.002				0.007	
18S	9/3/2013	0.005		0.003		0.113		0.001		0.006		0.009		0.0095		0.035		0.002		0.0002		0.077		0.079		0.002		0.002				0.02	
18S	12/11/2013	0.005		0.003		0.108		0.001		0.005		0.005		0.0077		0.033		0.002		0.0002		0.062		0.033		0.002		0.002				0.019	
18S	3/26/2014	0.005		0.003		0.102		0.001		0.005		0.005		0.0087		0.032		0.002		0.0002		0.061		0.019		0.002		0.002				0.02	
18S	6/17/2014	0.005		0.003		0.104		0.001		0.005		0.005		0.009		0.03		0.002		0.0002		0.06		0.028		0.002		0.002				0.019	
18S	8/20/2014	0.001		0.001		0.1		0.001		0.004		0.005		0.0078		0.027		0.001		0.0002		0.055		0.034		0.002		0.001				0.019	
18S	3/18/2015	0.001		0.001		0.086		0.001		0.003		0.005		0.005		0.017		0.001		0.0002		0.024		0.035		0.002		0.001				0.011	
18S	6/23/2015	0.001		0.001		0.086		0.001		0.002		0.005		0.005		0.013		0.001		0.0002		0.017		0.034		0.002		0.001				0.008	
18S	9/16/2015	0.001		0.001		0.082		0.001		0.002		0.005		0.005		0.008		0.001		0.0002		0.011		0.059		0.002		0.001				0.005	
18S	12/9/2015	0.001		0.001		0.078		0.001		0.002		0.005		0.005		0.009		0.001		0.0002		0.012		0.033		0.002		0.001				0.006	
18S	3/9/2016	0.001		0.001		0.079		0.001		0.002		0.005		0.005		0.006		0.001		0.0002		0.009		0.056		0.002		0.001				0.005	
18S	6/8/2016	0.001		0.001		0.079		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.006		0.059		0.002		0.001				0.005	
18S	8/31/2016	0.001		0.001		0.076		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.005		0.045		0.002		0.001				0.005	
18S	12/8/2016	0.001		0.001		0.067		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.004		0.051		0.002		0.001				0.005	
Class I Standard		0.006	0.006	0.01	0.01	2	2	0.004	0.004	0.005	0.005	0.1	0.1	1	1	0.65	0.65	0.0075	0.0075	0.002	0.002	0.1	0.1	0.05	0.05	0.05	0.05	0.002	0.002	0.049	0.049	5	5
# of Exceedances		0	0	0	0	0	0	0	0	36	7	0	0	0	0	0	0	0	1	0	0	1	1	5	0	0	0	0	0	0	0	0	0
Minimum Value		0.001	0.005	0.001	0.003	0.040	0.073	0.001	0.001	0.002	0.002	0.005	0.010	0.005	0.010	0.004	0.010	0.001	0.002	0.0002	0.0002	0.002	0.025	0.001	0.006	0.002	0.010	0.001	0.002	0.002	0.010	0.005	0.010
Maximum Value		0.005	0.005	0.010	0.004	0.113	0.127	0.004	0.001	0.011	0.008	0.010	0.012	0.029	0.032	0.063	0.041	0.005	0.007	0.0020	0.0002	0.101	0.114	0.079	0.010	0.010	0.010	0.002	0.002	0.010	0.012	0.075	0.051
# of Samples Analyzed		118	20	118	20	118	20	118	20	118	20	118	20	118	20	118	20	118	20	118	20	118	20	118	20	118	20	110	20	28	20	118	20

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Appendix H1: Illinois EPA Program Monitoring Results
Trace Metal Parameters - Upgradient Wells
Hydrogeologic Site Characterization Report
Ash Pond No. 2, Hennepin Power Station

Legend:
Value exceeds 35 IAC 620 Class I groundwater standard
Value below detection limit

Well No.	sample_date	Antimony, dissolved (mg/L)	Antimony, total (mg/L)	Arsenic, dissolved (mg/L)	Arsenic, total (mg/L)	Barium, dissolved (mg/L)	Barium, total (mg/L)	Beryllium, dissolved (mg/L)	Beryllium, total (mg/L)	Cadmium, dissolved (mg/L)	Cadmium,total (mg/L)	Chromium, dissolved (mg/L)	Chromium, total (mg/L)	Cobalt, dissolved (mg/L)	Cobalt, total (mg/L)	Copper, dissolved (mg/L)	Copper, total (mg/L)	Lead, dissolved (mg/L)	Lead, total (mg/L)	Mercury, dissolved (mg/L)	Mercury, total (mg/L)	Nickel, dissolved (mg/L)	Nickel, total (mg/L)	Selenium, dissolved (mg/L)	Selenium, total (mg/L)	Silver, dissolved (mg/L)	Silver, total (mg/L)	Thallium, dissolved (mg/L)	Thallium, total (mg/L)	Vanadium, dissolved (mg/L)	Vanadium, total (mg/L)	Zinc, dissolved (mg/L)	Zinc, total (mg/L)
7	12/29/2008	0.005	0.005	0.003	0.003	0.09	0.094	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.01	0.01	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
7	3/25/2009	0.005	0.005	0.003	0.003	0.106	0.112	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.01	0.01	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
7	6/18/2009	0.005	0.005	0.003	0.003	0.095	0.102	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.01	0.01	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
7	9/29/2009	0.005	0.005	0.003	0.003	0.088	0.096	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.01	0.01	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
7	12/29/2009	0.005	0.005	0.003	0.003	0.091	0.099	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.01	0.01	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
7	3/16/2010	0.005	0.005	0.003	0.003	0.088	0.095	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.01	0.01	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
7	8/31/2010	0.005		0.005		0.079		0.002		0.002		0.01		0.005		0.01		0.005		2		0.005		0.005		0.002				0.002		0.005	
7	12/29/2010	0.005		0.005		0.087		0.002		0.002		0.01		0.005		0.008		0.005		2		0.002		0.008		0.002				0.002		0.015	
7	6/29/2011	0.005		0.01		0.075		0.004		0.005		0.005		0.005		0.005		0.005		0.002		0.005		0.01		0.002		0.002				0.005	
7	8/24/2011	0.005		0.01		0.079		0.004		0.005		0.005		0.005		0.005		0.005		0.0002		0.005		0.01		0.002		0.002				0.005	
7	10/19/2011	0.005		0.003		0.092		0.004		0.005		0.005		0.005		0.005		0.004		0.0002		0.002		0.01		0.002		0.002				0.005	
7	3/1/2012	0.005		0.003		0.067		0.004		0.005		0.005		0.005		0.005		0.004		0.0002		0.002		0.01		0.002		0.002				0.005	
7	5/31/2012	0.005		0.003		0.038		0.004		0.005		0.005		0.005		0.005		0.004		0.0002		0.002		0.01		0.002		0.002				0.005	
7	8/29/2012	0.005		0.003		0.072		0.004		0.005		0.005		0.005		0.005		0.004		0.0002		0.002		0.01		0.002		0.002				0.005	
7	11/27/2012	0.005		0.003		0.082		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.002		0.006		0.002		0.002				0.005	
7	3/7/2013	0.005		0.003		0.089		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.002		0.006		0.002		0.002				0.005	
7	6/6/2013	0.005		0.003		0.071		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.002		0.006		0.002		0.002				0.005	
7	9/4/2013	0.005		0.003		0.089		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.002		0.006		0.002		0.002				0.005	
7	12/11/2013	0.005		0.003		0.087		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.002		0.006		0.002		0.002				0.005	
7	3/26/2014	0.005		0.003		0.087		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.002		0.006		0.002		0.002				0.005	
7	6/18/2014	0.005		0.003		0.092		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.003		0.006		0.002		0.002				0.005	
7	8/20/2014	0.001		0.001		0.092		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.001		0.002		0.001				0.005	
7	12/9/2014	0.001		0.001		0.108		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.005		0.001		0.002		0.001				0.005	
7	3/19/2015	0.001		0.001		0.095		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.001		0.002		0.001				0.005	
7	6/23/2015	0.001		0.001		0.093		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.001		0.002		0.001				0.005	
7	9/17/2015	0.001		0.001		0.095		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.001		0.002		0.001				0.005	
7	12/9/2015	0.001		0.001		0.132		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.006		0.001		0.002		0.001				0.005	
7	3/10/2016	0.001		0.001		0.098		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.001		0.002		0.001				0.005	
7	6/8/2016	0.001		0.001		0.129		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.001		0.002		0.001				0.005	
7	9/1/2016	0.001		0.001		0.106		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.001		0.002		0.001				0.014	
7	12/9/2016	0.001		0.001		0.124		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.017		0.001		0.002		0.001				0.005	
8	12/29/2008	0.005	0.005	0.003	0.003	0.131	0.132	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.01	0.012	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
8	3/25/2009	0.005	0.005	0.003	0.003	0.143	0.153	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.011	0.011	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
8	6/18/2009	0.005	0.005	0.003	0.003	0.141	0.147	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.013	0.013	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
8	9/29/2009	0.005	0.005	0.003	0.003	0.124	0.13	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.01	0.012	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
8	12/29/2009	0.005	0.005	0.003	0.003	0.134	0.141	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.038	0.039	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
8	3/16/2010	0.005	0.005	0.003	0.003	0.114	0.123	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.019	0.023	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
8	8/31/2010	0.005		0.005		0.11		0.002		0.002		0.01		0.005		0.01		0.005		2		0.013		0.008		0.002				0.002		0.005	
8	12/29/2010	0.005		0.008		0.12		0.002		0.002		0.01		0.005		0.001		0.005		2		0.007		0.008		0.002				0.002		0.005	
8	3/16/2011			0.005		0.15				0.002		0.01						0.005		2				0.016								0.005	
8	6/29/2011	0.005		0.01	0.01	0.11	0.11	0.004		0.005	0.005	0.005	0.005	0.005		0.005	0.005	0.005	0.005	0.002	0.002	0.037		0.01	0.01	0.002		0.002		0.005	0.005	0.005	0.005
8	8/24/2011	0.005		0.01		0.12		0.004		0.005		0.005		0.005		0.005		0.005		0.0002		0.021		0.01		0.002		0.002				0.005	
8	10/19/2011	0.005		0.003		0.13		0.004		0.005		0.005		0.005		0.005		0.004		0.0002		0.009		0.01		0.002		0.002				0.005	
8	3/1/2012	0.005		0.003		0.12		0.004		0.005		0.005		0.005		0.005		0.004		0.0002		0.021		0.01		0.002		0.002				0.005	
8	5/30/2012	0.005		0.005	0.003	0.15	0.13	0.004		0.005	0.005	0.005	0.005	0.005		0.005	0.005	0.004	0.004	0.0002	0.0002	0.019		0.01	0.01	0.002		0.002		0.005	0.005	0.005	0.005
8	8/29/2012	0.005		0.004		0.13		0.004		0.005		0.005		0.005		0.005		0.004		0.0002		0.021		0.01		0.002		0.002				0.005	
8	11/27/2012	0.005		0.003		0.161		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.032		0.006		0.002		0.002				0.005	
8	3/7/2013	0.005		0.003		0.173		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.032		0.006		0.002		0.002				0.005	
8	6/6/2013	0.005		0.003	0.003	0.11	0.127	0.001		0.002	0.002	0.005	0.005	0.005		0.005	0.005	0.002	0.002	0.0002	0.0002	0.01		0.006	0.006	0.003		0.002		0.01	0.01	0.005	0.007
8	9/3/2013	0.005		0.003		0.165		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.037		0.006		0.002		0.002				0.005	
8	12/11/2013	0.005		0.003		0.167		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.03		0.006		0.002		0.002				0.005	
8	3/26/2014	0.005		0.003		0.154		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.024		0.006		0.002		0.002				0.005	
8	6/18/2014	0.005		0.003	0.003	0.146	0.164	0.001		0.002	0.002	0.005	0.005	0.005		0.005	0.005	0.002	0.002	0.0002	0.0002	0.024		0.006	0.006	0.003		0.002		0.01	0.01	0.005	0.005
8	8/20/2014	0.001		0.001		0.142		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.048		0.001		0.002		0.001				0.007	
8	12/9/2014	0.001		0.001		0.126		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.121		0.001		0.002		0.001				0.005	
8	3/19/2015	0.001		0.001		0.119		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.04		0.001		0.002		0.001				0.005	
8	6/22/2015	0.001		0.001	0.001	0.125	0.136	0.0005		0.002	0.002	0.005	0.005	0.005		0.005	0.005	0.001	0.001	0.0002	0.0002	0.051		0.001	0.001	0.003		0.001		0.01	0.01	0.005	0.005
8	9/16/2015	0.001		0.001		0.124		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.055		0.001		0.002		0.001				0.005	
8	12/8/2015	0.001		0.001		0.111		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.104		0.001		0.002		0.001				0.005	
8	3/10/2016	0.001		0.001		0.132		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.066		0.001		0.002		0.001				0.005	
8	6/7/2016	0.001		0.001	0.001	0.115	0.123	0.0005		0.002	0.002	0.005	0.005	0.005		0.005	0.005	0.001	0.001	0.0002	0.0002	0.086		0.001	0.001	0.003		0.001		0.01	0.01	0.005	0.005
8	9/1/2016	0.001		0.001		0.144		0.001		0.002		0.005		0.0244		0.005		0.001		0.0002		0.234		0.001		0.002		0.001				0.005	
8	12/9/2016	0.001		0.001		0.109		0.001		0.002		0.005		0.0205		0.005		0.001		0.0002		0.183		0.001		0.002		0.001				0.005	

Appendix H1: Illinois EPA Program Monitoring Results
Trace Metal Parameters - Upgradient Wells
Hydrogeologic Site Characterization Report
Ash Pond No. 2, Hennepin Power Station

Legend:
Value exceeds 35 IAC 620 Class I groundwater standard
Value below detection limit

Well No.	sample_date	Antimony, dissolved (mg/L)	Antimony, total (mg/L)	Arsenic, dissolved (mg/L)	Arsenic, total (mg/L)	Barium, dissolved (mg/L)	Barium, total (mg/L)	Beryllium, dissolved (mg/L)	Beryllium, total (mg/L)	Cadmium, dissolved (mg/L)	Cadmium,total (mg/L)	Chromium, dissolved (mg/L)	Chromium, total (mg/L)	Cobalt, dissolved (mg/L)	Cobalt, total (mg/L)
08D	6/18/2009	0.005	0.005	0.003	0.003	0.117	0.143	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01
08D	9/29/2009	0.005	0.005	0.003	0.003	0.095	0.098	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01
08D	12/29/2009	0.005	0.005	0.003	0.003	0.121	0.135	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01
08D	3/16/2010	0.005	0.005	0.003	0.003	0.125	0.131	0.001	0.001	0.002	0.002	0.011	0.01	0.01	0.01
08D	8/31/2010	0.005		0.005		0.098		0.002		0.002		0.01		0.005	
08D	12/29/2010	0.005		0.008		0.1		0.002		0.002		0.01		0.005	
08D	3/16/2011			0.005		0.11				0.002		0.01			
08D	6/29/2011	0.005		0.01	0.01	0.1	0.11	0.004		0.005	0.005	0.005	0.005	0.005	
08D	8/23/2011	0.005		0.01		0.11		0.004		0.005		0.005		0.005	
08D	10/19/2011	0.005		0.003		0.11		0.004		0.005		0.005		0.005	
08D	3/1/2012	0.005		0.003		0.077		0.004		0.005		0.005		0.005	
08D	5/30/2012	0.005		0.003	0.003	0.1	0.092	0.004		0.005	0.005	0.005	0.005	0.005	
08D	8/29/2012	0.005		0.003		0.11		0.004		0.005		0.005		0.005	
08D	11/27/2012	0.005		0.003		0.104		0.001		0.002		0.005		0.005	
08D	3/7/2013	0.005		0.003		0.105		0.001		0.002		0.005		0.005	
08D	6/6/2013	0.005		0.003	0.003	0.116	0.13	0.001		0.002	0.002	0.005	0.005	0.0324	
08D	9/4/2013	0.005		0.003		0.106		0.001		0.002		0.005		0.005	
08D	12/11/2013	0.005		0.003		0.117		0.001		0.002		0.005		0.005	
08D	3/26/2014	0.005		0.003		0.121		0.001		0.002		0.005		0.005	
08D	6/18/2014	0.005		0.003	0.003	0.143	0.164	0.001		0.002	0.002	0.005	0.005	0.005	
08D	8/20/2014	0.001		0.001		0.134		0.001		0.002		0.005		0.005	
08D	12/10/2014	0.001		0.001		0.119		0.001		0.002		0.005		0.0188	
08D	3/19/2015	0.001		0.001		0.127		0.001		0.002		0.005		0.0264	
08D	6/22/2015	0.001		0.001	0.001	0.137	0.144	0.0005		0.002	0.002	0.005	0.005	0.0223	
08D	9/16/2015	0.001		0.001		0.141		0.001		0.002		0.005		0.005	
08D	12/8/2015	0.001		0.001		0.128		0.001		0.002		0.005		0.0149	
08D	3/10/2016	0.001		0.001		0.142		0.001		0.002		0.005		0.005	
08D	6/7/2016	0.001		0.001	0.001	0.134	0.138	0.0005		0.002	0.002	0.005	0.005	0.005	
08D	9/1/2016	0.001		0.001		0.175		0.001		0.002		0.005		0.0123	
08D	12/9/2016	0.001		0.001		0.168		0.001		0.002		0.005		0.0102	
Class I Standard		0.006	0.006	0.01	0.01	2	2	0.004	0.004	0.005	0.005	0.1	0.1	1	1
# of Exceedances		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Value		0.001	0.005	0.001	0.001	0.038	0.092	0.0005	0.001	0.002	0.002	0.005	0.005	0.0050	0.010
Maximum Value		0.005	0.005	0.010	0.010	0.175	0.164	0.0040	0.001	0.005	0.005	0.011	0.010	0.0324	0.010
# of Samples Analyzed		91	16	93	28	93	28	91	16	93	28	93	28	91	16

Well No.	sample_date	Copper, dissolved (mg/L)	Copper, total (mg/L)	Lead, dissolved (mg/L)	Lead, total (mg/L)	Mercury, dissolved (mg/L)	Mercury, total (mg/L)	Nickel, dissolved (mg/L)	Nickel, total (mg/L)	Selenium, dissolved (mg/L)	Selenium, total (mg/L)	Silver, dissolved (mg/L)	Silver, total (mg/L)	Thallium, dissolved (mg/L)	Thallium, total (mg/L)	Vanadium, dissolved (mg/L)	Vanadium, total (mg/L)	Zinc, dissolved (mg/L)	Zinc, total (mg/L)
08D	6/18/2009	0.01	0.01	0.002	0.004	0.0002	0.0002	0.029	0.035	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.024
08D	9/29/2009	0.01	0.01	0.002	0.002	0.0002	0.0002	0.025	0.026	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
08D	12/29/2009	0.01	0.01	0.002	0.002	0.0002	0.0002	0.027	0.03	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
08D	3/16/2010	0.01	0.01	0.002	0.002	0.0002	0.0002	0.027	0.028	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
08D	8/31/2010	0.01		0.005		2		0.012		0.01		0.002				0.002		0.005	
08D	12/29/2010	0.001		0.005		2		0.02		0.01		0.002				0.002		0.005	
08D	3/16/2011			0.005		2				0.016								0.005	
08D	6/29/2011	0.005	0.005	0.005	0.005	0.002	0.002	0.026		0.01	0.01	0.002		0.002		0.005	0.005	0.005	0.007
08D	8/23/2011	0.005		0.005		0.0002		0.013		0.014		0.002		0.002				0.005	
08D	10/19/2011	0.005		0.004		0.0002		0.011		0.01		0.002		0.002				0.005	
08D	3/1/2012	0.005		0.004		0.0002		0.012		0.01		0.002		0.002				0.005	
08D	5/30/2012	0.005	0.005	0.004	0.004	0.0002	0.0002	0.024		0.01	0.01	0.002		0.002		0.005	0.005	0.005	0.005
08D	8/29/2012	0.005		0.004		0.0002		0.019		0.01		0.002		0.002				0.005	
08D	11/27/2012	0.005		0.002		0.0002		0.015		0.006		0.002		0.002				0.005	
08D	3/7/2013	0.005		0.002		0.0002		0.029		0.006		0.002		0.002				0.005	
08D	6/6/2013	0.015	0.017	0.002	0.002	0.0002	0.0002	0.139		0.006	0.006	0.003		0.002		0.01	0.01	0.018	0.028
08D	9/4/2013	0.005		0.002		0.0002		0.039		0.006		0.002		0.002				0.005	
08D	12/11/2013	0.005		0.002		0.0002		0.032		0.006		0.002		0.002				0.005	
08D	3/26/2014	0.005		0.002		0.0002		0.044		0.006		0.002		0.002				0.008	
08D	6/18/2014	0.005	0.005	0.002	0.002	0.0002	0.0002	0.061		0.006	0.006	0.003		0.002		0.01	0.01	0.005	0.01
08D	8/20/2014	0.005		0.001		0.0002		0.056		0.001		0.002		0.001				0.011	
08D	12/10/2014	0.035		0.001		0.0002		0.11		0.001		0.002		0.001				0.018	
08D	3/19/2015	0.047		0.001		0.0002		0.144		0.001		0.002		0.001				0.02	
08D	6/22/2015	0.017	0.012	0.001	0.001	0.0002	0.0002	0.095		0.001	0.001	0.003		0.001		0.01	0.01	0.013	0.012
08D	9/16/2015	0.005		0.001		0.0002		0.028		0.001		0.002		0.001				0.006	
08D	12/8/2015	0.01		0.001		0.0002		0.066		0.001		0.002		0.001				0.011	
08D	3/10/2016	0.005		0.001		0.0002		0.05		0.001		0.002		0.001				0.006	
08D	6/7/2016	0.005	0.005	0.001	0.001	0.0002	0.0002	0.062		0.001	0.001	0.003		0.001		0.01	0.01	0.005	0.006
08D	9/1/2016	0.009		0.001		0.0002		0.113		0.001		0.002		0.001				0.012	
08D	12/9/2016	0.005		0.001		0.0002		0.089		0.001		0.002		0.001				0.008	
Class I Standard		0.65	0.65	0.0075	0.0075	0.002	0.002	0.1	0.1	0.05	0.05	0.05	0.05	0.002	0.002	0.049	0.049	5	5
# of Exceedances		0	0	0	0	8	0	8	0	0	0	0	0	0	0	0	0	0	0
Minimum Value		0.001	0.005	0.001	0.001	0.0002	0.0002	0.002	0.010	0.001	0.001	0.002	0.010	0.001	0.002	0.002	0.005	0.005	0.005
Maximum Value		0.047	0.017	0.005	0.005	2.0	0.002	0.234	0.039	0.016	0.010	0.010	0.010	0.002	0.002	0.010	0.010	0.020	0.028
# of Samples Analyzed		91	28	93	28	93	28	91	16	93	28	91	16	85	16	34	28	93	28

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Appendix H2

CCR Rule Monitoring Results

Appendix H2: CCR Rule Program Monitoring Results
Hydrogeologic Site Characterization Report
Ash Pond No. 2, Hennepin Power Station

Parameters (total)			**Wells**	**Upgradient**											
				07				**08**				**08D**			
Appendix III	**Units**	**Class I Standard**	**Sample Date**	not sampled first round	3/10/2016	6/7/2016	9/1/2016	12/8/2015	3/9/2016	6/7/2016	9/1/2016	12/8/2015	3/9/2016	6/7/2016	9/1/2016
Boron	mg/L	2.0		- - - -	0.0629	0.0673	0.0697	0.0972	0.0878	0.075	0.142	0.109	0.122	0.111	0.139
Calcium	mg/L	NS		- - - -	126	154	150	198	213	191	299	174	187	177	287
Chloride	mg/L	200		- - - -	51	55	49	**216**	145	**202**	**312**	184	**209**	**217**	**325**
Fluoride	mg/L	4.0		- - - -	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.12	0.10	0.10	0.12
Sulfate	mg/L	400		- - - -	70	82	75	164	133	129	209	119	130	113	161
TDS	mg/L	1,200		- - - -	536	758	574	1170	918	1060	**1370**	1050	1060	1090	**1340**
pH-Field	S.U.	6.5-9.0		- - - -	6.90	6.64	6.94	6.82	6.73	6.60	6.69	6.89	6.73	6.64	6.63
Appendix IV															
Antimony	mg/L	0.006		- - - -	<0.0002	0	<0.0002	<0.0002	0.0003	0.0003	<0.0002	<0.0002	0.0003	0.0003	<0.0002
Arsenic	mg/L	0.010		- - - -	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Barium	mg/L	2.0		- - - -	0.104	0.13	0.13	0.118	0.148	0.127	0.146	0.133	0.155	0.138	0.23
Beryllium	mg/L	0.004		- - - -	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	mg/L	0.005		- - - -	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0005	0.0005	0.0003	0.0011
Chromium	mg/L	0.1		- - - -	0.0005	0.0005	0.0005	0.0004	<0.0003	<0.0003	<0.0003	0.0004	<0.0003	<0.0003	<0.0003
Cobalt	mg/L	1.0		- - - -	<0.0002	<0.0002	<0.0002	0.0029	0.0017	0.0034	0.0285	0.0122	0.0036	0.0028	0.013
Fluoride	mg/L	4.0		- - - -	0.10	0.10	0.1	0.09	0.09	0.09	0.09	0.12	0.10	0.10	0.12
Lead	mg/L	0.0075		- - - -	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	<0.0002	0.0005
Lithium	mg/L	NS		- - - -	0.0079	0.0085	0.0091	0.01	0.0091	0.0092	0.0127	0.0121	0.0143	0.0108	0.0164
Mercury	mg/L	0.002		- - - -	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Molybdenum	mg/L	NS		- - - -	0.0008	0.0006	0.0008	0.0015	0.0016	0.0013	0.0014	0.0014	0.0013	0.0011	0.0014
Selenium	mg/L	0.05		- - - -	0.001	0.0011	0.0014	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009
Thallium	mg/L	0.002		- - - -	<0.0002	<0.0002	<0.0002	0.0004	<0.0002	<0.0002	<0.0002	0.0003	<0.0002	<0.0002	<0.0002
Radium 226/228	pCi/L	20		- - - -	0.12	1.09	0.36	0.89	0.72	0.74	0.33	0.94	0.12	0.35	0.55
Groundwater Elevation	feet			- - - -	451.59	452.75	453.4	449.20	447.80	448.93	450.35	447.92	447.52	447.60	450.19

Parameters (total)			**Wells**	**Downgradient**								**Downgradient**							
				03R				**18D**				**18S**				**45S**			
Appendix III	**Units**	**Class I Standard**	**Sample Date**	12/9/2015	3/9/2016	6/8/2016	8/31/2016	12/9/2015	3/9/2016	6/8/2016	8/31/2016	12/9/2015	3/9/2016	6/8/2016	8/31/2016	12/9/2015	3/9/2016	6/8/2016	8/31/2016
Boron	mg/L	2.0		1.24	1.38	1.25	1.03	1.98	1.93	1.82	1.86	**3.40**	**4.74**	**4.18**	**5.11**	0.400	0.436	0.544	0.497
Calcium	mg/L	NS		82.4	84.6	85.6	85.8	114	116	110	108	99.7	101	98.3	118	87.8	97.2	97.2	95.4
Chloride	mg/L	200		66	78	84	89	74	81	90	83	68	69	70	70	70	80	104	96
Fluoride	mg/L	4.0		0.20	0.26	0.26	0.27	0.13	0.15	0.14	0.14	0.14	0.13	0.13	0.12	0.29	0.33	0.33	0.34
Sulfate	mg/L	400		85	136	107	101	133	141	136	123	153	229	204	187	83	93	99	98
TDS	mg/L	1,200		548	566	532	560	680	686	648	608	656	670	654	678	534	594	574	542
pH-Field	S.U.	6.5-9.0		7.23	7.26	7.27	7.50	7.20	7.17	7.17	7.43	7.47	7.37	7.58	7.5	7.00	7.15	7.26	7.31
Appendix IV																			
Antimony	mg/L	0.006		0.0004	0.0004	0.0006	<0.0002	0.0003	0.0003	0.0003	<0.0002	0.0005	0.0005	0.0006	0.0004	0.0003	0.0003	0.0004	<0.0002
Arsenic	mg/L	0.010		0.0005	0.0005	0.0006	0.0003	0.0005	0.0006	0.0005	0.0004	0.0007	0.0006	0.0007	0.0007	0.0007	0.0004	0.0004	0.0003
Barium	mg/L	2.0		0.0656	0.067	0.0658	0.0617	0.0891	0.0937	0.0875	0.0873	0.0833	0.0813	0.0768	0.0861	0.0664	0.0709	0.0717	0.0691
Beryllium	mg/L	0.004		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	mg/L	0.005		0.0016	0.0013	0.001	0.0008	0.0011	0.0011	0.001	0.0008	0.0018	0.0014	0.0011	0.0007	0.0023	0.0022	0.0021	0.002
Chromium	mg/L	0.1		0.0006	0.0008	0.0008	<0.0003	0.0004	<0.0003	<0.0003	<0.0003	0.0016	0.0029	0.0014	0.0009	0.0013	0.0004	0.0004	<0.0003
Cobalt	mg/L	1.0		0.0007	0.0007	0.0011	0.0007	0.0093	0.0106	0.0088	0.008	0.0016	0.0012	0.0008	0.0006	0.0024	0.0028	0.006	0.0041
Fluoride	mg/L	4.0		0.20	0.26	0.26	0.27	0.13	0.15	0.14	0.14	0.14	0.13	0.13	0.12	0.29	0.33	0.33	0.34
Lead	mg/L	0.0075		<0.0002	0.0004	0.0003	<0.0002	<0.0002	0.0003	<0.0002	<0.0002	0.0004	<0.0002	<0.0002	<0.0002	0.001	0.0007	0.0005	0.0004
Lithium	mg/L	NS		0.0239	0.0289	0.0278	0.0219	0.0318	0.0306	0.0293	0.0317	0.0711	0.0806	0.0797	0.0844	0.0175	0.0165	0.0169	0.0178
Mercury	mg/L	0.002		<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Molybdenum	mg/L	NS		0.208	0.22	0.212	0.15	0.0299	0.0312	0.0292	0.0281	0.315	0.32	0.333	0.354	0.0972	0.0911	0.0847	0.0847
Selenium	mg/L	0.05		0.0055	0.0054	0.0075	0.0071	<0.0009	<0.0009	<0.0009	<0.0009	0.0338	**0.0596**	**0.0506**	0.0462	<0.0009	<0.0009	<0.0009	<0.0009
Thallium	mg/L	0.002		0.0004	<0.0002	0.0003	0.0004	0.0003	<0.0002	<0.0002	0.0003	0.0004	<0.0002	0.0003	0.0004	0.0004	0.0003	0.0003	0.0003
Radium 226/228	pCi/L	20		0.68	0.392	2.45	-0.05	0.41	0.388	0.64	0.44	0.91	0	1.22	0.75	1.09	0.706	1.27	0.37
Groundwater Elevation	feet			448.75	447.33	448.25	450.05	448.78	447.23	448.05	450.12	448.84	447.32	448.22	450.13	448.85	447.62	448.37	450.07

[O: KLT 7/11/16, C: ANS 7/12/16, U: ANS 8/8/16, C: KLT 8/8/16, U: ANS 10/6/16, C: KJS 10/7/16, U: Y_Z 11/3/16, C: DLB 11/9/16]

Notes:
All parameters collected and measured as totals

NS	no USEPA MCL established for parameter
pCi/L	pico Curies per Liter
S.U.	Standard Units
TDS	Total Dissolved Solids
Red Value	Parameter concentration exceeds USEPA MCL
<	Below reporting limit for parameter
- - - -	not sampled

Groundwater level data as collected on December 8, 2015 for R1,
March 8, 2016 for R2, June 7, 2016 for R3, and August 31, 2016 for R4

OBG

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ATTACHMENT I

RAMBOLL

ENVIRONMENT & HEALTH

Dynegy Midwest Generation, LLC
13498 East 800th Street
Hennepin, IL 61327

Groundwater Monitoring Plan Addendum for Ash Pond No. 2 and Ash Pond No. 4
Hennepin Power Plant, Hennepin, IL

October 25, 2021

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

T 414-837-3607
F 414-837-3608
www.ramboll.com

Ref. 1940100806-005

Ramboll Americas Engineering Solutions, Inc. (Ramboll) is providing the attached Addendum to the Groundwater Monitoring Plan (GMP) for inclusion in the Operating Permit Applications as required under Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.230 and allowed under 35 I.A.C. § 845.210(d)(1). The GMP was previously submitted to and approved by the Illinois Environmental Protection Agency (IEPA) as part of the *Closure and Post-Closure Care Plan for the Hennepin East Ash Pond No. 2* (Closure Plan; Civil and Environmental Engineers, Inc. [CEC], 2018) submitted for Hennepin Power Plant (HPP) Ash Pond Number [No.] 2 (AP2; Vistra Identification [ID] No. 802; IEPA ID No. W1550100002-04; and National Inventory of Dams [NID] No. IL50663) and Ash Pond No. 4 (AP4; Vistra ID No. 805; and IEPA ID No. W1550100002-07), identified by IEPA as East Ash Pond 2 and East Pond 4, respectively.

This Addendum to the HPP AP2 and AP4 GMP (Attachment 1), modifies the existing monitoring programs and networks to align with Part 845. Upon issuance of the Operating Permit, groundwater monitoring will be performed as specified in the Addendum.

BACKGROUND

CEC submitted the Closure Plan in February 2018 for the remaining inactive portions of AP2 that were previously planned to be capped during phased expansion of the Coal Combustion Waste Landfill. An addendum to the Closure Plan, which encompasses AP2 and AP4, was submitted in October 2018 (CEC and O'Brien & Gere Engineers, Inc. [OBG], 2018). IEPA provided comments on the Closure Plan in a letter dated May 2, 2019. Responses to comments were provided in a letter from OBG dated July 22, 2019. At the request of IEPA, a groundwater model was developed for simulation of episodic and transient flooding in the Illinois River that could potentially reach the base of ash. The requested modeling and evaluation of the effects on boron concentration was completed and provided in the *River Flood Evaluation Report* (OBG, 2020) dated January 15, 2020. IEPA approved the Closure Plan on March 5, 2020. A compiled copy of the Closure Plan and addenda was provided to IEPA on March 23, 2020 (Ramboll, 2020). The Closure Plan included the final GMP (OBG/Ramboll, 2019) dated July 22, 2019 (Attachment 2) which defined groundwater monitoring for AP2 and AP4 following approval of the Closure Plan. Closure construction began in May 2020 and was completed in November 2020.

On April 21, 2021 Part 845 became effective, and 35 I.A.C. § 845.100(i) provides the following with respect to certain CCR units closed prior to the effective date:

> *i) If a CCR surface impoundment has completed an Agency-approved closure before April 21, 2021, this Part does not require the owner or operator of the CCR surface impoundment to resubmit to the Agency any closure plan, closure report, or closure certification for that completed closure.*

SUBMITTALS

The attached documents are being provided to address requirements of 35 I.A.C. § 845.230 as follows:

- Addendum to the HPP AP2 and AP4 GMP (new submittal, Attachment 1). This Addendum includes revisions to the monitoring well network, analytical parameters, and statistical procedures included in the previously submitted Groundwater Monitoring Plan (OBG, 2019). These modifications are proposed to meet and fulfill the requirements in 35 I.A.C. § 845.630 and 35 I.A.C. § 845.640 (Groundwater Monitoring Systems and Statistical Procedures); and 35 I.A.C. § 845.650(b) (background samples). The proposed modifications were identified and developed using existing and previously approved documents, but additional information has been provided where necessary.
- Groundwater Monitoring Plan, as included in Compiled Copy of the Closure Plan and Addenda Provided to IEPA on March 23, 2020 (Attachment 2). This attachment provides a copy of the existing groundwater monitoring plan as it was approved by IEPA.

Sincerely,

Eric J. Tlachac, PE
Senior Managing Engineer

D +1 414 837 3541
M +1 262 719 4526
eric.tlachac@ramboll.com

Brian G. Hennings, PG
Senior Managing Hydrogeologist

D +1 414 837 3524
M +1 262 719 4512
brian.hennings@ramboll.com

ATTACHMENTS:

Attachment 1	Addendum to the Groundwater Monitoring Plan
Attachment 2	Groundwater Monitoring Plan, as included in Compiled Copy of the Closure Plan and Addenda Provided to IEPA on March 23, 2020

ATTACHMENT 1
ADDENDUM TO THE GROUNDWATER MONITORING PLAN

Intended for
Dynegy Midwest Generation, LLC

Date
October 25, 2021

Project No.
1940100806-005

ADDENDUM TO THE GROUNDWATER MONITORING PLAN

ASH POND NO. 2 AND ASH POND NO. 4
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

Bright ideas. Sustainable change.

ADDENDUM TO THE GROUNDWATER MONITORING PLAN HENNEPIN POWER PLANT ASH POND NO. 2 AND ASH POND NO. 4

Project Name	**Hennepin Power Plant Ash Pond No. 2 and Ash Pond No. 4**
Project No.	**1940100806-005**
Recipient	**Dynegy Midwest Generation, LLC**
Document Type	**Addendum to the Groundwater Monitoring Plan**
Revision	**FINAL**
Date	**October 25, 2021**

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

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

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 (Addendum to the Groundwater Monitoring Plan, Hennepin Power Plant Ash Pond No. 2 and Ash Pond No. 4), meets the intent of 35 I.A.C. § 845.630. The monitoring system was developed based on information included in the IEPA approved Hydrogeologic Site Characterization Report submitted with the IEPA approved Closure and Post Closure Care Plan.

____
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 (Addendum to the Groundwater Monitoring Plan, Hennepin Power Plant Ash Pond No. 2 and Ash Pond No. 4), meets the intent of 35 I.A.C. § 845.630. The monitoring system was developed based on information included in the IEPA approved Hydrogeologic Site Characterization Report submitted with the IEPA approved Closure and Post Closure Care Plan.

____
Brian G. Hennings
Professional Geologist
196.001482
Illinois
Date: October 25, 2021

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TABLES (IN TEXT)

TABLES (ATTACHED)

FIGURES (ATTACHED)

APPENDICES

ACRONYMS AND ABBREVIATIONS

§	Section
35 I.A.C.	Title 35 of the Illinois Administrative Code
40 C.F.R.	Title 40 of the Code of Federal Regulations
ASD	Alternate Source Demonstration
AP2	Ash Pond No. 2
AP4	Ash Pond No. 4
bgs	below ground surface
CCR	coal combustion residuals
CCWL	Coal Combustion Waste Landfill
CEC	Civil & Environmental Engineers, Inc.
Closure Plan	*Closure and Post-Closure Care Plan for the Hennepin East Ash Pond No. 2*
cm/s	centimeters per second
DMG	Dynegy Midwest Generation, LLC
EAP	East Ash Pond
EAPS	East Ash Pond System
GMP	Groundwater Monitoring Plan
GWPS	groundwater protection standards
HPP	Hennepin Power Plant
ID	identification
IEPA	Illinois Environmental Protection Agency
IFR	Initial Facility Report
NID	National Inventory of Dams
No.	number
NRT/OBG	Natural Resource Technology, Inc., an OBG Company
OBG	O’Brien & Gere Engineers, Inc.
Part 845	Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845
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

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.) Section (§) 845 (Part 845) (Illinois Environmental Protection Agency [IEPA], April 15 2021), Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this Addendum to the Groundwater Monitoring Plan (GMP) on behalf of Hennepin Power Plant (HPP) (**Figure 1-1**), operated by Dynegy Midwest Generation, LLC (DMG). This Addendum applies specifically to the CCR Units referred to as Ash Pond Number (No.) 2 (AP2; Vistra identification [ID] No. 802, IEPA ID No. W1550100002-04, and National Inventory of Dams [NID] No. IL50663; and the Ash Pond No. 4 (AP4; Vistra ID No. 805 and IEPA ID No. W1550100002-07). AP2 is a closed, unlined CCR SI that was previously used to manage CCR and non-CCR waste streams at the HPP. AP4 is designated capped or otherwise maintained. The locations of AP2 and AP4 are presented in **Figure 1-2**.

Civil and Environmental Engineers, Inc. (CEC) submitted the *Closure and Post-Closure Care Plan for the Hennepin East Ash Pond No. 2* (Closure Plan) in February 2018 for the remaining inactive portions of AP2 that were previously planned to be capped during phased expansion of the Coal Combustion Waste Landfill (CCWL). An addendum to the Closure Plan, which encompasses AP2 and AP4, was submitted in October 2018 (CEC and O'Brien & Gere Engineers, Inc. [OBG], 2018). IEPA provided comments to the Closure and Post Closure Care Plan in a letter dated May 2, 2019. Responses to comments were provided in a letter from OBG, part of Ramboll dated July 22, 2019. At the request of IEPA, a groundwater model was developed for simulation of episodic and transient flooding in the Illinois River that could potentially reach the base of ash. The requested modeling and evaluation of the effects on boron concentration was completed and provided in the *River Flood Evaluation Report* (Ramboll, 2020a) dated January 15, 2020. IEPA approved the Closure and Post Closure Care Plan for Hennepin AP2 and AP4 on March 5, 2020. A compiled copy of the Closure Plan and addenda was provided to IEPA on March 23, 2020 (Ramboll, 2020b). The Closure Plan included the final GMP (OBG, part of Ramboll, 2019) dated July 22, 2019 which defined groundwater monitoring for AP2 and AP4 following approval of the Closure Plan. Closure construction began in May 2020 and was completed in November 2020.

On April 21, 2021, Part 845 became effective, and for CCR units closed prior to the effective date the following section was included (35 I.A.C. § 845.100(i)):

> *If a CCR surface impoundment has completed an Agency-approved closure before April 21, 2021, this Part does not require the owner or operator of the CCR surface impoundment to resubmit to the Agency any closure plan, closure report, or closure certification for that completed closure.*

This Addendum includes modifications to the previously approved GMP to provide content required by 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 AP2 and AP4. Specifically, this Addendum incorporates monitoring parameters specified in 35 I.A.C. § 845.600.

1.2 Purpose and Scope

The purpose of this Addendum is to provide updated GMP text, tables, and figures to incorporate modifications made to the existing monitoring program to comply with Part 845. Following issuance of the Part 845 Operating Permit, the application for which this Addendum is attached, groundwater monitoring specific to AP2 and AP4 will include the following:

- Monitoring required by Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257 Subpart D (pre-existing with no modifications)
- Part 845 Monitoring (proposed)

Details of the monitoring programs (schedules and parameters), monitoring well networks, and analysis (statistical methods) are included in this Addendum. No changes are proposed to the monitoring networks utilized for the current IEPA-approved Closure Plan and 40 C.F.R. § 257 Subpart D monitoring; however, those details have been included for completeness. Additional information regarding the hydrogeology and groundwater quality were included with the Closure Plan and are not reproduced in this Addendum.

2. GROUNDWATER MONITORING SYSTEMS

The Part 845 groundwater monitoring network for AP2 and AP4 was developed to monitor post-closure groundwater quality and trends and demonstrate compliance with the applicable groundwater quality standards identified in **Section 3**. The existing and proposed groundwater monitoring well networks consist of a sufficient number of wells, installed at appropriate locations and depths, to monitor post-closure compliance with groundwater quality standards for 40 C.F.R. § 257 and 35 I.A.C. § 845.600.

The monitoring wells are designed and constructed in a manner consistent with the standards of 40 C.F.R. § 257 and 77 I.A.C. § 920.170, as required by 35 I.A.C. § 845.630(e), including the following:

- All monitoring wells are cased in a manner that maintains the integrity of the boreholes.
- Wells are screened to allow sampling only at the specified interval.
- All wells are covered with vented caps, unless located in flood-prone areas, and equipped with devices to protect against tampering and damage.

Consistent with applicable standards, the monitoring well networks described above fulfill the following goals:

- Enable the collection of groundwater samples that represent the quality of background water that has not been affected by AP2 or AP4.
- Enable the collection of groundwater samples that represent the quality of downgradient groundwater.
- Include wells that are located within the stratigraphic unit(s) that may serve as potential chemical migration pathways.

Several monitoring programs are currently being conducted as required by the IEPA and the United States Environmental Protection Agency (USEPA) to evaluate the CCR units associated with the HPP East Ash Pond System (EAPS) and the CCWL. The networks have changed over time and many of the wells and parameters overlap as a result of previously approved GMPs and permits which were developed to focus on specific (and separate) units at the EAPS. The monitoring networks for each of the CCR and non-CCR Units at the EAPS include:

- AP2 and AP4 (subject of this GMP)
  - 40 C.F.R. § 257 for AP2 (AP4 was classified as capped or otherwise maintained and not subject to 40 C.F.R § 257)
  - IEPA Closure Plan (2019 GMP included in Closure and Post-Closure Care Plan) and Proposed network for Part 845.
- CCWL
  - Initial Facility Report (IFR) (Section 28)
  - 40 C.F.R. § 257
- EAPS (also includes Leachate Pond, and Polishing Pond)
  - IEPA Water Pollution Control Permit 2019-EO-64097 – Special Condition No. 4

- East Ash Pond (EAP)
  - 40 C.F.R. § 257
  - Proposed network for Part 845

This Addendum is being provided to propose a groundwater monitoring network and monitoring program specific to AP2 and AP4 that will comply with Part 845. Monitoring networks and programs that apply to other units are not discussed in this Addendum. Those programs will continue to be performed as specified in IEPA approvals or 40 C.F.R. § 257. Upon approval of the Operating Permit applications (and by extension the Groundwater Monitoring Plans) for AP2 and AP4, and the EAP, the monitoring program required by IEPA Water Pollution Control Permit 2019-EO-64097 Special Condition No. 4, will be discontinued following approval of a future permit modification submittal and will be replaced by the proposed Part 845 monitoring program. The remaining discussion in this document will include only the networks and monitoring programs that are applicable and specific to AP2 and AP4, specifically the 40 C.F.R. § 257 network and the IEPA Closure Plan and proposed Part 845 monitoring network.

2.1 40 C.F.R. § 257 Monitoring Program

The 40 C.F.R. § 257 monitoring well network for AP2 consists of seven groundwater monitoring wells installed nearby or adjacent to AP2 within the unlithified uppermost aquifer including: three background wells (07, 08, and 08D), and four compliance wells (03R, 18S, 18D, and 45S). The well locations are shown on **Figure 2-1**.

Assessment monitoring in accordance with 40 C.F.R. § 257.95 was initiated on April 9, 2018. Details on the procedures and techniques used to fulfill the groundwater sampling and analysis program requirements are found in the Sampling and Analysis Plan for AP2 (Natural Resource Technology, Inc., an OBG Company [NRT/OBG], 2017).

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

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

Field Parameters[1]			
Groundwater Elevation	pH		
Appendix III Parameters (Total, except total dissolved solids [TDS])			
Boron	Chloride	Sulfate	
Calcium	Fluoride	TDS	
Appendix IV Parameters (Total)			
Antimony	Cadmium	Lithium	Selenium
Arsenic	Chromium	Mercury	Thallium
Barium	Cobalt	Molybdenum	Radium 226 and 228 combined
Beryllium	Lead		

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

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.

2.2 IEPA Closure Plan and Proposed Part 845 Monitoring Well Network

The IEPA Closure Plan monitoring well network consists of seven wells screened in the uppermost aquifer, three background wells (07, 08, and 08D) and four compliance wells (03R, 18S, 18D, and 45S). This same monitoring well network is proposed for groundwater monitoring required by Part 845.

The groundwater samples collected from the seven 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 B** below.

Table B. Proposed Part 845 Monitoring Well Network

Well ID	Monitored Unit	Well Screen Interval (feet bgs)	Well Type[1]
07	UA	67.5 – 77.5	Background
08	UA	51.5 – 61.5	Background
08D	UA	83.0 – 88.0	Background
03R	UA	42.0 – 52.0	Compliance
18S	UA	40.0 – 50.0	Compliance
18D	UA	71.0 – 76.0	Compliance
45S	UA	35.0 – 45.0	Compliance

[1] Well Type refers to the role of the well in the monitoring network.
bgs = below ground surface
UA = uppermost aquifer

2.3 Well Abandonment

No wells are currently proposed for abandonment.

3. APPLICABLE GROUNDWATER QUALITY STANDARDS

3.1 Groundwater Classification

The 35 I.A.C. § 620 groundwater classification at AP2 and AP4 was presented in the GMP (OBG, part of Ramboll, 2019) and is summarized here. Groundwater at AP2 and AP4 meets the definition of Class I – Potable Resource Groundwater (35 I.A.C. § 620.210) based on the following criteria:

- Field hydraulic conductivity tests performed on the mixed alluvial deposits (clay, silt, and sand) and underlying outwash sand had geometric mean hydraulic conductivity of approximately 5.6 x 10^{-2} centimeters per second (cm/s).
- The thickness of the uppermost aquifer is greater than five feet.

3.2 Statistical Evaluation of Background Groundwater Data

A Statistical Analysis Plan (**Appendix A**) has been developed to describe procedures that will be used to establish background conditions and implement compliance monitoring as necessary and required by 35 I.A.C. § 845.640 and 35 I.A.C. § 845.650. The Statistical Analysis Plan was prepared in accordance with the requirements of 35 I.A.C. § 845.640(f), with reference to the acceptable statistical procedures provided in USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (*Unified Guidance,* 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 groundwater protection standards (GWPSs) are summarized in **Table 3-1**.

3.3 Applicable Groundwater Quality 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 exceptions include chloride, cobalt, and TDS, where the background concentration is greater than the 35 I.A.C. § 845.600(a)(1) standard. In these instances, 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. The groundwater monitoring program will include sampling and analysis procedures that are consistent and provide an accurate representation of groundwater quality at the background and compliance wells as required by 35 I.A.C. § 845.630. As discussed within **Section 2**, two monitoring programs specific to AP2 and AP4 exist, the 40 C.F.R. § 257 monitoring program and the Closure Plan monitoring program. It is expected that upon acceptance and approval of the Operating Permit applications (and by extension the GMPs) for the HPP and upon acceptance and approval of Part 845 by the USEPA as a State CCR Permit Program, the proposed Part 845 monitoring program will supersede the Closure Plan and 40 C.F.R. § 257 monitoring programs.

4.1 Monitoring Networks and Parameters

4.1.1 40 C.F.R. § 257 Groundwater Monitoring

The existing 40 C.F.R. § 257 monitoring program was discussed in detail in **Section 2.1**. Seven groundwater monitoring wells, including three background wells (07, 08, and 08D) and four compliance wells (03R, 18S, 18D, and 45S) are sampled for Appendix III and Appendix IV parameters on a semi-annual frequency. Well locations and parameters will continue to be monitored and reported as required by 40 C.F.R. § 257 until USEPA approves Part 845.

4.1.2 Closure Plan Groundwater Monitoring

The existing Closure Plan monitoring program was discussed in **Section 2.2**. Seven groundwater monitoring wells are used to monitor the uppermost aquifer, including three background wells (07, 08, and 08D) and four compliance wells (03R, 18S, 18D, and 45S), and are sampled on a quarterly frequency for the parameters listed in the GMP (OBG, part of Ramboll, 2019). Well locations and parameters will continue to be monitored and reported as required by the Closure Plan until IEPA approves the proposed Part 845 monitoring network.

4.1.3 Part 845 Groundwater Monitoring

The proposed Part 845 Monitoring Network will consist of the same three background monitoring wells (07, 08, and 08D) and four compliance wells (03R, 18S, 18D, and 45S) to monitor potential impacts from AP2 and AP4 (**Figure 2-1**). These monitoring wells are screened within the uppermost aquifer along the perimeter of AP2 and AP4. Groundwater samples will be collected and analyzed for the laboratory and field parameters 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 will be recorded during sample collection.

4.2 Sampling Schedule

Groundwater sampling for the approved Closure Plan will be maintained until IEPA approval of the Part 845 GMP. Groundwater sampling for the Part 845 monitoring well network will initially be performed quarterly according to the schedule below in **Table D**.

Table D. 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).

Groundwater monitoring for the 40 C.F.R. § 257 well network will continue to follow a schedule in accordance with the requirements of 40 C.F.R. § 257.94 and 40 C.F.R. § 257.95. Upon USEPA approval of Part 845 as a State CCR Permit Program, the 40 C.F.R. § 257 monitoring will be discontinued, and replaced by the Part 845 monitoring.

4.3 Groundwater Sample Collection

Groundwater sampling procedures have been developed and the collection of groundwater samples is being implemented to meet the requirements of 35 I.A.C. § 845.640. In addition to groundwater well samples, quality assurance samples will be collected as described in **Section 4.5** (**Table 4-1**).

4.4 Laboratory Analysis

Laboratory analysis will be performed consistent with the requirements of 35 I.A.C. § 845.640(j) by a state-certified laboratory using methods approved by IEPA and USEPA. Laboratory methods may be modified based on laboratory equipment availability or procedures, but the Reporting Limit (RL) for all parameters analyzed, regardless of method, will be lower than the applicable groundwater quality standard. RLs for the applicable parameters are summarized in **Table 4-2**. Concentrations lower than the RL will be reported as less than the RL.

4.5 Quality Assurance Program

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

- Field duplicates will be collected at a frequency of one per group of ten or fewer investigative water samples.
- One equipment blank sample will be collected and analyzed for each day of sampling. If dedicated sampling equipment is used, then equipment blank samples will not be collected.

The duplicate and equipment blank quality assurance samples will be supplemented by the laboratory QA/QC program, which typically includes:

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

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

4.6 Groundwater Monitoring System Maintenance Plan

Consistent with the requirements of 35 I.A.C. § 845.630(e)(2), maintenance will be performed as needed to assure that the monitoring wells provide representative groundwater samples. Monitoring wells will be inspected during each groundwater sampling event; inspections will consist of the following:

- Visual inspection, clearing of vegetation, replacement of markers, and painting of protective casings as needed to assure that monitoring wells are clearly marked and accessible.
- Visual inspection and repair or replacement of well aprons as needed to assure that they are intact, drain water away from the well, and have not heaved.
- Visual inspection and repair or replacement of protective casings as needed to assure that they are undamaged, and that locks are present and functional.
- Checks to assure that well caps are intact and vented, unless in flood-prone areas in which case caps will not be vented.

- Annual measurement of monitoring well depths to determine the degree of siltation within the wells. Wells will be redeveloped as needed to remove siltation from the screened interval if it impedes flow of water into the well.
- Checks to assure that wells are clear of internal obstructions, and flow freely.

If maintenance of a monitoring well cannot address an identified deficiency, a replacement well will be installed.

4.7 Statistical Analysis

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

4.8 Data Reporting

Data reporting for the 40 C.F.R. § 257 monitoring well program will be consistent with recordkeeping, notification, and internet posting requirements described in 40 C.F.R. § 257.105 through 40 C.F.R. § 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 place the data in the facility's operating record as required by 35 I.A.C. § 845.610(b)(3)(D). Within 14 days of posting to the operating record, information will be posted to the publicly accessible internet site "Illinois CCR Rule Compliance Data and Information" as required by 35 I.A.C. § 845.810(d). Information will also be submitted to IEPA annually by January 31 as required by 35 I.A.C. § 845.550, for data collected the preceding year. The report will include the status of the groundwater monitoring and corrective action plan for the HPP AP2 and AP4 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 AP2 or AP4 caused the contamination and AP2 or AP4 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.

TABLES

TABLE 2-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
ADDENDUM TO THE GROUNDWATER MONITORING PLAN
HENNEPIN POWER PLANT
ASH POND NO. 2 AND ASH POND NO. 4
HENNEPIN, 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)
03R	C	UA	01/16/2015	481.92	481.92	Top of PVC	479.40	42.00	52.00	437.38	427.38	52.00	427.40	10	2	41.304578	-89.308691
07	B	UA	11/15/1984	518.27	518.27	Top of PVC	515.10	67.50	77.50	447.61	437.61	78.00	437.10	10	2	41.297986	-89.305712
08	B	UA	11/17/1984	501.38	501.38	Top of PVC	498.70	51.50	61.50	447.24	437.24	62.00	436.70	10	2	41.300698	-89.3044
08D	B	UA	04/17/2009	501.34	501.34	Top of PVC	498.80	83.00	88.00	415.79	410.79	90.00	408.80	5	2	41.300799	-89.304522
18S	C	UA	04/14/2009	487.70	487.70	Top of PVC	485.59	40.00	50.00	445.59	435.59	52.00	433.60	10	2	41.304939	-89.3071
18D	C	UA	04/14/2009	487.60	487.60	Top of PVC	485.51	71.00	76.00	414.51	409.51	78.00	407.50	5	2	41.30492	-89.307093
45S	C	UA	06/29/2015	467.48	467.48	Top of PVC	465.70	35.00	45.00	430.70	420.70	45.00	420.70	10	2	41.303751	-89.310195

Notes:
All elevation data are presented relative to the North American Vertical Datum 1988 (NAVD88), GEOID 12A
Type refers to the role of the well in the monitoring network: background (B), compliance (C), or water level measurements only (WLO)
WLO wells are temporary pending implementation of impoundment closure per an approved Construction Permit application
BGS = below ground surface
ft = foot or feet
HSU = Hydrostratigraphic Unit
PVC = polyvinyl chloride
UA = uppermost aquifer

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TABLE 3-1. BACKGROUND GROUNDWATER QUALITY AND STANDARDS
ADDENDUM TO THE GROUNDWATER MONITORING PLAN
HENNEPIN POWER PLANT
ASH POND NO. 2 AND ASH POND NO. 4
HENNEPIN, ILLINOIS

Parameter	Background Concentration	845 Limit	Groundwater Protection Standard	Unit
Antimony, total	0.001	0.006	0.006	mg/L
Arsenic, total	0.001	0.010	0.010	mg/L
Barium, total	0.212	2.0	2.0	mg/L
Beryllium, total	0.001	0.004	0.004	mg/L
Boron, total	0.163	2	2	mg/L
Cadmium, total	0.0023	0.005	0.005	mg/L
Chloride, total	435	200	435	mg/L
Chromium, total	0.001	0.1	0.1	mg/L
Cobalt, total	0.038	0.006	0.038	mg/L
Fluoride, total	0.12	4.0	4.0	mg/L
Lead, total	0.0015	0.0075	0.0075	mg/L
Lithium, total	0.019	0.04	0.04	mg/L
Mercury, total	0.0002	0.002	0.002	mg/L
Molybdenum, total	0.0017	0.1	0.1	mg/L
pH (field)	7.5 / 6.6	9.0 / 6.5	9.0 / 6.5	SU
Radium 226 and 228 combined	1.5	5	5	pCi/L
Selenium, total	0.0014	0.05	0.05	mg/L
Sulfate, total	215	400	400	mg/L
Thallium, total	0.001	0.002	0.002	mg/L
Total Dissolved Solids	1620	1200	1620	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

generated 10/07/2021, 6:48:50 AM CDT

RAMBOLL

TABLE 4-1. SAMPLING AND ANALYSIS SUMMARY
ADDENDUM TO THE GROUNDWATER MONITORING PLAN
HENNEPIN POWER PLANT
ASH POND NO. 2 AND ASH POND NO. 4
HENNEPIN, 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	7	1	0	0	1	9	plastic	600 mL	HNO_3 to pH<2	6 months
Mercury	7470A or 6020	7	1	0	0	1	9	plastic	400 mL	HNO_3 to pH<2	28 days
Inorganic Parameters											
Fluoride	9214 or EPA 300	7	1	0	0	1	9	plastic	300 mL	Cool to 4 °C	28 days
Chloride	9251 or EPA 300	7	1	0	0	1	9	plastic	100 mL	Cool to 4 °C	28 days
Sulfate	9036 or EPA 300	7	1	0	0	1	9	plastic	50 mL	Cool to 4 °C	28 days
Total Dissolved Solids	SM 2540 C	7	1	0	0	1	9	plastic	200 mL	Cool to 4 °C	7 days
Radium											
Radium 226	9315 or EPA 903	7	0	0	0	0	7	plastic	1000 mL	HNO_3 to pH<2	6 months
Radium 228	9320 or EPA 904	7	0	0	0	0	7	plastic	1000 mL	HNO_3 to pH<2	6 months
Field Parameters											
pH	SM 4500-H+ B	7	NA	NA	NA	NA	7	flow-through cell	NA	none	immediately
Dissolved Oxygen [8]	SM 4500-O/405.1	7	NA	NA	NA	NA	7	flow-through cell	NA	none	immediately
Temperature [8]	SM 2550	7	NA	NA	NA	NA	7	flow-through cell	NA	none	immediately
Oxidation/Reduction Potential [8]	SM 2580 B	7	NA	NA	NA	NA	7	flow-through cell	NA	none	immediately
Specific Conductance [8]	SM 2510 B	7	NA	NA	NA	NA	7	flow-through cell	NA	none	immediately
Turbidity [7]	SM 2130 B	7	NA	NA	NA	NA	7	flow-through cell or hand-held turbidity meter	NA	none	immediately

[O: CJC 08/18/21; C: LDC 08/31/21]

Notes:
1 Analytical method numbers are from SW-846 unless otherwise indicated. Analytical methods may be updated with more recent versions as appropriate.
2 Field duplicates will be collected at a frequency of one per group of 10 or fewer investigative water samples. Field duplicates will not be collected for radium analysis.
3 Field blanks will be collected at the discretion of the project manager; Equipment blanks will be collected at a rate of 1 per sampling event if non-dedicated equipment is used.
4 Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples will be collected at a frequency of one per group of 20 or fewer investigative water samples per CCR unit/multi-unit. Additional volume to be determined by laboratory.
5 Sample volume is estimated and will be determined by the laboratory.
6 Metals = antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, lead, lithium, molybdenum, selenium, thallium. Metals may be analyzed via ICP/ ICP-MS USEPA methods 6010 or 6020 depending on laboratory instrument availability.
7 If turbidity exceeds 10 NTUs, a duplicate sample filtered through a .45 micron filter may be collected for metals analysis in addition to the unfiltered sample. Both samples would be submitted for analysis.
8 Parameter collected for quality assurance and quality control for field sampling purposes only; not required to be collected or reported under Part 845; collection of parameter may be discontinued without notification.
< = less than
°C = degrees Celsius
HNO_3 = nitric acid
mL = milliliter
NA = not applicable
NTU = nephelometric turbidity unit

RAMBOLL

TABLE 4-2. DETECTION AND REPORTING LIMITS FOR PART 845 PARAMETERS

ADDENDUM TO THE GROUNDWATER MONITORING PLAN

HENNEPIN POWER PLANT

ASH POND NO. 2 AND ASH POND NO. 4

HENNEPIN, ILLINOIS

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

TABLE 4-2. DETECTION AND REPORTING LIMITS FOR PART 845 PARAMETERS

ADDENDUM TO THE GROUNDWATER MONITORING PLAN

HENNEPIN POWER PLANT

ASH POND NO. 2 AND ASH POND NO. 4

HENNEPIN, ILLINOIS

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

[O: CJC 08/11/21; C: LDC 08/31/21]

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.

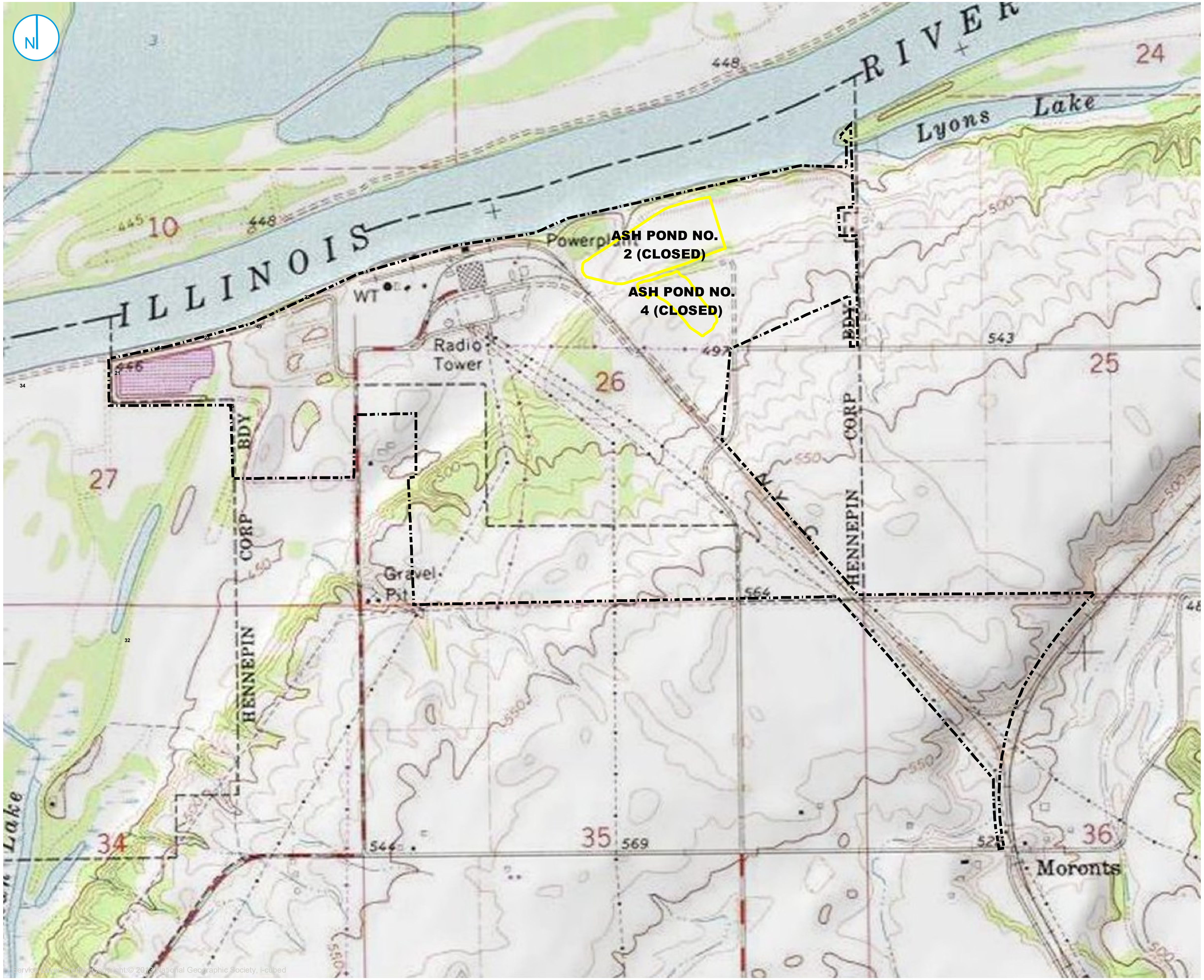
[5] RLs and method detection limits (MDL) will vary depending on the laboratory performing the work.

[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
NA = Not applicable
NS = No standard
NTU = nephelometric turbidity unit
pCi/L = picoCuries per liter
RL = Reporting limit as established by the laboratory
SM = Standard Methods for the Examination of Water and Wastewater
SU = standard units

FIGURES



PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

SITE LOCATION MAP

ADDENDUM TO THE GROUNDWATER MONITORING PLAN
ASH POND NO.2 AND ASH POND NO.4
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

FIGURE 1-1

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

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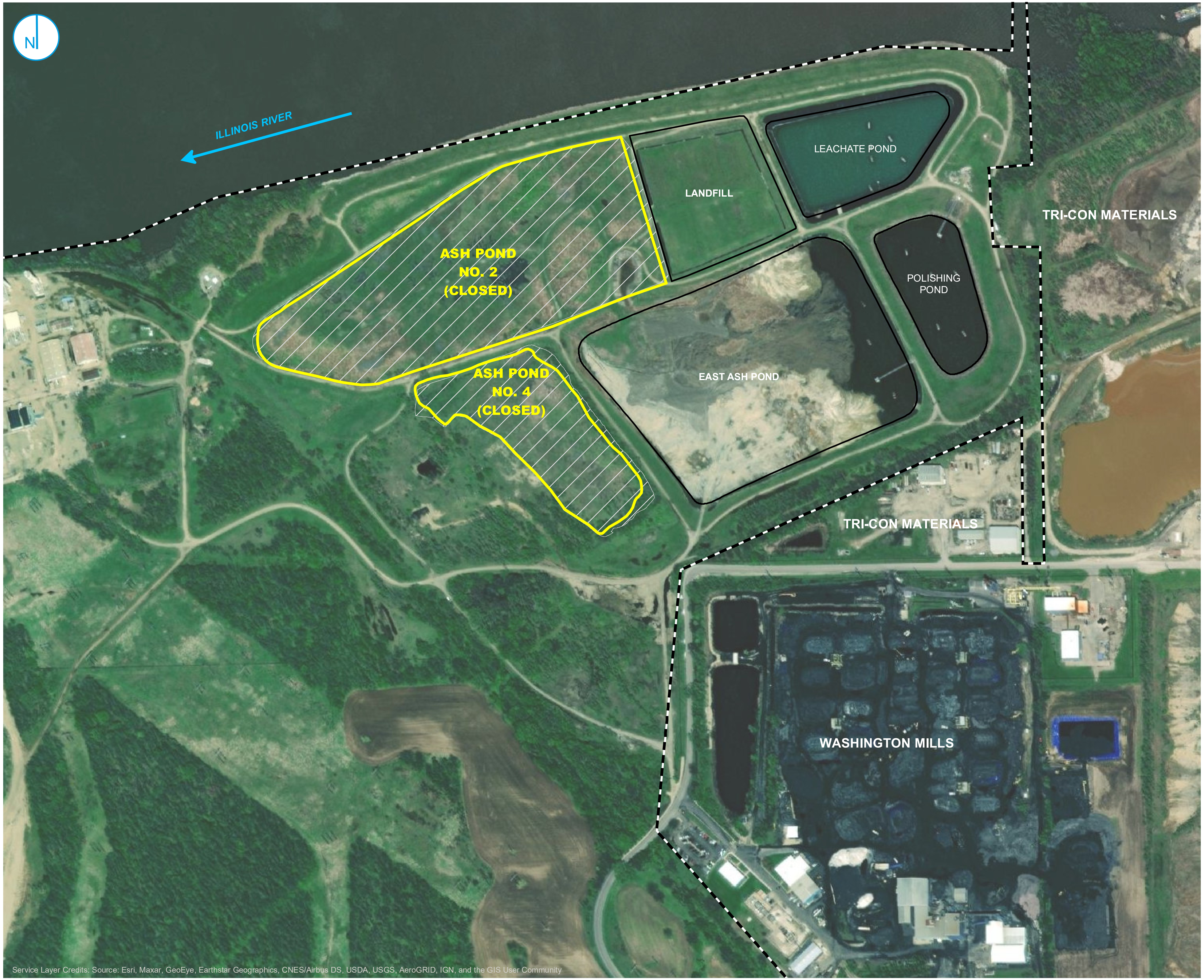
PROJECT: 169000XXXX | DATED: 10/1/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\GMP_802\Figure 1-1_Site Location Map.mxd



Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\GMP_802\Figure 1-2_Site Map.mxd

PROJECT: 169000XXXX | DATED: 9/29/2021 | DESIGNER: STOLZSD

PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 175 350 Feet

SITE MAP

ADDENDUM TO THE GROUNDWATER MONITORING PLAN ASH POND NO.2 AND ASH POND NO.4
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

FIGURE 1-2

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

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Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\GMP_802\Figure 2-1_Proposed Monitoring Well Network.mxd

PROJECT: 169000XXXX | DATED: 9/29/2021 | DESIGNER: STOLZSD

PROPOSED PART 845 GROUNDWATER MONITORING WELL NETWORK

ADDENDUM TO THE GROUNDWATER MONITORING PLAN ASH POND NO.2 AND ASH POND NO.4
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

FIGURE 2-1

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

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APPENDIX A
STATISTICAL ANALYSIS PLAN

Prepared for
Dynegy Midwest Generation, LLC

Date
October 25, 2021

Project No.
1940100806-005

STATISTICAL ANALYSIS PLAN

ASH POND NO. 2 AND ASH POND NO. 4
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

RAMBOLL Bright ideas. Sustainable change.

STATISTICAL ANALYSIS PLAN
HENNEPIN POWER PLANT ASH POND NO. 2 AND ASH POND NO. 4

Project Name	**Hennepin Power Plant Ash Pond No. 2 and Ash Pond No. 4**
Project No.	**1940100806-005**
Recipient	**Dynegy Midwest Generation, LLC**
Document Type	**Statistical Analysis Plan**
Version	**FINAL**
Date	**October 25, 2021**

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

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

Brian G. Hennings, PG
Senior Managing Hydrogeologist

Eric J. Tlachac, PE
Senior Managing Engineer

Rachel A. Banoff, EIT
Project Statistician

LICENSED PROFESSIONAL CERTIFICATIONS

This certification is based on the description of the statistical methods selected to evaluate groundwater as presented in the following Statistical Analysis Plan; Hennepin Power Plant Ash Pond No. 2 and Ash Pond No. 4. 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; Hennepin Power Plant Ash Pond No. 2 and Ash Pond No. 4) are appropriate for evaluating the groundwater monitoring data collected as described in the attached document and are in substantial compliance with 35 I.A.C. § 845.640.

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
Date: October 25, 2021

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

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

I, Brian G. Hennings, a qualified professional geologist in good standing in the State of Illinois, certify that the statistical methods described in this document (Statistical Analysis Plan; Hennepin Power Plant Ash Pond No. 2 and Ash Pond No. 4) 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; Hennepin Power Plant Ash Pond No. 2 and Ash Pond No. 4), are appropriate for evaluating the groundwater monitoring data collected as described in the attached document and are in substantial compliance with 35 I.A.C. § 845.640.

Rachel A. Banoff, EIT
Project Statistician
Date: October 25, 2021

CONTENTS

TABLES (IN TEXT)

ACRONYMS AND ABBREVIATIONS

§	Section
35 I.A.C.	Title 35 of the Illinois Administrative Code
ANOVA	analysis of variance
CCR	coal combustion residuals
COC	constituents of concern
GWPS	groundwater protection standard
IEPA	Illinois Environmental Protection Agency
LCL	lower confidence limit
LTL	lower tolerance limit
MSE	mean squared error
P	probability
Part 845	Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845
RCRA	Resource Conservation and Recovery Act
RL	reporting limit
ROS	regression on order statistics
SI	surface impoundment
SSI	statistically significant increase
SWFPR	site-wide false positive rate
Unified Guidance	*Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (USEPA, 2009)
UPL	upper prediction limit
USEPA	United States Environmental Protection Agency
UTL	upper tolerance limit

1. INTRODUCTION

In April 2021, the Illinois Environmental Protection Agency (IEPA) issued a final rule for the regulation and management of Coal Combustion Residuals (CCR) in surface impoundments (SIs) under the Standards for the Disposal of CCR in Surface Impoundments: Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845 (Part 845). Facilities regulated under Part 845 are required to develop and sample a groundwater monitoring well network to evaluate whether impounded CCR materials are impacting downgradient groundwater quality. The groundwater quality evaluation must include selection and certification by a qualified professional engineer of the statistical procedures to be used. The procedures described in the evaluation will be used to establish background conditions and implement compliance and corrective action monitoring as necessary and required by 35 I.A.C. § 845.640 and 35 I.A.C. § 845.650. This Statistical Analysis Plan was prepared in accordance with the requirements of 35 I.A.C. § 845.640(f), with reference to the acceptable statistical procedures provided in United States Environmental Protection Agency's (USEPA's) *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (*Unified Guidance*) (March 2009).

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

1.1 Statistical Analysis Objectives

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

1.2 Statistical Analysis Plan Approach

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

The CCR Rule outlines two phases of groundwater monitoring:

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

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

2. BACKGROUND MONITORING AND DATA PREPARATION

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

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

As required by 35 I.A.C. § 845.650(a)(1), eight sampling events were completed within 180 days of April 21, 2021. As outlined, groundwater sampling procedures included sampling of the background and compliance wells using low-flow sampling methods, collection of one field quality control sample per event, and groundwater samples were not field filtered before laboratory analysis of total recoverable metals.

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

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

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

2.1 Sample Independence

Independence of sample results is a major assumption for most statistical analyses. To ensure physical independence of groundwater sampling results, the minimum time between sampling events must be longer than the time required for groundwater to move through the monitoring well. The sampling schedules for both the baseline and compliance monitoring periods are specified in 35 I.A.C. § 845.650(b) and may conflict with the statistical assumption of independence of sample results.

2.2 Non-Detect Data Processing

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

For all statistical test procedures:

- If the frequency of non-detect data are less than or equal to 15 percent, half of the RL will be substituted for these data
- If the non-detect frequency is between 15 percent and 50 percent, either the Kaplan-Meier or robust regression on order statistics (ROS) will be used to estimate the mean and standard deviation adjusted for the presence of left-censored values
- If the non-detect frequency is greater than 50 percent, a non-parametric test will be used
- If only one background result is detected that value will be used as the non-parametric upper prediction limit (UPL)

2.3 Testing for Normality

Many statistical analyses assume that sample data are normally distributed (parametric). However, environmental data are frequently not normally distributed (nonparametric). 35 I.A.C. § 845.640(g) requires the knowledge of the background data distribution for comparison to compliance results. The *Unified Guidance* document recommends the Shapiro-Wilk normality test for sample sizes of 50 or less, and the Shapiro-Francia normality test for sample sizes greater than 50.

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

2.4 Testing for Outliers

Part 845 constituents will be screened for the existence of outliers using a method described by the *Unified Guidance*. Outliers are extreme data points that may represent an anomaly or erroneous data point. To test for outliers, one or more of the following outlier tests will be utilized:

- Dixon's test, for well-constituent pairs with less than 25 samples, assumes normally distributed data.
- Rosner's test, for well-constituent pairs with more than 20 samples, assumes normally distributed data.
- Grubb's test for well-constituent pairs with seven or more samples, assumes normally distributed data.
- Time series, box-whisker plots, and probability plots provide visual tools to identify potential outliers, and evaluation of seasonal, spatial, or temporal variability for both normally and non-normally distributed data.

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

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

2.5 Trend Analysis

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

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

2.6 Spatial Variation

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

2.7 Temporal Variation

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

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

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

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

2.8 Updating Background

Updating the background dataset periodically by adding recent results to an existing background dataset can improve the statistical power and accuracy of the statistical analysis, especially for non-parametric prediction intervals. The *Unified Guidance* recommends updating statistical limits (background) when at least four to eight new measurements (every 1 to 2 years under a quarterly monitoring program), are available for comparison to historical data. Professional judgement will be used to evaluate whether any background data appear to be affected by a release and need to be excluded from a background update. A t-test for equal means (if normal data distribution) or appropriate non-parametric test (if non-normal data distribution) such as a Mann-Whitney (or Wilcoxon) rank-sum or box-whisker plots, will be conducted to evaluate whether the two groups of background sample populations are statistically different prior to updating any background datasets. A 0.05 significance level will be utilized when evaluating the two populations, with the null hypothesis that they are equivalent. In addition, time series graphs or other trend evaluation statistics will be conducted on the new background dataset to verify the absence of a release or changing groundwater quality. If the tests indicate that there are no statistical differences between the two background populations, the new data will be combined with the existing dataset. If the two populations are found to be different, the data will be reviewed to evaluate the cause of the difference. If the differences appear to be caused by a release (if the new data are significantly higher, or lower for pH), then the previous background dataset may continue to be used. Furthermore, verified outliers will not be added to an existing background dataset. In accordance with the *Unified Guidance*, continual background updates will not be conducted due to the lack of sufficient samples for a statistical comparison.

3. COMPLIANCE MONITORING

Compliance monitoring is designed to monitor groundwater for evidence of a release by comparing Part 845 constituents in compliance wells to both background concentrations and the GWPS. Compliance Monitoring will begin the quarter following approval of this Addendum to the 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 ɑ values are tabulated in Table 22-2 of Appendix D of the *Unified Guidance*. The selected minimum ɑ 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 (a_{const}) will be determined as follows:

$$\alpha_{const} = 1 - (1 - \alpha)^{1/c}$$

α = the site-wide false positive rate (SWFPR) of 0.10 recommended by the *Unified Guidance*

c = the number of monitoring constituents

The number of yearly statistical evaluation (nE) will be multiplied by the number of compliance wells (w) to determine the look-up table entry, w*. The background sample size (n) and w* will be used to select an achievable per-constituent false positive rate value in Table 19-24 of Appendix D in the *Unified Guidance*. The chosen achievable per-constituent false positive rate value will determine the type of non-parametric prediction limit (maximum or 2nd highest value in background) and a retesting scheme for a future median. The background data will be sorted in ascending order, and the upper prediction limit will be set to the appropriate order statistic previously determined by the achievable per-constituent false positive rate value in Table 19-24. If all constituent measurements in a background sample are non-detect, the Double Quantification rule will be used. The use of the Double Quantification rule in Compliance Monitoring will only be applicable if the RL is above the 35 I.A.C. § 845.600(a)(1) constituent concentration or a constituent concentration is not specified in § 845.600(a)(1). This scenario is highly unlikely. The constituent will also be removed from calculations identifying the target false positive rate.

Two initial measurements per compliance well will be collected. If both do not exceed the upper prediction limit, a third initial measurement will not be collected since the median of order 3 will also not exceed the limit. If both exceed the prediction limit, a third initial measurement will not be collected since the median will also exceed the limit. If one initial measurement is above and one below the limit, a third initial observation may be collected to determine the position of the median relative to the UPL. Up to three resamples will be collected in order to assess the resample median. In all cases, if two or more of the compliance point observations are non-detect, the median will be set equal to the RL. The median value for each compliance well will be compared to the UPL. For the 1-of-2 retesting scheme, if any compliance point median exceeds the limit, up to three additional resamples will may be collected from that well. The resample median will be computed and compared to the UPL. A GWPS exceedance has been deemed to occur at a compliance well when either the initial median, or both the initial median and resample median exceed the UPL.

If the concentrations of detected constituents are below the established GWPS, Compliance Monitoring will continue.

3.1.6 Parametric Linear Regression and Confidence Band

If the t-test detects a significant trend in the parametric linear regression line using either background or compliance data for a particular constituent, confidence bands accounting for trends will be constructed to account for the trend-induced variation. If this is not accounted for, a wider confidence interval will inevitably be calculated for a given confidence level and sample size (n). A wider confidence interval will result in less statistical power, or ability to demonstrate an exceedance or return to compliance. When a linear trend line has been estimated, a series of confidence intervals is estimated at each point along the trend. This creates a simultaneous confidence band that follows the trend line. As the underlying population mean increases or decreases, the confidence band does also to reflect this change at that point in time.

Linear regression will be used when background or compliance data are approximately normally distributed, with a constant sample variance around the mean, and the frequency of non-detects is low. The linear regression of concentration against sampling date (time) will be computed as follows:

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

x_i = i^{th} concentration value and

t_i = i^{th} sampling date

$\bar{t}$ = sampling mean date

s_t^2 = variance of the sampling dates

This estimate leads to the following regression equation:

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

$\bar{x}$ = mean concentration level

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

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

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

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

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

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

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

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

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

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

For background data, the UCL around the linear regression line will be used as the GWPS for the trending constituent. For compliance data, confidence bands around the linear regression line will be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance wells. A GWPS exceedance is determined when the LCL based on the trend line first exceeds the GWPS.

3.1.7 Non-Parametric Thiel-Sen Trend Line and Confidence Band

If the Mann-Kendall test detects a significant trend in the non-parametric Thiel-Sen line using either background or compliance data for a particular constituent, confidence bands accounting for trends will be constructed to account for the trend-induced variation. The Thiel-Sen trend line will be used as a non-parametric alternative to linear regression when trend residuals cannot be normalized or if there are a higher percentage of non-detects in either background or compliance data. The Thiel-Sen trend line estimates the median concentration over time by combining the median pairwise slope with the median concentration value and the median sample date. To compute the Thiel-Sen line, the data will first be ordered by sampling event x1, x2, xn. All possible distinct pairs of measurements (x_i, x_j) for j > i will be considered and the simple pairwise slope estimate will be computed for each pair as follows:

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

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

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

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

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

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

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

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

For background data, the UCL around the Thiel-Sen trend line will be used as the GWPS for the trending constituent. For compliance data, confidence bands around the Thiel-Sen trend line will be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance wells. A GWPS exceedance is confirmed when the LCL based on the trend line first exceeds the GWPS.

3.2 Determination of Statistically Significant Increases over Background

In accordance with 35 I.A.C. §§ 845.610(b)(3)(B) and 845.640(h), individual monitoring event concentrations for each constituent detected in the compliance monitoring wells during compliance monitoring sampling events will be compared to the background concentration as determined by the methods described above. An exceedance of the background concentration for any constituent measured at any compliance monitoring well, or constituent detection if not detected in the background samples, constitutes a Statistically Significant Increase (SSI). An exception to this method is pH, where two-sided (upper and lower) tolerance limits are established from the distribution of the background groundwater quality data. An exceedance of either the UTL or lower tolerance limit (LTL) would constitute an SSI for pH.

4. REFERENCES

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 2
GROUNDWATER MONITORING PLAN, AS INCLUDED IN THE COMPILED COPY OF THE CLOSURE PLAN PROVIDED TO IEPA ON MARCH 23, 2020

Part of Ramboll

July 22, 2019

Phil Morris
Vistra Energy
1500 Eastport Plaza Drive
Collinsville, IL 62234-6135

RE: Response to IEPA Comments – Closure and Post-Closure Care Plan for the Hennepin East Ash Pond No. 2, and Closure Plan Addendum Hennepin East Ash Pond No. 2 which includes closure of Ash Pond No. 4

Dear Mr. Morris:

O'Brien & Gere Engineers, part of Ramboll (OBG) is providing this letter to Vistra Energy (Vistra) in response to comments received from the Illinois Environmental Protection Agency (IEPA) dated May 2, 2019 regarding *Closure and Post-Closure Care Plan for the Hennepin East Ash Pond No. 2* (Closure Plan; CEC, February, 2018) and *Closure Plan Addendum Hennepin East Ash Pond No. 2* (Closure Plan Addendum; OBG, October 2018) at Dynegy Midwest Generation, LLC Hennepin Power Station, in Hennepin, IL.

This Response to Comments will serve as Addendum 2 to the Closure Plan and Closure Plan Addendum dated February and October 2018, respectively. For ease of review, IEPA comments are presented below in italics, followed by responses. Supplemental information to support the responses, when required, is included. This document provides responses to all IEPA comments numbered 1 - 18.

Comment 1 - Section 2.1.2

The referenced eight rounds of monitoring should have been completed, please provide the full set of updated results.

Response: The results of the first eight rounds of monitoring are attached in Table 1 and Table 2.

Comment 2 - Section 2.2

The monitoring wells listed in the table in this Section are acceptable for the groundwater monitoring system.

Response: No response required.

Comment 3 - Section 3.2

The Agency notes that USEPA has adopted numerical groundwater protection standards for Cobalt, Lithium and Molybdenum that may be more appropriate for comparison with background concentrations.

Response: The USEPA adopted alternative risk-based groundwater protection standards for cobalt (6 micrograms per Liter [ug/L]), lithium (40 ug/L), and molybdenum (100 ug/L) that became effective on August 29, 2018, after submittal of the Closure Plan and during the preparation of the Closure Plan Addendum. As specified in 40 CFR Part 257 Subpart D (the CCR rule), concentrations detected in downgradient wells will be compared to either these standards or calculated background concentrations, whichever is higher. Tables 2 and 4, in the Groundwater Monitoring Plan have been updated consistent with the CCR rule to identify applicable groundwater standards. The revised Groundwater Monitoring Plan is included in Attachment 1.

Comment 4 - Section 4.1, First Paragraph

The text appears to contain a drafting error referencing West Ash Pond System monitoring wells. Please amend the text of the first paragraph of Section 4.1 in the Addendum to reflect the correct monitoring wells.

Response: This error was corrected and included in the Groundwater Monitoring Plan included as Appendix C of the Closure Plan Addendum submitted in October 2018. As stated in Section 5 of the Closure Plan Addendum, the October 2018 Groundwater Monitoring Plan replaced the previously submitted version. The Final Groundwater Monitoring Plan which incorporates changes requested in these comments is attached (Attachment 1).

Comment 5 - Section 4.1

The Agency finds that the set of parameters listed in the table in this Section is adequate to characterize groundwater quality around East Ash Ponds 2 and 4.

Response: No response required.

Comment 6 - Section 4.2

The Agency finds that the sampling schedule listed in this Section is adequate for Agency monitoring and reporting. Please confirm that the proposed sampling schedule will not conflict with any monitoring requirements of 40 CFR, Part 257, as stated in the Addendum.

Response: Additional statement(s) have been included in Section 4.2 of the revised Groundwater Monitoring Plan to indicate that changes in the frequency of monitoring and reporting approved by the Illinois EPA are applicable only to the Illinois EPA monitoring program and will not change the monitoring or reporting required under the federal CCR program.

Comment 7 - Section 4.7

Please rephrase the introductory paragraph to be consistent with the proposed monitoring schedule, which varies in frequency.

Response: The text has been modified to account for the variable frequency in monitoring.

Comment 8 - Groundwater Monitoring Plan Table 2

As noted in Comment 3, USEPA has adopted numerical groundwater protection standards for Cobalt, Lithium, and Molybdenum that may be more appropriate for comparison with background concentrations.

Response: The table has been revised, see also response to Comment 3.

Comment 9 - Groundwater Model Report, Section 1.2.4

Please provide additional discussion of the probable impact that occasional inundation of ash during flood events will have on predicted Boron, Lithium and Molybdenum concentrations (also see Comment 11).

Response: The occasional saturation of ash during flood events will not have significant effect on the predicted concentration of boron, lithium or molybdenum concentration. The flow and transport model was calibrated against long term observed groundwater elevations and boron concentrations in monitoring wells, using a river stage elevation of 444 ft. Although there were significant transient river flood events that caused short-term deviations in groundwater elevations and boron concentrations, overall the calibrated model accounts for the longer term baseflow conditions to the Illinois River that control the extent and concentration of the modeled plume. In several downgradient wells (Figure 1: wells 3R, 5R, and 6), there are over 20 years of data which includes multiple years when flood conditions were present on the Illinois River. During these short-term events, surface water and/or groundwater likely came into contact with the base of ash in some areas; however, these events do not result in deviations from the model simulated trends, which match the long-term baseflow conditions to the Illinois River. Observed concentrations at 5R tend to lag behind predicted concentrations as compared to the other downgradient wells 06 and 03R (Figure 1); however, the observed concentrations are decreasing over time to match long-term predictions. Wells 10, 12, and 13 also have over 20 years of data with observed and predicted concentrations matching very well.

The relationship between groundwater elevation and concentration has further been evaluated by comparing observed groundwater concentration to observed groundwater elevations in Figure 1. Trend lines and coefficient of determination values (R^2) have also been provided. The correlation coefficients range from 0.043 to 0.18 for wells with 10 or more data points. Well 45S has a correlation coefficient of 0.65 with seven data points and boron concentrations are below the applicable groundwater standard. The low correlation coefficients in observed data indicate that the boron concentration is not strongly related to higher or lower groundwater elevations. Flooding (and short-term groundwater elevation increases) may occasionally coincide with increases in boron concentration; however, they do not correlate on a regular basis, nor do they cause deviations from long-term concentration trends as discussed above.

Boron was modeled because it is a primary indicator of coal ash leachate, exceeds the applicable groundwater quality standard (2 mg/L), is mobile in groundwater, and is more representative of coal ash leachate than sulfate, which may originate from other anthropogenic or natural sources. Boron is more mobile in groundwater than lithium and molybdenum; therefore, the extent of boron in groundwater is expected to be greater than the extent of lithium or molybdenum. The site-specific relationships between boron, lithium, and molybdenum presented in response to Comment 13 (below) confirm that boron is an appropriate surrogate for lithium and molybdenum in groundwater attributable to coal ash. The occasional saturation of ash during flood events will not have significant effect on the predicted concentration of boron; which also applies to reductions in lithium and molybdenum concentrations with strong correlations to boron.

Comment 10 - Groundwater Model Report, Section 1.2.4

Please compare the time required to meet groundwater protection concentrations for an enhanced cover scenario (i.e. two feet of compacted clay with a hydraulic conductivity of 1 x10^{-7} cm/sec or less, or an equivalent synthetic cover) in addition to the Part 257 compliant cover and the baseline case provided.

Response: The final cover system for Hennepin East Ash Ponds No. 2 and No. 4, as detailed in the closure and post-closure care plan and addendum, will have a compacted soil barrier layer that is a minimum of 18 inches of earthen material with a maximum permeability of 1×10^{-5} centimeters per second (cm/sec) and a vegetative layer that is a minimum of 6 inches of earthen material capable of sustaining native plant growth. The final cover system achieves the requirements of the low permeability layer to limit accumulation of water in the ponds, meets the requirements in 40 CFR 257.102(d), and modeling of that cover shows that the reduced mass flux is expected to be protective of groundwater.

As requested in Comment 10, an enhanced cover scenario has been simulated to compare the time required to meet groundwater protection standards versus the planned cover system. The original prediction model was modified to predict groundwater concentrations for a cover comprised of 2-ft (24 inches) compacted clay with a hydraulic conductivity of 1×10^{-7} cm/s, overlain with 6-in soil. The infiltration rate was calculated as 1.9 in/yr using the HELP Model, about one third of the 5.9 in/yr calculated for the original clay cover. As shown in Figure 2, the enhanced clay cover results in additional reductions in predicted boron concentrations at downgradient wells 03R, 06, 18S, 18D and 45S relative to the original clay cover. However, the differences are negligible in either magnitude or time to reach the groundwater quality standard (2 mg/L). Well 18S is the location with the greatest observable differences. Under both capping scenarios boron concentrations drop below the groundwater quality standard before the first simulated timestep which occurs 200 days after placement of the cap. The predicted boron concentration at 200 days is 1.87 mg/L for the original clay cover compared with 1.39 mg/L for the enhanced cover. The predicted boron concentrations decrease to approximately 1.5 mg/L when they stabilize in the prediction of the original clay cover compared with 0.88 mg/L for the enhanced cover.

The modeling indicates an enhanced cover will not significantly improve performance over the original planned cover system as put forth in the closure and post-closure care plan and addendum for East Ash Ponds No. 2 and No. 4. Time required to meet groundwater protection concentrations between the original modeled cover versus the enhanced cover is negligible at all monitoring wells. The difference in overall reduction of boron concentrations (both short and long term) between the original modeled cover versus the enhanced cover is negligible at all monitoring wells other than well 18S, which had a boron reduction difference of 0.62 mg/L long term, but still 0.5 mg/L below the groundwater quality standard.

Comment 11 - Groundwater Model Report, Section 2.4.2, River Sensitivity

Documents indicate that the groundwater flow model and the transport model are sensitive to fluctuations in river stage. To simplify the model, river stage has been ignored. However, long term groundwater elevation monitoring shows that groundwater flow direction is affected by river stage. Please provide further explanation of any anticipated effect this model simplification may have on the long-term plume concentration and extent of Boron, Lithium and Molybdenum concentrations at the site.

Response: River stage is variable, but on a relatively short timeframe (days to weeks) relative to the long term steady state flow of groundwater via baseflow to the Illinois River. Relative to the long-term timeline of the model (25 years), the transient effects of short periods of high river stage on groundwater elevations and quality do not significantly impact the extent or concentrations of the modeled boron plume (and similarly lithium and molybdenum, see response to Comments 9 and 13). The flow and transport model was calibrated against long-term observed groundwater elevations and boron concentrations in monitoring wells, using a river stage near the mean observed elevation 444 ft. Although there were significant transient river flood events that caused short-term deviations in groundwater elevations and boron concentrations, overall the calibrated model accounts for the longer term baseflow conditions to the Illinois River that control the extent and concentration of the modeled plume. It is therefore appropriate to use a static river stage for modeling the groundwater system.

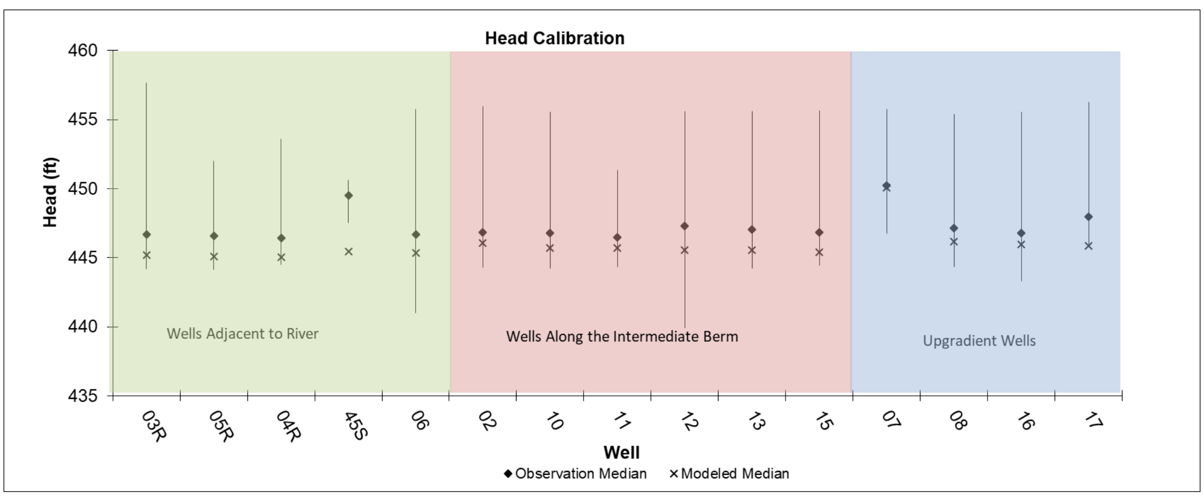
Comment 12 - Groundwater Model Report, Section 3.2 and Figure 3-1; Calibration Flow and Transport Model Results

The observed and modeled head elevations displayed in Figure 3-1, do not match well at many of the data points. Further, Section 3.2 does not include a description of the relative standard deviation given as a percentage of standard deviation to the data mean. Typically, this value should be less than 10%. Please refer to the Wood River Closure Plan. Part 2 Appendix D, Section 3.4 Calibration Flow and Transport Model Results, and Figure 3-6 as an example. An inadequately calibrated model may significantly impact predicted compliance with groundwater standards. Please provide documentation that the model submitted did meet the 10% calibration criteria, or rework the model to meet the 10% criteria, and rerun the predictive flow and transport modeling.

Response: Similar to the Wood River Closure Plan, this groundwater model has been calibrated in multiple stages to match longer term baseflow observations of groundwater head and concentration trends collected that control the extent and concentration of the plume over many years. Both models started with a steady state model calibrated to observed head and concentration values. The current Hennepin model was initially calibrated and discussed in the Groundwater Impact Assessment (NRT, 2010) which started with a steady state model calibrated to head and concentration conditions measured in September 1995 when Ash Pond No. 2 was in service. Heads were calibrated within 1.5 feet of observed values (Figure 3A), the standard deviation over the range of observed heads was 17.7% and the calibration residuals are near the 1 to 1 line with good scatter on the observed versus residual graph (Figure 3B). The model was also verified by changing recharge rates to simulate dewatering of Pond 2 and the addition of the primary and secondary ponds. Results of the verification show the model was adequate to reproduce changes in observed concentrations resulting from changes in land use/recharge. The 10% criteria referenced in this comment is an indicator of how well modeled and observed values correlate within the model domain; however, it is not a requirement that a model meet this statistical benchmark to adequately simulate flow and transport. No steady state models have been calibrated since the modeling was completed for the Groundwater Impact Assessment. However, the following analysis and additional model verification, provided below, documents how the current model calibration continues to be appropriate for predictive modeling.

Median modeled heads match median observed heads: Figure A below plots the range (maximum and minimum) of head observed for a distribution of wells that is representative of the monitoring network with the median observation value and the modeled value illustrated for comparison. Median modeled heads were calculated from the model results generated after dewatering of Pond 2 (1997 through 2019). This period is representative of long-term groundwater flow conditions during the bulk of the observed data collected. The predicted heads fell in the range of monitoring data at these wells with the exception of well 45S which is lower than the range. The median head at 45S is 449.5 and is the second highest value at the site; only well 07 at the upgradient edge of the monitoring network has a higher median head value. During individual sampling events the heads at 45S are consistent with neighboring wells, indicating the higher median observed value is due to the limited amount of monitoring data available for this newer well which hasn't captured a representative range of periodic high and low head fluctuations observed at other wells. Well 06 (located near well 45S) has more observations and is more consistent with other wells (Figure A below). The predicted heads were all lower than their corresponding observed medians at each well, indicating the model generally under-predicts median head values. The average difference between the observed median and the modeled head for these wells is approximately 1.4 feet. The average range in head (maximum – minimum observed) is approximately 10.6 feet at each well. The average difference in head (1.4 feet) over the average range in head (10.6 feet) is 13.2%. When the observations from 45S are removed, the average difference in head reduces to 1.2 feet while the average range in head increases to 11.2 feet; resulting in a value of 10.7%. The difference in head compared to the range of values at these wells approaches the recommended value of 10% or less; and, demonstrates how the modeled heads are representative of long-term (median) flow conditions discharging to the Illinois River.

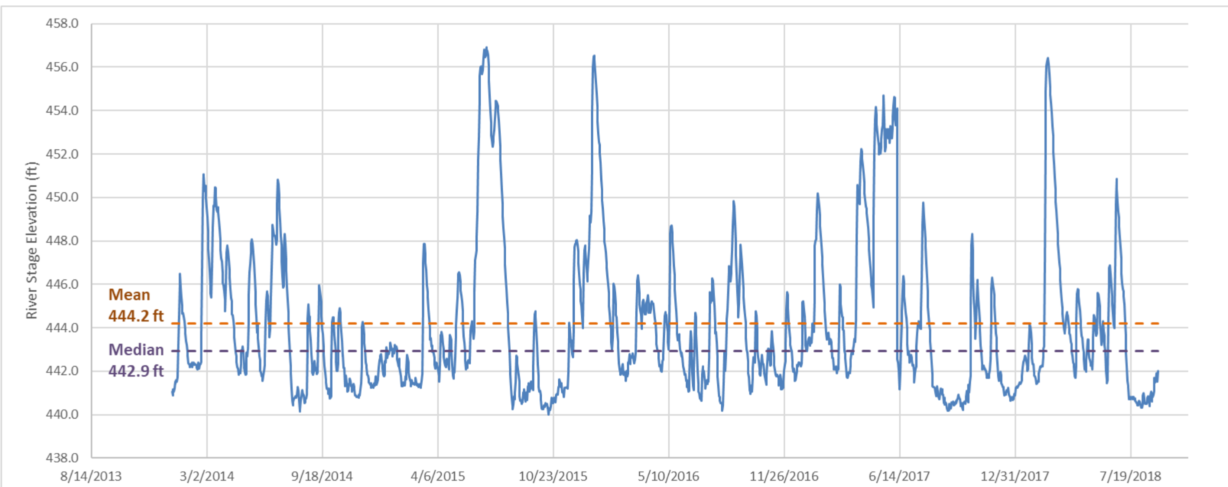
Figure A. Observed vs Modeled Median Groundwater Elevations for Representative Wells



Due to the lack of representative data collected from well 45S, this well was removed from further calibration evaluations involving the median of observed values. Well 06 is more representative of heads in this portion of the site.

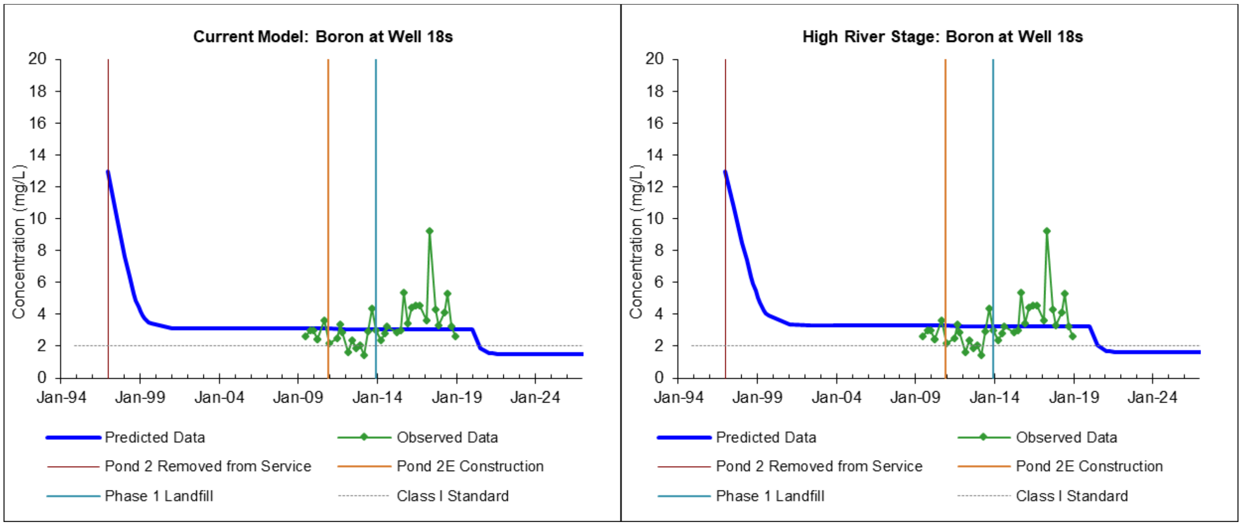
Model verification using median observed heads: The median observed head values were placed in the transient model as calibration targets during a timestep in 2008 (the mid-point between the range of modeled values used to calculate the model median). The median observed river elevation (442.9 feet) calculated from Illinois River stage data collected at the Hennepin plant between 2014 and 2018 (Figure B below) was also placed in the model as a calibration target. The residuals presented on Figure 4A illustrate how the model generally under-predicts (blue numbers are low compared to the target value) the observed median values with residuals ranging from -1.19 to 3.06 feet. The upgradient edge of the well network (well 07) has the lowest residual of 0.12 and the downgradient end of the model slightly over-predicts (red number) the median elevation of the Illinois River with a residual of -1.19. The standard deviation over the range of values is 13.2% in this simulation as compared to the recommended 10%. This is a very good result considering these are median values and further supports how well the model simulates long-term conditions. The calibration residuals clustered below the 1 to 1 line of the Observed vs Computed Target Values graph and the cluster of residuals on the Observed vs Residuals graph (Figure 4B) is consistent with the generally under-predicted heads.

Figure B. Illinois River Stage Elevations (January 2014 to September 2018)



Model verification with increased river stage: The same verification model was run a second time keeping all inputs the same except for the head used for the Illinois River. The head of the river was increased from 444 feet to 446 feet. The residuals shown on Figure 5A illustrate a more mixed combination of over-predicted and under-predicted values with residuals ranging from -3.18 to 1.12 feet. In this simulation most of the wells are over-predicted with the highest residuals occurring at the upgradient (07) and downgradient (river) ends of the model. The standard deviation over the range is 12.7% in this simulation as compared to the recommended 10%. The observed versus computed target head values are close to and equally distributed about the 1 to 1 line on Figure 5B and the calibration residuals are clustered close to (i.e. -1.0 to +1.0) the zero residual horizontal line on Figure 5B, consistent with the slightly improved calibration statistic and more over-predicted heads as compared to the initial verification model with the lower river elevation (Figure 4B). This verification model did not result in significant changes in predicted boron concentrations as compared to the current model (Figure C below). The concentration at well 18S is predicted to stabilize below the Class I standard at 1.5 mg/L in the current model versus a stabilized concentration of 1.6 mg/L in the high river stage verification model.

Figure C. Predicted Concentrations in the Current Model and Model with Increased River Stage



The modeled groundwater flow matches long-term groundwater flow and discharge to the Illinois River. The verification model indicates median heads are very well calibrated at the upgradient edge of the monitoring well network (07) and the downgradient edge of the model domain (the Illinois River), which closely matches observed mean river elevation. Verification model residuals are, on average, within 1.5 feet and result in a standard deviation over the range of 13.2%, which is a very good result considering it uses median values; and, further supports how well the model simulates long-term conditions. Short-term changes in groundwater elevation have been demonstrated not to have significant effect on concentration trends (Comment 9 above). Concentration versus time graphs demonstrate the model accurately simulates changes in observed concentrations resulting from changes in land use/recharge; and, observed long-term concentration trends. The results of the high river stage verification modeling indicate an alternative calibration with slightly over-prediction of heads does not result in significant changes in predicted concentrations.

The 10% criteria is an indicator of how well modeled and observed values correlate within the model domain; however, it is not a requirement that a model meet this statistical benchmark to adequately simulate flow and transport. The residuals of the verification model approach the recommended 10%, indicating the model deviations remain small compared to the range of heads observed at the site; and, the model is appropriate for prediction modeling in its current form. Additional calibration beyond river elevation inputs would be required to whittle down the calibration statistics from 13.2% to 10% to meet the recommended criteria. This level of effort is not necessary given the model's proven ability to simulate observed changes in concentration.

As a reminder, the groundwater monitoring plan will monitor natural attenuation of contaminants after construction and evaluate groundwater quality to demonstrate compliance with the groundwater quality standards for Class I: Potable Resource Groundwater as well as USEPA MCLs or background exceedances, as appropriate. If a statistically significant increasing trend is observed to continue over a period of two or more years in groundwater sampled at the well network, and a subsequent hydrogeologic site investigation demonstrates that such exceedances are due to a release from Ash Pond No. 2 and 4 and corrective actions are appropriate to mitigate such releases, a corrective action plan will be proposed as a modification to the post-closure care plan..

Comment 13 - Summary Section 4

Available monitoring results from monitoring conducted by Vistra during 2018 indicates that both Lithium and Molybdenum at statistically significant concentrations in some down gradient monitoring wells. Please provide an evaluation of the estimated time required to meet applicable groundwater protection concentrations for these constituents, including an enhanced cover scenario, in addition to the Part 257 compliant cover and the baseline case.

Response: The concentration of lithium exceeds the applicable (see Comment 3 and updated Groundwater Monitoring Plan Table 2) USEPA risk based standard (0.04 mg/L) in well 18S, and molybdenum concentrations are above the applicable standard (0.1 mg/L) in wells 18S and 3R. The transport and fate of lithium in the groundwater is expected to be similar to boron since both are mobile in groundwater and relatively unaffected by sorption to organic matter or iron hydroxides in the aquifer. Molybdenum has the potential to be sorbed onto iron hydroxides or organic matter in the aquifer materials depending on the geochemical conditions. The potential for sorption may increase the length of time required for molybdenum to reach applicable groundwater quality standards (IEPA or USEPA), as molybdenum will desorb from the aquifer materials while concentrations decline.

Comparisons of the molybdenum and lithium concentrations to boron (Figures D through F below) indicate that these compounds are relatively well correlated at downgradient wells of interest 18S, 3R, and 45S. Boron and lithium have a strong linear correlation coefficient (R^2) of 0.94 (Figure D). Boron and molybdenum have a good linear correlation coefficient of 0.72 (Figure E); and, molybdenum shows a stronger exponential correlation coefficient of 0.94 with boron (Figure F), likely due to sorption of molybdenum on aquifer materials as discussed above. Based on the data collected and the existing strong linear or exponential correlations, concentrations of lithium and molybdenum are expected to decrease at similar rates to those of boron as predicted in the computer model.

Figure D. Boron vs Lithium

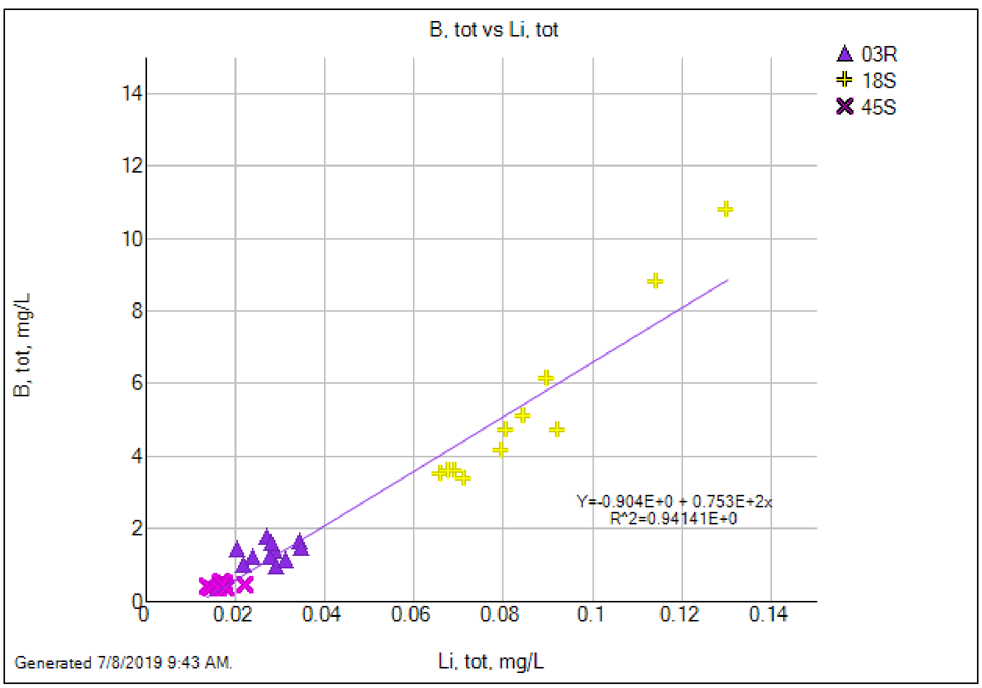


Figure E. Boron vs Molybdenum

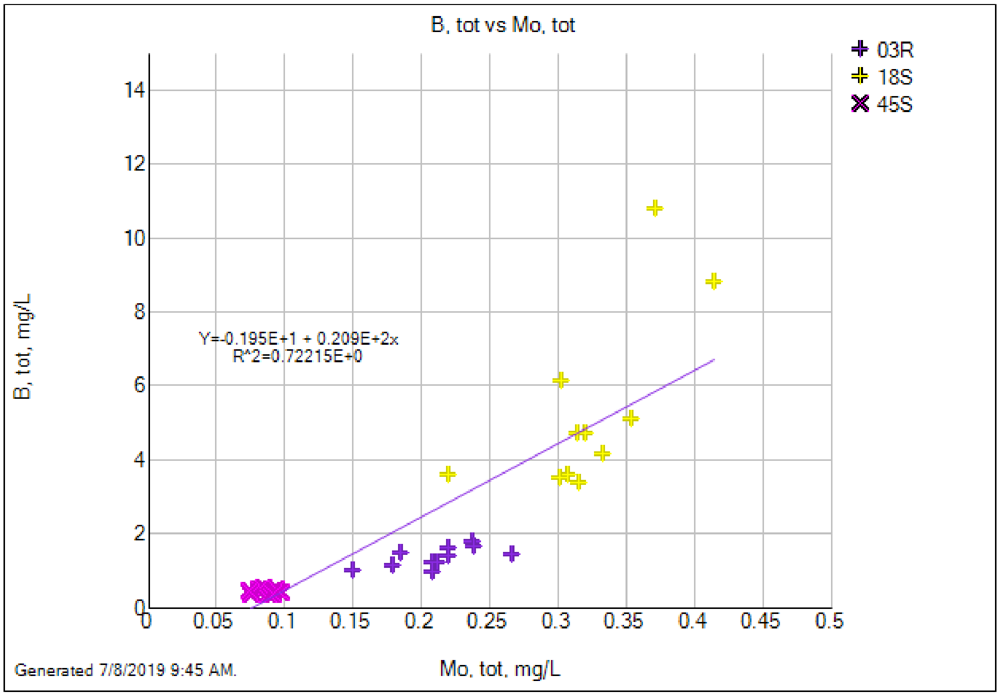
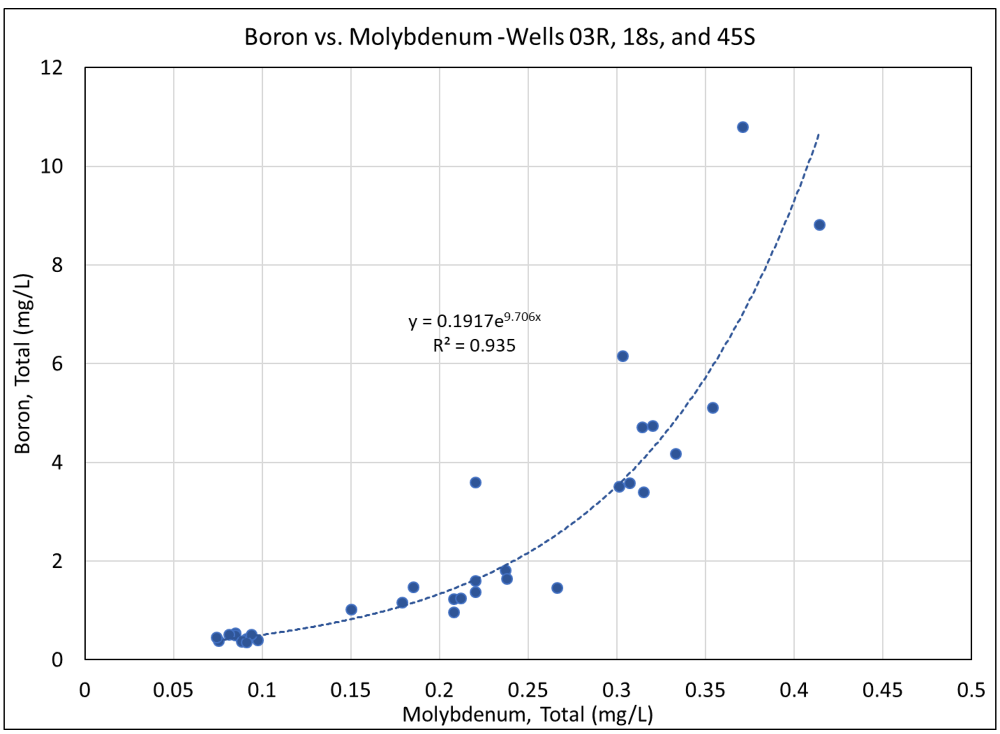


Figure F. Boron vs Molybdenum (Exponential)



Review of the correlation coefficients at the individual wells (Table A below) indicates the correlations with boron are stronger at well 18S where the concentrations of boron exceed the applicable groundwater standard (i.e., the correlations are stronger in the modeled and observed boron plume). There is almost no linear correlation at well 45S where there have not been any exceedances of boron, lithium, or molybdenum. The strong correlations associated with the boron plume indicate boron is an acceptable surrogate for lithium and molybdenum and concentrations of lithium and molybdenum are expected to decrease along with model predicted boron concentrations.

Table A. Summary of Linear Correlation Coefficients

Linear Correlation (R^2)	Combined Wells 18S, 3R, and 45S	Well 18S	Well 3R	Well 45S
B vs Li	0.94	0.95	0.06	0.07
B vs Mo	0.72	0.49	0.39	0.02

Comment 14 - Summary Section 4

Please provide additional discussion of the anticipated impact that achieving groundwater standards will have on surface water quality. In that discussion please include Boron, Lithium and Molybdenum relative to surface water quality standards.

Response: Currently there are no significant impacts to the Illinois River and the increase in concentration attributed to East Ash Pond No. 2 and 4 is less than the laboratory detection limit for all three parameters (boron, lithium, and molybdenum, see calculations in Attachment 2). Achieving groundwater standards for boron will reduce concentrations of lithium and molybdenum discharging to the river and have a beneficial impact on the Illinois River.

Comment 15 - Summary Section Prediction Graphs

Monitoring Well MW-45S is a down gradient compliance well. Please provide a Boron, Lithium and Molybdenum groundwater concentration prediction graphs for MW-45S.

Response: A boron groundwater concentration prediction graph for well 45S has been provided on Figure 1D. As shown, the concentrations predicted in 45S are approximately 1 mg/L, while the observed concentrations range from 0.328 to 0.544 mg/L. Both observed and predicted concentrations are below the applicable groundwater quality standard (2 mg/L). Observed concentrations of molybdenum (0.0741 to 0.0972 mg/L) and lithium (0.0137 to 0.0223 mg/L) at 45S also do not exceed the applicable groundwater standards (Mo 0.1 mg/L, and Li 0.04 mg/L); and, they correlate well with boron (see response to Comment 13). With boron as a surrogate and the lack of exceedances at well 45S, additional modeling of lithium and molybdenum is not necessary to generate additional prediction graphs.

Comment 16 - Groundwater Management Zone, Appendix E

The Groundwater Management Zone GMZ application in the Addendum supersedes the GMZ application contained in the Plan. The Agency finds that it is acceptable for the proposed (GMZ) to replace the existing GMZ upon approval of the Plan and Addendum.

Response: No response required.

Comment 17 - Groundwater Management Zone, Appendix E, Part 1, Item 7a

The answer to the question is marked "no", but a NPDES permit number is provided. Further the NPDES number does not appear to be associated with the Hennepin Station. Please correct theses apparent discrepancies.

Response: This discrepancy has been corrected and the applicable Generator ID number has been provided in a new GMZ form included in Attachment 3.

Comment 18 - Groundwater Management Zone, Appendix E, Part 1, Item 6

The statement provided indicates that groundwater standards will be achieved within 20 years. However, the modeling provided in the Plan and referenced in Item 6 indicates compliance with groundwater standards two years after cover installation. Please confirm the applicable time and correct this apparent discrepancy.

Response: This discrepancy in Part III, Item 6 has been corrected and a new GMZ form has been included in Attachment 3.

Very truly yours,
O'BRIEN & GERE ENGINEERS, INC.

Brian G. Hennings
Senior Hydrogeologist

Nicole M. Pagano, PE, PG
Senior Managing Engineer

LICENSED PROFESSIONAL GEOLOGIST
NICOLE M. PAGANO
196-000750
ILLINOIS

TABLES

Table 1	Appendix III Analytical Results
Table 2	Appendix IV Analytical Results

FIGURES

Figure 1A to 1F	Comparison of Observed and Modeled Concentrations, Observed and Modeled Heads, and Observed Concentration versus Observed Head by Well Location
Figure 2A to 2C	Boron Prediction Concentration of Original Clay Cover (Capped) and Enhanced Clay Cover (Enhanced Capped)
Figure 3A	Comparison between Observed and Modeled Heads (1995)
Figure 3B	Model Calibration Results (1995)
Figure 4A	Comparison between Observed and Modeled Median Heads
Figure 4B	Verification Model Residuals Using Median Elevation Targets
Figure 5A	Comparison between Observed and Modeled Median Heads with Increased River Elevation
Figure 5B	Verification Model Residuals Using Median Elevation Targets with Increased River Elevation

ATTACHMENTS

Attachment 1	Groundwater Monitoring Plan
Attachment 2	Groundwater Discharge Calculations
Attachment 3	Groundwater Management Zone Application

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Tables

Hennepin CCR

June 5, 2019

Table 1. Hennepin Ash Pond No. 2: Appendix III Analytical Results

2:29:29 PM

Location ID	Sample Date	B, tot, mg/L	Ca, tot, mg/L	Cl, tot, mg/L	F, tot, mg/L	pH (field), STD	SO4, tot, mg/L
03R	12/9/2015	1.240	82.40	66.00	0.2000	7.200	85.00
	3/9/2016	1.380	84.60	78.00	0.2600	7.300	136.0
	6/8/2016	1.250	85.60	84.00	0.2600	7.300	107.0
	8/31/2016	1.030	85.80	89.00	0.2700	7.500	101.0
	12/8/2016	1.460	87.20	70.00	0.2800	7.300	102.0
	2/22/2017	1.810	84.50	55.00	0.2800	7.500	97.00
	4/26/2017	1.600	77.20	60.00	0.3200	7.000	97.00
	6/9/2017	0.9660	85.20	71.00	0.3100	7.400	93.00
	11/16/2017	1.130	96.00	62.00	0.3200	7.500	78.00
	6/14/2018	1.160	89.40	71.00	0.2900	6.800	104.0
	9/13/2018	1.650	113.0	73.00	0.2900	7.300	92.00
	3/13/2019	1.470	96.50	80.00	0.2900	7.300	94.00
07	3/10/2016	0.06290	126.0	51.00	0.1000	6.900	70.00
	6/7/2016	0.06730	154.0	55.00	<0.1000	6.600	82.00
	7/29/2016	0.07450	131.0	48.00	<0.1000	7.500	71.00
	9/1/2016	0.06970	150.0	49.00	0.1000	6.900	75.00
	12/9/2016	0.09390	158.0	63.00	0.1000	6.800	82.00
	2/22/2017	0.05440	137.0	46.00	<0.1000	7.000	66.00

Hennepin CCR

Table 1. Hennepin Ash Pond No. 2: Appendix III Analytical Results

Location ID	Sample Date	TDS, mg/L
03R	12/9/2015	548.0
	3/9/2016	566.0
	6/8/2016	532.0
	8/31/2016	560.0
	12/8/2016	458.0
	2/22/2017	454.0
	4/26/2017	478.0
	6/9/2017	470.0
	11/16/2017	530.0
	6/14/2018	552.0
	9/13/2018	558.0
	3/13/2019	574.0
07	3/10/2016	536.0
	6/7/2016	758.0
	7/29/2016	632.0
	9/1/2016	574.0
	12/9/2016	718.0
	2/22/2017	660.0

Hennepin CCR

Table 1. Hennepin Ash Pond No. 2: Appendix III Analytical Results

Location ID	Sample Date	B, tot, mg/L	Ca, tot, mg/L	Cl, tot, mg/L	F, tot, mg/L	pH (field), STD	SO4, tot, mg/L
07	4/27/2017	0.05880	125.0	48.00	<0.1000	6.700	69.00
	6/8/2017	0.07010	118.0	56.00	0.1000	6.900	75.00
	11/16/2017	0.07020	136.0	48.00	0.1200	7.200	68.00
	6/14/2018	0.08650	133.0	50.00	<0.1000	6.800	67.00
	9/13/2018	0.07310	168.0	44.00	<0.1000	6.800	67.00
	12/13/2018	0.07900	155.0	39.00	<0.1000	7.000	60.00
	3/14/2019	0.08690	140.0	44.00	<0.1000	6.900	59.00
08	12/8/2015	0.09720	198.0	216.0	<0.1000	6.800	164.0
	3/10/2016	0.08780	213.0	145.0	<0.1000	6.700	133.0
	6/7/2016	0.07500	191.0	202.0	<0.1000	6.600	129.0
	9/1/2016	0.1420	299.0	312.0	<0.1000	6.700	209.0
	12/9/2016	0.1030	244.0	241.0	<0.1000	6.600	198.0
	2/22/2017	0.08730	208.0	223.0	<0.1000	6.900	140.0
	4/27/2017	0.1210	182.0	300.0	<0.1000	6.700	139.0
	6/9/2017	0.1330	152.0	127.0	<0.1000	6.900	134.0
	11/16/2017	0.1350	243.0	277.0	0.1000	7.000	167.0
	6/14/2018	0.1680	211.0	290.0	<0.1000	6.700	128.0
	9/13/2018	0.1140	235.0	241.0	<0.1000	6.700	184.0

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Table 1. Hennepin Ash Pond No. 2: Appendix III Analytical Results

Location ID	Sample Date	TDS, mg/L
07	4/27/2017	630.0
	6/8/2017	572.0
	11/16/2017	658.0
	6/14/2018	644.0
	9/13/2018	684.0
	12/13/2018	656.0
	3/14/2019	590.0
08	12/8/2015	1170.
	3/10/2016	918.0
	6/7/2016	1060.
	9/1/2016	1370.
	12/9/2016	1200.
	2/22/2017	1160.
	4/27/2017	1310.
	6/9/2017	972.0
	11/16/2017	1370.
	6/14/2018	1280.
	9/13/2018	1200.

Table 1. Hennepin Ash Pond No. 2: Appendix III Analytical Results

Location ID	Sample Date	B, tot, mg/L	Ca, tot, mg/L	Cl, tot, mg/L	F, tot, mg/L	pH (field), STD	SO4, tot, mg/L
08	12/13/2018	0.1510	273.0	288.0	0.1100	6.800	264.0
	3/14/2019	0.1720	239.0	272.0	<0.1000	6.800	193.0
08D	12/8/2015	0.1090	174.0	184.0	0.1200	6.900	119.0
	3/10/2016	0.1220	187.0	209.0	0.1000	6.700	130.0
	6/7/2016	0.1110	177.0	217.0	0.1000	6.600	113.0
	9/1/2016	0.1390	287.0	325.0	0.1200	6.600	161.0
	12/9/2016	0.1250	233.0	313.0	0.1000	6.600	164.0
	2/22/2017	0.1150	220.0	262.0	<0.1000	6.800	124.0
	4/27/2017	0.1180	175.0	315.0	0.1000	6.600	119.0
	6/9/2017	0.1390	208.0	366.0	<0.1000	6.800	123.0
	11/16/2017	0.1220	189.0	200.0	0.1200	7.000	157.0
	6/14/2018	0.1330	204.0	315.0	0.1200	6.800	114.0
	9/13/2018	0.09410	252.0	269.0	<0.1000	6.700	161.0
	12/13/2018	0.1160	205.0	251.0	0.1100	6.800	182.0
	3/14/2019	0.1700	184.0	246.0	0.1200	6.800	143.0
18D	12/9/2015	1.980	114.0	74.00	0.1300	7.200	133.0
	3/9/2016	1.930	116.0	81.00	0.1500	7.200	141.0
	6/8/2016	1.820	110.0	90.00	0.1400	7.200	136.0

Table 1. Hennepin Ash Pond No. 2: Appendix III Analytical Results

Location ID	Sample Date	TDS, mg/L
08	12/13/2018	1520.
	3/14/2019	1370.
08D	12/8/2015	1050.
	3/10/2016	1060.
	6/7/2016	1090.
	9/1/2016	1340.
	12/9/2016	954.0
	2/22/2017	1220.
	4/27/2017	1250.
	6/9/2017	1320.
	11/16/2017	1200.
	6/14/2018	1310.
	9/13/2018	1330.
	12/13/2018	1320.
	3/14/2019	1220.
18D	12/9/2015	680.0
	3/9/2016	686.0
	6/8/2016	648.0

Table 1. Hennepin Ash Pond No. 2: Appendix III Analytical Results

Location ID	Sample Date	B, tot, mg/L	Ca, tot, mg/L	Cl, tot, mg/L	F, tot, mg/L	pH (field), STD	SO4, tot, mg/L
18D	**8/31/2016**	1.860	108.0	83.00	0.1400	7.400	123.0
	12/8/2016	2.230	113.0	89.00	0.1600	7.200	135.0
	2/22/2017	1.790	108.0	73.00	0.1400	7.300	119.0
	4/26/2017	1.920	104.0	76.00	0.1500	7.000	126.0
	6/9/2017	1.730	104.0	84.00	0.1500	7.200	131.0
	11/16/2017	1.760	105.0	73.00	0.1800	7.500	108.0
	6/14/2018	1.770	104.0	68.00	0.1400	6.700	95.00
	9/13/2018	1.750	108.0	74.00	0.1500	7.200	126.0
	3/13/2019	2.010	104.0	75.00	0.1500	7.300	102.0
18S	**12/9/2015**	3.400	99.70	68.00	0.1400	7.500	153.0
	3/9/2016	4.740	101.0	69.00	0.1300	7.400	229.0
	6/8/2016	4.180	98.30	70.00	0.1300	7.600	204.0
	8/31/2016	5.110	118.0	70.00	0.1200	7.500	187.0
	12/8/2016	3.590	102.0	71.00	0.1400	7.300	163.0
	2/22/2017	3.520	93.90	61.00	0.1400	7.500	181.0
	4/26/2017	10.80	172.0	49.00	0.1000	7.100	418.0
	6/9/2017	8.820	159.0	46.00	0.1100	7.500	421.0
	11/16/2017	3.290	93.40	57.00	0.1600	7.600	145.0

Table 1. Hennepin Ash Pond No. 2: Appendix III Analytical Results

Location ID	Sample Date	TDS, mg/L
18D	8/31/2016	608.0
	12/8/2016	266.0
	2/22/2017	612.0
	4/26/2017	608.0
	6/9/2017	584.0
	11/16/2017	594.0
	6/14/2018	614.0
	9/13/2018	618.0
	3/13/2019	578.0
18S	12/9/2015	656.0
	3/9/2016	670.0
	6/8/2016	654.0
	8/31/2016	678.0
	12/8/2016	502.0
	2/22/2017	470.0
	4/26/2017	900.0
	6/9/2017	836.0
	11/16/2017	528.0

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Table 1. Hennepin Ash Pond No. 2: Appendix III Analytical Results

Location ID	Sample Date	B, tot, mg/L	Ca, tot, mg/L	Cl, tot, mg/L	F, tot, mg/L	pH (field), STD	SO4, tot, mg/L
18S	**6/14/2018**	6.160	126.0	87.00	0.1200	6.900	79.00
	9/13/2018	4.720	118.0	68.00	0.1400	7.400	182.0
	3/13/2019	3.600	117.0	74.00	0.1600	7.400	149.0
45S	**12/9/2015**	0.4000	87.80	70.00	0.2900	7.000	83.00
	3/9/2016	0.4360	97.20	80.00	0.3300	7.200	93.00
	6/8/2016	0.5440	97.20	104.0	0.3300	7.300	99.00
	8/31/2016	0.4970	95.40	96.00	0.3400	7.300	98.00
	12/8/2016	0.3940	88.90	75.00	0.3600	7.100	77.00
	2/22/2017	0.3730	86.60	65.00	0.3500	7.300	69.00
	4/26/2017	0.5110	90.60	84.00	0.3400	7.100	82.00
	6/9/2017	0.5090	105.0	113.0	0.3200	7.200	115.0
	11/16/2017	0.3280	93.00	70.00	0.3600	7.500	61.00
	6/14/2018	0.3810	90.80	56.00	0.3100	7.200	228.0
	9/13/2018	0.3650	98.10	86.00	0.3100	7.200	66.00
	3/14/2019	0.4580	100.0	85.00	0.3200	7.100	70.00

Table 1. Hennepin Ash Pond No. 2: Appendix III Analytical Results

Location ID	Sample Date	TDS, mg/L
18S	6/14/2018	700.0
	9/13/2018	600.0
	3/13/2019	614.0
45S	12/9/2015	534.0
	3/9/2016	594.0
	6/8/2016	574.0
	8/31/2016	542.0
	12/8/2016	460.0
	2/22/2017	502.0
	4/26/2017	532.0
	6/9/2017	580.0
	11/16/2017	516.0
	6/14/2018	596.0
	9/13/2018	542.0
	3/14/2019	548.0

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Table 2. Hennepin Ash Pond No. 2: Appendix IV Analytical Results

Location ID	Sample Date	As, tot, mg/L	Ba, tot, mg/L	Be, tot, mg/L	Cd,tot, mg/L	Co, tot, mg/L	Cr, tot, mg/L
03R	12/9/2015	<0.001000	0.06560	<0.001000	0.001600	<0.001000	<0.001000
	3/9/2016	<0.001000	0.06700	<0.001000	0.001300	<0.001000	<0.001000
	6/8/2016	<0.001000	0.06580	<0.001000	<0.001000	0.001100	<0.001000
	8/31/2016	<0.001000	0.06170	<0.001000	<0.001000	<0.001000	<0.001000
	12/8/2016	<0.001000	0.07770	<0.001000	<0.001000	<0.001000	0.001600
	2/22/2017	<0.001000	0.05910	<0.001000	<0.001000	<0.001000	<0.001000
	4/26/2017	<0.001000	0.05420	<0.001000	<0.001000	<0.001000	<0.001000
	6/9/2017	<0.001000	0.05850	<0.001000	<0.001000	<0.001000	<0.001000
	11/16/2017						
	6/14/2018	<0.001000	0.06370	<0.001000	<0.001000	<0.001000	<0.001500
	9/13/2018		0.08420		<0.001000	<0.001000	<0.001500
	3/13/2019	<0.001000	0.06960	<0.001000	<0.001000	<0.001000	<0.001500
07	3/10/2016	<0.001000	0.1040	<0.001000	<0.001000	<0.001000	<0.001000
	6/7/2016	<0.001000	0.1300	<0.001000	<0.001000	<0.001000	<0.001000
	7/29/2016	<0.001000	0.1110	<0.001000	<0.001000	<0.001000	<0.001000
	9/1/2016	<0.001000	0.1300	<0.001000	<0.001000	<0.001000	<0.001000
	12/9/2016	<0.001000	0.1680	<0.001000	<0.001000	<0.001000	0.001000
	2/22/2017	<0.001000	0.1150	<0.001000	<0.001000	<0.001000	<0.001000

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Table 2. Hennepin Ash Pond No. 2: Appendix IV Analytical Results

Location ID	Sample Date	F, tot, mg/L	Hg, tot, mg/L	Li, tot, mg/L	Mo, tot, mg/L	Pb, tot, mg/L	Ra-226,228, tot, pCi/L
03R	**12/9/2015**	0.2000	<0.0002000	0.02390	0.2080	<0.001000	0.6800
	3/9/2016	0.2600	<0.0002000	0.02890	0.2200	<0.001000	0.3920
	6/8/2016	0.2600	<0.0002000	0.02780	0.2120	<0.001000	2.450
	8/31/2016	0.2700	<0.0002000	0.02190	0.1500	<0.001000	0.2700
	12/8/2016	0.2800	<0.0002000	0.02060	0.2660	<0.001000	0.1700
	2/22/2017	0.2800	<0.0002000	0.02720	0.2370	<0.001000	0.2600
	4/26/2017	0.3200	<0.0002000	0.02810	0.2200	<0.001000	0.4600
	6/9/2017	0.3100	<0.0002000	0.02910	0.2080	<0.001000	1.520
	11/16/2017	0.3200					
	6/14/2018	0.2900	<0.0002000	0.03130	0.1790	<0.001000	1.150
	9/13/2018	0.2900		0.03440	0.2380		0.2800
	3/13/2019	0.2900	<0.0002000	0.03490	0.1850	<0.001000	0.1800
07	**3/10/2016**	0.1000	<0.0002000	0.007900	<0.001000	<0.001000	0.1200
	6/7/2016	<0.1000	<0.0002000	0.008500	<0.001000	<0.001000	1.090
	7/29/2016	<0.1000	<0.0002000	0.009000	<0.001000	<0.001000	1.100
	9/1/2016	0.1000	<0.0002000	0.009100	<0.001000	<0.001000	0.3600
	12/9/2016	0.1000	<0.0002000	0.008400	0.001000	<0.001000	1.210
	2/22/2017	<0.1000	<0.0002000	0.008400	<0.001000	<0.001000	0.6700

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Table 2. Hennepin Ash Pond No. 2: Appendix IV Analytical Results

Location ID	Sample Date	Sb, tot, mg/L	Se, tot, mg/L	Tl, tot, mg/L
03R	12/9/2015	<0.001000	0.005500	<0.001000
	3/9/2016	<0.001000	0.005400	<0.001000
	6/8/2016	<0.001000	0.007500	<0.001000
	8/31/2016	<0.001000	0.007100	<0.001000
	12/8/2016	<0.001000	0.007100	<0.001000
	2/22/2017	<0.001000	0.007700	<0.001000
	4/26/2017	<0.001000	0.007600	<0.001000
	6/9/2017	<0.001000	0.008100	<0.001000
	11/16/2017			
	6/14/2018	<0.001000	0.006100	<0.002000
	9/13/2018		0.005800	
	3/13/2019	<0.001000	0.005100	<0.002000
07	3/10/2016	<0.001000	<0.001000	<0.001000
	6/7/2016	<0.001000	0.001100	<0.001000
	7/29/2016	<0.001000	<0.001000	<0.001000
	9/1/2016	<0.001000	0.001400	<0.001000
	12/9/2016	<0.001000	0.001100	<0.001000
	2/22/2017	<0.001000	<0.001000	<0.001000

Table 2. Hennepin Ash Pond No. 2: Appendix IV Analytical Results

Location ID	Sample Date	As, tot, mg/L	Ba, tot, mg/L	Be, tot, mg/L	Cd,tot, mg/L	Co, tot, mg/L	Cr, tot, mg/L
07	4/27/2017	<0.001000	0.1040	<0.001000	<0.001000	<0.001000	<0.001000
	6/8/2017	<0.001000	0.1010	<0.001000	<0.001000	<0.001000	<0.001000
	11/16/2017						
	6/14/2018	<0.001000	0.1060	<0.001000	<0.001000	<0.001000	<0.001500
	9/13/2018		0.1360		<0.001000	<0.001000	<0.001500
	12/13/2018						
	3/14/2019	0.001600	0.1090	<0.001000	<0.001000	<0.001000	<0.001500
08	12/8/2015	<0.001000	0.1180	<0.001000	<0.001000	0.002900	<0.001000
	3/10/2016	<0.001000	0.1480	<0.001000	<0.001000	0.001700	<0.001000
	6/7/2016	<0.001000	0.1270	<0.001000	<0.001000	0.003400	<0.001000
	9/1/2016	<0.001000	0.1460	<0.001000	<0.001000	0.02850	<0.001000
	12/9/2016	<0.001000	0.1070	<0.001000	<0.001000	0.02160	<0.001000
	2/22/2017	<0.001000	0.1110	<0.001000	<0.001000	0.01390	<0.001000
	4/27/2017	<0.001000	0.1190	<0.001000	<0.001000	0.01580	<0.001000
	6/9/2017	<0.001000	0.09920	<0.001000	<0.001000	0.008300	<0.001000
	11/16/2017						
	6/14/2018	<0.001000	0.1190	<0.001000	<0.001000	0.007300	<0.001500
	9/13/2018		0.1350		<0.001000	0.005000	<0.001500

Table 2. Hennepin Ash Pond No. 2: Appendix IV Analytical Results

Location ID	Sample Date	F, tot, mg/L	Hg, tot, mg/L	Li, tot, mg/L	Mo, tot, mg/L	Pb, tot, mg/L	Ra-226,228, tot, pCi/L
07	4/27/2017	<0.1000	<0.0002000	0.008800	<0.001000	<0.001000	0.8100
	6/8/2017	0.1000	<0.0002000	0.008100	<0.001000	<0.001000	0.7900
	11/16/2017	0.1200					
	6/14/2018	<0.1000	<0.0002000	0.008600	<0.001500	<0.001000	0.2300
	9/13/2018	<0.1000	<0.0002000	0.01130	<0.001500		0.8600
	12/13/2018	<0.1000					
	3/14/2019	<0.1000	<0.0002000	0.009400	<0.001500	<0.001000	0.5900
08	12/8/2015	<0.1000	<0.0002000	0.01000	0.001500	<0.001000	0.8900
	3/10/2016	<0.1000	<0.0002000	0.009100	0.001600	<0.001000	0.7200
	6/7/2016	<0.1000	<0.0002000	0.009200	0.001300	<0.001000	0.7400
	9/1/2016	<0.1000	<0.0002000	0.01270	0.001400	<0.001000	0.3300
	12/9/2016	<0.1000	<0.0002000	0.009500	0.001400	<0.001000	0.6300
	2/22/2017	<0.1000	<0.0002000	0.009300	0.001400	<0.001000	0.8500
	4/27/2017	<0.1000	<0.0002000	0.01180	0.001300	<0.001000	1.010
	6/9/2017	<0.1000	<0.0002000	0.009400	0.001500	<0.001000	0.8500
	11/16/2017	0.1000					
	6/14/2018	<0.1000	<0.0002000	0.01220	<0.001500	<0.001000	0.4500
	9/13/2018	<0.1000	<0.0002000	0.01320	<0.001500		0.1400

Table 2. Hennepin Ash Pond No. 2: Appendix IV Analytical Results

Location ID	Sample Date	Sb, tot, mg/L	Se, tot, mg/L	Tl, tot, mg/L
07	4/27/2017	<0.001000	0.001000	<0.001000
	6/8/2017	<0.001000	0.001000	<0.001000
	11/16/2017			
	6/14/2018	<0.001000	<0.001000	<0.002000
	9/13/2018		0.001000	
	12/13/2018			
	3/14/2019	<0.001000	<0.001000	<0.002000
08	12/8/2015	<0.001000	<0.001000	<0.001000
	3/10/2016	<0.001000	<0.001000	<0.001000
	6/7/2016	<0.001000	<0.001000	<0.001000
	9/1/2016	<0.001000	<0.001000	<0.001000
	12/9/2016	<0.001000	<0.001000	<0.001000
	2/22/2017	<0.001000	<0.001000	<0.001000
	4/27/2017	<0.001000	<0.001000	<0.001000
	6/9/2017	<0.001000	<0.001000	<0.001000
	11/16/2017			
	6/14/2018	<0.001000	<0.001000	<0.002000
	9/13/2018		<0.001000	

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Table 2. Hennepin Ash Pond No. 2: Appendix IV Analytical Results

Location ID	Sample Date	As, tot, mg/L	Ba, tot, mg/L	Be, tot, mg/L	Cd,tot, mg/L	Co, tot, mg/L	Cr, tot, mg/L
08	12/13/2018						
	3/14/2019	0.001200	0.1050	<0.001000	<0.001000	0.03190	<0.001500
08D	12/8/2015	<0.001000	0.1330	<0.001000	<0.001000	0.01220	<0.001000
	3/10/2016	<0.001000	0.1550	<0.001000	<0.001000	0.003600	<0.001000
	6/7/2016	<0.001000	0.1380	<0.001000	<0.001000	0.002800	<0.001000
	9/1/2016	<0.001000	0.2300	<0.001000	0.001100	0.01300	<0.001000
	12/9/2016	<0.001000	0.1810	<0.001000	<0.001000	0.01520	<0.001000
	2/22/2017	<0.001000	0.1670	<0.001000	<0.001000	0.007800	<0.001000
	4/27/2017	<0.001000	0.1580	<0.001000	0.002300	0.03850	<0.001000
	6/9/2017	<0.001000	0.1840	<0.001000	0.001100	0.01620	<0.001000
	11/16/2017						
	6/14/2018	<0.001000	0.1710	<0.001000	<0.001000	0.01360	<0.001500
	9/13/2018		0.2200		<0.001000	0.01120	0.008700
	12/13/2018						
	3/14/2019	0.001200	0.1450	<0.001000	0.002300	0.01570	<0.001500
18D	12/9/2015	<0.001000	0.08910	<0.001000	0.001100	0.009300	<0.001000
	3/9/2016	<0.001000	0.09370	<0.001000	0.001100	0.01060	<0.001000
	6/8/2016	<0.001000	0.08750	<0.001000	<0.001000	0.008800	<0.001000

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Table 2. Hennepin Ash Pond No. 2: Appendix IV Analytical Results

Location ID	Sample Date	F, tot, mg/L	Hg, tot, mg/L	Li, tot, mg/L	Mo, tot, mg/L	Pb, tot, mg/L	Ra-226,228, tot, pCi/L
08	12/13/2018	0.1100					
	3/14/2019	<0.1000	<0.0002000	0.01580	0.001700	<0.001000	0.6600
08D	12/8/2015	0.1200	<0.0002000	0.01210	0.001400	<0.001000	0.9400
	3/10/2016	0.1000	<0.0002000	0.01430	0.001300	<0.001000	0.1200
	6/7/2016	0.1000	<0.0002000	0.01080	0.001100	<0.001000	0.3500
	9/1/2016	0.1200	<0.0002000	0.01640	0.001400	<0.001000	0.5500
	12/9/2016	0.1000	<0.0002000	0.01310	0.001200	<0.001000	0.3500
	2/22/2017	<0.1000	<0.0002000	0.01360	0.001100	<0.001000	0.3800
	4/27/2017	0.1000	<0.0002000	0.01710	0.001000	0.001500	1.410
	6/9/2017	<0.1000	<0.0002000	0.01660	0.001700	<0.001000	0.9400
	11/16/2017	0.1200					
	6/14/2018	0.1200	<0.0002000	0.01630	<0.001500	<0.001000	0.2200
	9/13/2018	<0.1000	<0.0002000	0.02000	0.002100		0.4100
	12/13/2018	0.1100					
	3/14/2019	0.1200	<0.0002000	0.01990	0.001500	0.001600	0.4800
18D	12/9/2015	0.1300	<0.0002000	0.03180	0.02990	<0.001000	0.4100
	3/9/2016	0.1500	<0.0002000	0.03060	0.03120	<0.001000	0.3880
	6/8/2016	0.1400	<0.0002000	0.02930	0.02920	<0.001000	0.6400

Table 2. Hennepin Ash Pond No. 2: Appendix IV Analytical Results

Location ID	Sample Date	Sb, tot, mg/L	Se, tot, mg/L	Tl, tot, mg/L
08	12/13/2018			
	3/14/2019	<0.001000	<0.001000	<0.002000
08D	12/8/2015	<0.001000	<0.001000	<0.001000
	3/10/2016	<0.001000	<0.001000	<0.001000
	6/7/2016	<0.001000	<0.001000	<0.001000
	9/1/2016	<0.001000	<0.001000	<0.001000
	12/9/2016	<0.001000	<0.001000	<0.001000
	2/22/2017	<0.001000	<0.001000	<0.001000
	4/27/2017	<0.001000	<0.001000	<0.001000
	6/9/2017	<0.001000	<0.001000	<0.001000
	11/16/2017			
	6/14/2018	<0.001000	<0.001000	<0.002000
	9/13/2018		<0.001000	
	12/13/2018			
	3/14/2019	<0.001000	<0.001000	<0.002000
18D	12/9/2015	<0.001000	<0.001000	<0.001000
	3/9/2016	<0.001000	<0.001000	<0.001000
	6/8/2016	<0.001000	<0.001000	<0.001000

Hennepin CCR

Table 2. Hennepin Ash Pond No. 2: Appendix IV Analytical Results

Location ID	Sample Date	As, tot, mg/L	Ba, tot, mg/L	Be, tot, mg/L	Cd,tot, mg/L	Co, tot, mg/L	Cr, tot, mg/L
18D	**8/31/2016**	<0.001000	0.08730	<0.001000	<0.001000	0.008000	<0.001000
	12/8/2016	<0.001000	0.09570	<0.001000	<0.001000	0.009400	<0.001000
	2/22/2017	<0.001000	0.08150	<0.001000	<0.001000	0.007400	<0.001000
	4/26/2017	<0.001000	0.08360	<0.001000	<0.001000	0.006700	<0.001000
	6/9/2017	<0.001000	0.08010	<0.001000	<0.001000	0.007200	<0.001000
	11/16/2017						
	6/14/2018	<0.001000	0.08010	<0.001000	<0.001000	0.006000	<0.001500
	9/13/2018		0.08750		<0.001000	0.006200	0.002100
	3/13/2019	<0.001000	0.08030	<0.001000	<0.001000	0.004300	<0.001500
18S	**12/9/2015**	<0.001000	0.08330	<0.001000	0.001800	0.001600	0.001600
	3/9/2016	<0.001000	0.08130	<0.001000	0.001400	0.001200	0.002900
	6/8/2016	<0.001000	0.07680	<0.001000	0.001100	<0.001000	0.001400
	8/31/2016	<0.001000	0.08610	<0.001000	<0.001000	<0.001000	<0.001000
	12/8/2016	<0.001000	0.07010	<0.001000	<0.001000	<0.001000	0.002000
	2/22/2017	<0.001000	0.06670	<0.001000	<0.001000	<0.001000	0.001700
	4/26/2017	<0.001000	0.07800	<0.001000	<0.001000	<0.001000	0.001100
	6/9/2017	<0.001000	0.05180	<0.001000	<0.001000	<0.001000	0.006400
	11/16/2017						

Hennepin CCR

Table 2. Hennepin Ash Pond No. 2: Appendix IV Analytical Results

Location ID	Sample Date	F, tot, mg/L	Hg, tot, mg/L	Li, tot, mg/L	Mo, tot, mg/L	Pb, tot, mg/L	Ra-226,228, tot, pCi/L
18D	**8/31/2016**	0.1400	<0.0002000	0.03170	0.02810	<0.001000	0.4400
	12/8/2016	0.1600	<0.0002000	0.02860	0.03690	<0.001000	0.6400
	2/22/2017	0.1400	<0.0002000	0.02830	0.03050	<0.001000	0.6000
	4/26/2017	0.1500	<0.0002000	0.02960	0.03140	<0.001000	0.7600
	6/9/2017	0.1500	<0.0002000	0.02800	0.03180	<0.001000	1.000
	11/16/2017	0.1800					
	6/14/2018	0.1400	<0.0002000	0.03110	0.03470	<0.001000	1.790
	9/13/2018	0.1500		0.03550	0.03780		0.6200
	3/13/2019	0.1500	<0.0002000	0.03090	0.03320	<0.001000	0.1100
18S	**12/9/2015**	0.1400	<0.0002000	0.07110	0.3150	<0.001000	0.9100
	3/9/2016	0.1300	<0.0002000	0.08060	0.3200	<0.001000	0.0
	6/8/2016	0.1300	<0.0002000	0.07970	0.3330	<0.001000	1.220
	8/31/2016	0.1200	<0.0002000	0.08440	0.3540	<0.001000	0.7500
	12/8/2016	0.1400	<0.0002000	0.06890	0.3070	<0.001000	0.1200
	2/22/2017	0.1400	<0.0002000	0.06590	0.3010	<0.001000	0.0
	4/26/2017	0.1000	<0.0002000	0.1300	0.3710	<0.001000	0.0
	6/9/2017	0.1100	<0.0002000	0.1140	0.4140	<0.001000	0.4400
	11/16/2017	0.1600					

Hennepin CCR

Table 2. Hennepin Ash Pond No. 2: Appendix IV Analytical Results

Location ID	Sample Date	Sb, tot, mg/L	Se, tot, mg/L	Tl, tot, mg/L
18D	8/31/2016	<0.001000	<0.001000	<0.001000
	12/8/2016	<0.001000	<0.001000	<0.001000
	2/22/2017	<0.001000	<0.001000	<0.001000
	4/26/2017	<0.001000	<0.001000	<0.001000
	6/9/2017	<0.001000	<0.001000	<0.001000
	11/16/2017			
	6/14/2018	<0.001000	<0.001000	<0.002000
	9/13/2018		<0.001000	
	3/13/2019	<0.001000	<0.001000	<0.002000
18S	12/9/2015	<0.001000	0.03380	<0.001000
	3/9/2016	<0.001000	0.05960	<0.001000
	6/8/2016	<0.001000	0.05060	<0.001000
	8/31/2016	<0.001000	0.04620	<0.001000
	12/8/2016	<0.001000	0.03380	<0.001000
	2/22/2017	<0.001000	0.04420	<0.001000
	4/26/2017	<0.001000	0.1170	<0.001000
	6/9/2017	<0.001000	0.1110	<0.001000
	11/16/2017			

Table 2. Hennepin Ash Pond No. 2: Appendix IV Analytical Results

Location ID	Sample Date	As, tot, mg/L	Ba, tot, mg/L	Be, tot, mg/L	Cd,tot, mg/L	Co, tot, mg/L	Cr, tot, mg/L
18S	**6/14/2018**	<0.001000	0.06870	<0.001000	<0.001000	<0.001000	0.001600
	9/13/2018		0.08220		<0.001000	<0.001000	<0.001500
	3/13/2019	0.001100	0.06430	<0.001000	<0.001000	<0.001000	<0.001500
45S	**12/9/2015**	<0.001000	0.06640	<0.001000	0.002300	0.002400	0.001300
	3/9/2016	<0.001000	0.07090	<0.001000	0.002200	0.002800	<0.001000
	6/8/2016	<0.001000	0.07170	<0.001000	0.002100	0.006000	<0.001000
	8/31/2016	<0.001000	0.06910	<0.001000	0.002000	0.004100	<0.001000
	12/8/2016	<0.001000	0.06170	<0.001000	0.001100	0.001300	<0.001000
	2/22/2017	<0.001000	0.06750	<0.001000	0.001200	0.002600	<0.001000
	4/26/2017	<0.001000	0.07430	<0.001000	0.001800	0.004200	<0.001000
	6/9/2017	<0.001000	0.08800	<0.001000	0.001600	0.009600	<0.001000
	11/16/2017						
	6/14/2018	<0.001000	0.07860	<0.001000	0.001300	0.006500	<0.001500
	9/13/2018		0.08140		<0.001000	0.001700	<0.001500
	3/13/2019						
	3/14/2019	<0.001000	0.08120	<0.001000	<0.001000	0.003200	<0.001500

Hennepin CCR

Table 2. Hennepin Ash Pond No. 2: Appendix IV Analytical Results

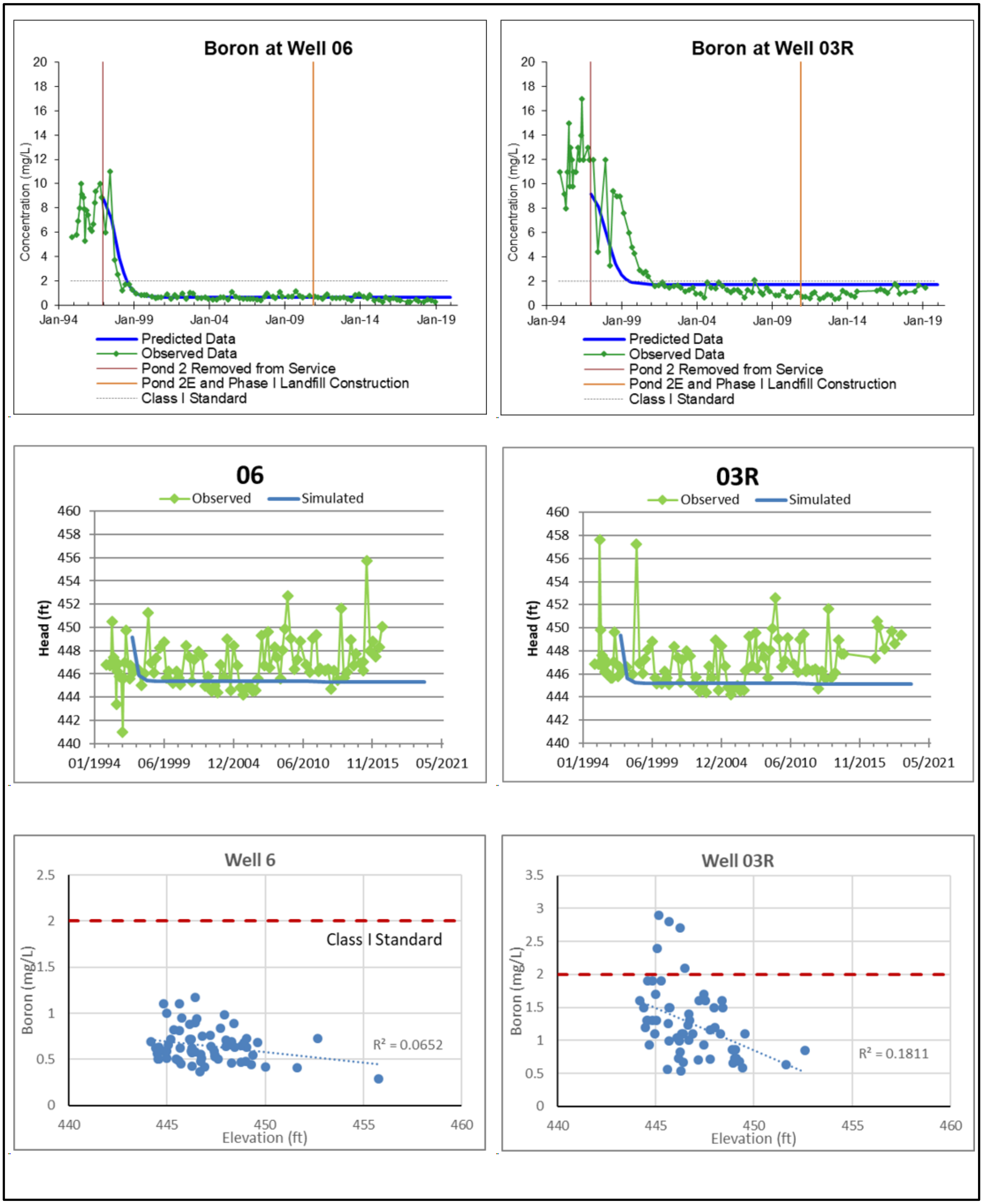
Location ID	Sample Date	F, tot, mg/L	Hg, tot, mg/L	Li, tot, mg/L	Mo, tot, mg/L	Pb, tot, mg/L	Ra-226,228, tot, pCi/L
18S	**6/14/2018**	0.1200	<0.0002000	0.08980	0.3030	<0.001000	1.230
	9/13/2018	0.1400		0.09200	0.3140		0.09000
	3/13/2019	0.1600	<0.0002000	0.06750	0.2200	<0.001000	0.2400
45S	**12/9/2015**	0.2900	<0.0002000	0.01750	0.09720	0.001000	1.090
	3/9/2016	0.3300	<0.0002000	0.01650	0.09110	<0.001000	0.7060
	6/8/2016	0.3300	<0.0002000	0.01690	0.08470	<0.001000	1.270
	8/31/2016	0.3400	<0.0002000	0.01780	0.08470	<0.001000	0.3700
	12/8/2016	0.3600	<0.0002000	0.01370	0.08960	<0.001000	0.4900
	2/22/2017	0.3500	<0.0002000	0.01450	0.08830	<0.001000	0.5600
	4/26/2017	0.3400	<0.0002000	0.01670	0.09380	<0.001000	0.8900
	6/9/2017	0.3200	<0.0002000	0.01710	0.08110	<0.001000	0.2900
	11/16/2017	0.3600					
	6/14/2018	0.3100	<0.0002000	0.01630	0.07530	<0.001000	1.000
	9/13/2018	0.3100		0.01810	0.09110		0.4400
	3/13/2019						0.6600
	3/14/2019	0.3200	<0.0002000	0.02230	0.07410	<0.001000	

Table 2. Hennepin Ash Pond No. 2: Appendix IV Analytical Results

Location ID	Sample Date	Sb, tot, mg/L	Se, tot, mg/L	Tl, tot, mg/L
18S	6/14/2018	<0.001000	0.05230	<0.002000
	9/13/2018		0.03360	
	3/13/2019	<0.001000	0.03830	<0.002000
45S	12/9/2015	<0.001000	<0.001000	<0.001000
	3/9/2016	<0.001000	<0.001000	<0.001000
	6/8/2016	<0.001000	<0.001000	<0.001000
	8/31/2016	<0.001000	<0.001000	<0.001000
	12/8/2016	<0.001000	<0.001000	<0.001000
	2/22/2017	<0.001000	<0.001000	<0.001000
	4/26/2017	<0.001000	<0.001000	<0.001000
	6/9/2017	<0.001000	<0.001000	<0.001000
	11/16/2017			
	6/14/2018	<0.001000	<0.001000	<0.002000
	9/13/2018		<0.001000	
	3/13/2019			
	3/14/2019	<0.001000	<0.001000	<0.002000

Figures

FIGURE NO. 1A



COMPARISON OF OBSERVED AND MODELED CONCENTRATIONS, OBSERVED AND MODELED HEADS, AND OBSERVED CONCENTRATION VERSUS OBSERVED HEAD BY WELL LOCATION

RESPONSE TO IEPA COMMENTS
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

OBG
Part of Ramboll

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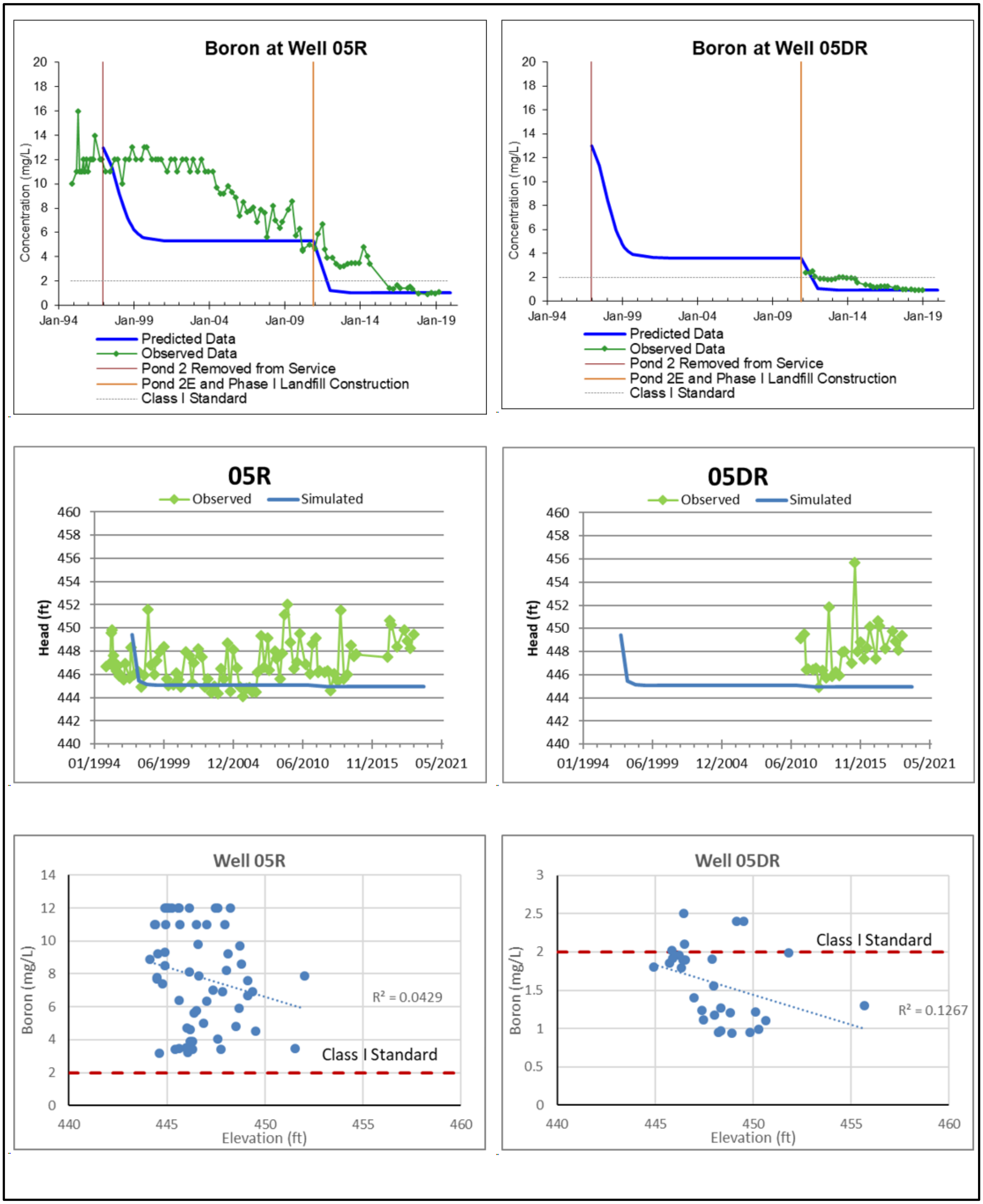
Y:\Mapping\Projects\7\72980\MXD\Figure 1A.mxd



COMPARISON OF OBSERVED AND MODELED CONCENTRATIONS, OBSERVED AND MODELED HEADS, AND OBSERVED CONCENTRATION VERSUS OBSERVED HEAD BY WELL LOCATION

RESPONSE TO IEPA COMMENTS
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

OBG
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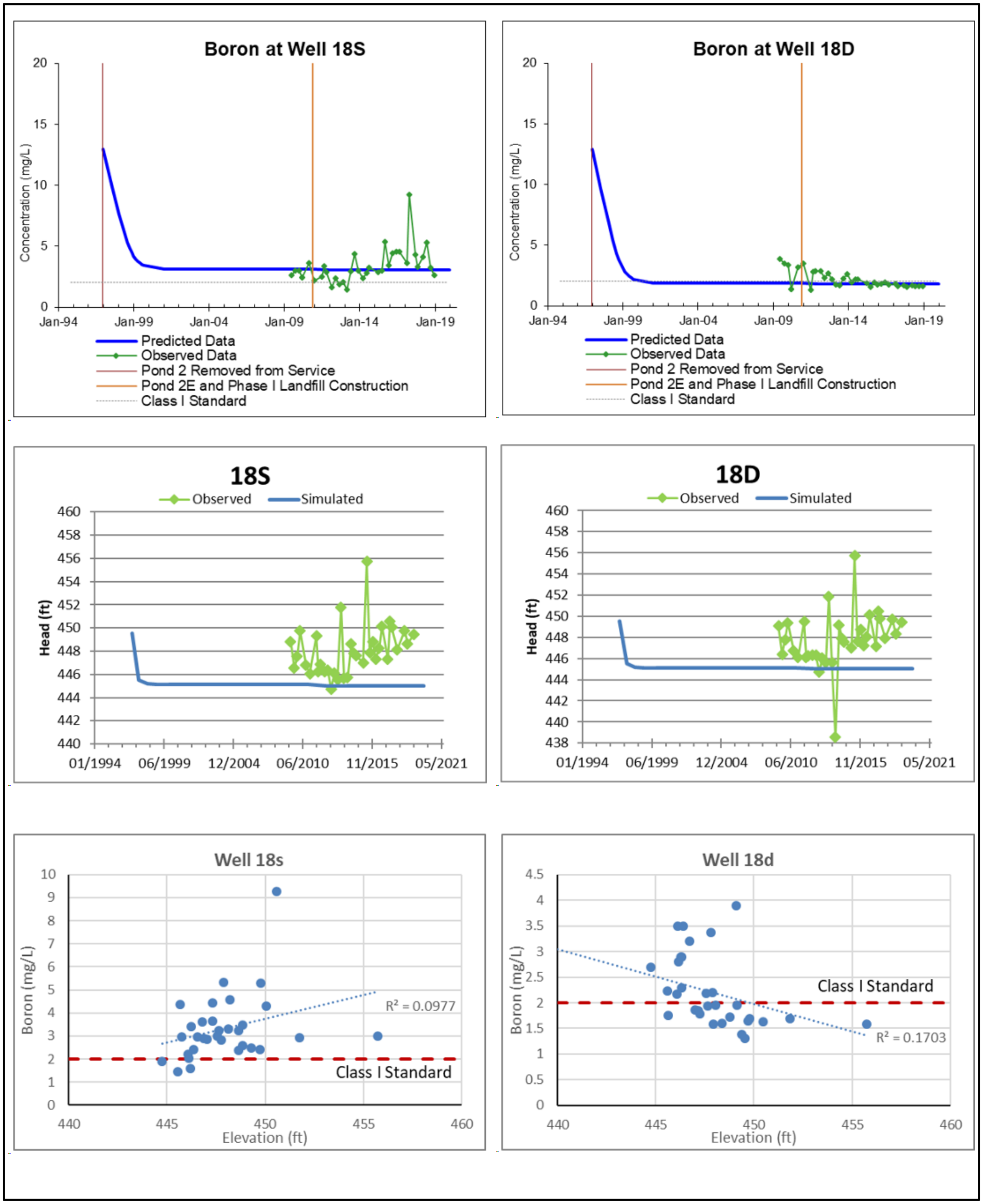
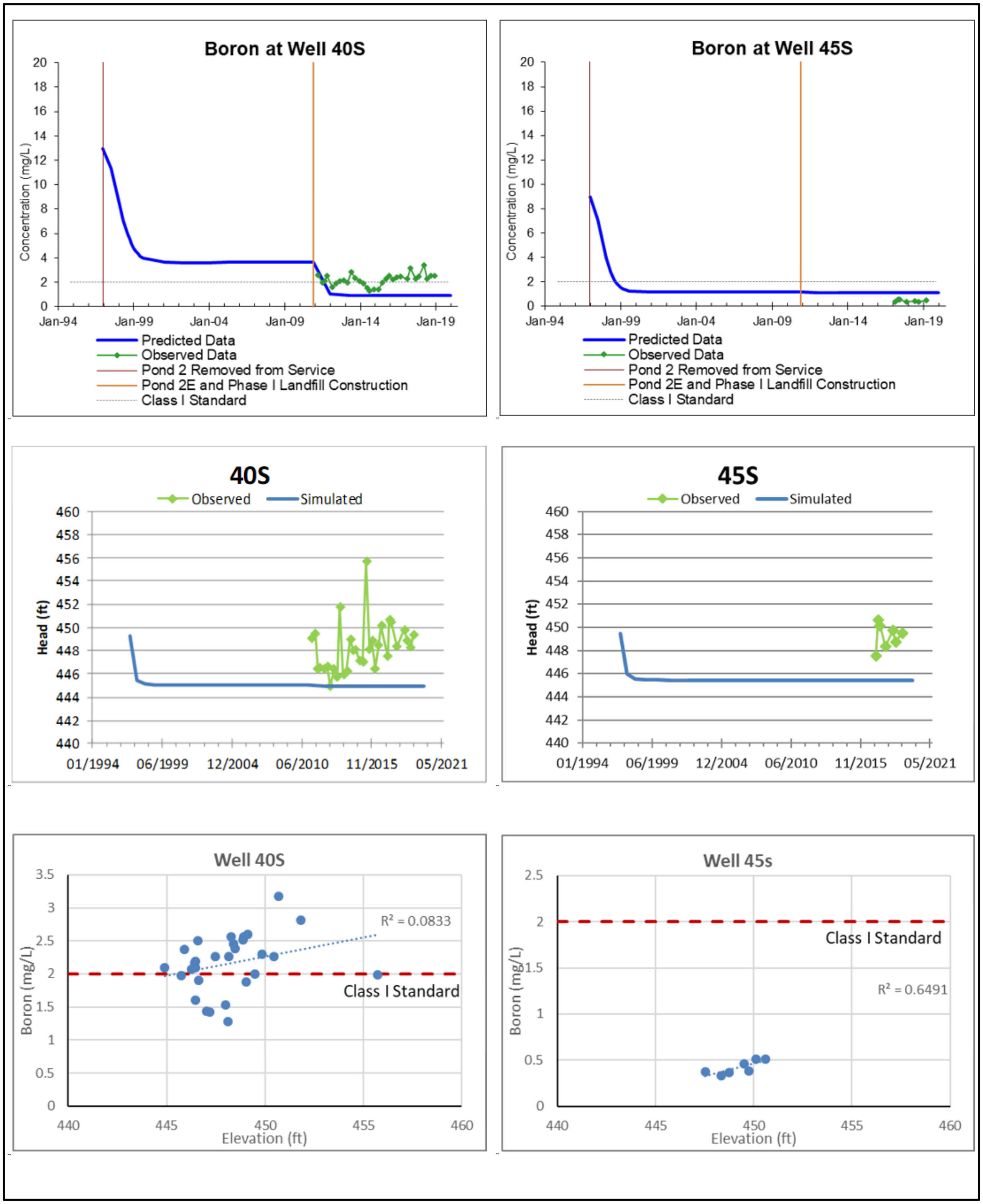


COMPARISON OF OBSERVED AND MODELED CONCENTRATIONS, OBSERVED AND MODELED HEADS, AND OBSERVED CONCENTRATION VERSUS OBSERVED HEAD BY WELL LOCATION

RESPONSE TO IEPA COMMENTS
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

OBG
Part of Ramboll



COMPARISON OF OBSERVED AND MODELED CONCENTRATIONS, OBSERVED AND MODELED HEADS, AND OBSERVED CONCENTRATION VERSUS OBSERVED HEAD BY WELL LOCATION

RESPONSE TO IEPA COMMENTS
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

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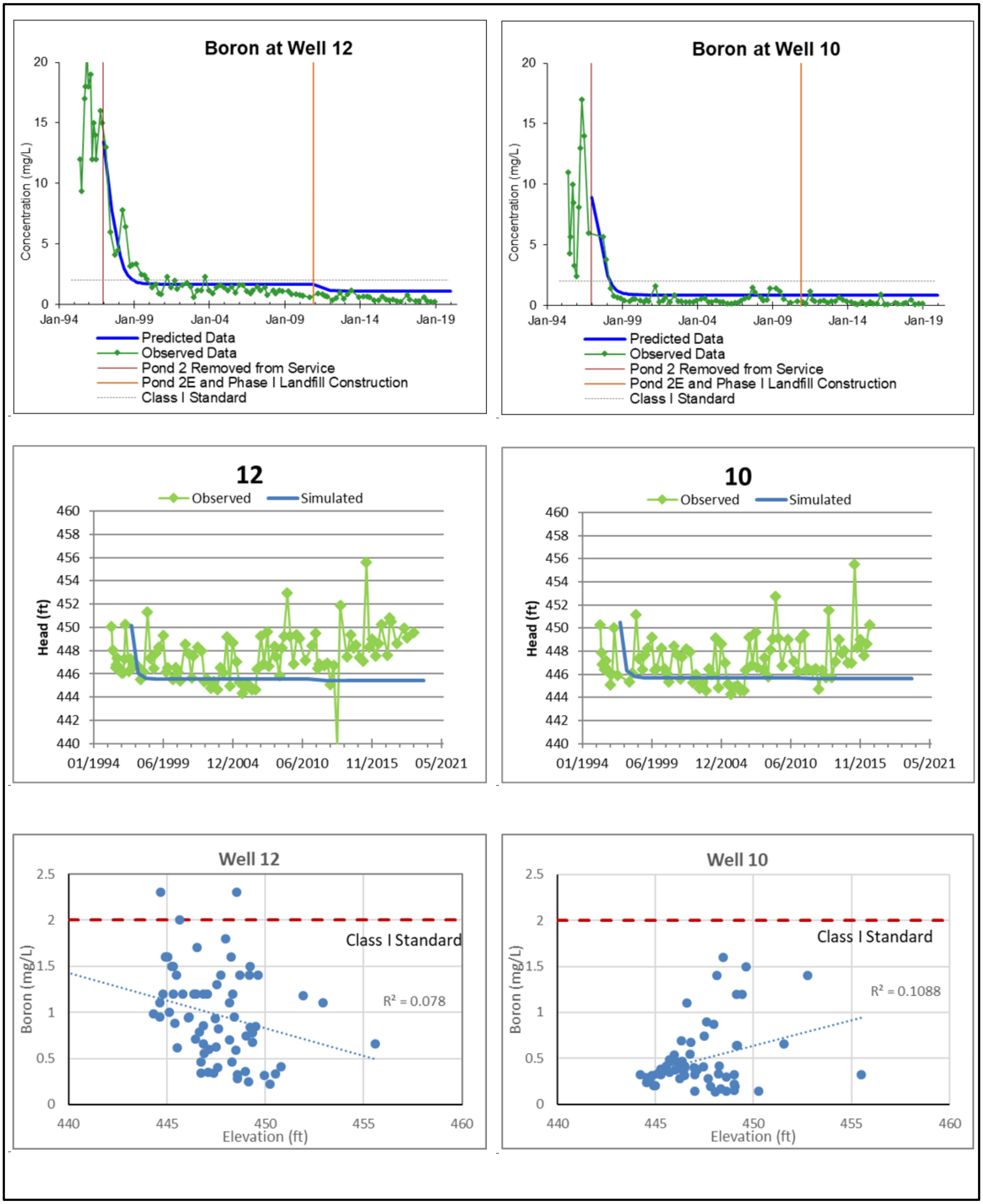

COMPARISON OF OBSERVED AND MODELED CONCENTRATIONS, OBSERVED AND MODELED HEADS, AND OBSERVED CONCENTRATION VERSUS OBSERVED HEAD BY WELL LOCATION

RESPONSE TO IEPA COMMENTS
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

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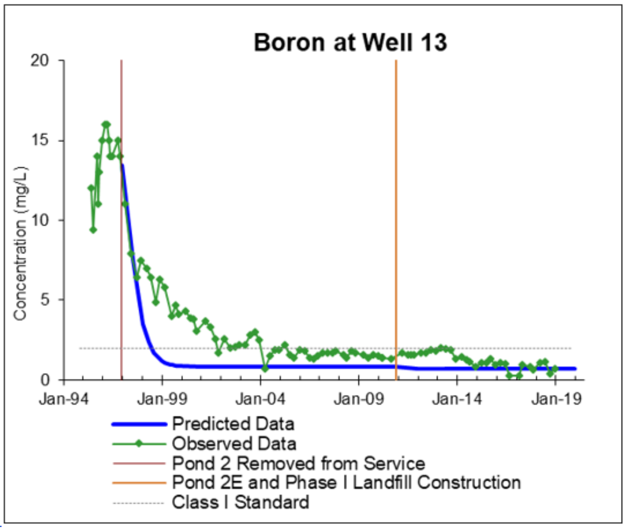

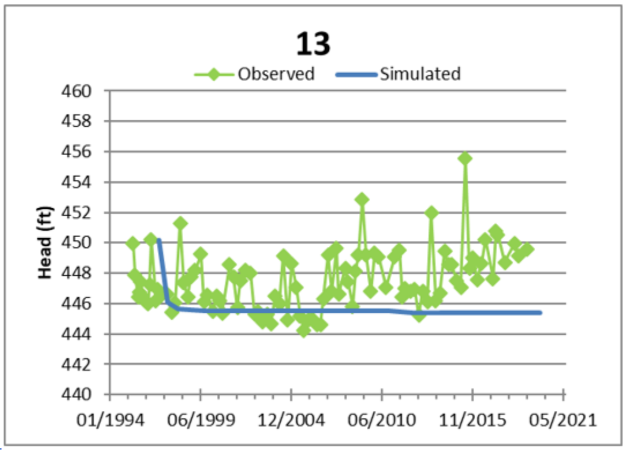

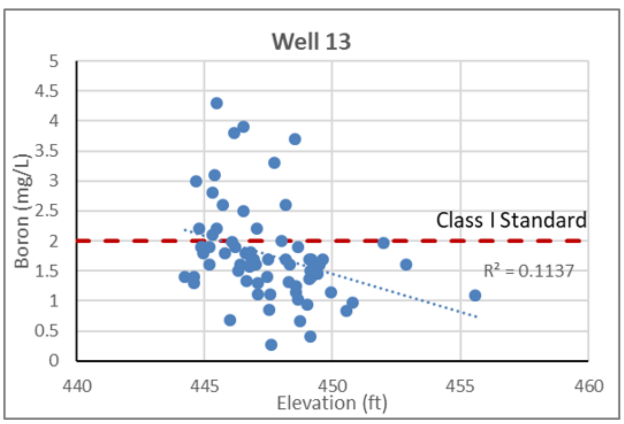

COMPARISON OF OBSERVED AND MODELED CONCENTRATIONS, OBSERVED AND MODELED HEADS, AND OBSERVED CONCENTRATION VERSUS OBSERVED HEAD BY WELL LOCATION

RESPONSE TO IEPA COMMENTS
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

OBG
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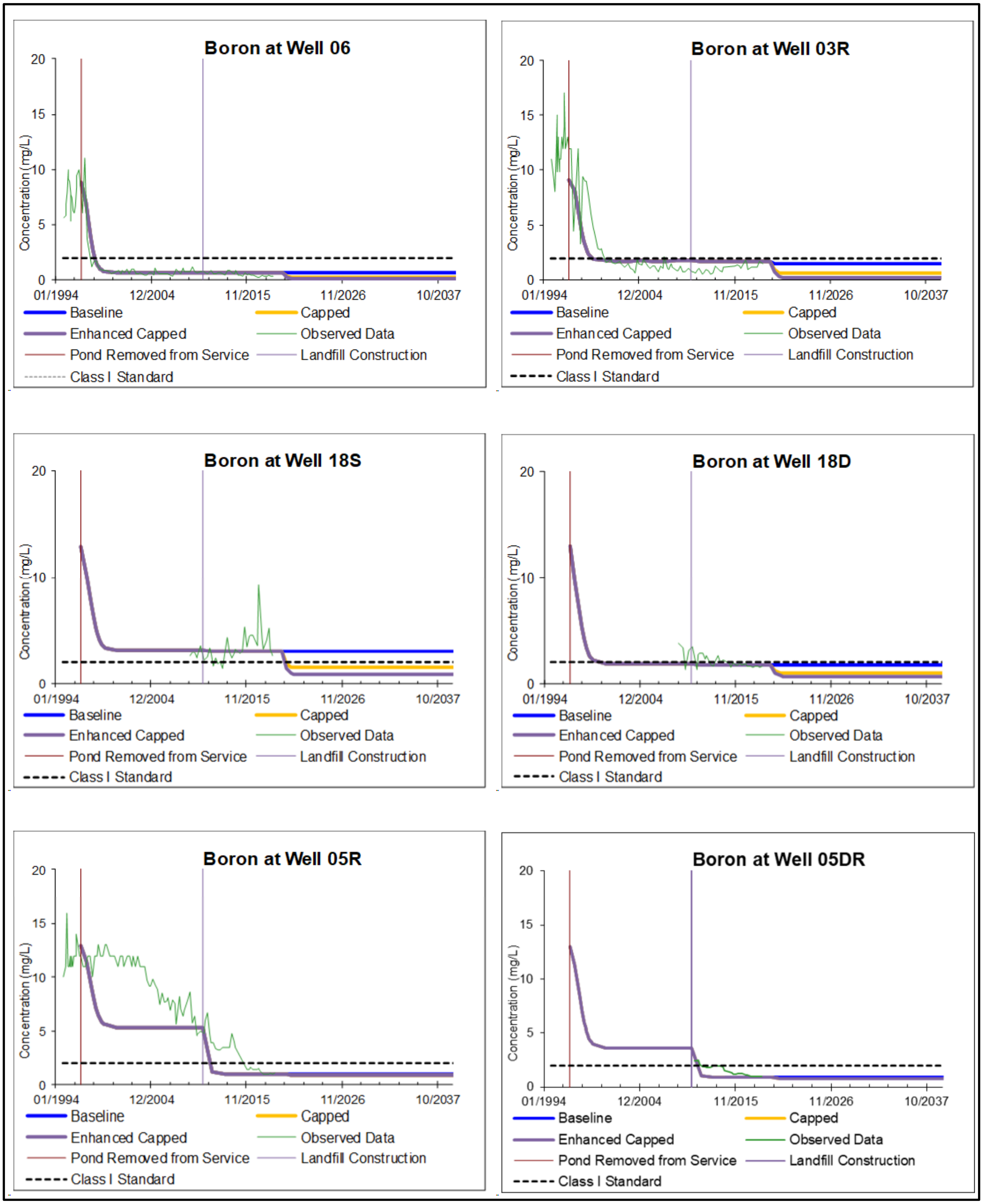
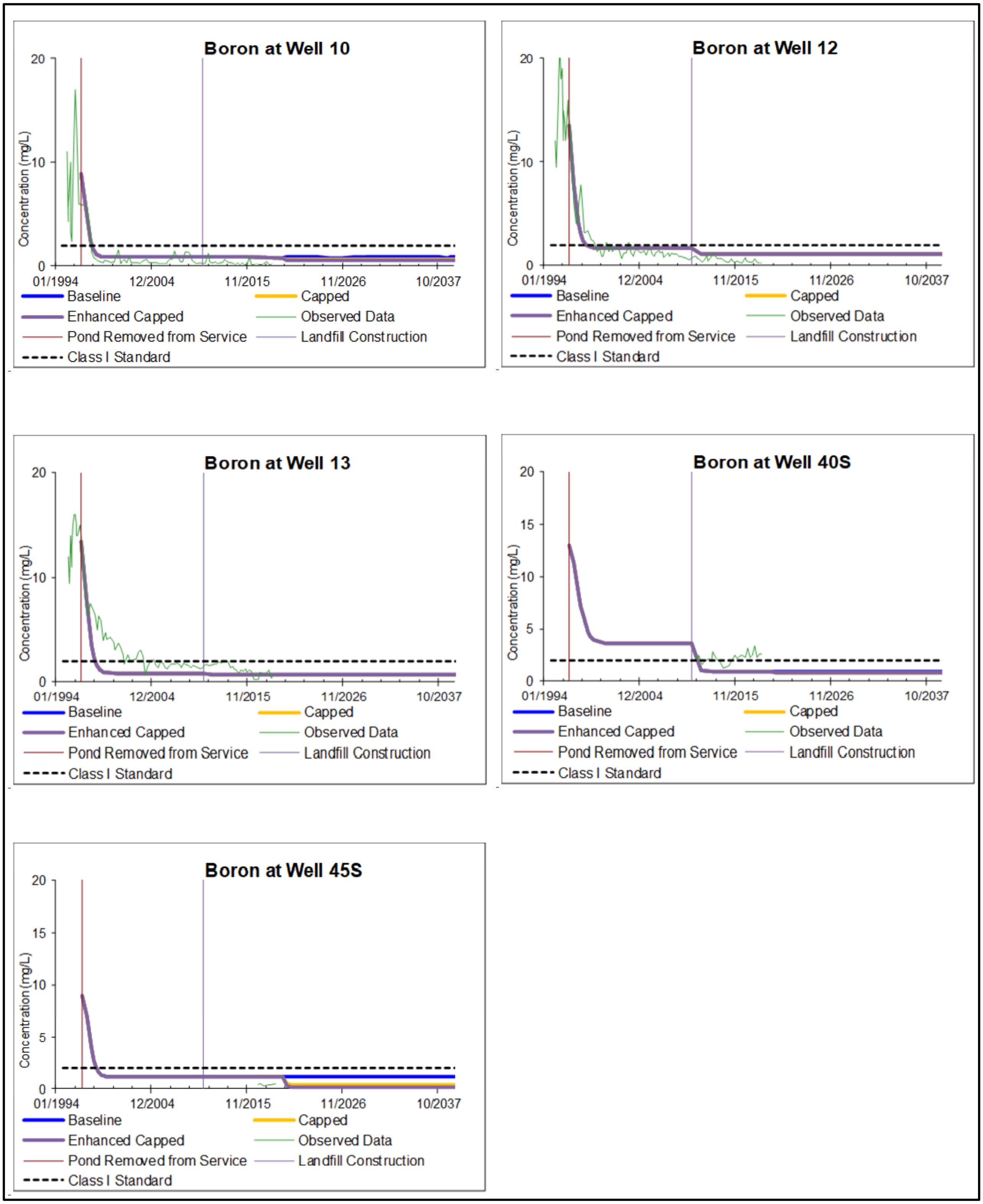


BORON PREDICTION CONCENTRATION OF ORIGINAL CLAY COVER (CAPPED) AND ENHANCED CLAY COVER (ENHANCED CAPPED)

RESPONSE TO IEPA COMMENTS
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

OBG
Part of Ramboll



BORON PREDICTION CONCENTRATION OF ORIGINAL CLAY COVER (CAPPED) AND ENHANCED CLAY COVER (ENHANCED CAPPED)

RESPONSE TO IEPA COMMENTS
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

OBG
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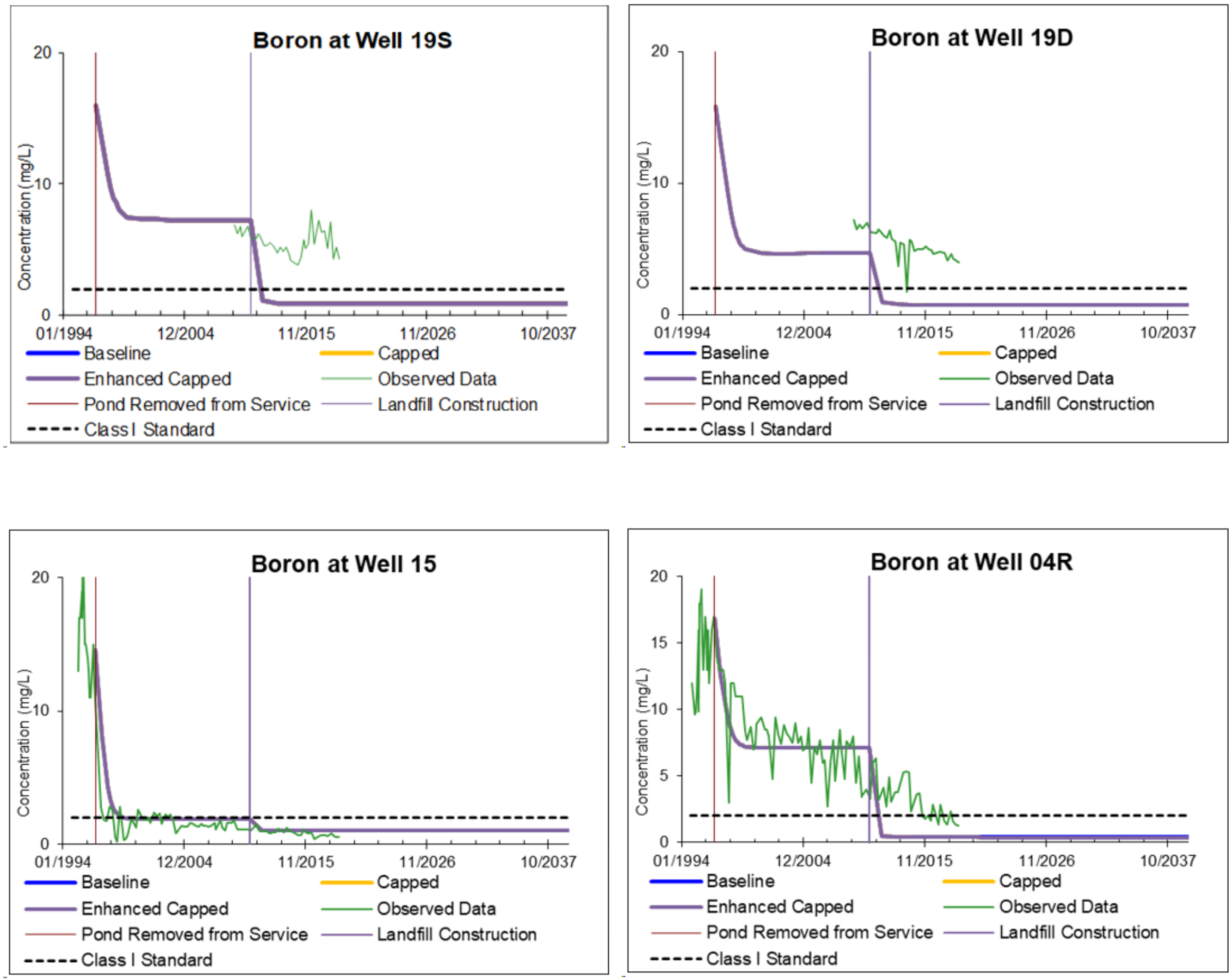

BORON PREDICTION CONCENTRATION OF ORIGINAL CLAY COVER (CAPPED) AND ENHANCED CLAY COVER (ENHANCED CAPPED)

RESPONSE TO IEPA COMMENTS
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

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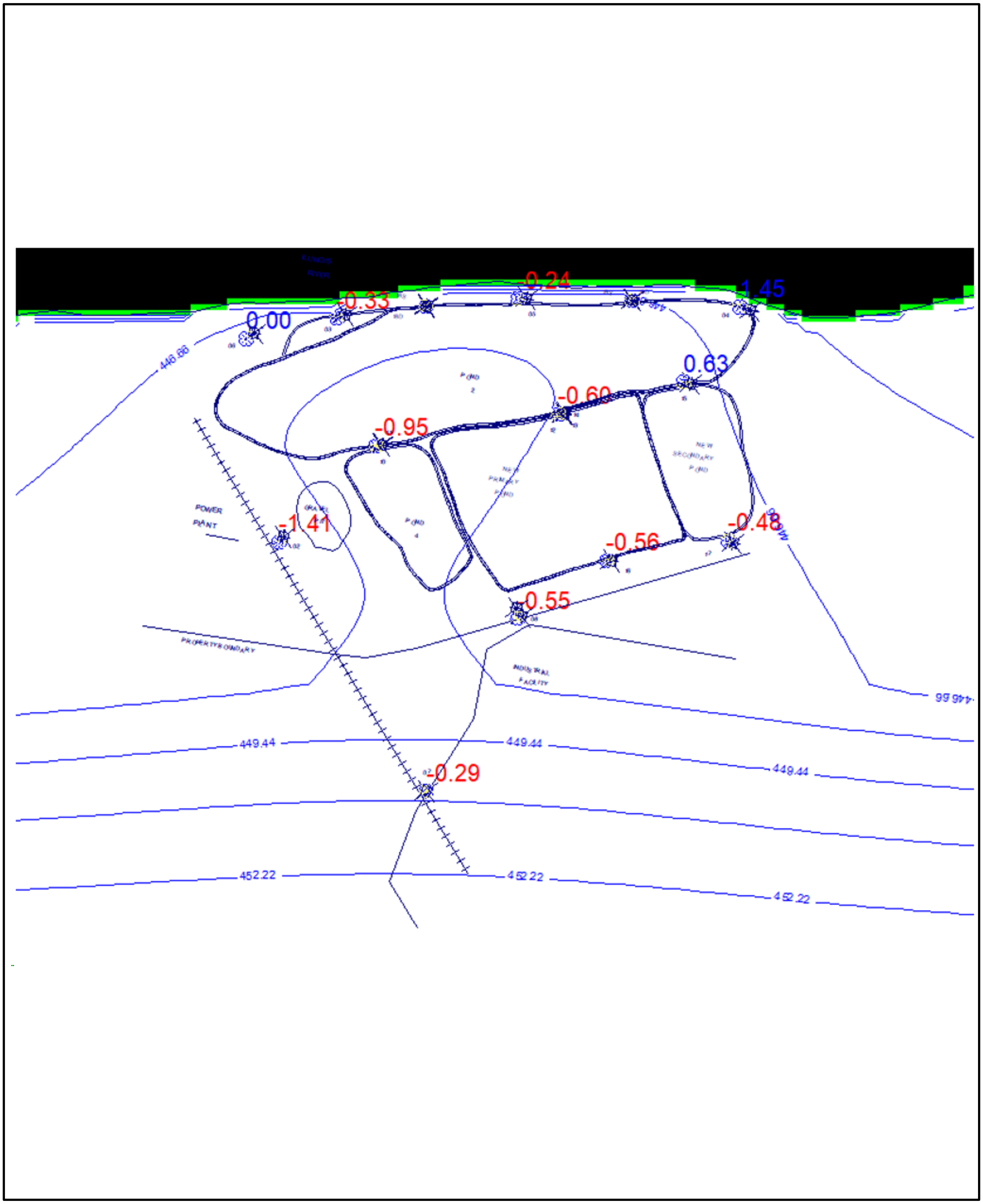
FIGURE NO. 3A



COMPARISON BETWEEN OBSERVED AND MODELED HEADS (1995)

RESPONSE TO IEPA COMMENTS
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

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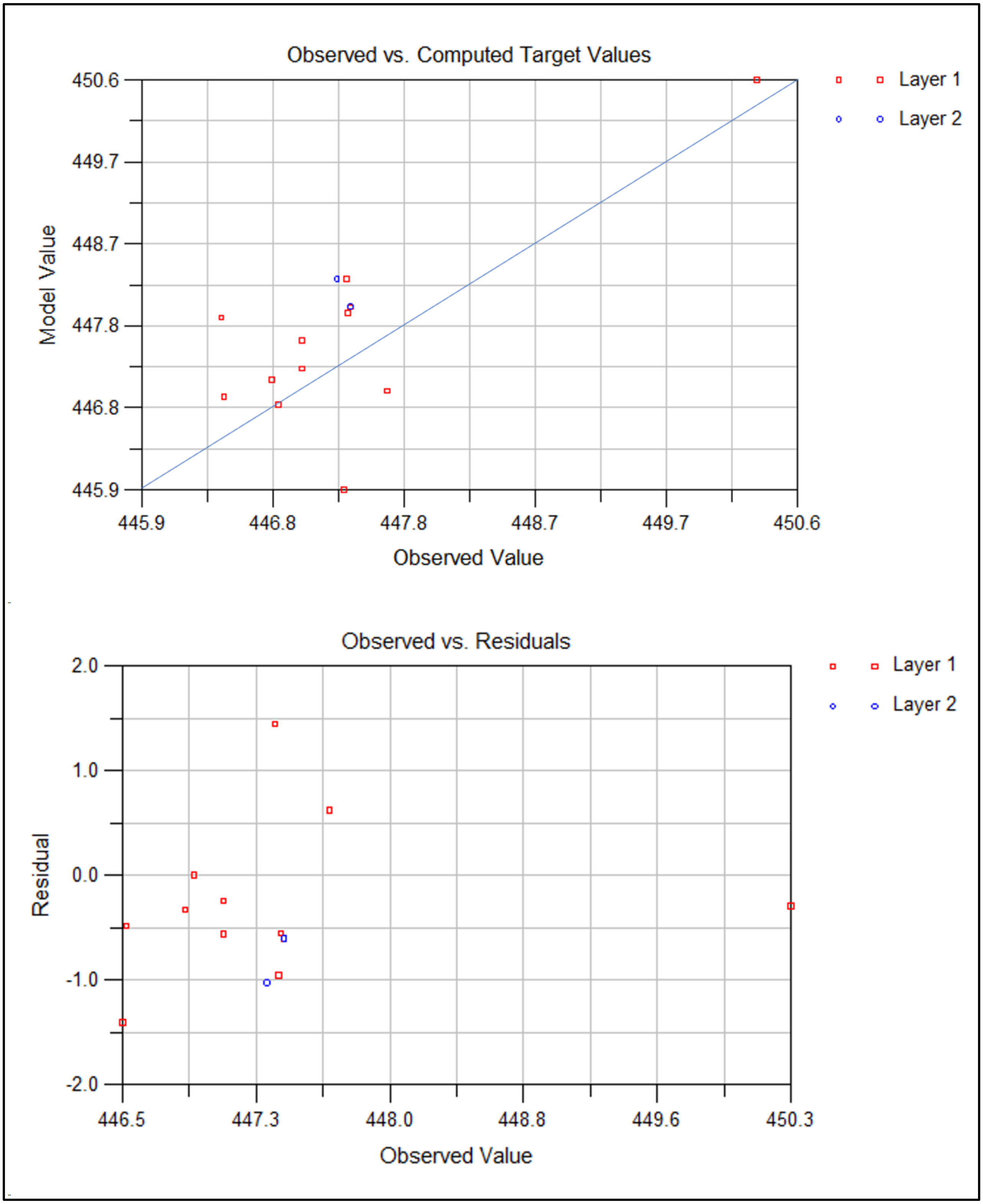
Y:\Mapping\Projects\7\72980\MXD\Figure 3A.mxd



MODEL CALIBRATION RESULTS (1995)

RESPONSE TO IEPA COMMENTS
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

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Part of Ramboll

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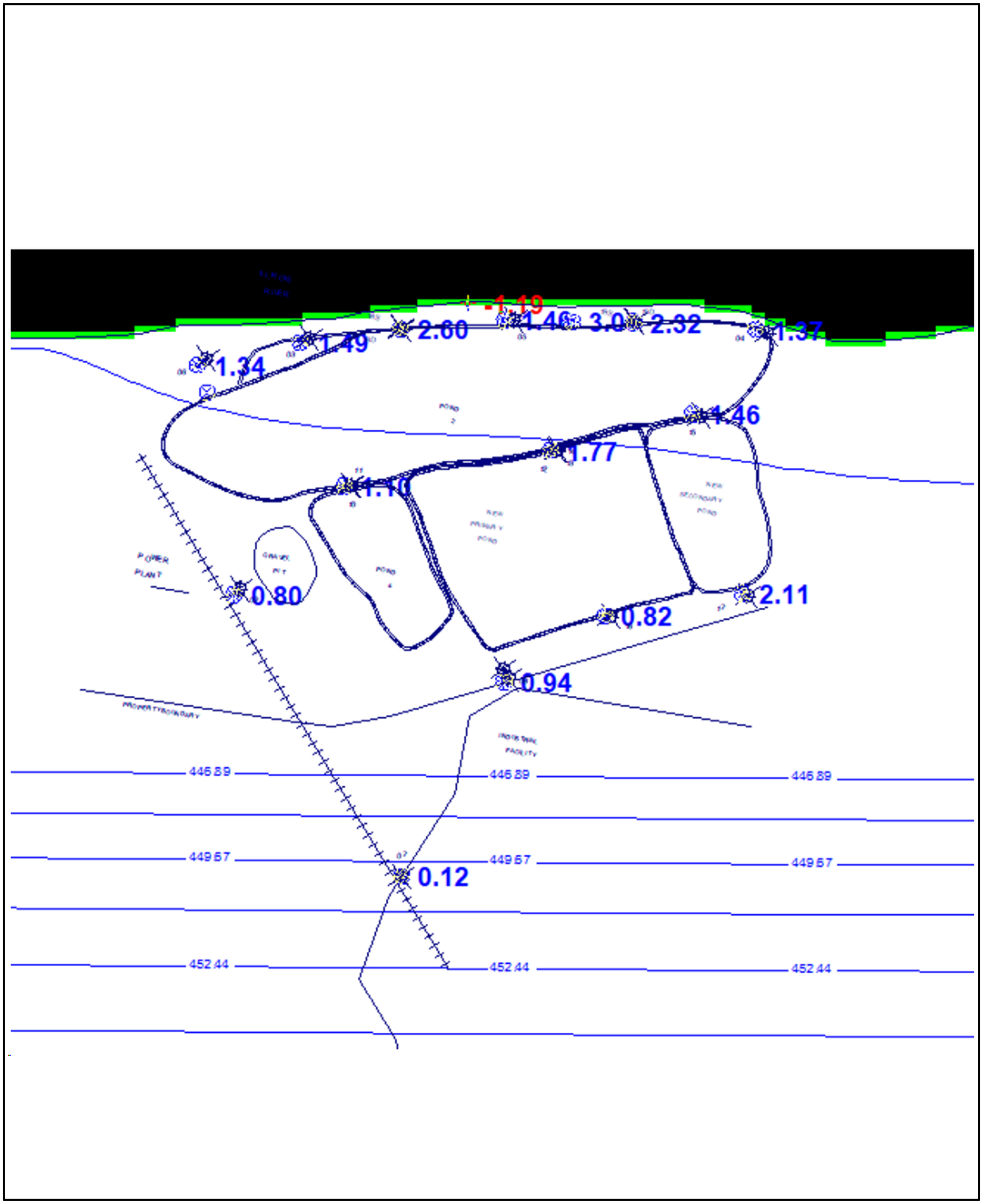

COMPARISON BETWEEN OBSERVED AND MODELED MEDIAN HEADS

RESPONSE TO IEPA COMMENTS
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

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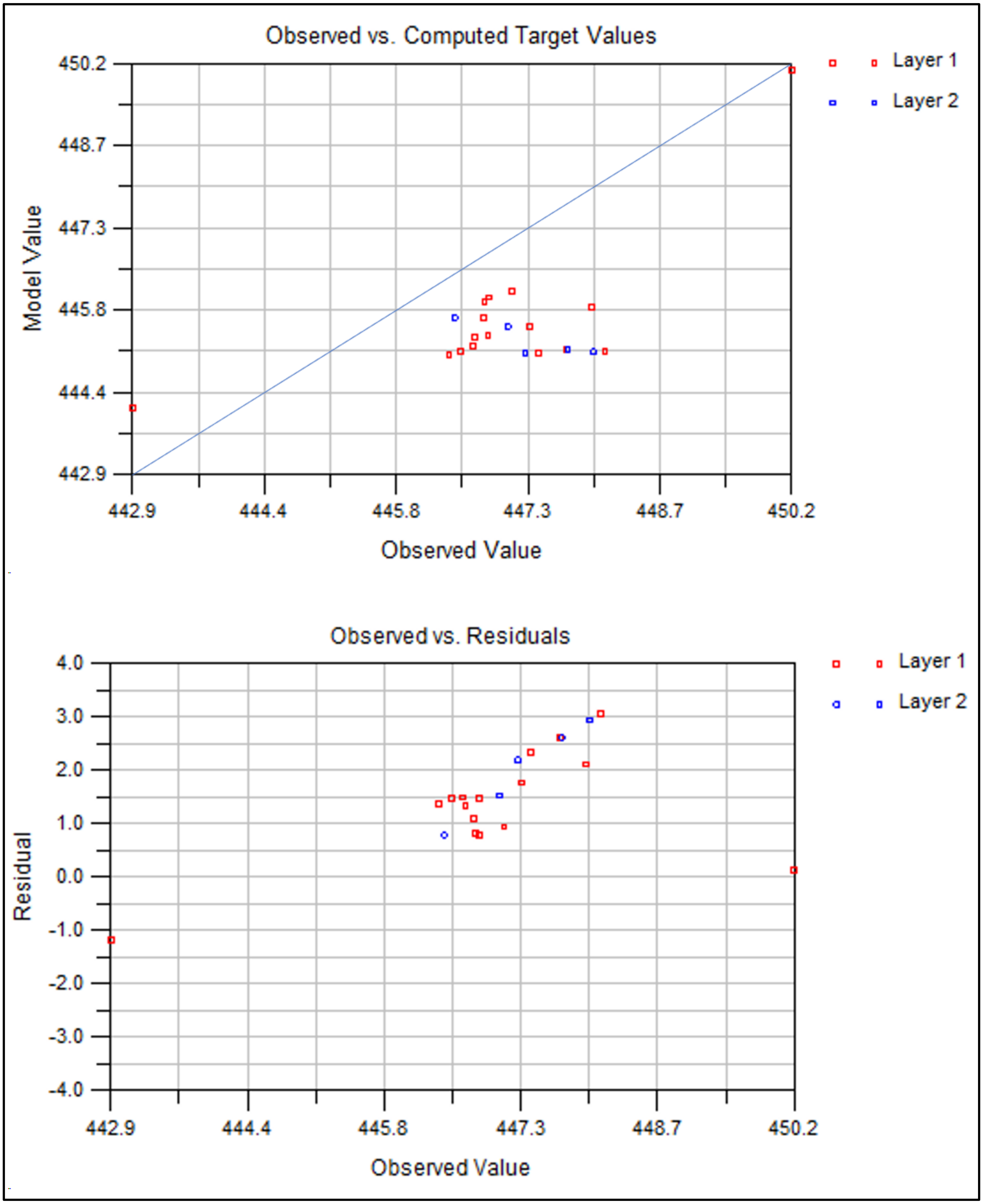

VERIFICATION MODEL RESIDUALS USING MEDIAN ELEVATION TARGETS

RESPONSE TO IEPA COMMENTS
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

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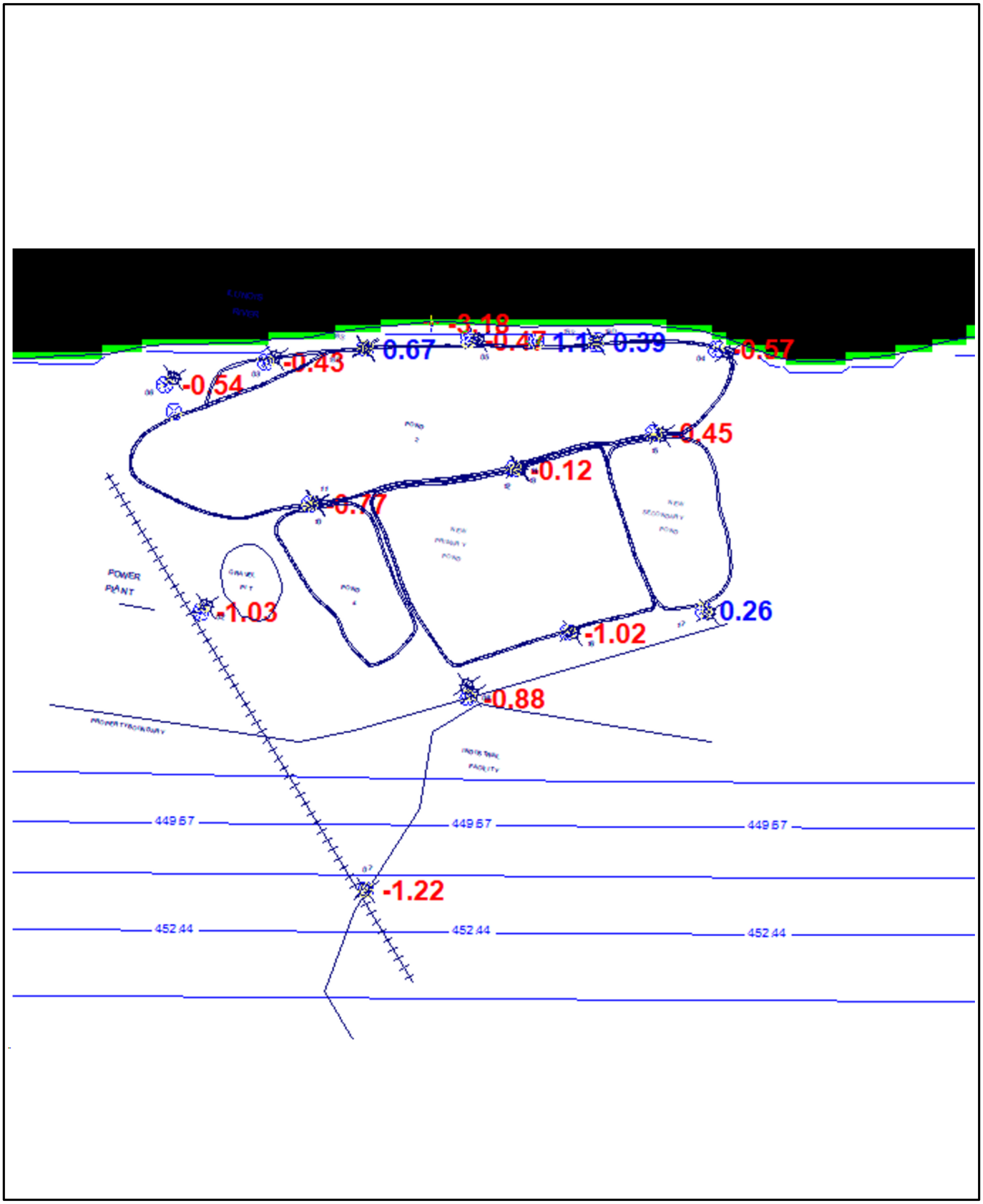
FIGURE NO. 5A



COMPARISON BETWEEN OBSERVED AND MODELED
MEDIAN HEADS WITH INCREASED RIVER ELEVATION

RESPONSE TO IEPA COMMENTS
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

OBG
Part of Ramboll

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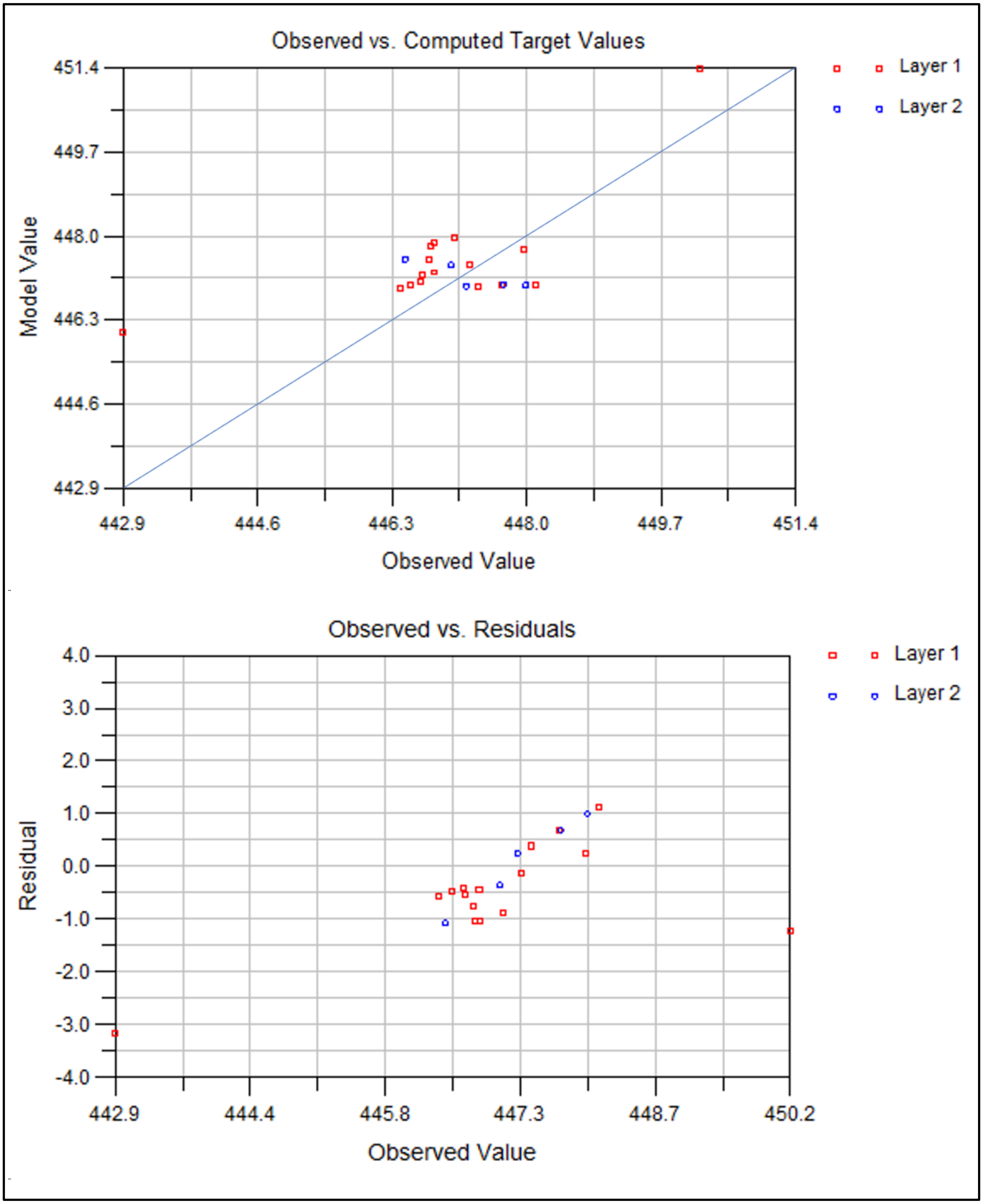

VERIFICATION MODEL RESIDUALS USING MEDIAN ELEVATION TARGETS WITH INCREASED RIVER ELEVATION

RESPONSE TO IEPA COMMENTS
EAST ASH POND NO. 2
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

OBG
Part of Ramboll

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Attachment 1

Groundwater Monitoring Plan

Groundwater Monitoring Plan

Hennepin East Ash Pond No.2 and No. 4
Hennepin, Illinois

Dynegy Midwest Generation, LLC

July 22, 2019

OBG
Part of Ramboll

JULY 22, 2019 | FINAL | PROJECT #67938

Groundwater Monitoring Plan

Hennepin East Ash Pond No. 2 and No. 4
Hennepin, Illinois

Prepared for:

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

BRIAN G. HENNINGS
Managing Hydrogeologist

NATHANIEL R. KELLER
Senior Hydrogeologist

NICOLE M. PAGANO, PE, PG
Senior Managing Engineer

LICENSED PROFESSIONAL GEOLOGIST
NICOLE M. PAGANO
196-000750
ILLINOIS

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ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CCR	coal combustion residual
CFR	Code of Federal Regulations
cm/s	centimeters per second
DBCP	1,2-Dibromo-3-Chloropropane
DMG	Dynegy Midwest Generation, Inc.
EDB	Ethyl Dibromide
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
ft	feet
IAC	Illinois Administrative Code
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
NRT	Natural Resource Technology, Inc., an OBG Company
OBG	O'Brien & Gere Engineers, Inc., part of Ramboll
PCB	Polychlorinated Biphenyl
QA/QC	Quality Assurance/Quality Control
RL	Reporting Limit
S.U.	Standard Units
TDS	total dissolved solids
USEPA	United States Environmental Protection Agency

1 INTRODUCTION

1.1 OVERVIEW

This Groundwater Monitoring Plan was prepared by O'Brien and Gere Engineers, Inc., part of Ramboll (OBG) in support of a Closure Plan for impoundments located at the Hennepin Power Station, Hennepin, Illinois which is owned by Dynegy Midwest Generation, LLC (DMG).

This plan, the Closure Plan, and Closure Plan Addendum describes the groundwater monitoring and reporting to be completed for the Coal Combustion Residuals (CCR) surface water impoundment Ash Pond No. 2 and Ash Pond No. 4 within the East Ash Pond System. In addition to this groundwater monitoring plan, a Groundwater Management Zone Application (OBG, 2018) is being submitted under separate cover.

1.2 SITE LOCATION AND BACKGROUND

Hennepin East Ash Pond No. 2 and No. 4 are located in the northeast quarter of Section 26, Township 33 North, Range 2 West, Putnam County, Illinois and approximately 3 miles north-northeast of the Village of Hennepin (Figure 1). The impoundment is situated less than 200 feet south of the Illinois River and approximately one mile east of the Big Bend, where the river shifts course from predominantly west to predominantly south. The Hennepin Power Station had two coal-fired units constructed in 1953 and 1959. Surrounding areas include industrial properties to the east and south of the impoundments, agricultural land to the southwest and the Hennepin Power Station to the west.

East Ash Pond No. 2 (Ash Pond No. 2), currently encompassing approximately 18 acres, is classified as an inactive, unlined CCR surface impoundment (Figure 2). East Ash Pond No. 4 by definition, is a non-CCR Unit, designated capped or otherwise maintained and encompasses approximately 5 acres. Ash Pond No. 2 is surrounded by a perimeter road and is bounded to the north by the Illinois River, to the east by the CCR Landfill, to the southeast by the East Ash Pond, to the southwest by Ash Pond No. 4, and a gravel pit (non-CCR Unit). Ash Pond No. 4 is bounded to the south by agricultural property, to the west by the gravel pit and to the east by the East Ash Pond.

East Ash Pond No. 2 was used to store and dispose fly ash, bottom ash, and other non-CCR waste streams including coal pile runoff. The pond is unlined with a variable but lowermost bottom elevation of 451 feet. The approximate dates of construction of each successive stage of East Ash Pond No. 2 are summarized below.

Date	Event
1958	Construction of Ash Pond No. 2
1978	Embankment raise of Ash Pond No. 2
1985	Embankment raise of Ash Pond No. 2 to elevation 484 feet
1989	Embankment raise of Ash Pond No. 2 to elevation 494 feet
1996	Pond was removed from service and completely unwatered
2009 to 2010	Eastern portion of Ash Pond No. 2 was removed to facilitate construction of Leachate Pond.
2010 / 2011	Landfill Phase I cell was constructed in 2010 over placed CCR in Ash Pond No. 2, adjacent to the Leachate Pond. In February 2011, 7,500 cubic yards of bottom ash was placed into the Phase I cell as a post-construction freeze-protection measure to protect the leachate collection system and geomembrane liner. No other material (fly ash or bottom ash) has been placed in the landfill since then.
2014	North Embankment tree removal, grading, and vegetation re-establishment of Ash Pond No. 2

Based on review of aerial photographs and other site information, ash was placed Ash Pond No. 4, a former sand and gravel quarry, between 1978 and 1984.

A notice of intent to close the remaining uncapped portion of Ash Pond No. 2, encompassing approximately 25.5 acres, was submitted in November 2015. The cap system, as designed by Civil & Environmental Consultants, Inc. (CEC), is proposed to be implemented on the remaining areas of Ash Pond No. 2 (Landfill Phases II, III and IV, and bottom ash pond, that will not be completed) and Ash Pond No. 4. References to Ash Pond No. 2 refer only to the current uncovered area of ash located west of Landfill Phase I that is proposed for capping. A Closure Plan Addendum was submitted to include closure of Ash Pond No. 4 in conjunction with the closure of Ash Pond No. 2.

The closure activities for Ash Pond No. 2 and No. 4 include ash dewatering, relocating/reshaping the CCR to achieve acceptable grades and construction of a cover system comprised of (from bottom to top) 18-inch protective compacted soil barrier and 6-inch top cover system of topsoil and vegetative cover to minimize long-term erosion (CEC, 2017 and OBG, 2018).

Other impoundments within the East Ash Pond System include the following:

- **East Ash Pond (Primary Pond)**: Used to store and dispose bottom ash, fly ash, and other non-CCR waste and to clarify process water prior to discharge in accordance with the station's NPDES permit. The 510 acre-foot pond was constructed in 1995. In 2003, the sidewall liners were raised an additional 12 feet, and the total water depth was raised to approximately 30 feet.
- **Polishing Pond (Secondary Pond)**: Constructed in 1995 with a 48-inch thick compacted clay liner having a vertical hydraulic conductivity of 1 x 10^{-7} cm/sec.
- **Leachate Pond (Pond 2 East)**: A 25.5 acre-foot pond constructed with a composite liner consisting of 60-mil HDPE overlying two feet of compacted clay with a vertical hydraulic conductivity of 1 x 10^{-7} cm/sec. Construction was completed December 2010.

These impoundments are not included in the scope of this Groundwater Monitoring Plan or the Ash Pond No. 2 and No. 4 closure.

1.3 CONCEPTUAL MODEL

Significant site investigation has been completed at the Hennepin Power Plant to characterize the geology, hydrogeology and groundwater quality. Based on extensive investigation and monitoring, the East Ash Pond System has been well characterized and detailed in the Hydrogeologic Site Characterization Report (NRT, 2017b). A site conceptual model has been developed and is discussed below.

Three hydrogeologic units are present at the site.

- Fill Unit, the uppermost unit, is comprised of CCRs – fly ash, bottom ash and minor slag. In some areas, such as constructed berms, the Fill Unit is CCR mixed with sand, silt, and clay.
- Uppermost Aquifer Unit is comprised of mixed alluvial deposits (Cahokia Alluvium clay, silt, and sand) which overlie coarser grained outwash sand and gravel deposits (Henry Formation). This unit is the primary groundwater transport pathway.
- Bedrock Confining Unit is defined by Pennsylvanian age shale with minor layers of limestone, sandstone, and coal. This low permeability unit defines the lower boundary of the Uppermost Aquifer.

The Illinois River is located directly adjacent to and downgradient from the East Ash Pond System. The Illinois River is the regional groundwater discharge area and localized groundwater flow under Ash Pond No. 2 and No. 4 occurs in a general northerly orientation (Figure 3).

Ash Pond No. 2 and No. 4 are not subject to 100-year flooding at the base flood elevation value of 462 feet. Flood events typically occur in March, April, May, and sometimes June, while lesser flooding occasionally occurs during autumn. During high precipitation and/or flood events, the river stage may rise above adjacent groundwater elevations and the river recharges the aquifer, temporarily reversing the direction of groundwater flow to the south (Figure 4). High precipitation and/or flood events that recharge the aquifer may result in temporary groundwater elevation increases above the base grade of Ash Pond No. 2 and potentially Ash Pond No. 4. These events appear to be short in duration but occur on an almost annual basis.

Parameters observed in groundwater exceeding Class I standards during the 2016 Illinois EPA and CCR Rule monitoring programs that are likely derived from CCRs included boron and selenium. Exceedances of these constituents occur only in downgradient monitoring wells 18S and/or 18D located immediately adjacent to Ash Pond No. 2. The Class I standard exceedances at these wells appear to be related to partial saturation of the ash for short periods when high precipitation/flood events result in aquifer recharge and groundwater elevation increases above the base grade of Ash Pond No. 2. The lack of exceedances in wells 10 and 11 downgradient of Ash Pond No. 4 indicates that it is unlikely that ash is saturated even during periods of high elevations.

Based on the frequency of detection, the parameter distribution and/or observed anomalous concentrations, exceedances of Class I standards for cadmium, chloride, lead, iron, manganese, nickel, nitrate-N, TDS and pH are not related to Ash Pond No. 2 or No. 4 or CCR at the East Ash Pond System. These exceedances of Class I groundwater quality standards are attributable to non-CCR sources and/or variations in groundwater geochemistry rather than a release from Ash Pond No. 2 or No. 4.

2 GROUNDWATER MONITORING

Currently, there are two monitoring programs for the Hennepin East Ash Pond System. Detection groundwater monitoring was initiated during the 1st Quarter of 2011 pursuant to DMG's Initial Facility Report (NRT/Kelron, 2010) prepared for the CCR Landfill, which calls for annual reports in accordance with the 35 IAC 815 rules providing an assessment of groundwater quality data. Annual reports prepared from 2011 through 2016 have included groundwater monitoring results for all of the ponds actively monitored under Illinois EPA permit or Initial Facility Report (IFR) requirements (Landfill, Ash Pond No. 2 and East Ash/Primary Pond as well as the non-CCR units (Polishing Pond, Leachate Pond, and Ash Pond No. 4).

A separate monitoring program commenced in December 2015 consistent with the requirements of 40 CFR Part 257 (CCR Rule). This monitoring program addresses the groundwater monitoring requirements for CCR units within the East Ash Pond System, including the Landfill, Ash Pond No. 2 and East Ash/Primary Pond.

Upon approval of the Closure Plan Addendum in which this document is attached, the monitoring network will consist of one program to comply with both Illinois EPA and CCR Rule requirements for Ash Pond No. 2 and IEPA requirements for Ash Pond No. 4.

The proposed groundwater monitoring well network consists of a sufficient number of wells, installed at appropriate locations and depths, to monitor post-closure compliance with groundwater quality standards for Class I: Potable Resource Groundwater. The wells will monitor the mixed alluvial deposits (Cahokia Alluvium) overlying coarser grained outwash sand and gravel deposits (Henry Formation) underlying Ash Pond No. 2 and No. 4 which have been designated the uppermost aquifer.

The monitoring wells are designed and constructed in accordance with applicable standards, including the following:

- All monitoring wells are cased in a manner that maintains the integrity of the boreholes
- Wells are screened to allow sampling only at the specified interval
- All wells are covered with vented caps, unless located in flood-prone areas, and equipped with devices to protect against tampering and damage

The monitoring well network described below fulfills the following goals:

- Enable the collection of groundwater samples that represent the quality of background water that has not been affected by Ash Pond No. 2 or No. 4
- Enable the collection of groundwater samples that represent the quality of downgradient groundwater
- Include wells that are located within the stratigraphic unit that may serve as potential chemical migration pathways

2.1 EXISTING MONITORING WELL NETWORK AND ANALYSIS

The existing well network for the East Ash Pond System currently includes 25 monitoring wells as shown on Figure 2. Boring logs and monitoring well construction reports for the groundwater monitoring system are provided in Appendix A.

2.1.1 Illinois EPA Closure Work Plan Monitoring – East Ash Pond System

The monitoring program performed in compliance with the current Illinois EPA-approved Closure Plan (Dynegy, 2016) consists of collecting samples from 6 background wells (02, 07, 08, 08D, 16 17) and 12 downgradient wells (03R, 04R, 05R, 06, 10, 12, 13, 15, 18S, 18D, 19S, 19D) as shown on Figure 2. All wells are screened in the sand units underlying and near the East Ash Pond System. Samples are collected quarterly to assess compliance with the IAC 35 Part 620 Section 410 Groundwater Quality Standards for Class I: Potable Resource Groundwater. Groundwater samples are analyzed for the following parameters:

Field Parameters	
Ph	Temperature
Specific Conductivity	Groundwater Elevation

Laboratory Parameters			
General Inorganics			
Boron	Fluoride	Nitrate-N	
Chloride	Iron	Sulfate	
Cyanide	Manganese	Total Dissolved Solids (TDS)	
Metals			
Antimony	Cadmium	Lead	Silver
Arsenic	Chromium	Mercury	Thallium
Barium	Cobalt	Nickel	Zinc
Beryllium	Copper	Selenium	
Organic Compounds			
Volatile Organic Compounds	Polychlorinated Biphenyls (PCBs)		
Semi-Volatile Organic Compounds	Specialized Organic Parameters: Endohall, Ethyl Dibromide (EDB) and 1,2-Dibromo-3-Chloropropane (DBCP)		
Chlorinated Pesticides			
Chlorinated Herbicides			

The groundwater quality results for field and inorganic parameters listed in 35 IAC 620.410 are provided in Appendix C1. Groundwater monitoring results are reported to the Illinois EPA annually in accordance with the approved Closure Work Plan. The most recent data and analysis were submitted in '2016 Closure Work Plan Annual Report' (NRT, March 13, 2017c).

2.1.2 40 CFR Part 257 Monitoring – East Ash Pond No. 2

Monitoring commenced in December 2015 to comply with the CCR Rule for Ash Pond No. 2 and consists of quarterly groundwater elevation measurements and water quality samples collected at background wells 07, 08, 08D and downgradient monitoring wells 03R, 18S, 18D and 45S. The groundwater is analyzed for Appendix III and Appendix IV parameters (see below). All existing groundwater monitoring wells are measured for groundwater elevation.

40 CFR Part 257 Monitoring			
Field Parameters			
Dissolved Oxygen	Oxidation/Reduction Potential	Temperature	pH
Groundwater Elevation	Specific Conductivity	Turbidity	
Appendix III Parameters (Total, except TDS)			
Boron	Chloride	Sulfate	
Calcium	Fluoride	Total Dissolved Solids (TDS)	
Appendix IV Parameters (Total)			
Antimony	Cadmium	Lead	Selenium
Arsenic	Chromium	Lithium	Thallium
Barium	Cobalt	Mercury	Radium 226/228
Beryllium	Fluoride	Molybdenum	

The groundwater quality results for the above field, inorganic and organic parameters listed in Appendix III and Appendix IV during the first four quarters of sampling are provided in Appendix C2. Following the completion of eight quarterly sampling events, the monitoring program will be modified so that the analytical parameters and sampling frequency are appropriate to the objectives and requirements of the CCR Rule.

2.2 PROPOSED MONITORING NETWORK

This Closure Plan proposes a single groundwater monitoring program at Ash Pond No. 2 and No. 4 to meet the requirements of both 40 CFR 257 and 35 IAC Part 620.410. Ash Pond No. 4 has been classified as a non-CCR Rule unit, as it is capped or otherwise maintained, and therefore monitoring will be completed to meet 35 IAC Part 620.410 requirements. The proposed groundwater monitoring system will consist of three background monitoring wells (07, 08, 08D) and four downgradient monitoring wells (03R, 18S, 18D, 45S). Well locations are shown on Figure 5.

Well 45S was installed in 2015 to supplement the monitoring network at Ash Pond No. 2. Well 45S will replace existing well 06, which was drilled in 1982 and is located approximately 300 feet beyond the Ash Pond No. 2 berm (Figure 2). Well 06 continues to be monitored under the existing Illinois EPA permit but will be made inactive due its distance from Ash Pond No. 2, following approval of this monitoring plan.

The proposed monitoring wells will yield groundwater samples that represent the quality of downgradient groundwater at the property boundary and within the GMZ. Monitoring well depths and construction details are listed in Table 1 and summarized below.

The well depths, well screen intervals, depth to groundwater, and position are summarized below:

Well Number	Well Screen Interval (ft bgs)	Depth To Groundwater (ft bgs)	Well Position Relative to Ash Pond No. 2
07	67-77	66.1	Background
08	52-62	52.2	Background
08D	80-90	53.4	Background
03R	39-53	33.2	Downgradient
18S	40-50	38.9	Downgradient
18D	71-76	38.9	Downgradient
45S	35-45	16.9	Downgradient

2.3 WELL ABANDONMENT

It may be necessary to abandon some wells adjacent to Ash Pond No. 2 or No. 4 during closure construction. If so, these wells will be replaced as close to the former location as possible, at the same screened interval as the former well, and utilizing the requirements for well construction as per Illinois Department of Health regulations (77 IAC Part 920.170).

Piezometers HEN-P004 and HEN-P005 will be abandoned prior to capping of Ash Pond No. 2. The locations of the piezometers that will be abandoned are shown on Figure 5.

3 APPLICABLE GROUNDWATER QUALITY STANDARDS

3.1 GROUNDWATER CLASSIFICATION

The classification of groundwater at Ash Pond No. 2 and No. 4 has been evaluated and, based on the detailed geologic information for the mixed alluvial deposits (clay, silt, and sand) and underlying outwash sand and gravel deposits at the Site, can be classified as Class I - Potable Resource Groundwater, per the provisions of 35 IAC 620.210. The thickness of the uppermost aquifer is greater than 5 feet and field hydraulic conductivity tests performed on sand and sand and gravel units had a geometric mean hydraulic conductivity of 5.6×10^{-2} cm/s.

3.2 APPLICABLE GROUNDWATER QUALITY STANDARDS

The applicable groundwater quality standards for the proposed monitoring well network are Groundwater Quality Standards for Class I: Potable Resource Groundwater [35 IAC 620.410] or background concentrations based on statistical analyses, as described in Section 3.3.

Background groundwater quality for all parameters was completed through statistical evaluation following completion of 8 quarters of groundwater sampling of background wells 07, 08 and 08D that commenced in December 2015. The groundwater quality standard for these parameters at the proposed monitoring well network at Ash Pond No. 2 and No. 4 will be the greater of either the background concentration or the groundwater quality standard for Class I Potable Resource Groundwater. This is consistent with the methods outlined in 40 CFR Part 257. The current list of applicable groundwater quality standards for the monitoring well network is shown on Table 2.

3.3 STATISTICAL EVALUATION OF BACKGROUND GROUNDWATER DATA

A statistical evaluation was performed to determine the maximum background concentrations likely to occur upgradient of Ash Pond No. 2 and No. 4. The groundwater quality data collected from upgradient monitoring wells 07, 08 and 08D were evaluated using the Electric Power Research Institute (EPRI, March 2014) computer database and analysis program, MANAGES™ (Version 3.4.49). The statistical analysis procedures used here are consistent with procedures described in the document: 2009 Unified Guidance. "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities—Unified Guidance," March 2009, EPA 530/R-09-2007 (USEPA, 2009).

The statistical methodology is provided in Appendix B. Establishing the prediction limit(s) or tolerance interval(s) for the groundwater constituents utilized either a parametric or non-parametric procedure based on the percentage of non-detects in the data sets and the distribution of the sample population. If the statistical data for a constituent had less than 50 percent non-detects and was normally or log-normally distributed, a parametric procedure was used. If the data was not normally or log-normally distributed or had more than 50 percent non-detects, a non-parametric procedure was used. Appendix B, Figure B-1 is a flow chart which illustrates the process used to determine the appropriate statistical procedure for each constituent based on its statistical characteristics.

3.4 PROPOSED EXCEPTIONS TO THE GROUNDWATER MONITORING PARAMETERS

Based on the results of groundwater monitoring performed at Ash Pond No. 2, No. 4, and the East Ash Pond System to date, and reductions to the closure monitoring program approved by the IEPA, the following exceptions to the above applicable Class I: Potable Resource Groundwater standards are proposed:

- Exceedances of Class I groundwater standards for manganese occurred only in downgradient well 18D, suggesting differences in groundwater chemistry occur at depth rather than from Ash Pond No. 2 leachate. Detailed discussions of the manganese geochemistry in wells at the Hennepin Power Station are provided in the EPRI manganese research report submitted to the IEPA on November 6, 2002 (EPRI, 2002). Based on extensive analysis, elevated metals concentrations have been attributed to reducing conditions and aquifer composition and are not prevalent in groundwater associated with Ash Pond No. 2 or No. 4.

- Iron exceedances occurred in three unfiltered (total) samples. These detections were anomalously high values compared to all other analytical results and may have been related to sample turbidity. There have been no Class I standard exceedances of dissolved iron in upgradient or downgradient wells.
- Nitrate is included in the inorganic parameters for Class I Potable Resource Groundwater. Exceedances of groundwater standards for nitrate are distributed across the site and occurred sporadically in all monitoring wells indicating that the concentrations reflect background variability in groundwater.
- The following constituents (total and dissolved, unless otherwise designated) were either not detected or were detected sporadically in less than 5 percent of the samples collected in the upgradient and/or downgradient wells: aluminum, beryllium, copper, mercury, silver (dissolved), vanadium, and zinc. None of these parameters exceeded the Class I groundwater standards. However, beryllium and mercury are required monitoring parameters under the CCR Rule and will initially be monitored as per requirements of the CCR Rule.
- Total and dissolved nickel is consistently detected in all downgradient monitoring wells but only exceeded the Class I groundwater standard (0.10 mg/L) at well 06 in one sampling event. Dissolved nickel has been frequently detected in upgradient wells 08 and 08D since 2013, exceeding the standard and all downgradient well concentrations. The observed distribution of nickel concentrations reflect background variability in groundwater from an upgradient source.
- Organic constituents detected in conjunction with monitoring the CCR Landfill Phase I cell included PCP, Picloram, acetone and phenol. These constituents were detected below Class I standards and are not related to CCR.

The proposed groundwater monitoring parameters for the proposed monitoring well network are discussed further in Section 4.1.

4 GROUNDWATER MONITORING PLAN

The proposed groundwater monitoring program described in this document is consistent with the requirements of 35 IAC Part 620 and Illinois EPA-approved modifications as well as 40 CFR Part 257. The groundwater monitoring plan will monitor and evaluate groundwater quality to demonstrate compliance with the groundwater quality standards for Class I: Potable Resource Groundwater as well as USEPA MCLs or background exceedances, as appropriate.

4.1 GROUNDWATER MONITORING

As discussed in Section 2.2, the proposed post-closure Illinois EPA and CCR Rule groundwater sampling network consists of three background monitoring wells (07, 08, and 08D) and four compliance monitoring wells (03R, 18S, 18D, 45S) installed in the alluvial and underlying outwash sand and gravel deposits adjacent to East Ash Pond No. 2 and No. 4 (Figure 5). Groundwater samples will be collected and analyzed for the following laboratory and field parameters:

Laboratory Parameters (Total)		
Metals (totals)		
Antimony	Cadmium	Lithium
Arsenic	Calcium	Mercury
Barium	Chromium	Molybdenum
Beryllium	Cobalt	Selenium
Boron	Lead	Thallium
Inorganics (totals)		
Fluoride	Sulfate	
Chloride	Total Dissolved Solids	
Other (total)		
Radium 226 and 228 combined		
Field Parameters		
pH	Specific Conductivity	Turbidity
Dissolved Oxygen	Temperature	

As discussed in Section 3.4, other inorganic constituents listed under 35 IAC 620 and/or 40 CFR Part 257 Appendix IV will not be monitored at the proposed monitoring well network because the groundwater monitoring results to date indicate the following:

- The constituent meets the Class I: Potable Resource Groundwater standards.
- The constituent has not been consistently observed above detection limits in monitoring wells at Ash Pond No. 2 or No. 4 during previous sampling events.
- The constituent is not associated with the chemical characteristics of Ash Pond No. 2 or No. 4.
- The constituent reflects background concentrations from an upgradient source not associated with the East Ash Pond System, Ash Pond No. 2 or Ash Pond No. 4.

All parameters listed above were be sampled a minimum of eight times by October 17, 2017 to establish background groundwater quality. Following the initial eight rounds of sampling, the parameters to be monitored and the frequency of monitoring will be in accordance with the requirements of 40 CFR Part 257.94 and 257.95 and this plan.

4.2 SAMPLING SCHEDULE

Groundwater sampling for the proposed monitoring well network will initially be performed quarterly according to the following schedule:

Frequency	Duration
Quarterly	Begins: The quarter following approval of this plan. *(All parameters with the exception of Radium 226/228, which will be sampled semiannually after the first 8 quarterly rounds of background sampling)*
	Ends: 5 years after completion of cap and upon demonstration that monitoring effectiveness is not compromised and that there are no increasing trends attributable to the East Ash Pond System.
Semiannual	Begins: after IEPA approves that quarterly monitoring requirements have been satisfied.
	Ends: 5 years after initiation of semiannual monitoring and upon demonstration that monitoring effectiveness is not compromised and that there are no increasing trends attributable to the East Ash Pond System.
Annual	Begins: after IEPA approves that semiannual monitoring requirements have been satisfied.
	Ends: upon IEPA approval of a certified post-closure care report, but no less than 30 years from the date of closure as specified in 40 CFR 257

Five years after approval of the Closure Plan, a request may be made to modify the post-closure care plan to reduce the frequency of groundwater monitoring to semi-annual sampling by demonstrating all of the following:

- Monitoring effectiveness will not be compromised by the reduced frequency of monitoring
- Sufficient data has been collected to characterize groundwater
- Concentrations of constituents monitored at the downgradient boundaries show no statistically significant increasing trends that can be attributed to Ash Pond No. 2 or No. 4

If concentrations of parameters of concern at the downgradient wells of the site show no statistically significant increasing trends that can be attributed to Ash Pond No. 2 or No. 4 for the five years after reducing the monitoring frequency to semi-annual, a request may be made to modify the post closure care plan to reduce monitoring parameters and/or monitoring frequency to annual sampling by demonstrating the same items above as for the reduction to semi-annual monitoring.

Groundwater monitoring may be discontinued upon Illinois EPA's approval of a certified post-closure care report after a minimum 30 years of post-closure groundwater monitoring has been completed. Specifically, when no statistically significant increase is detected in the concentration of any constituent above that measured and recorded during the immediately preceding scheduled sampling for four consecutive years after changing to an annual monitoring frequency. Any changes in the sampling network or monitoring frequency approved by the IEPA will apply only to IEPA requirements, and will not affect groundwater monitoring required under 40 CFR Part 257.

Groundwater monitoring for the 40 CFR Part 257 well network will follow a schedule in accordance with the requirements of 40 CFR Part 257.94 and 257.95. Post-closure care groundwater monitoring will continue for a minimum of 30 years in accordance with 40 CFR Part 257.104.

4.3 GROUNDWATER SAMPLE COLLECTION

Groundwater samples will be collected consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.93 as described in Appendix D. In addition to groundwater well samples, quality assurance samples will be collected as described in Section 4.5 (Table 3).

4.4 LABORATORY ANALYSIS

Laboratory analysis will be performed consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.93 by a state-certified laboratory using methods approved by Illinois EPA and USEPA (Table 4). The reporting limits (RLs) for all parameters analyzed will be lower than the applicable groundwater quality standard. Concentrations lower than the RL will be reported as less than the RL. A list of these parameters and the required RLs are summarized in Table 4.

4.5 QUALITY ASSURANCE PROGRAM

Consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.93, the sampling and analysis program includes procedures and techniques for quality assurance and quality control (Table 3). Additional quality assurance samples to be collected will include the following:

- Minimum of one blind duplicate groundwater samples from randomly selected monitoring wells
- One equipment blank sample will be collected and analyzed for each day of sampling. If dedicated sampling equipment is used, 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

4.6 GROUNDWATER MONITORING SYSTEM MAINTENANCE PLAN

Consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.91, 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. Monitoring well 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 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 ANNUAL STATISTICAL ANALYSIS

Trend analysis will be performed annually for each of the monitored parameters. Sen's Estimate of Slope will be applied to a minimum of four consecutive monitoring results (quarterly, semiannual, or other approved frequency). If there are increasing trends during closure and post-closure care periods, they will be further investigated as described below.

- If the results of sampling and analysis show an increasing trend at any compliance monitoring well, a Mann-Kendall analysis will be performed at 95 percent confidence to determine whether or not the increasing trend is statistically significant.
- If a statistically significant increasing trend occurs during post-closure care, further investigation of monitored concentrations will be performed as well as more frequent inspections of the surface of the cover system.
- If the investigation attributes a statistically significant increasing trend to a source other than Ash Pond No. 2, then the Illinois EPA will be notified in writing, stating the cause of the increasing trend and providing the rationale used in such a determination.
- If there is not an alternative source causing the statistically significant increasing concentration and the sampling frequency had been reduced to semi-annual or annual sampling, a quarterly sampling schedule will be reestablished. The frequency of sampling will return to either semi-annual or annual, once four consecutive quarterly samples show no statistically significant increasing trend.

Notifications concerning statistically significant increasing trends and revisions of the sampling frequency will be reported to Illinois EPA in writing within 30 days after making the determinations.

In addition, as required in 40 CFR Part 257.93, statistical analysis will be performed to determine whether or not a statistically significant increase over a background value has occurred for each constituent and at each well. Appropriate statistical methods will be chosen from the list of methods provided and the test chosen will be conducted separately for each constituent in each monitoring well. In addition, each statistical method chosen will comply with the performance standards, as appropriate, based on the test method used. If a statistically significant increase over background values is determined, procedures from 40 CFR Part 257 will be followed including: 1) establishing an assessment monitoring program; or 2) demonstrating that a source other than Ash Pond No. 2 caused the increase or demonstrating another plausible reason for the increase (error in sampling, etc.).

4.8 DATA REPORTING

Sampling and analysis data from quarterly, semi-annual and/or annual groundwater monitoring for the monitoring well network will be reported to Illinois EPA within 60 days after completion of sampling. Statistical analysis of the laboratory analytical data will be reported to Illinois EPA with the annual report for the facility, as described in the closure plan.

Data reporting for the 40 CFR Part 257 monitoring well network will be consistent with recordkeeping, notification, and internet posting requirements described in 40 CFR 257.105 through 257.107.

4.9 COMPLIANCE WITH APPLICABLE ON-SITE GROUNDWATER QUALITY STANDARDS

In accordance with IAC 620 Section 620.240, the compliance boundary is a lateral distance of 25 feet outward from the outermost edge of the Ash Pond No. 2 and No. 4 berms. Following completion of the corrective action, the groundwater standard at the compliance boundary will be in accordance with IAC 620 Section 450(a)(4) for groundwater quality restoration such that the standard for each released chemical constituent will be the higher of either the Class I groundwater standard or the concentration determined by groundwater monitoring at the compliance boundary.

Compliance with on-site groundwater quality standards, as measured at the proposed monitoring well network, will be achieved when there are no statistically significant increasing trends that are attributed to Ash Pond No. 2 for parameters detected at the compliance boundary after a minimum 30 years of post-closure groundwater monitoring has been completed. Evaluation of groundwater quality data under USEPA (2015) will be consistent with 40 CFR Part 257.93 and 257.94.

4.10 CORRECTIVE ACTION

If a statistically significant increasing trend is observed to continue over a period of two or more years in groundwater sampled at the well network, and a subsequent hydrogeologic site investigation demonstrates that such exceedances are due to a release from Ash Pond No. 2 and corrective actions are appropriate to mitigate such releases, a corrective action plan will be proposed as a modification to the post-closure care plan. A corrective action plan will be submitted to Illinois EPA within 180 days after completion of the investigation activities. The plan will propose corrective actions to be undertaken to mitigate the impacts associated with the constituents of concern which exceed applicable groundwater standards.

REFERENCES

AECOM, January 12, 2016. 30% Design Data Report for Dynegy Hennepin Power Station; West Polishing Pond, West Ash Pond, East Ash Pond and Ash Pond No. 2 CCR Units.

Dynegy Midwest Generation, LLC, October 17, 2016. Closure Plan for Existing CCR Surface Impoundment, Ash Pond No. 2, Hennepin Power Station, Hennepin, Illinois (REV 2).

Natural Resource Technology, an OBG Company, 2017a. Groundwater Management Zone Application. West Ash Pond System, Dynegy Midwest Generation, LLC, Hennepin Power Station, Hennepin, IL.

Natural Resource Technology, an OBG Company, 2017b. Hydrogeologic Site Characterization Report, East Ash Pond No. 2, Hennepin Power Station, Hennepin, Illinois

Natural Resource Technology, an OBG Company, March 13, 2017c. 2016 East Ash Pond and Coal Combustion Waste Landfill Annual Report, Hennepin Power Station, Dynegy Operating Company, Hennepin, Illinois.

USEPA, 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. EPA 530/R-09/007, U.S. Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, D.C., 554 p. + 4 app.

USEPA, January 2014. Technical Fact Sheet – Perchlorate

USEPA, April 17, 2015. 40 CFR Parts 257and 261. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule

Tables

Table 1. Monitoring Well Construction Summary
Groundwater Monitoring Plan
East Ash Pond No. 2 and No. 4, Hennepin Power Station

Well ID	08	08D	07	03R	18S	18D	45S
Well Location Latitude	41°18'2.35"	41°18'2.87"	41°17'52.60"	41°18'16.48"	41°18'17.72"	41°18'17.72"	41°18'13.51"
Well Location Longitude	-89°18'16.15"	-89°18'16.32"	-89°18'20.73"	-89°18'31.29"	-89°18'25.59"	-89°18'25.57"	-89°18'36.70"
Well Construction Material	PVC	PVC	PVC	PVC	PVC	PVC	PVC
Well Diameter (inches)	2	2	2	2	2	2	2
Top of Casing Well Elevation (ft) (1)	501.38	501.34	518.27	481.92	487.70	487.60	467.48
Well Depth Below Ground Surface (ft) (2)	61.5	90.0	77.5	52.0	52.0	78.0	45.0
Screen Length (ft)	10.0	5.0	10.0	10.0	10.0	5.0	10.0
Top of Screen Elevation (ft) (3)	447.2	416.2	447.7	437.4	445.2	414.2	430.7
Bottom of Screen Elevation (ft) (3)	437.2	411.2	437.7	427.4	435.2	409.2	420.7
Well Stick-up Above Ground Surface (ft) (4)	2.18	2.14	2.67	2.54	2.11	2.09	1.78
Hydraulic Position of Well (5)	U	U	U	D	D	D	D

[U:KJS 4/19/16; CB: JJW 4/22/16][U: KLT 5/6/16, C:PMH 5/11/16]

Notes:
PVC = polyvinyl chloride
ft = feet
1. Top of Casing Elevations are referenced to NAVD88.
2. Well Depth Below Ground Surface referenced to ground surface at time of well construction.
3. Top and Bottom of Screen Elevations reported as listed on well construction forms.
45S Screen Elevations are referenced to NAVD88.
08 and 07 Screen Elevations are referenced to NGVD29.
The vertical datum for 08D, 03R, 18S, and 18D Screen Elevations was assumed to be NAVD88.
4. Well Stick-up Above Ground Surface calculated from Top of Casing Well Elevation and Ground Surface Elevation collected on August 13, 2015 by Chastain & Associates LLC.
5. Upgradient (U) or downgradient (D)

Table 2. Background Groundwater Quality and Applicable Groundwater Quality Standards
Groundwater Monitoring Plan
East Ash Pond No.2 and No. 4, Hennepin Power Station

Parameters (totals)	IL Class I Std[1] (mg/L)	Basis for Groundwater Standard	Applicable Groundwater Standard[2] for IEPA (mg/L)	Maximum[3] (mg/L)	Minimum[3] (mg/L)
Antimony	0.006	IEPA Standard	0.006	<0.001	<0.001
Arsenic	0.01	IEPA Standard	0.01	<0.001	<0.001
Barium	2	IEPA Standard	2	0.0957	0.0518
Beryllium	0.004	IEPA Standard	0.004	<0.001	<0.001
Boron	2	IEPA Standard	2	**10.8**	0.373
Calcium	NS	PTI	297	172	77
Cadmium	0.005	IEPA Standard	0.005	0.0023	<0.001
Chloride	200	PTI	435	113	46
Chromium	0.1	IEPA Standard	0.1	0.0064	<0.001
Cobalt	1 [5]	IEPA Standard	1	0.0106	<0.001
Fluoride	4	IEPA Standard	4	0.36	0.1
Lead	0.0075	IEPA Standard	0.0075	0.001	<0.001
Lithium	0.04[4]	CCR Rule	0.04	**0.13**	0.0137
Mercury	0.002	IEPA Standard	0.002	<0.002	<0.002
Molybdenum	0.1[4]	CCR Rule	0.1	**0.414**	0.0281
Selenium	0.05	IEPA Standard	0.05	**0.117**	<0.001
Sulfate	400	IEPA Standard	400	**421**	69
Thallium	0.002	IEPA Standard	0.002	<0.001	<0.001
Total Dissolved Solids	1,200	PTI	1,623	900	266
Field pH	6.5 - 9.0	IEPA Standard	6.5 - 9.0	7.58	7.00
Radium 226/228*	20/20	IEPA Standard	20/20	2.45	0

Notes:
All parameters are totals unless noted. Standards apply to dissolved or total concentrations.
Red = Exceeds Applicable Groundwater Standard
NS = No Class I Groundwater Standard
PTI = Parametric Tolerance Interval

[1] IAC Title 35, Part 620.410, Groundwater Quality Standards for Class I: Potable Resource Groundwater Standard
[2] Applicable Groundwater Standard is the higher of the Background Concentration and the Class I Groundwater Standard (or the lower if compared to the pH lower limit)
[3] Concentrations measured between December 2015 and July 2017 at monitoring wells within IEPA Program
[4] Standards listed are USEPA risk based standards included in the CCR Rule (40 CFR Part 257)
[5] The USEPA risk based standard for cobalt is 0.006 mg/L, the IL 620 Class I Standard for cobalt will be used for comparison.
* Radium 226 and 228 (pCi/L) reported separately for Class I Groundwater Standard, although USEPA 40 CFR Part 257 requires combined reporting.

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Table 3. Sampling and Analysis Summary
Groundwater Monitoring Plan
East Ash Pond No. 2 and No. 4, Hennepin Power Station

Parameter	Analytical Method	Number of Samples	Field Duplicates[5]	Field Blanks[6]	Equipment Blanks[6]	MS/MSD[7]	Total	Container Type	Minimum Volume[8]	Preservation (Cool to 4 °C for all samples)	Sample Hold Time from Collection Date
Metals - Appendix III [1]											
Boron	6020	7	1	0	0	1	9	plastic	600 mL	HNO_3 to pH<2	6 months
Calcium	6020	7	1	0	0	1	9	plastic	600 mL	HNO_3 to pH<3	6 months
Metals - Appendix IV [2] and Additional Metals											
Other Metals [3]	6020	7	1	0	0	1	9	plastic	600 mL	HNO3 to pH<2	6 months
Mercury	7470A or 6020	7	1	0	0	1	9	plastic	400 mL	HNO_3 to pH<2	28 days
Inorganic Parameters - Appendix III [1]											
Fluoride	9214	7	1	0	0	1	9	plastic	300 mL	Cool to 4 °C	28 days
Chloride	9251	7	1	0	0	1	9	plastic	100 mL	Cool to 4 °C	28 days
Sulfate	9036	7	1	0	0	1	9	plastic	50 mL	Cool to 4 °C	28 days
Total Dissolved Solids	SM 2540 C	7	1	0	0	1	9	plastic	200 mL	Cool to 4 °C	7 days
Radium - Appendix IV [2]											
Radium 226	9315 or EPA 903	7	0	0	0	1	8	plastic	1000 mL	HNO3 to pH<2	6 months
Radium 228	9320 or EPA 904	7	0	0	0	1	8	plastic	1000 mL	HNO_3 to pH<2	6 months
Field Parameters											
pH [1]	SM 4500-H+ B	7	NA	NA	NA	NA	7	flow-through cell	NA	none	immediately
Dissolved Oxygen	SM 4500-O/405.1	7	NA	NA	NA	NA	7	flow-through cell	NA	none	immediately
Temperature	SM 2550	7	NA	NA	NA	NA	7	flow-through cell	NA	none	immediately
Specific Conductivity	SM 2510 B	7	NA	NA	NA	NA	7	flow-through cell	NA	none	immediately
Turbidity [4]	SM 2130 B	7	NA	NA	NA	NA	7	flow-through cell or hand-held turbidity meter	NA	none	immediately

Notes:
[1] USEPA Appendix III Parameters (boron, calcium, chloride, fluoride, pH, sulfate, total dissolved solids (TDS))
[2] USEPA Appendix IV Parameters
(antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, selenium, thallium, radium 226 and 228 combined)
[3] Other Metals = antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, lead, lithium, molybdenum, selenium, thallium
[4] 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 submitted for analysis
[5] Field duplicates will be collected at a frequency of one per group of 10 or fewer investigative water sample. Field duplicates will not be collected for radium analysis
[6] 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
[7] 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.
[8] Sample volume is estimated and will be determined by the laboratory.
Analytical method numbers are from SW-846 unless otherwise indicated. Analytical methods may be updated with more recent versions as apropriate.
NA = not applicable
HNO_3 = nitric acid
°C = degrees Celsius
mL = milliliter

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Table 4. Summary of Detection Limits for Proposed Class I Groundwater Standards Monitoring Program
Groundwater Monitoring Plan
East Ash Pond No. 2 and No. 4, Hennepin Power Station

Constituent	Unit	Analytical Methods [1]	USEPA MCL [2]	IL Class I Std[7]	RL [4]	MDL [4]
Metals						
Antimony	µg/L	6020	6	6	1	0.25
Arsenic	µg/L	6020	10	10	1	0.25
Barium	µg/L	6020	2000	2000	1	0.4
Beryllium	µg/L	6020	4	4	1	0.5
Boron	µg/L	6020	NS	2000	25	10
Cadmium	µg/L	6020	5	5	1	0.25
Calcium	µg/L	6020	NS	NS	125	100
Chromium	µg/L	6020	100	100	1	0.3
Cobalt	µg/L	6020	6	1,000	1	0.25
Lead	µg/L	6020	15	7.5	1	0.25
Lithium	µg/L	6020	40	NS	1	0.5
Mercury	µg/L	6020 or 7470A	2	2	0.2	0.051
Molybdenum	µg/L	6020	100	NS	1	0.25
Selenium	µg/L	6020	50	50	1	0.9
Thallium	µg/L	6020	2	2	1	0.25
Inorganics						
Fluoride	mg/L	9214	4	4	0.1	0.05
Chloride	mg/L	9251	250 [3]	200	5	1
Sulfate	mg/L	9036	250 [3]	400	10	5
Total Dissolved Solids	mg/L	SM 2540 C	500 [3]	1200	20	10
Other						
Combined Radium 226/228	pCi/L	9315/9320 or EPA 903/904	5	20/20	-- [5]	-- [6]
Field						
pH	SU	SM 4500-H+ B	NS	6.5-9.0	NA	NA
Dissolved Oxygen	mg/L	SM 4500-O/405.1	NS	NS	NA	NA
Temperature	^{o}C	SM 2550	NS	NS	NA	NA
Specific Conductivity	µS/cm	SM 2510 B	NS	NS	NA	NA
Turbidity	NTU	SM 2130 B	NS	NS	NA	NA

Notes:
NS = No standard
RL = Reporting limit as established by the laboratory
MDL = Method detection limit as established by the laboratory
SM = Standard Methods for the Examination of Water and Wastewater
ug/L = micrograms per liter
mg/L = milligrams per liter
pCi/L = picoCuries per liter
µS/cm = microSiemens per centimeter
NTU = nephelometric turbidity unit
(d) = dissolved analysis

1. Analytical method numbers are from SW-846 unless otherwise indicated.
2. USEPA MCL = United States Environmental Protection Agency Maximum Contaminant Level, or Risk Based Standard for CCR Rule.
3. USEPA SMCL = United States Environmental Protection Agency Secondary Maximum Contaminant Level.
4. Reporting limits and method detection limits will vary depending on the laboratory performing the work.
5. All radium results will be reported (values may be positive or negative) and will include uncertainty and the calculated MDC.
6. Laboratories calculate a minimum detectable concentration (MDC) based on the sample.
7. Standards listed include those listed in 35 Ill. Adm. Code Part 620 by Illinois EPA

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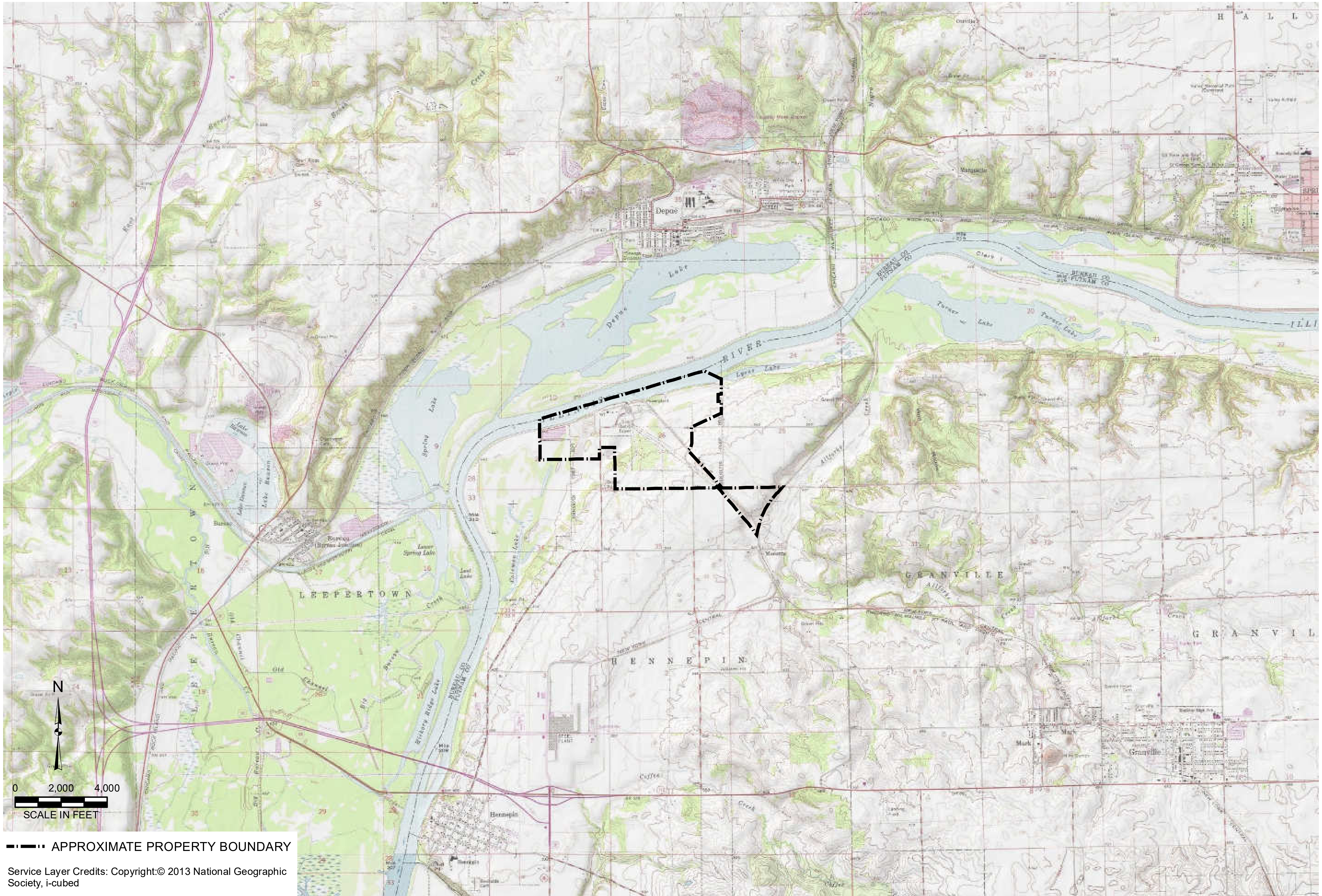
Figures



APPROXIMATE PROPERTY BOUNDARY

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DRAWN BY/DATE: TDC 9/10/18
REVIEWED BY/DATE: RJK 9/10/18
APPROVED BY/DATE: SJC 9/10/18

SITE LOCATION MAP

GROUNDWATER MONITORING PLAN
EAST ASH POND NO. 2 AND NO. 4
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

PROJECT NO: 2414

FIGURE NO: 1

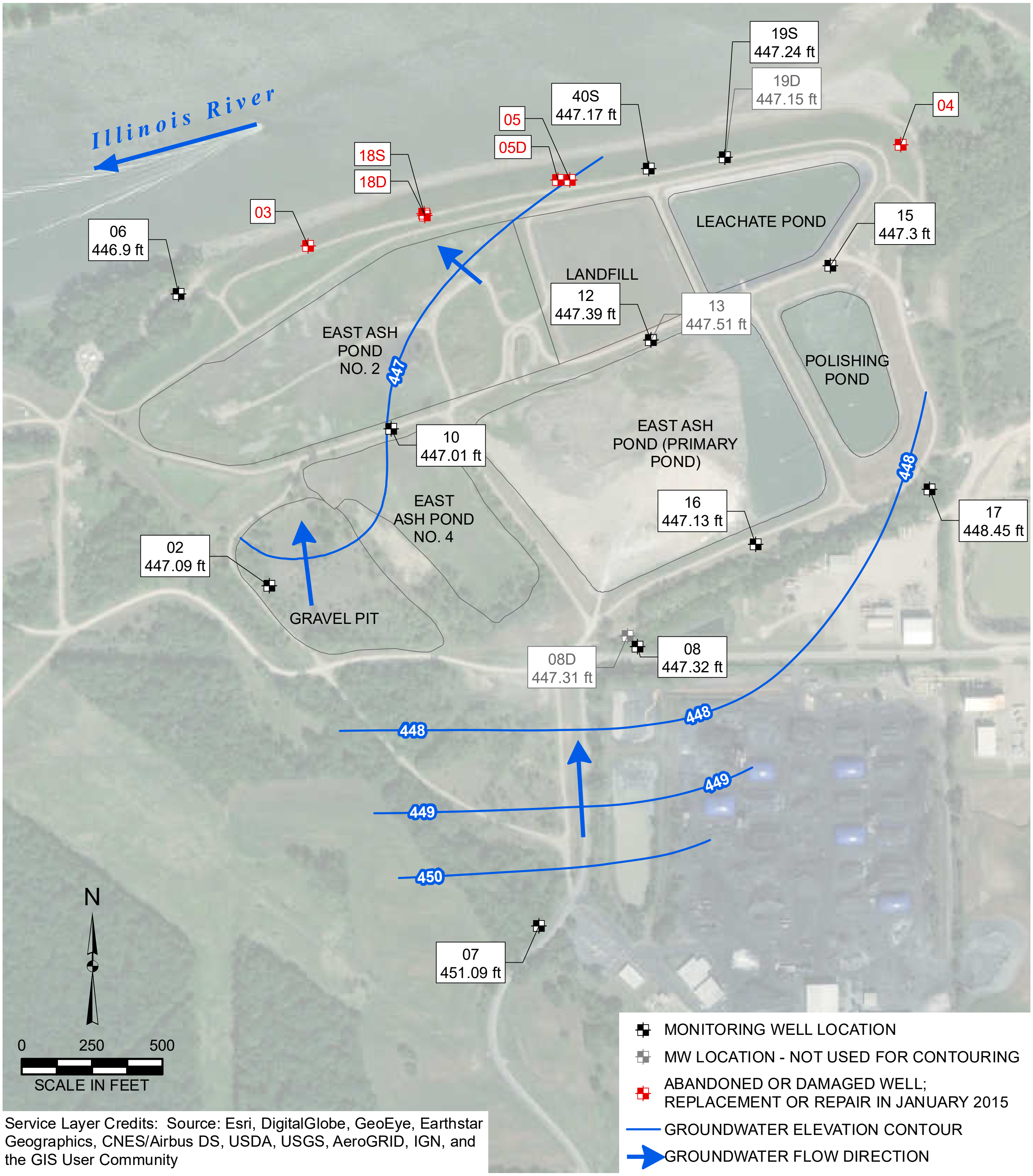
DRAWN BY/DATE: TDC 9/10/18
REVIEWED BY/DATE: RJK 9/10/18
APPROVED BY/DATE: SJC 9/10/18

EAST ASH POND SYSTEM MONITORING WELL NETWORK

GROUNDWATER MONITORING PLAN
EAST ASH POND NO. 2 AND NO. 4
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

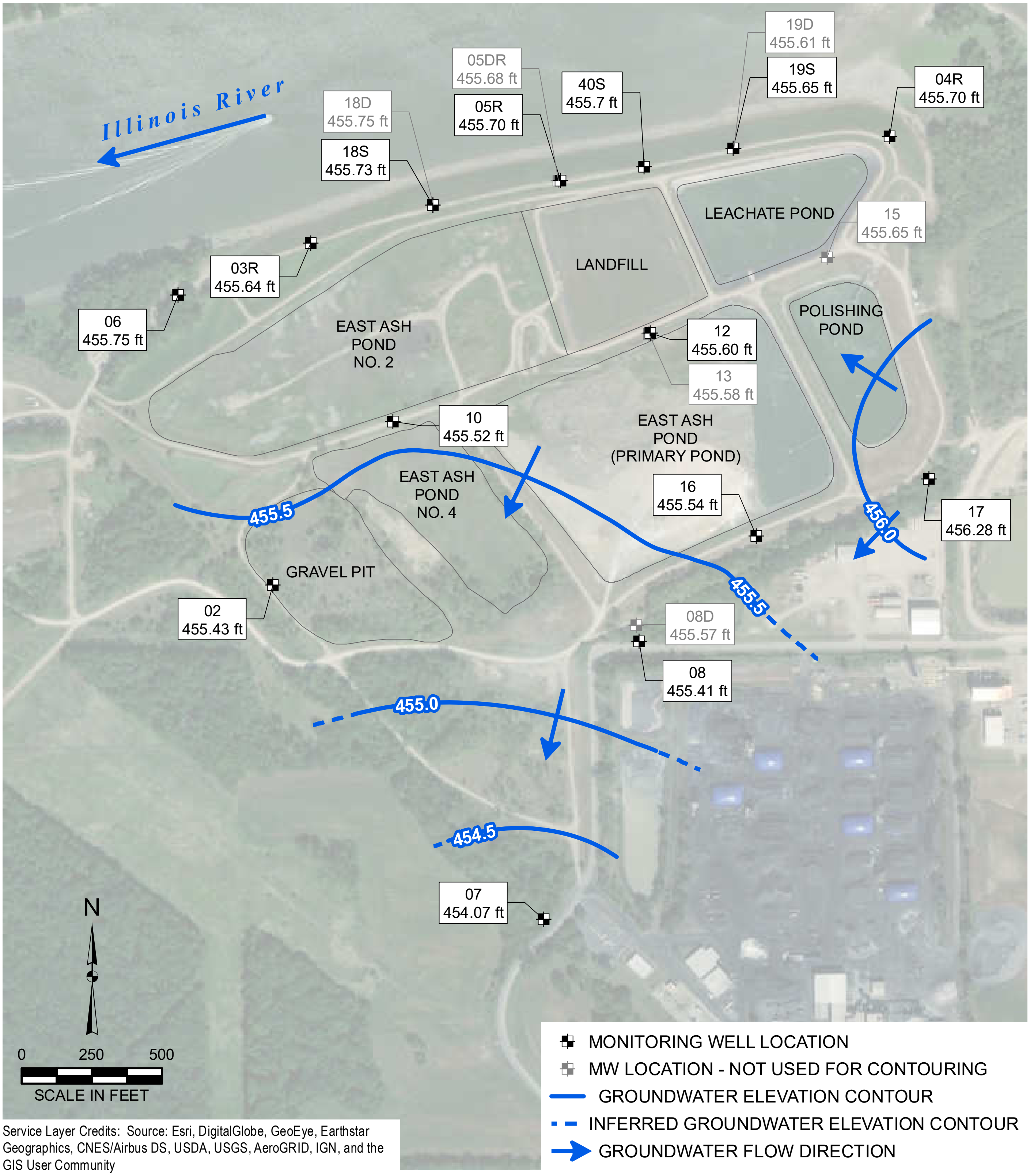
PROJECT NO: 2414

FIGURE NO: 2



DRAWN BY/DATE: TDC 9/10/18 REVIEWED BY/DATE: RJK 9/10/18 APPROVED BY/DATE: SJC 9/10/18	WATER TABLE CONTOUR MAP DECEMBER 9, 2014 GROUNDWATER MONITORING PLAN EAST POND NO. 2 AND NO. 4 DYNEGY MIDWEST GENERATION, LLC HENNEPIN POWER STATION, HENNEPIN, ILLINOIS	PROJECT NO: 2414 FIGURE NO: 3

Y:\Mapping\Projects\24\2414\MXD\GWMP\Figure 3_Water Table Contour Map_Dec 2014.mxd Author: GalamMC; Date/Time: 9/11/2018, 9:34:47 AM



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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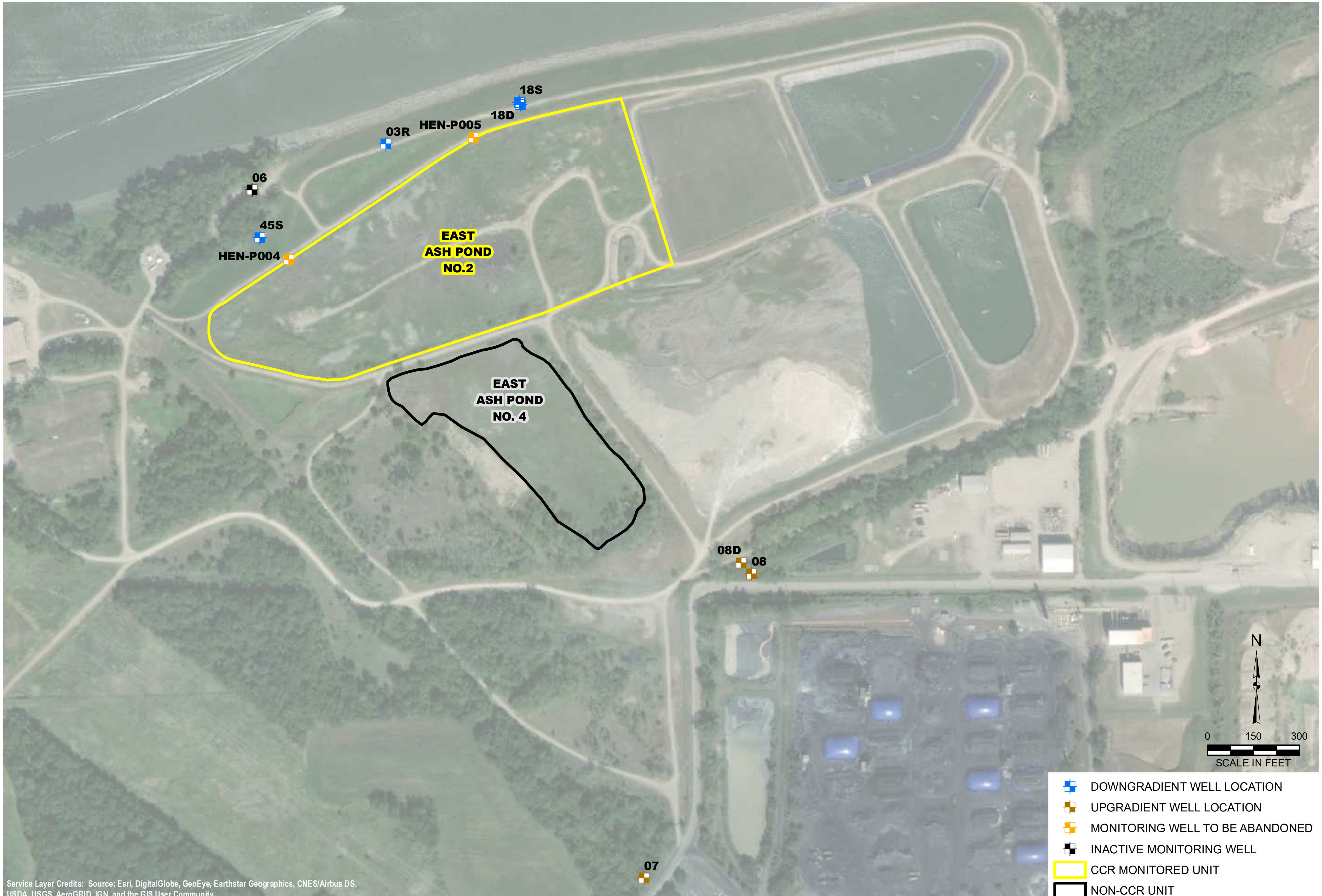

DRAWN BY/DATE:
TDC 9/11/18
REVIEWED BY/DATE:
RJK 9/11/18
APPROVED BY/DATE:
SJC 9/11/18

PROPOSED EAST ASH POND NO. 2 MONITORING WELL NETWORK AND ABANDONMENTS

GROUNDWATER MONITORING PLAN
EAST ASH POND NO. 2 AND NO. 4
DYNEGY MIDWEST GENERATION, LLC
HENNEPIN POWER STATION, HENNEPIN, ILLINOIS

PROJECT NO: 2414

FIGURE NO: 5

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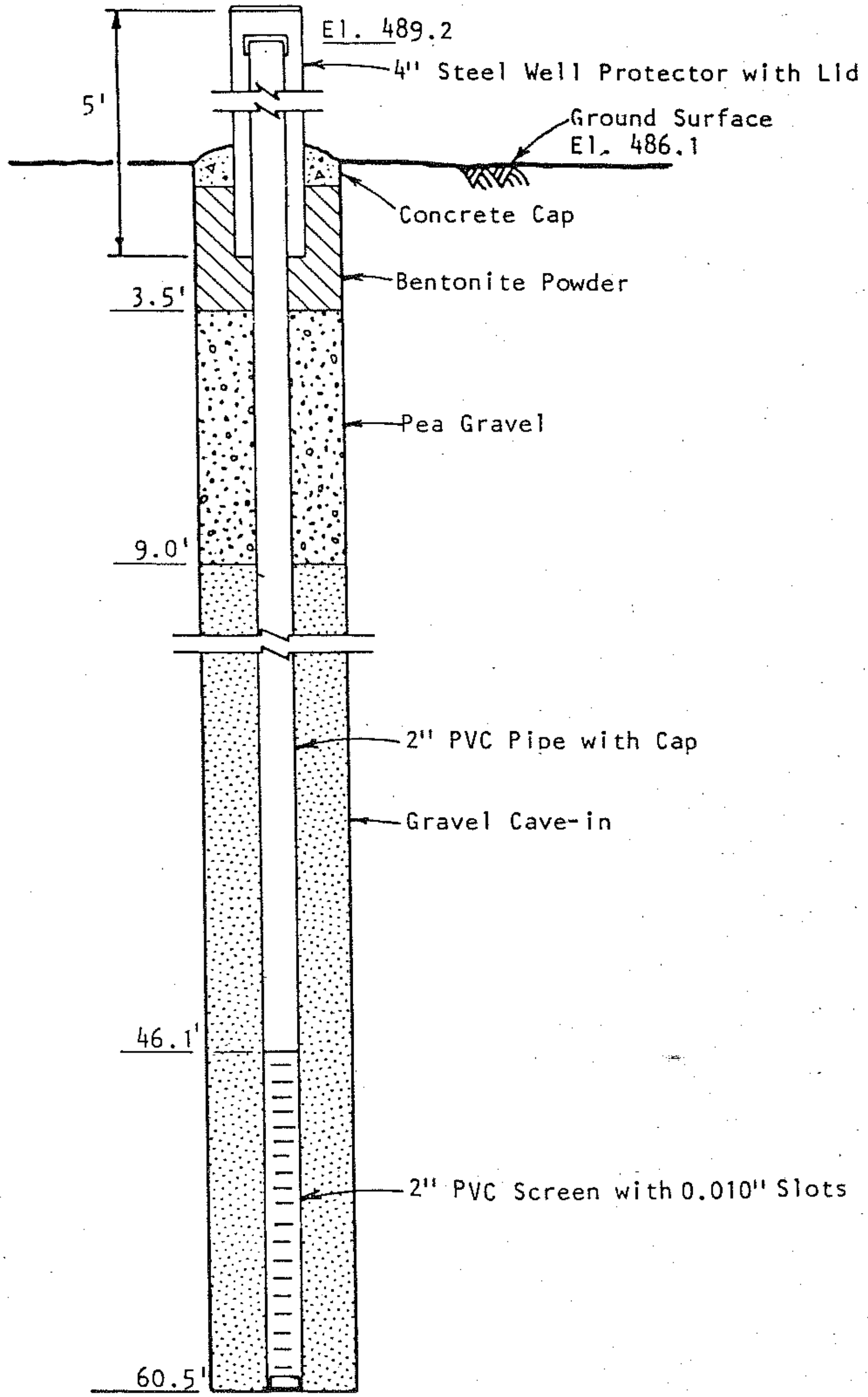
Appendix A

Monitoring Well Network Boring Logs and Monitoring Well Construction Reports

Appendix A1

MATHES Boring Logs and Well Details



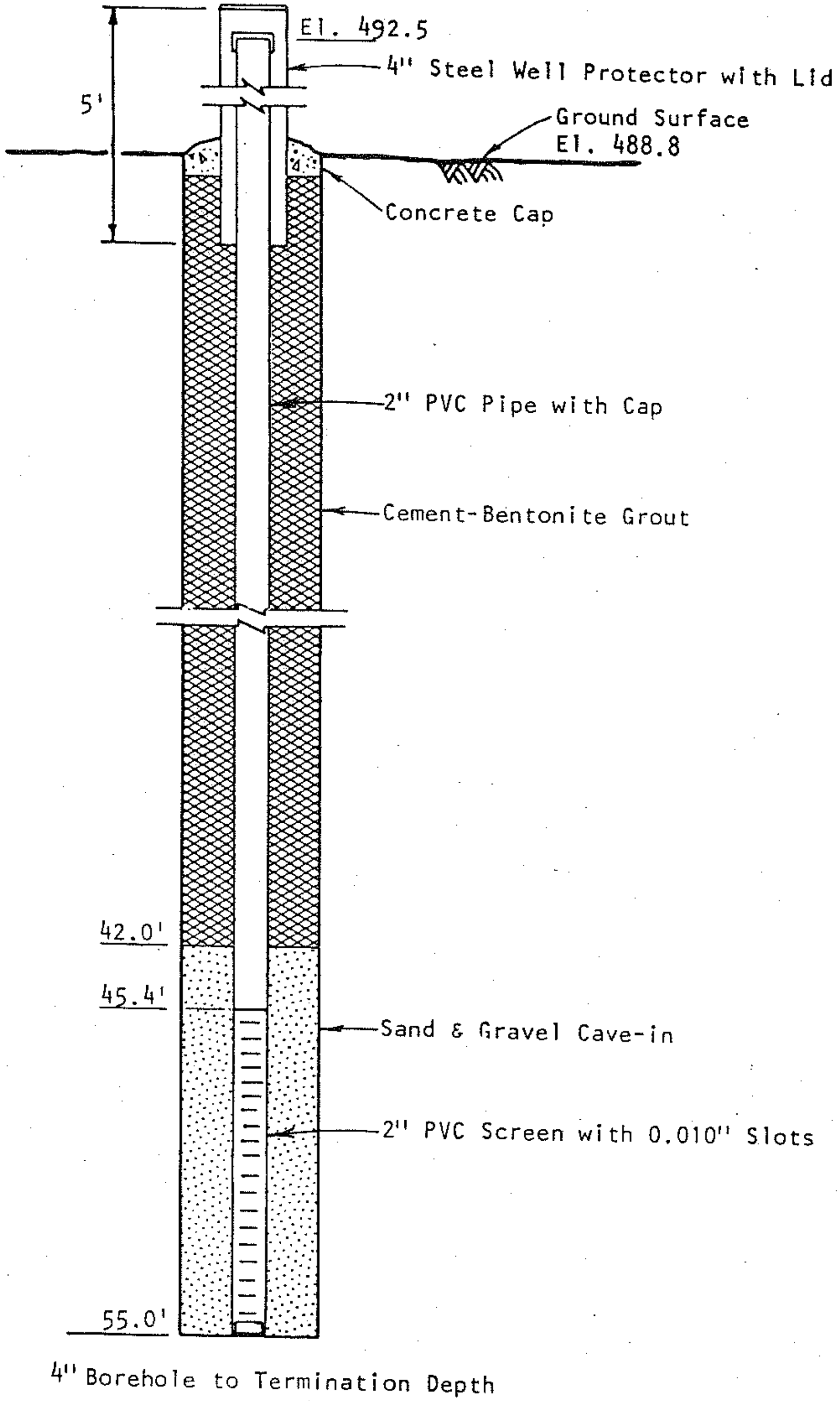
4" Borehole to Termination Depth

Not to Scale

PIEZOMETER E-1

John Mathes & Associates, Inc.

PLATE 9



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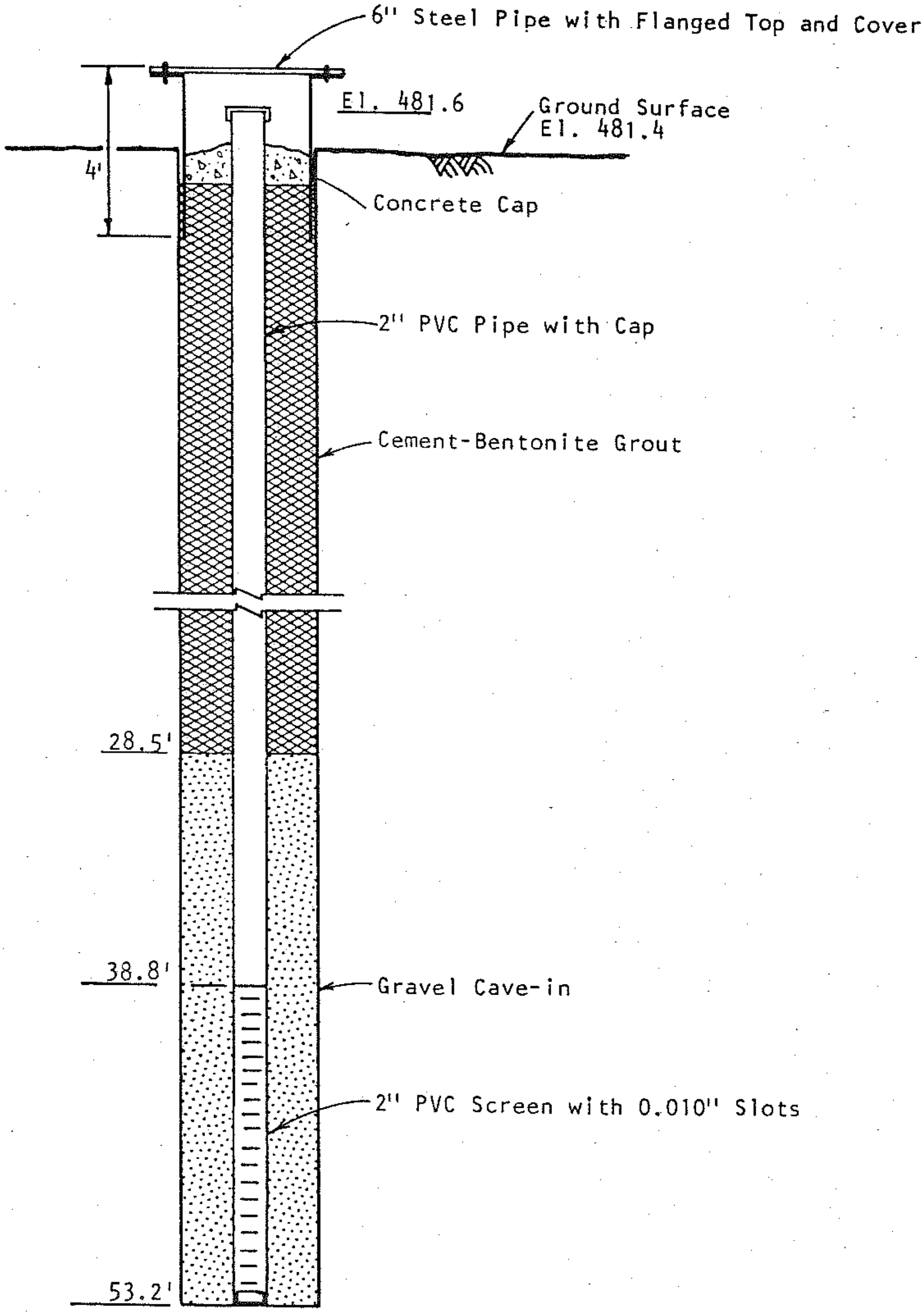
PIEZOMETER E-2

John Mathes & Associates, Inc.

PLATE 10



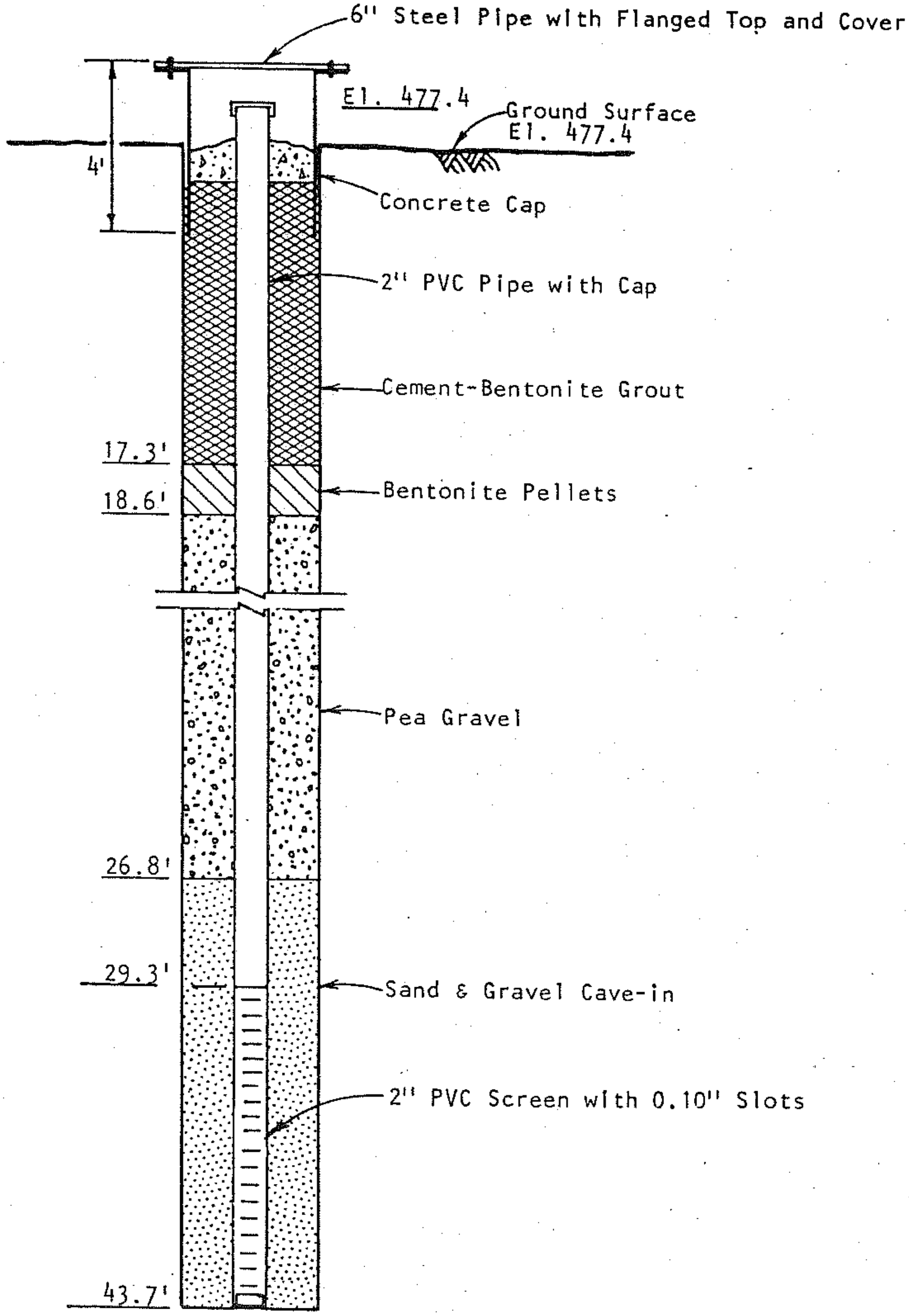
6" Borehole to Termination Depth

Not to Scale

mathes

PIEZOMETER E-3

John Mathes & Associates, Inc.



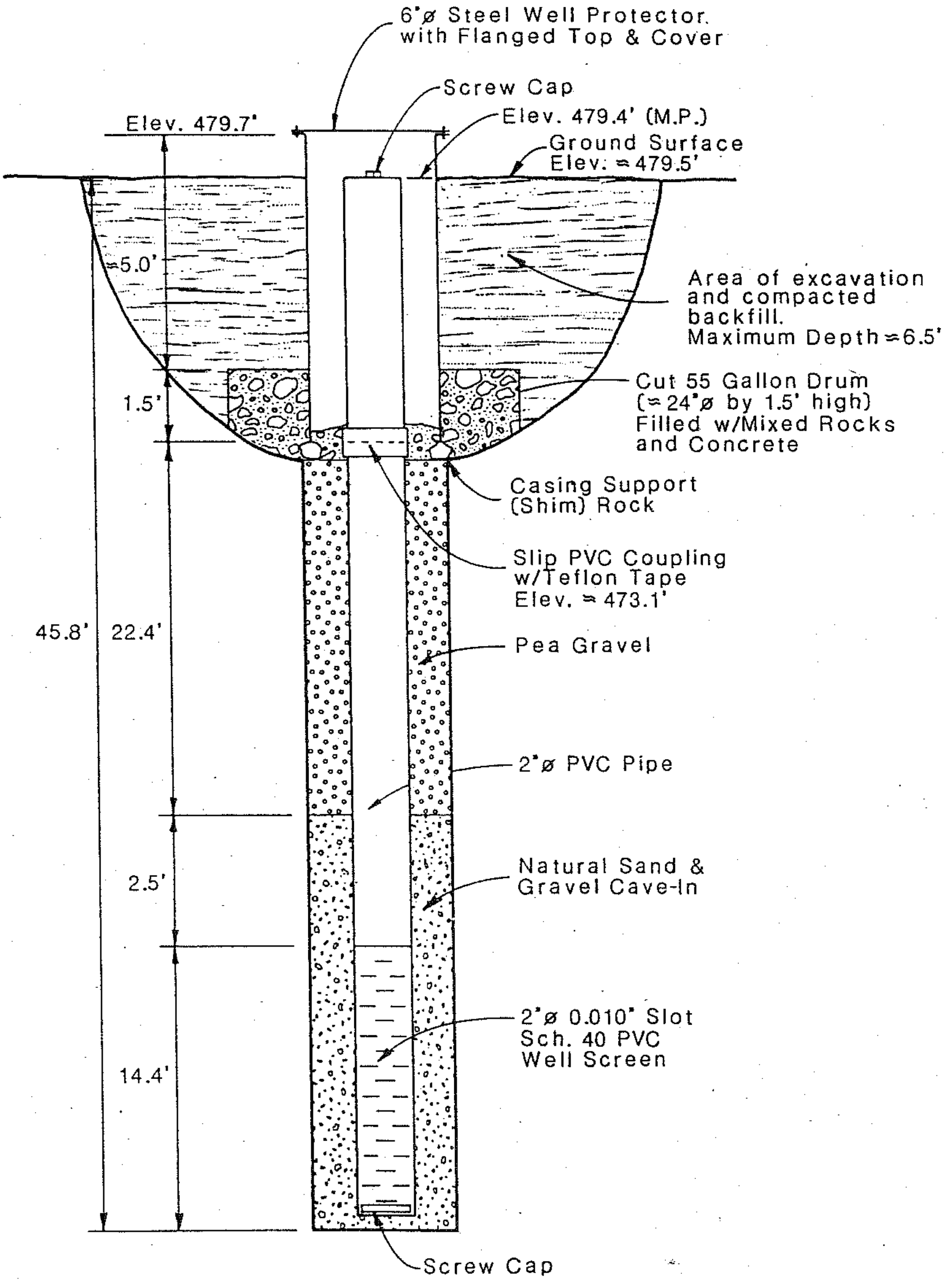
6" Borehole to Termination Depth

Not to Scale

John Mathes & Associates, Inc.

PIEZOMETER E-4

PLATE 12



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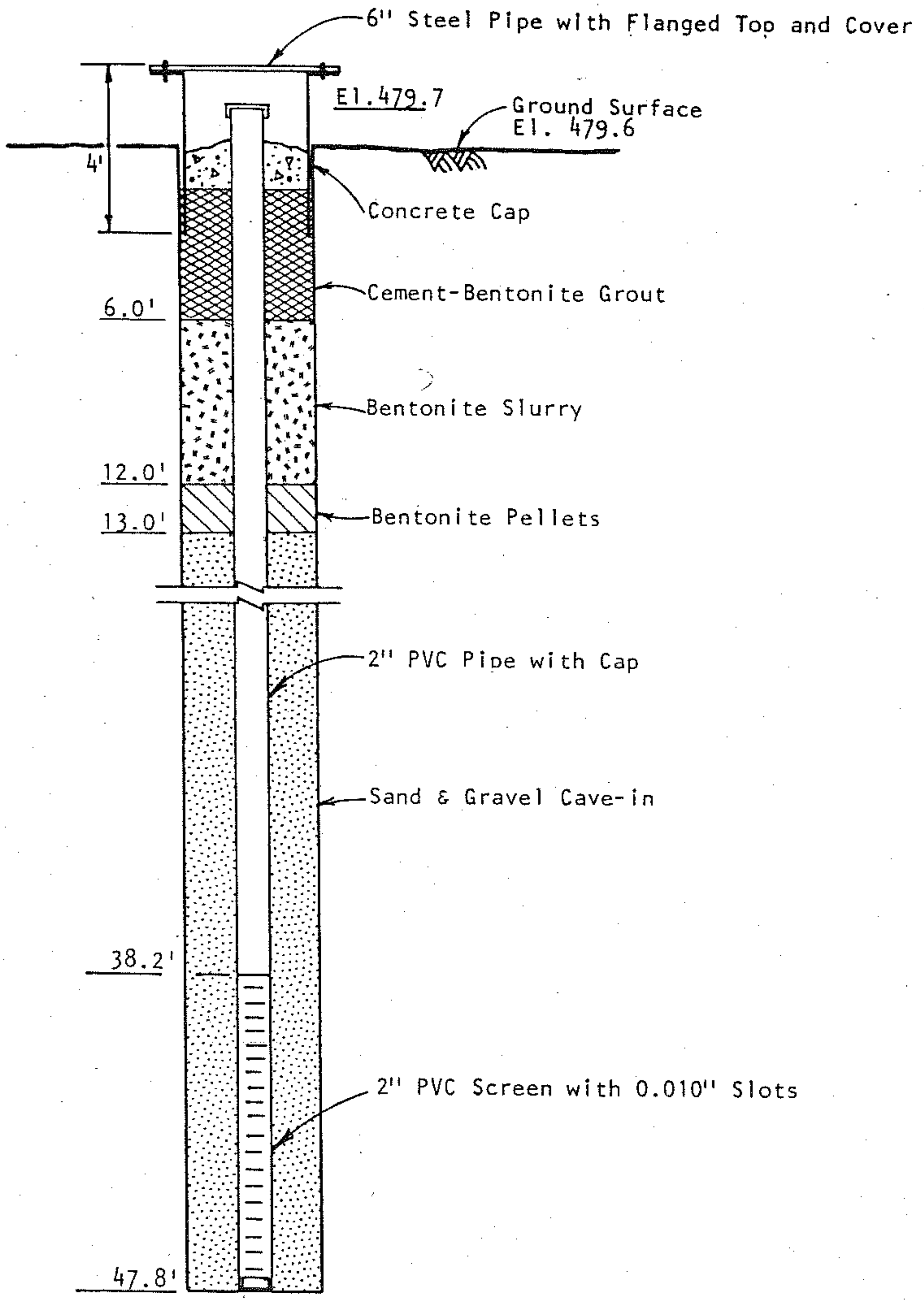
John Mathes & Associates, Inc.



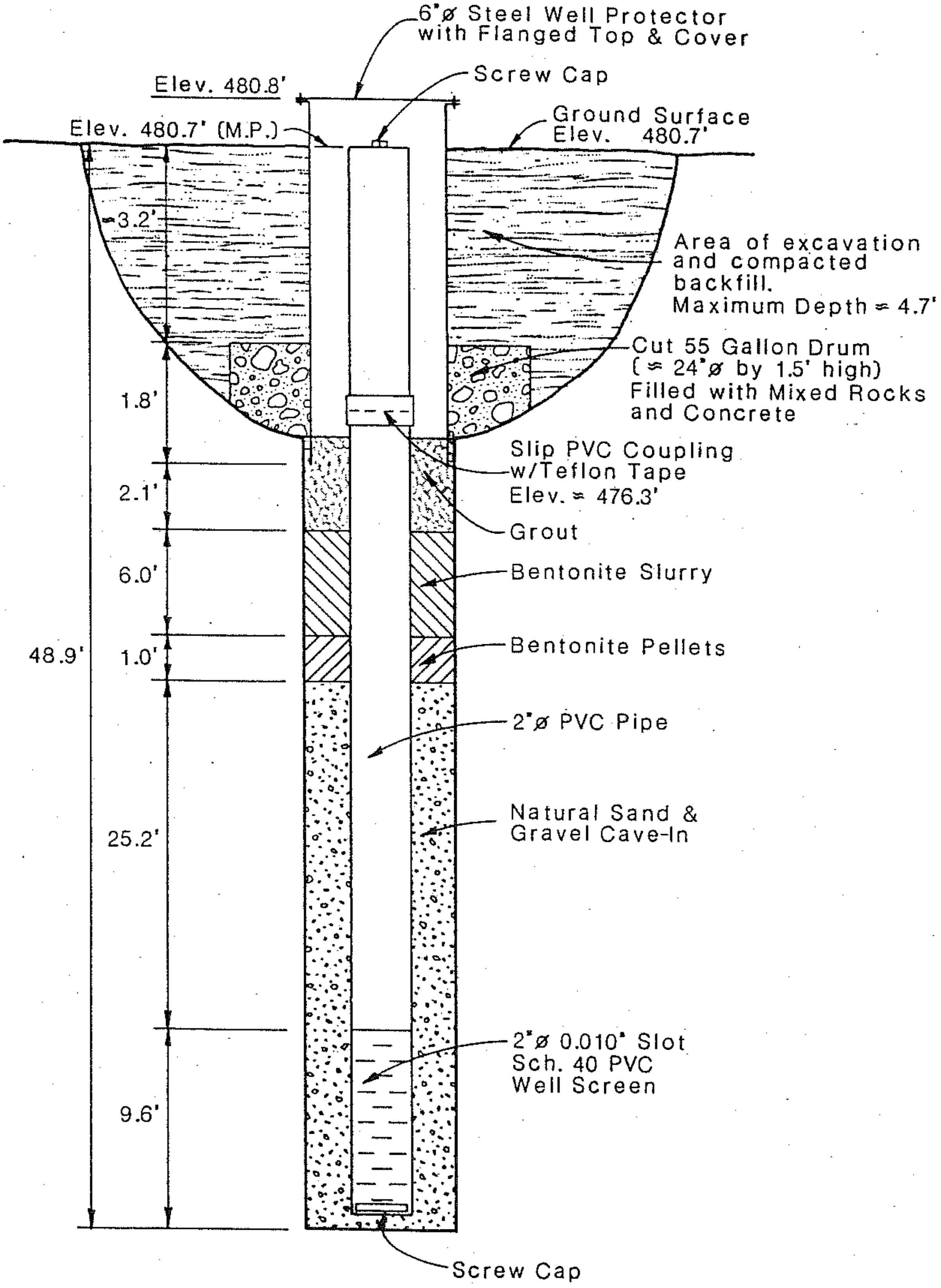
6'' Borehole to Termination Depth
Borehole Enlarged to 12'' in Upper Zones

Not to Scale

PIEZOMETER E-5

John Mathes & Associates, Inc.

PLATE 13



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(Modified)

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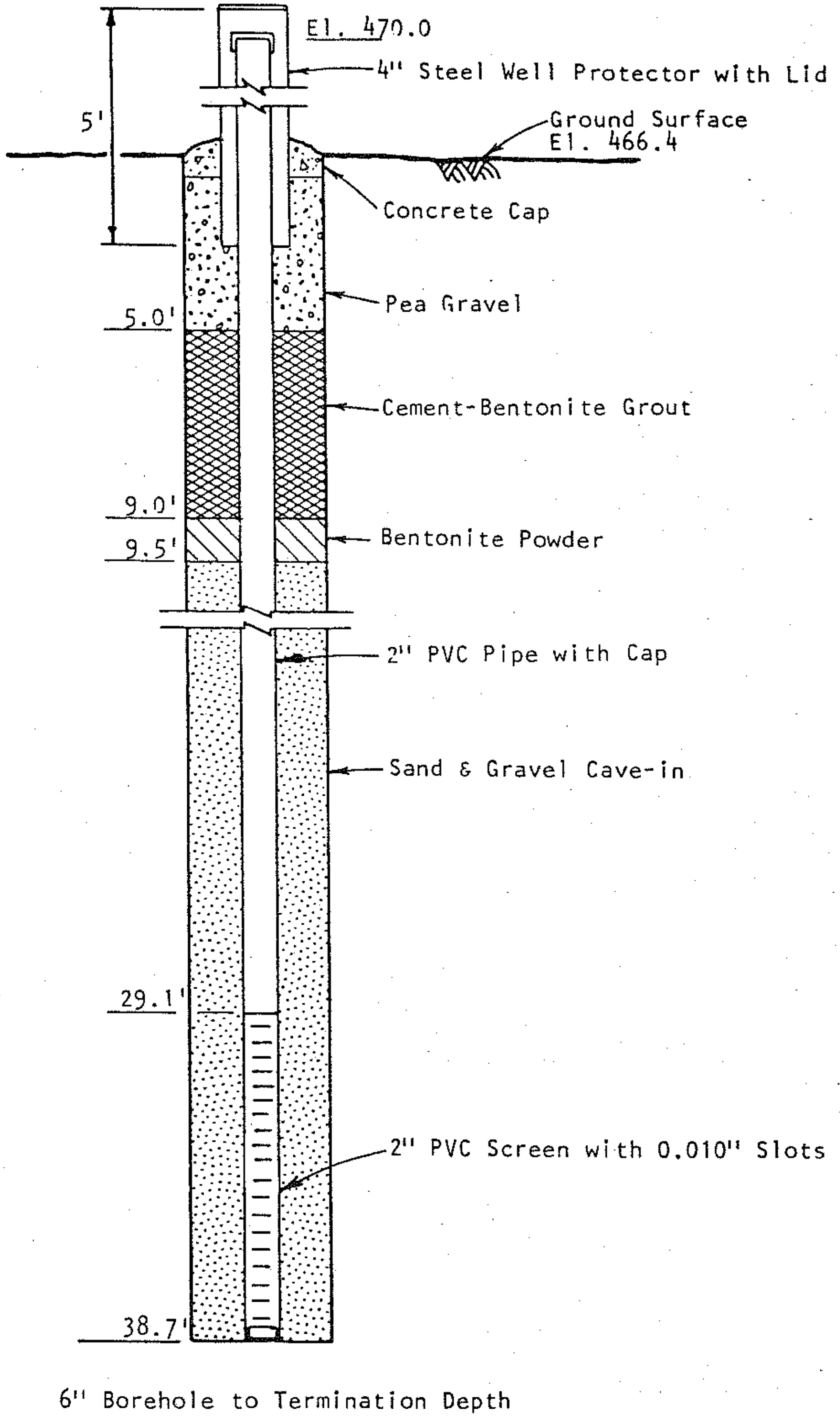

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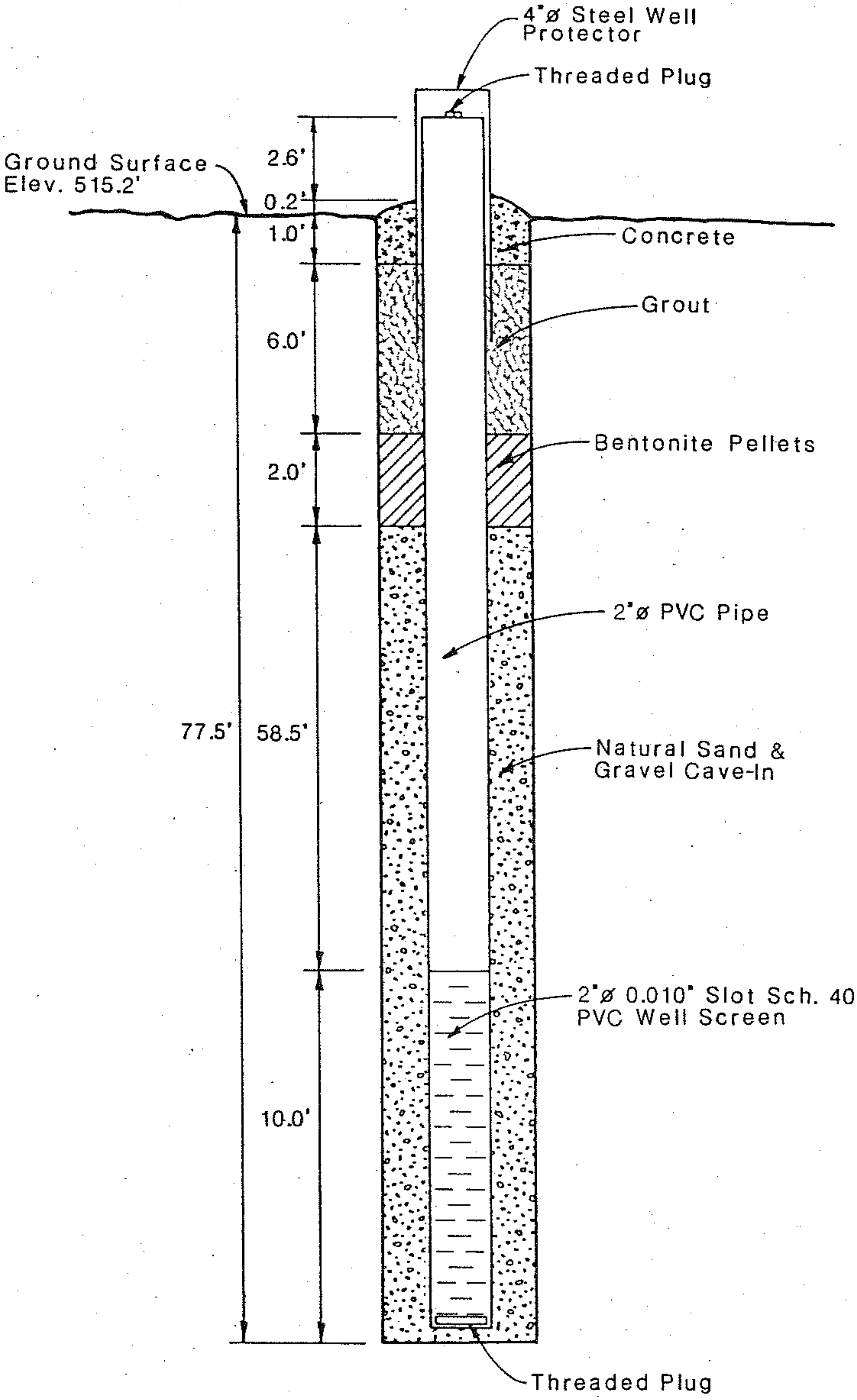
PIEZOMETER E-6

John Mathes & Associates, Inc.

PLATE 14



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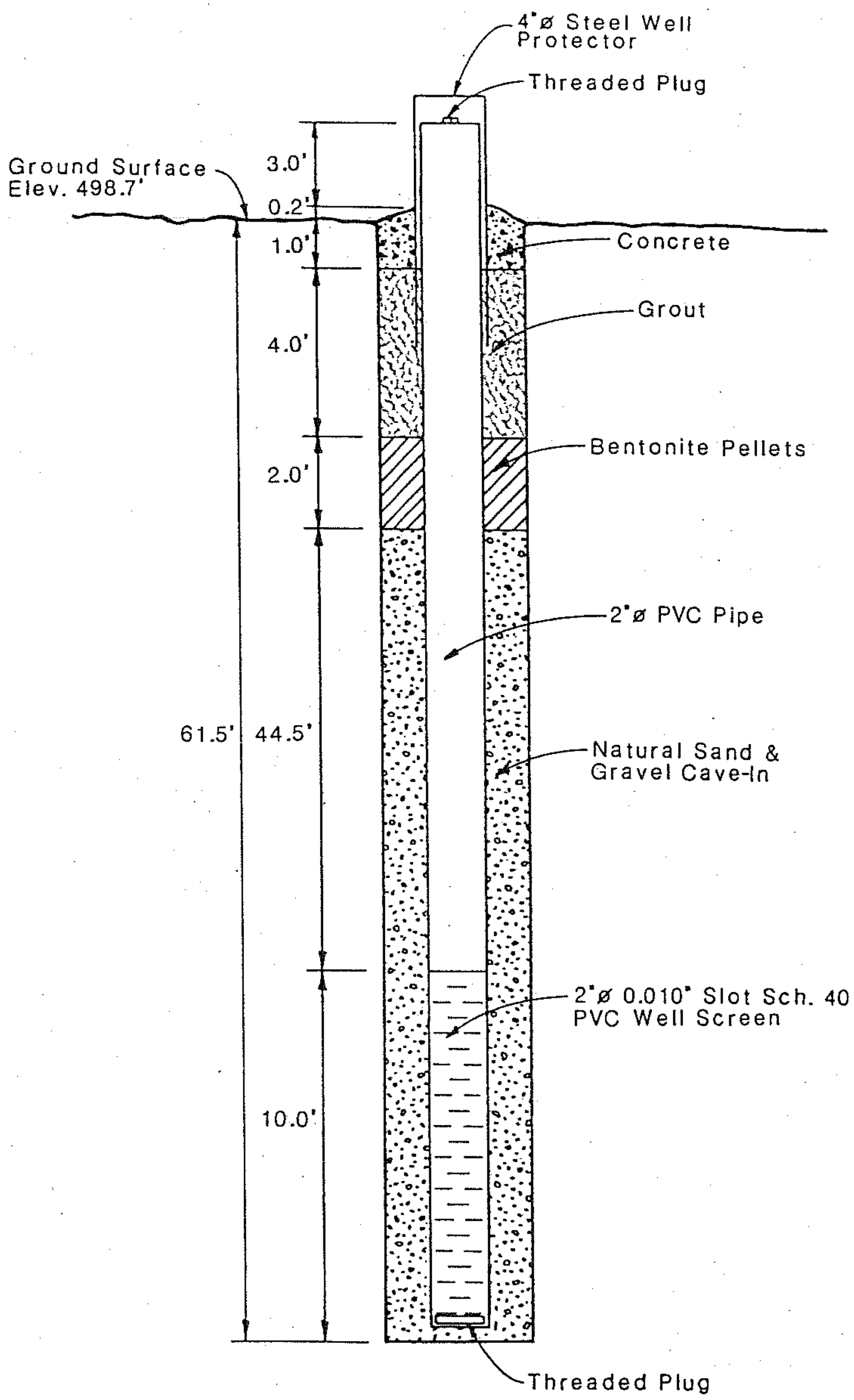
John Mathes & Associates, Inc.



Not To Scale

PIEZOMETER E-8B

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic
Hennepin Power Plant
JOB NO. 82-1293

BORING E-1
SHEET 1 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 486.1'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf: SV△ QP/2□ QU/2○ (0 ½ 1 1½ 2 2½); PL + NMC • LL x (0 50 100); Rock Quality Designation (0 50 100)
					Brown Silty CLAY w/Sand, CL			
					Brown Sandy CLAY w/Silt, Gravel, CL			
5	1	SS	30/20	1	Gray-Brown GRAVEL w/Sand Trace Clay, GP	10-24-34		
10	2	SS	18/12			38-31-14		
15	3	SS	18/5			11-44-36		
20	4	SS	18/13			16-16-17		
					-Sand Seam 22.5-23.5'			
25	5	SS	18/6			9-10-14		
30	6	SS	18/12			10-10-9		
35	7	SS	18/4			9-17-16		

DRILLING METHOD NW Casing Advancer
DATE DRILLED 11/23, 24/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at 39.3 Feet
15 Hours after completion 39.7 Feet
22 Days after completion 31.9 Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT: Hydrogeologic Study, Hennepin Power Plant
JOB NO. 82-1293

BORING: E-1
SHEET 2 OF 2

DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification)

Soil Classification System: Unified

Surface Elevation: 486.1'

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf (SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½); PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
	7	SS			Gray-Brown GRAVEL w/Sand Trace Clay, GP			
40	8	SS	18/9			8-11-8		
45	9	SS	18/8			8-9-8		
50	10	SS	18/3			6-17-20		
55	11	SS	18/3			15-19-21		
60	12	SS	15/7		TOB ≈ 426.0'	13-16-100/3"		
65								

Remarks:

1. Sample was driven 30" Blow counts are for the first 3-6" increments.

DRILLING METHOD: NW Casing Advancer
DATE DRILLED: 11/23, 24/82
DRILLED BY: Roberts
LOGGED BY: Maxeiner
PIEZOMETER: Yes

GROUNDWATER LEVELS

Encountered at 39.3 Feet
15 Hours after completion 39.7 Feet
22 Days after completion 31.9 Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

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John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant
JOB NO. 82-1293

BORING E-2
SHEET 1 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 488.8'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
					Brown Silty CLAY, CL			
					Brown GRAVEL w/ Sand, Clay, GC			
5	1	SS	18/4			5-2-22		
10	2	SS	18/12		Brown Medium-Coarse SAND w/ Gravel, Clay, SC	10-23-19		
15	3	SS	18/8			15-14-11		
20	4	SS	18/10			8-17-12		
25	5	SS	18/5		Gray-Brown GRAVEL w/Sand, GP	49-27-25		
30	6	SS	18/8		Gray-Brown Fine SAND Trace Silt, SP-SM	15-12-9		
35	7	SS	18/14			7-10-13		

DRILLING METHOD NW Casing Advancer
DATE DRILLED 11/24, 29/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at ___ Feet
15 Hours after completion 42.1 Feet
17 Days after completion 34.3 Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant

JOB NO. 82-1293

BORING E-2
SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 488.8'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
	7	SS	18/14		Gray-Brown Fine SAND Trace Silt, SP-SM	7-10-13		
40	8	SS	18/18		-Clay Seam 40.2-41.1'	5-8-10		
					Brown Silty Fine SAND, SM			
					-Black Peat @ 45.3'			
45	9	SS	18/10		Gray-Brown Sandy GRAVEL Trace Clay, GP	8-9-10		
50	10	SS	18/8			34-29-32		
					Brown Medium SAND Trace Coarse, SP			
55	11	SS	18/6		TOB ~ 433.0'	5-18-16		
60								

DRILLING METHOD NW Casing Advancer
DATE DRILLED 11/24, 29/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at — Feet
15 Hours after completion 42.1 Feet
17 Days after completion 34.3 Feet
— after completion — Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

mathes

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant
JOB NO. 82-1293

BORING E-3
SHEET 1 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 481.4'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf (SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½); PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
					Brown GRAVEL w/Sand Trace Clay, FILL, GP			
5	1	SS	18/12			7-27-32		
					Dark Gray FLYASH, FILL, ML.			
10	2	SS	18/15			3-5-5		
					Dark Gray Brown Fine SAND w/Flyash, FILL, SP			
15	3	SS	18/4			3-5-10		
					Dark Gray FLYASH w/Bottom Ash, FILL, ML			
20	4	SS	18/15			4-8-14		•
25	5	SS	18/16			11-23-19		
					Gray-Brown Sandy GRAVEL, GP			
30	6	SS	18/13			16-30-40		
					Gray-Brown GRAVEL w/Sand Trace Clay, GP-GC			
35	7	SS	18/15			27-49-29		

DRILLING METHOD Hollow Auger
DATE DRILLED 12/1/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at 34.6 Feet
0 Hours after completion 38.0 Feet
15 Days after completion 27.8 Feet
____ after completion ____ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Hennepin Power Plant

JOB NO. 82-1293

BORING E-3

SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 481.4'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf: SV△ QP/2□ QU/2○ (0 ½ 1 1½ 2 2½); PL + NMC • LL x (0 50 100); Rock Quality Designation (0 50 100)
	7	SS			Gray-Brown GRAVEL w/Sand Trace Clay, GP-GC			
40	8	SS	18/11			12-11-11		
45	9	SS	18/8			6-8-8		
50	10	SS	18/5			6-7-9		
55	11	SS	18/8		TOB ~426.0'	11-10-11		
60								

DRILLING METHOD Hollow Auger

DATE DRILLED 12/1/82

DRILLED BY Roberts

LOGGED BY Maxeiner

PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at 34.6 Feet

0 Hours after completion 38.0 Feet

15 Days after completion 27.8 Feet

___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant

JOB NO. 82-1293

BORING E-4
SHEET 1 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 477.4'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
	1	AS			Gray-Brown GRAVEL w/Sand Trace Clay, FILL, GP			
5	2	SS	18/18		Dark Gray Silty CLAY Trace Coal, Gravel, FILL, CL	8-12-15		•
10	3	SS	18/15		Gray-Brown Clayey SILT w/Sand Trace Gravel, FILL, ML	4-6-12		•
					Gray GRAVEL w/Silt, Clay Trace FlyAsh, Fill, GC			
15	4	SS	18/15		Gray FLYASH, FILL, ML	19-19-18		•
20	5	SS	18/6		Brown Fine SAND w/Gravel, SP	3-22-31		
25	6	SS	18/13		Gray-Brown Sandy GRAVEL, GP	15-15-15		
30	7	SS	18/18		Gray-Brown GRAVEL w/Sand Trace Clay, GP	14-33-38		
35	8	SS	18/16		Gray-Brown Sandy GRAVEL, GP	8-28-41		

DRILLING METHOD Hollow Auger
DATE DRILLED 12/23/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at 28.9 Feet
0 Hours after completion 27.0 Feet
13 Days after completion 24.5 Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

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John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant
JOB NO. 82-1293

BORING E-4
SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 477.4'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf (SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½); PL NMC LL 0 50 100; Rock Quality Designation 0 50 100
	8	SS			Gray-Brown Sandy GRAVEL, GP			
					Gray-Brown GRAVEL w/Sand, Silt, GM			
40	9	SS	18/7			5-9-13		
					Gray CLAY, CH			
45	10	SS	15/9		TOB ~432.0'	32-50-50/3"		•
50								

DRILLING METHOD Hollow Auger
DATE DRILLED 12/23/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at 28.9 Feet
0 Hours after completion 27.0 Feet
13 Days after completion 24.5 Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant

JOB NO. 82-1293

BORING E-5
SHEET 1 OF 2

Soil Classification System: Unified
Surface Elevation: 479.6'

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification)	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf / PL NMC LL / Rock Quality Designation
					Gray-Brown Gravel w/Sand Trace Clay, FILL, GP			
5	1	SS	18/8			5-14-19		
					Gray FLYASH w/Bottom Ash, Fill, ML			
10	2	SS	18/12			4-5-5		•
				1	Brown Silty Fine SAND w/Gravel, SM			
15	3	SS	18/13		Gray-Brown Gravel w/Sand, GP	4-14-10		•
	3A	AS			Brown Clayey SAND, SC			
					Brown Fine SAND, SP			
20	4	SS	18/3		Gray-Brown Sandy Gravel, GP	8-24-49		
25	5	SS	18/10			6-32-27		
30	6	SS	14/11			8-34-50/2"		
					Gray-Brown Fine-Medium SAND SP			
35	7	SS	18/16		Gray-Brown GRAVEL w/Sand, Silt, GP-GM	12-12-20		

DRILLING METHOD Hollow Auger
DATE DRILLED 12/6/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at 27.3 Feet
0 Hours after completion 29.0 Feet
16 Hrs. after completion 23.3 Feet
10 Days after completion 25.7 Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

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RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant
JOB NO. 82-1293

BORING E-5
SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 479.6'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
	7	SS			Gray-Brown GRAVEL w/Sand, Silt GP-GM			
40	8	SS	18/15		Gray-Brown Silty GRAVEL w/SAND, GM	15-45-16		
45	9	SS	18/11		Brown GRAVEL w/Sand Trace Silt GP-GM	3-9-12		
50	10	SS	18/6		~ 429.0' TOB	2-10-11		
55					Remarks: 1. Rough Drilling @ 11.5' Boulders could not penetrate offset 7.0' East & Augered to 14.0' without sampling.			

DRILLING METHOD Hollow Auger
DATE DRILLED 12/6/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at 27.3 Feet
0 Hours after completion 29.0 Feet
16 Hrs. after completion 23.3 Feet
10 Days after completion 25.7 Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

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RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant

JOB NO. 82-1293

BORING E-6

SHEET 1 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL, Classification) Soil Classification System Unified; Surface Elevation 466.4'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
	1	AS			Dark Brown Silty CLAY w/Sand, CL			
5	2	SS	18/8		Brown Sandy CLAY w/Gravel, CL	3-3-2		
					Gray-Brown Sandy GRAVEL, GP			
10	3	SS	18/9			12-12-13		
15	4	SS	18/10		Gray-Brown GRAVEL w/Sand Trace Clay, GP	9-30-35		
20	5	SS	4/4			50/4"		
25	6	SS	18/6			6-10-14		
30	7	SS	18/4			3-5-7		
35	8	SS	18/7			5-7-12		

DRILLING METHOD Hollow Auger
DATE DRILLED 12/8/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at 18.0 Feet
___ Hours after completion ___ Feet
8 Days after completion 12.4 Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant

JOB NO. 82-1293

BORING E-6
SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 466.4'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
	8	SS			Gray-Brown GRAVEL w/Sand Trace Clay, GP			
40	9	SS	18/6		TOB ~ 426.0'	5-6-6		

DRILLING METHOD Hollow Auger
DATE DRILLED 12/8/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at 18.0 Feet
__ Hours after completion __ Feet
8 Days after completion 12.4 Feet
__ after completion __ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT I.P. Hennepin, Hydrogeologic Investigation

JOB NO. 04-1934

BORING E-7

SHEET 1 OF 3

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL, Classification) Soil Classification System: Unified; Surface Elevation: 515.2'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf (SV△ QP/2□ QU/2○; 0 ½ 1 1½ 2 2½) / PL + NMC • LL x (0 50 100) / Rock Quality Designation (0 50 100)
					Brown Fine SAND w/Silt, SM			
5	1	SS	18/18			4-6-6		
					Brown Fine SAND w/Coarse Trace Gravel, Silt, SP			
10	2	SS	18/14			7-7-8		
					Brown Gravelly Medium-Coarse SAND w/Fine, Silt, SM			
15	3	SS	18/16			18-35-33		
20	4	SS	18/12			18-34-31		
25	5	SS	18/6			36-48-51		
					Brown Gravelly Fine SAND w/Medium Trace Silt, SP-SM			
30	6	SS	18/-			17-31-44		
					Brown Gravelly Medium-Coarse SAND w/Silt, SM			
35	7	SS	18/-			19-29-37		

DRILLING METHOD Casing Advancer & NW

DATE DRILLED 11/13-15/84

DRILLED BY Maniaci

LOGGED BY Hebel/Maxeiner

PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet

___ Hours after completion ___ Feet

___ after completion ___ Feet

___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

mathes

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RECORD OF SUBSURFACE EXPLORATION

PROJECT I.P. Hennepin, Hydrogeologic Investigation

JOB NO. 04-1934

BORING E-7

SHEET 2 OF 3

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 515.2'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf (SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½); PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
					Brown Gravelly Medium-Coarse SAND w/Silt, SM			
40	8	SS	18/12			10-23-27		
45	9	SS	18/14			12-20-25		
50	10	SS	18/11			14-31-36		
55	11	SS	18/14		- Boulders 55.0-57.0'	16-46-52		
					Gray Fine-Medium SAND Trace Coarse, SP			
60	12	SS	18/3			12-22-30		
65	13	SS	18/12			18-27-43		
70	14	SS	18/12			20-22-34		

DRILLING METHOD Casing Advancer & NW

DATE DRILLED 11/13-15/84

DRILLED BY Maniaci

LOGGED BY Hebel/Maxeiner

PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet

___ Hours after completion ___ Feet

___ after completion ___ Feet

___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT I. P. Hennepin, Hydrogeologic Investigation

JOB NO. 04-1934

BORING E-7

SHEET 3 OF 3

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 515.2'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf (SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½); PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
					Gr Fi-Med SAND Tr Co, SP			
					Gray Medium SAND w/Fine Trace Gravel, SP			
	15	SS	18/10			15-15-22		
75								
					TOB			
80								
85								
90								
95								
100								
105								

DRILLING METHOD Casing Advancer & NW

DATE DRILLED 11/13-15/84

DRILLED BY Maniaci

LOGGED BY Hebel/Maxeiner

PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet

Hours after completion Feet

after completion Feet

after completion Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

mathes

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT I. P. Hennepin, Hydrogeologic Investigation
BORING E-8B
SHEET 1 OF 2
JOB NO. 04-1934

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 498.7'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf (SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½); PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
					Dark Brown Silty CLAY w/Sand Trace Gravel, CL			
5	1	SS	18/14			6-11-13		
					Brown Sandy GRAVEL Trace Clay, Silt, GC-GP			
	2	SS	18/12			11-9-7		
10								
	3	SS	18/12			5-7-8		
15								
	4	SS	18/12			5-5-10		
20								
					Gray Medium-Coarse SAND w/Fine, SP			
	5	SS	18/14			5-6-9		
25								
	6	SS	18/0			11-15-18		
30								
					Brown Fine SAND w/Silt Trace Clay, SM			
	7	SS	18/12			3-10-10		
35								

DRILLING METHOD Casing Advancer & NW
DATE DRILLED 11/16-17/84
DRILLED BY Maniaci
LOGGED BY Hebel/Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT I. P. Hennepin, Hydrogeologic Investigation

JOB NO. 04-1934

BORING E-8B

SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 498.7'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ (0 ½ 1 1½ 2 2½); PL + NMC • LL x (0 50 100); Rock Quality Designation (0 50 100)
					Brown Fine SAND w/Silt Trace Clay, SM			
	8	SS	18/14			3-7-9		
40								
	9	SS	18/16		-w/Gravel @ 43.0'	4-7-10		
45								
	10	SS	18/14			12-10-12		
50								
	11	SS	18/10		-Trace Gravel @ 53.0'	5-8-11		
55								
					Brown Sandy GRAVEL w/Silt, Clay, GC-GM			
	12	SS	18/10			25-30-33		
60								
					TOB			
65								
70								

DRILLING METHOD Casing Advancer & NW

DATE DRILLED 11/16-17/84

DRILLED BY Maniaci

LOGGED BY Hebel/Maxeiner

PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet

___ Hours after completion ___ Feet

___ after completion ___ Feet

___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

mathes

John Mathes & Associates, Inc.

Appendix A2

STMI Boring Logs and Well Details

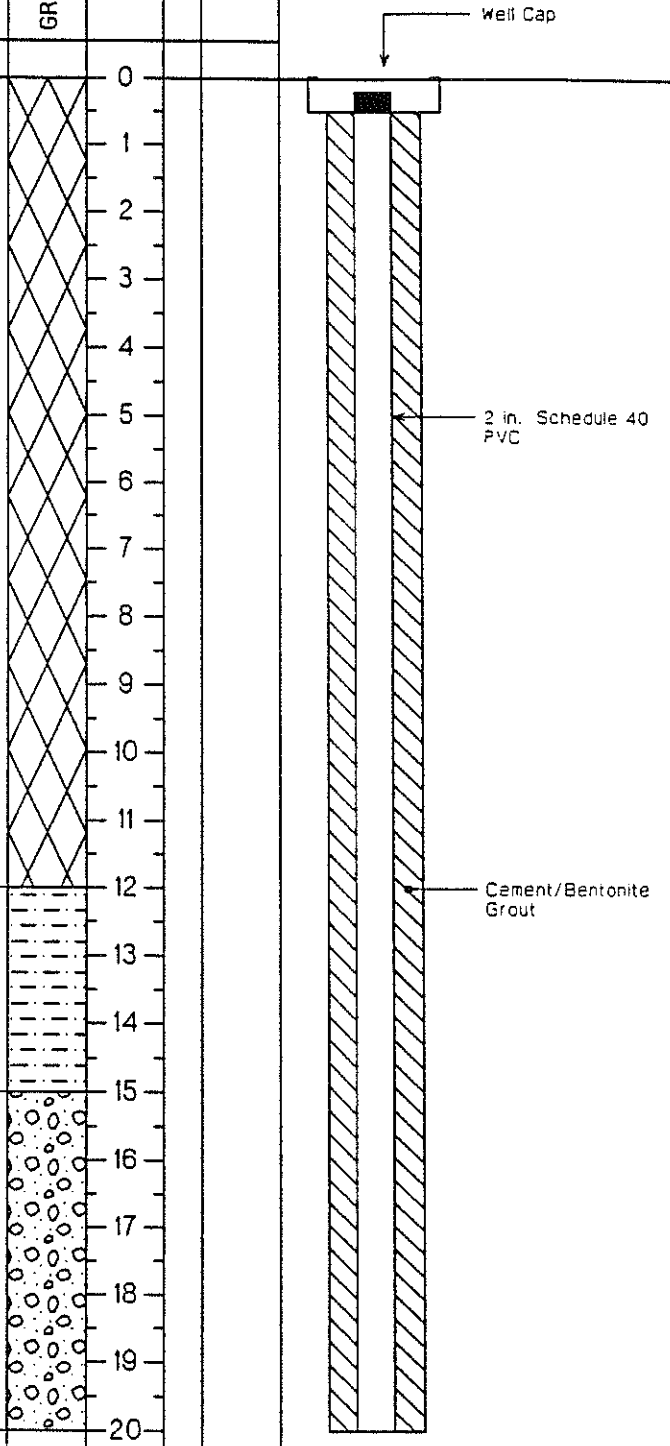
Monitoring Well No. 10

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: Not Measured ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 495.10 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Blind Drilling (Refer to boring log for MW 11 for lithologic descriptions)			0–20			



STMI

2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:

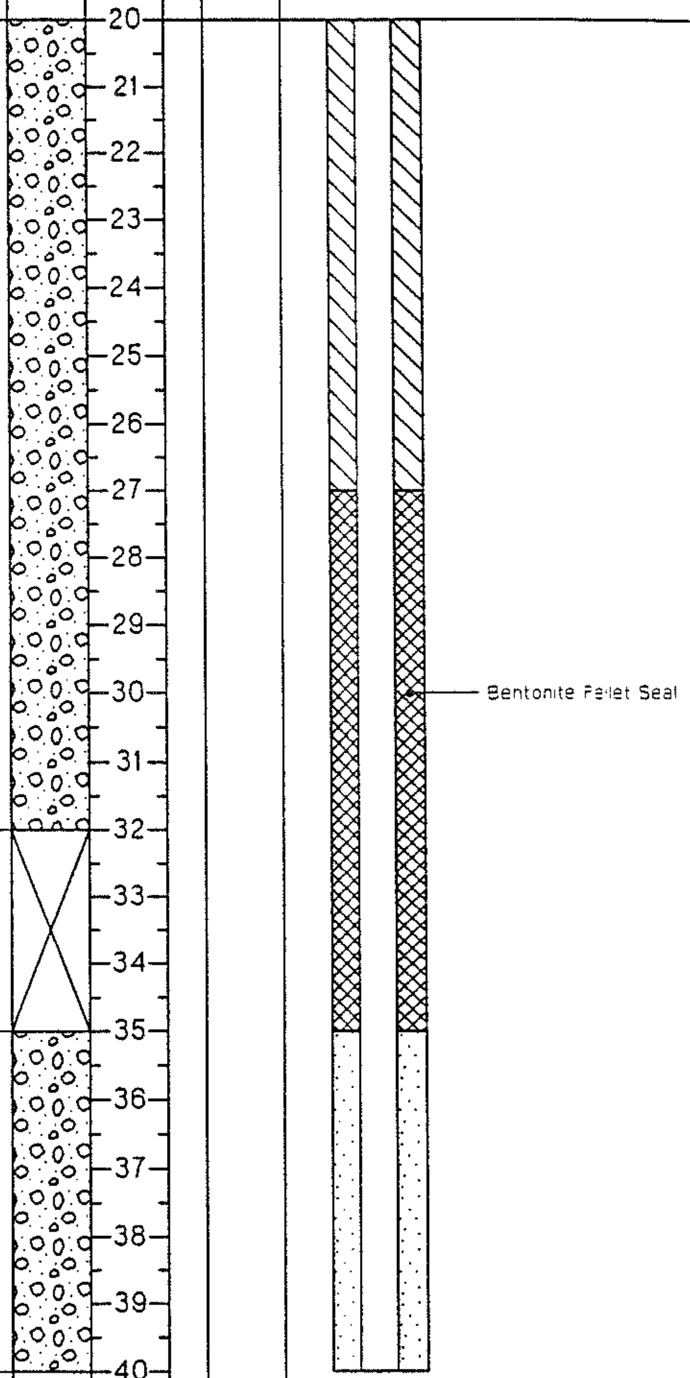
Sample 10-1 was collected between 45-55 feet

Project No.
135-1.21

Monitoring Well No. 10

PROJECT: Hennepin East Ash Impoundment	**DATE:** 03-28-95	**LOGGED BY:** Hensel/Tu
DRILL RIG: Rotosonic Drill	**HOLE DIA.:** 6 in.	**SAMPLER:** Core Barrel
DRILLER: Boart Longyear	**GW DEPTH:** Not Measured ft.	**HOLE ELEV.:** 495.10 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Blind Drilling (Refer to boring log for MW 11 for lithologic descriptions)			20–40			



STMI

2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Sample 10-1 was collected between 45-55 feet

Project No.
135-1.21

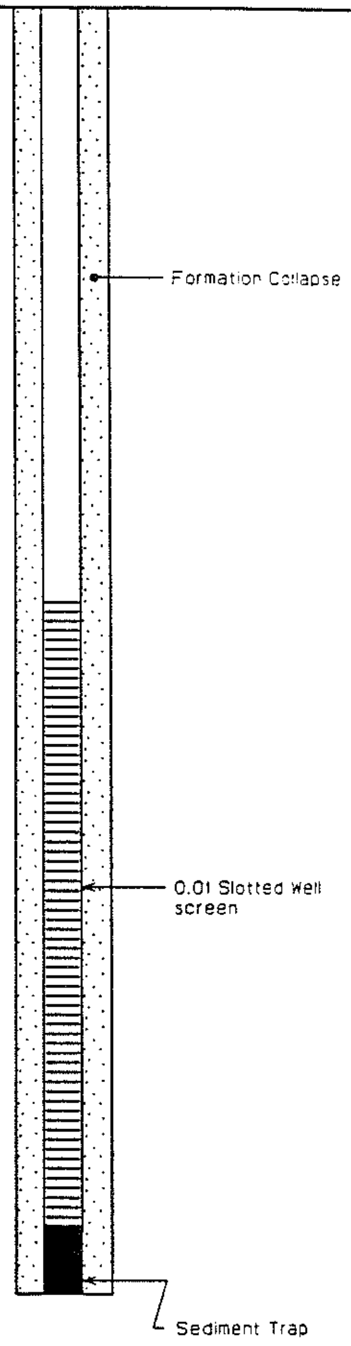
Monitoring Well No. 10

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: Not Measured ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 495.10 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE	WELL CONSTRUCTION DETAIL
			40–45		
Clean, fine to coarse gravels w/ cobbles up to 4" in diameter, well rounded to subangular			45–55	10-1	
Blind Drilling (Refer to boring log for MW 11 for lithologic descriptions)			55–59		
			59–60		



STMI

2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Sample 10-1 was collected between 45-55 feet

Project No.
135-1.21

Monitoring Well No. 11

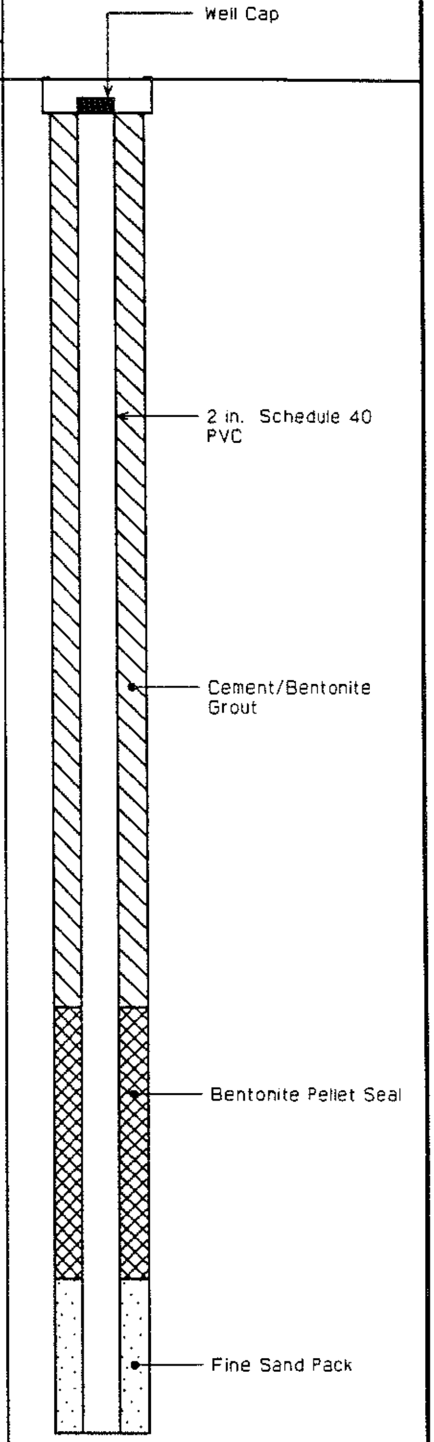
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-27-95
HOLE DIA.: 6 in.
GW DEPTH: 50 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 494.84 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Fill, consisting of poorly sorted sand, gravels (gravels up to 3") and crushed limestone			0–12	
Olive, silty clay w/ gravels up to 2", and some fine sand			12–15	11-1
Dry, brown, med sand to coarse gravel, cobbles up to 4"			15–20	

WELL CONSTRUCTION DETAIL



STMI
2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

Monitoring Well No. 11

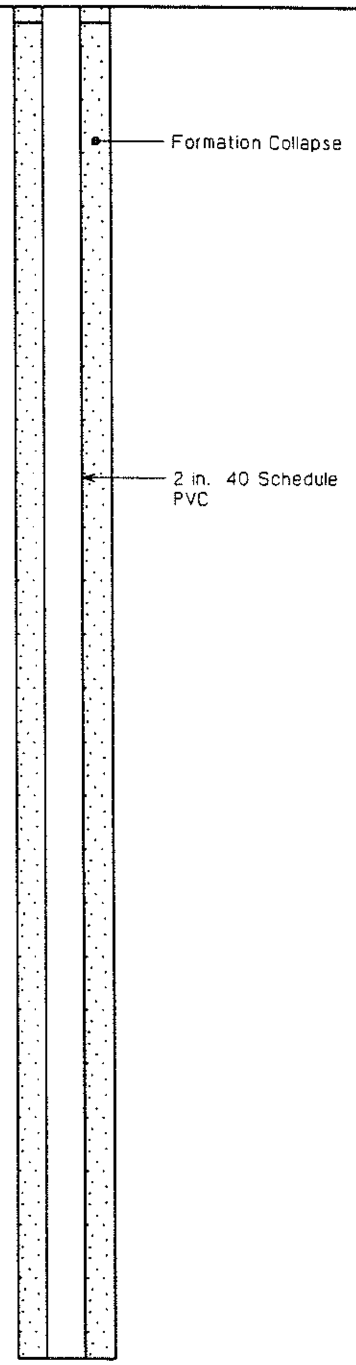
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-27-95
HOLE DIA.: 6 in.
GW DEPTH: 50 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 494.84 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Dry, brown, med. sand to coarse gravel, gravels up to 2" in diameter, subrounded to subangular			20–32	11-2
No sample			32–35	
Brown, dry coarse sand and gravel, some silt, some clay, cobbles up to 4", subangular to rounded			35–40	11-3

WELL CONSTRUCTION DETAIL



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Project No.
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Monitoring Well No. 11

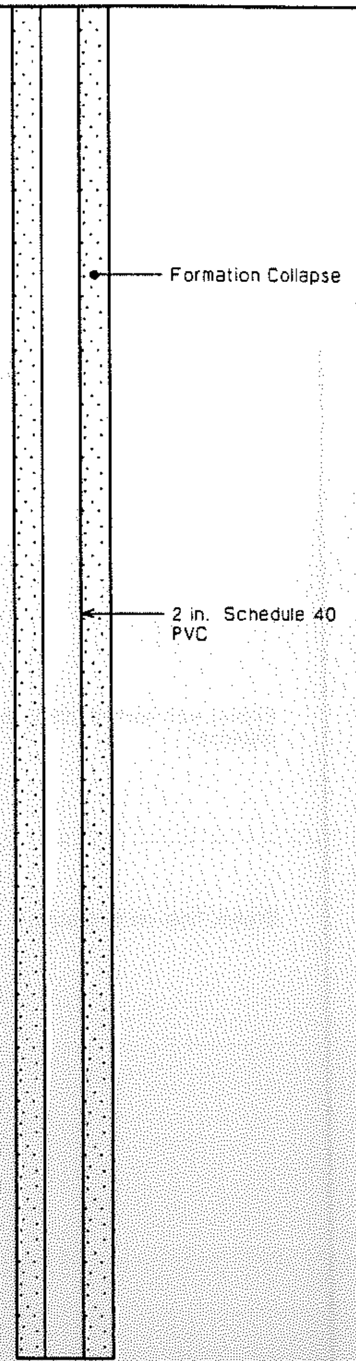
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-27-95
HOLE DIA.: 6 in.
GW DEPTH: 50 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 494.84 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Grading from fine to coarse sand w/ some gravels and fines			40–46	
2' Dark brown, sandy clay w/ gravels			46–48	11-4
Coarse sand and gravel, some silt, gravels to 2", subrounded to subangular, fines may have been washed out during drilling			48–	
Coarse sand and gravel, some silt; well rounded, gravels up to 2"				
Clean fine to coarse gravel, gravels up to 3"			–60	

WELL CONSTRUCTION DETAIL



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Notes:
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Project No.
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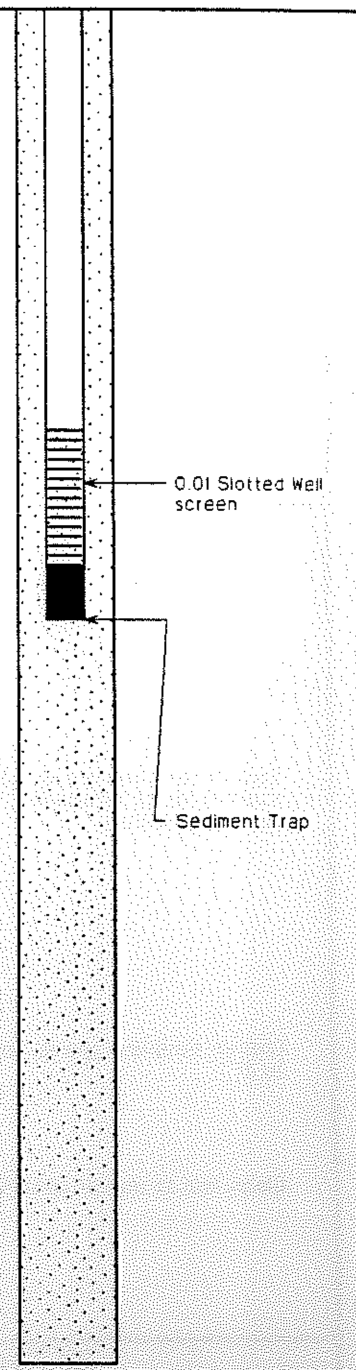
Monitoring Well No. 11

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-27-95
HOLE DIA.: 6 in.
GW DEPTH: 50 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 494.84 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
			60			
			61			
			62			
			63	11-5		
			64			
			65			
			66			
			67	11-6		
			68			
			69			
Brown, well sorted, clean med. sand w/ small gravels 1" in diameter			70			
			71			
			72			
Brown, fine uniform sand			73			
			74			
			75	11-7		
			76			
			77			
			78			
			79			
			80			



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Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

Monitoring Well No. 12

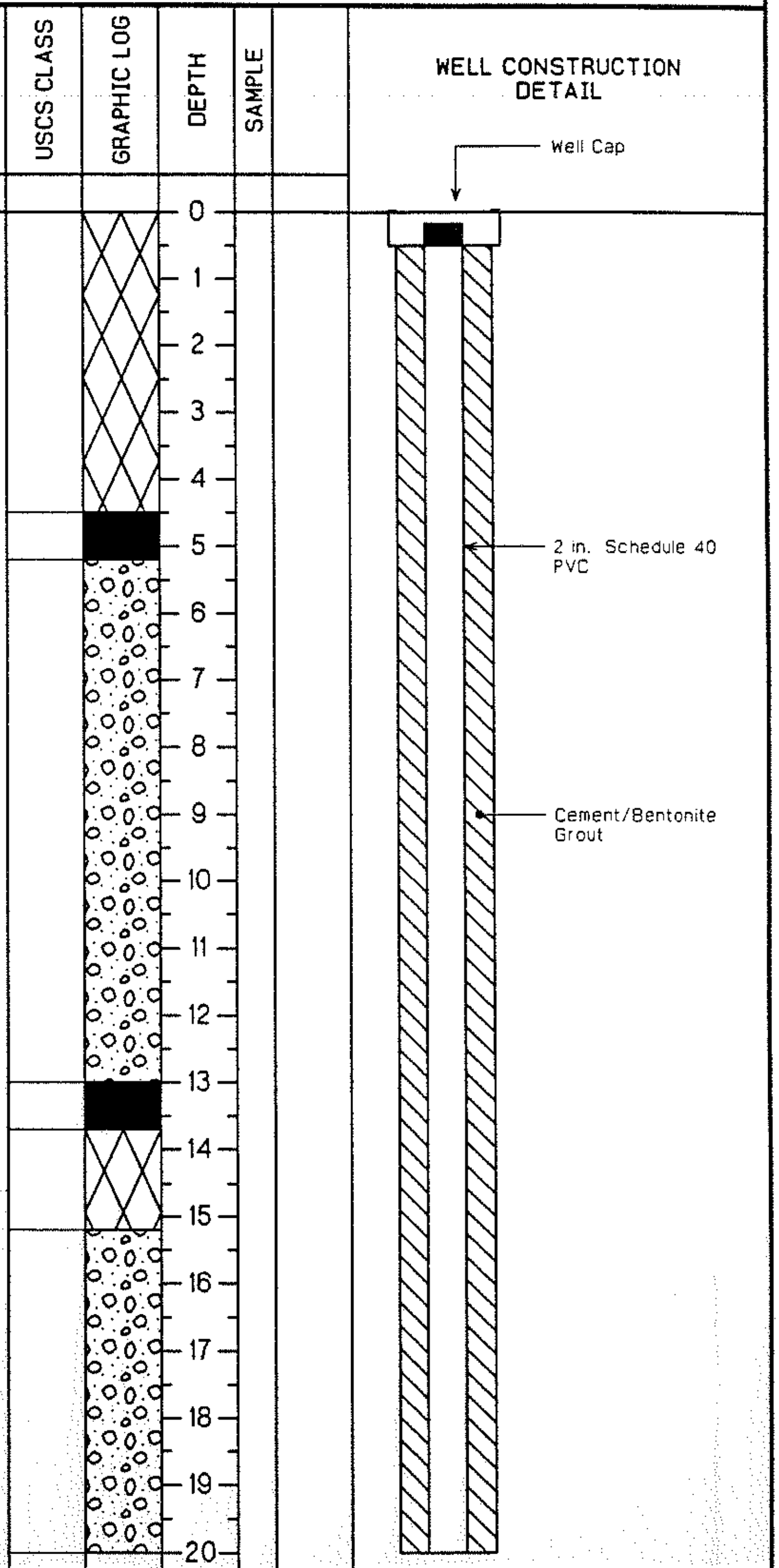
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: 48.5 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.84 ft. MSL

DESCRIPTION

Blind Drilling (Refer to boring log for MW 13 for lithologic descriptions)



STMI

2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
No samples were collected from MW 12

Project No.
135-1.21

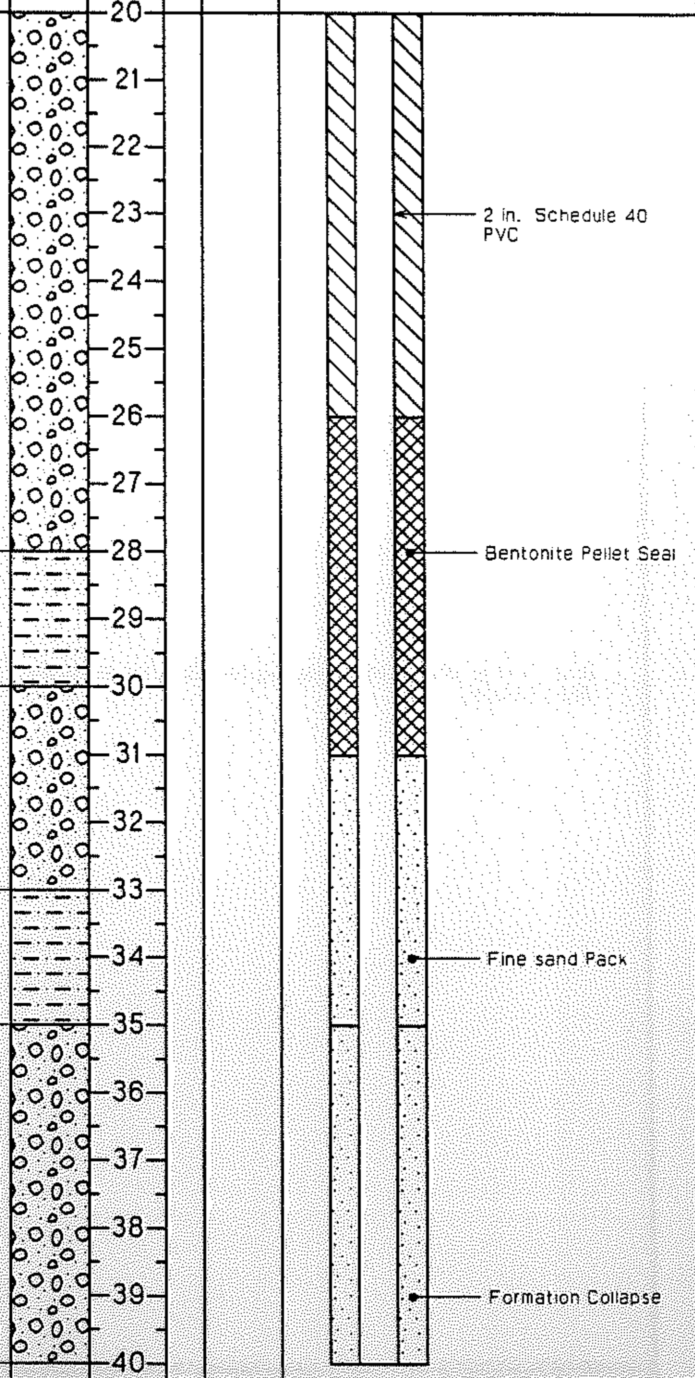
Monitoring Well No. 12

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: 48.5 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.84 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Blind Drilling (Refer to boring log for MW 13 for lithologic descriptions)			20–40			



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Notes:
No samples were collected from MW 12

Project No.
135-1.21

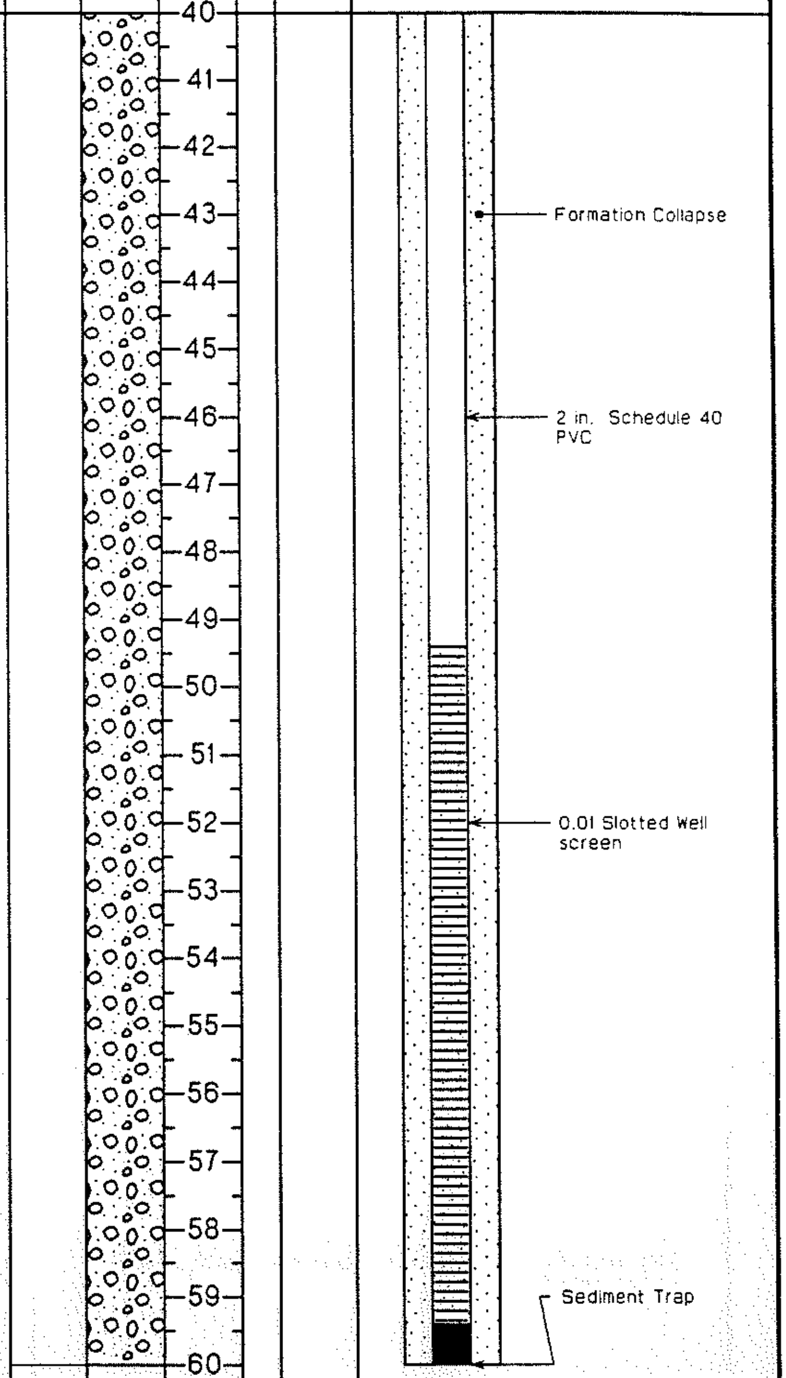
Monitoring Well No. 12

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: 48.5 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.84 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Blind Drilling (Refer to boring log for MW 13 for lithologic descriptions)			40–60			



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Brookfield, Wisconsin 53005-8208

Notes:
No samples were collected from MW 12

Project No.
135-1.21

Monitoring Well No. 13

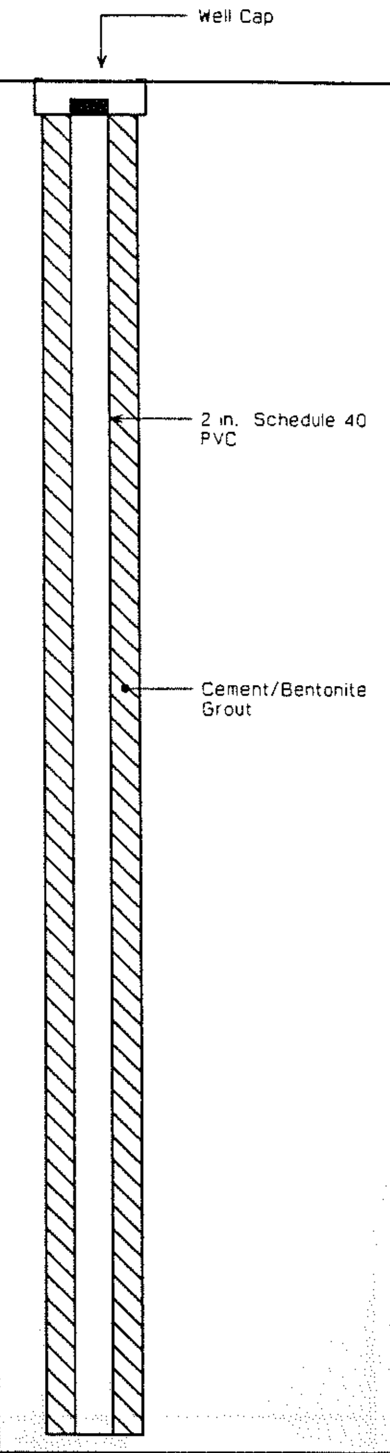
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: 49.5 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.82 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Fill, consisting of olive, silty clay loam, with gravels up 3 in in diameter			0, 1, 2, 3, 4	
Fly ash			5	
Brown gravel w/ sand and silt, gravels up to 3", poorly sorted, subrounded to subangular			6, 7, 8, 9, 10, 11, 12	
Fly ash			13	
Fill, consisting of fine silty sand, wood chips, gravels up to 1".			14, 15	
Tan sand and gravel, some silt, gravels up to 3", poorly sorted, rounded			16, 17, 18, 19, 20	

WELL CONSTRUCTION DETAIL



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Notes:
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Project No.
135-1.21

Monitoring Well No. 13

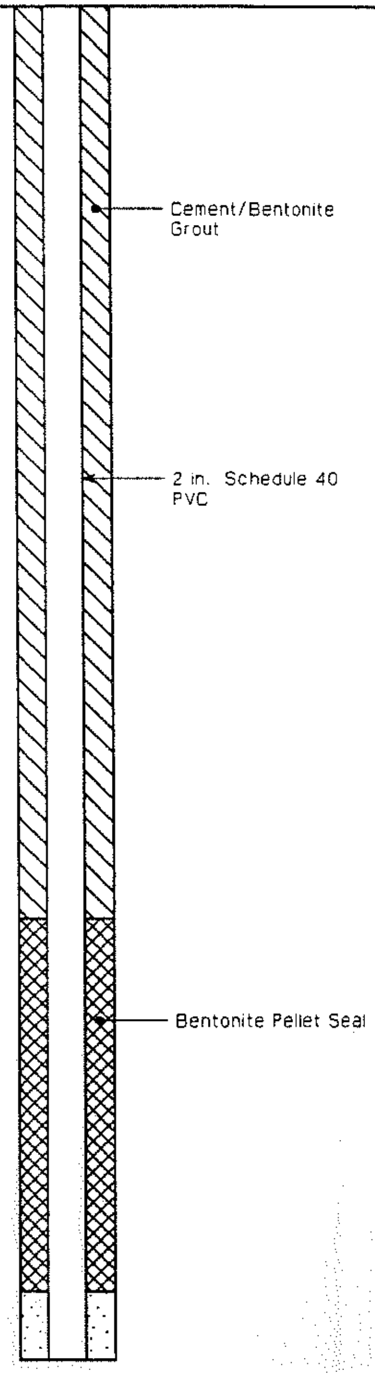
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: 49.5 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.82 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
			20	
			21	
			22	13-1
			23	
			24	
			25	
			26	
			27	
			28	
Brown, fine silty, sandy clay w/ gravels (well-rounded)			29	
			30	
Gray, fine to coarse sand and gravel, well-rounded			31	
			32	13-2
Red, silty, sandy clay w/ gravels up to 2" in diameter			33	
			34	
White, fine sand w/ gravels up to 3"			35	
			36	
			37	
Brown, coarse sand and gravel with silt, cobbles up to 4"			38	
			39	
			40	

WELL CONSTRUCTION DETAIL



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Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

Monitoring Well No. 13

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: 49.5 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.82 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
			40			
			41			
			42			
			43	13-3		
			44			Formation Collapse
			45			
			46			
			47			
Brown gravel w/ some sand and silt. cobbles up to 4"			48			
			49			2 in. Schedule 40 PVC
			50			
			51			
			52			
			53	13-4		
			54			
			55			
			56			
			57			
			58			
			59			
			60			

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Notes:
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Project No.
135-1.21

Monitoring Well No. 13

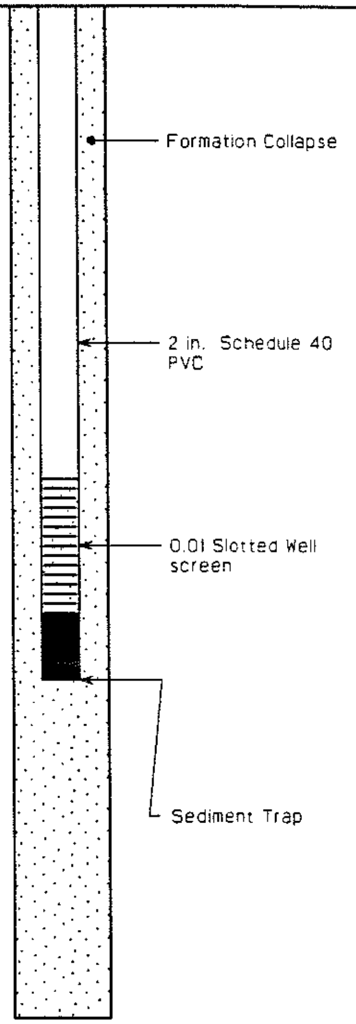
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-28-95
HOLE DIA.: 6 in.
GW DEPTH: 49.5 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.82 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
			60	
			61	
			62	
Gravel becomes finer			63	13-5
			64	
			65	
Brown, fine gravel w/ little silt and sand, well rounded, well sorted			66	13-6
			67	
			68	13-7
			69	
			70	
			71	
Fine, uniform silty sand w/ cobbles up to 3"			72	
Brown, uniform fine to med. sand with some gravel			73	
			74	
			75	
			76	
			77	
			78	
			79	
			80	

WELL CONSTRUCTION DETAIL



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Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

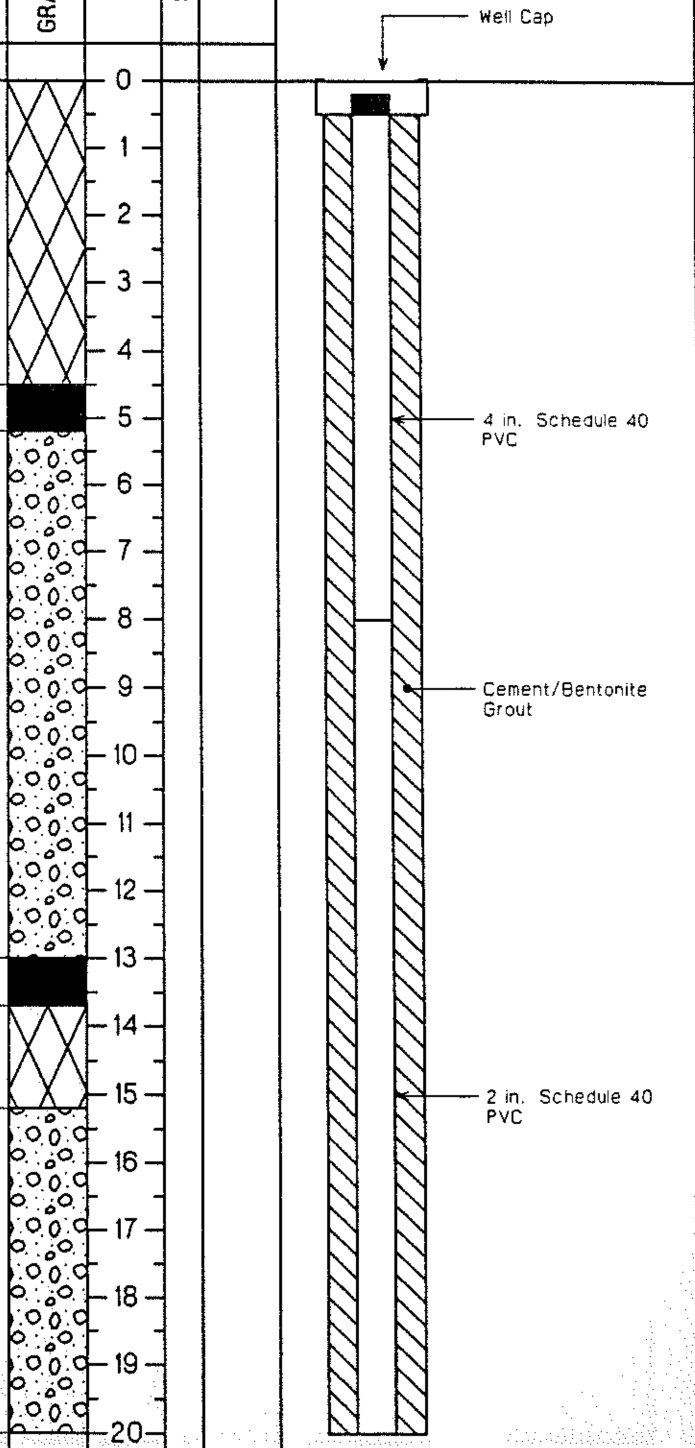
Monitoring Well No. 14

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-29-95
HOLE DIA.: 6 in.
GW DEPTH: Not Measured ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.83 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Blind Drilling (Refer to boring log for MW 13 for lithologic descriptions)			0–20			



STMI
2511 N. 124th St. Suite 205
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Notes:
No samples were collected from MW 14

Project No.
135-1.21

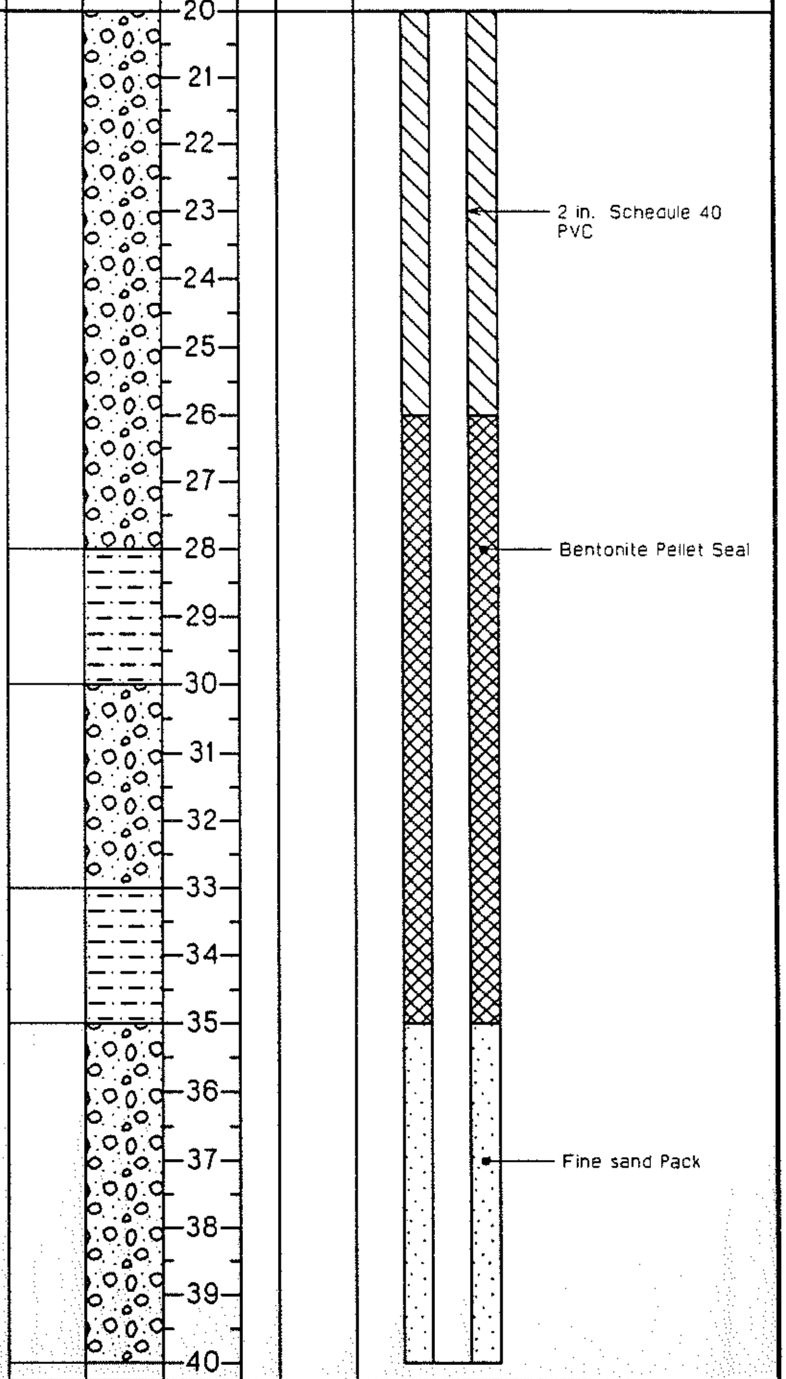
Monitoring Well No. 14

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-29-95
HOLE DIA.: 6 in.
GW DEPTH: Not Measured ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.83 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Blind Drilling (Refer to boring log for MW 13 for lithologic descriptions)			20–40			



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2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
No samples were collected from MW 14

Project No. 135-1.21

Monitoring Well No. 14

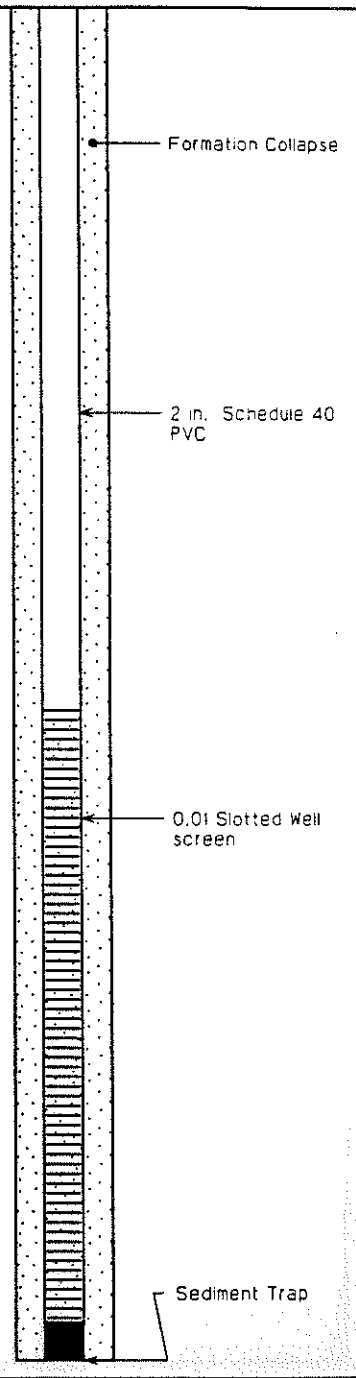
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-29-95
HOLE DIA.: 6 in.
GW DEPTH: Not Measured ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core Barrel
HOLE ELEV.: 494.83 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Blind Drilling (Refer to boring log for MW 13 for lithologic descriptions)			40–60			

Depth: 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60



STMI

2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
No samples were collected from MW 14

Project No.
135-1.21

Monitoring Well No. 15

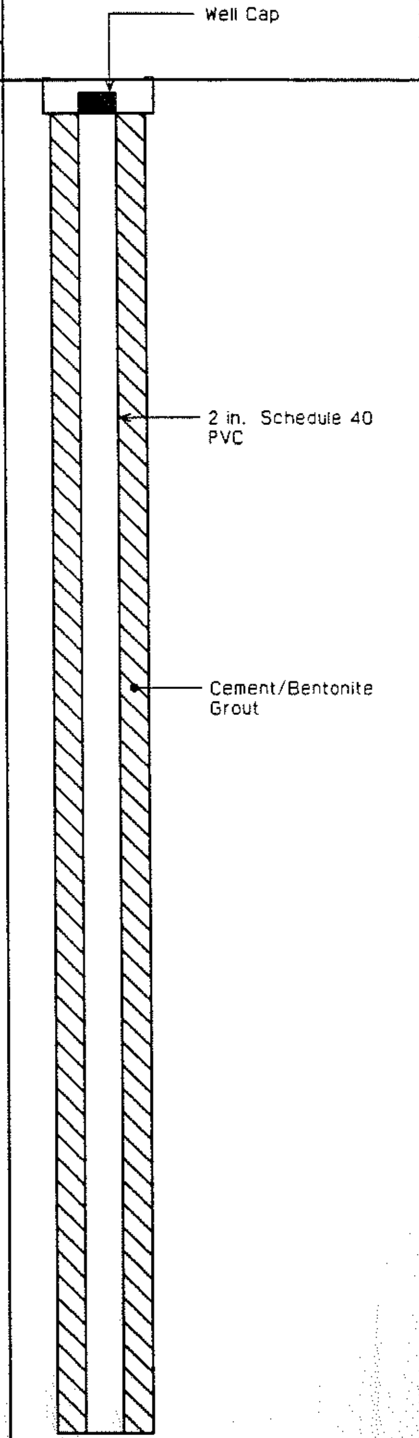
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-29-95
HOLE DIA.: 6 in.
GW DEPTH: Not Measured ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 494.41 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Fill, consisting of poorly sorted sand, gravels			0 1 2 3	
Fly ash			4	
Fill, consisting of poorly sorted sand, gravels up to 3"			5 6 7	
Bottom ash			8 9 10 11 12 13 14	15-1
Fly ash			15 16 17 18 19 20	15-2

WELL CONSTRUCTION DETAIL



STMI
2511 N. 124th St. Suite 205
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Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

Monitoring Well No. 15

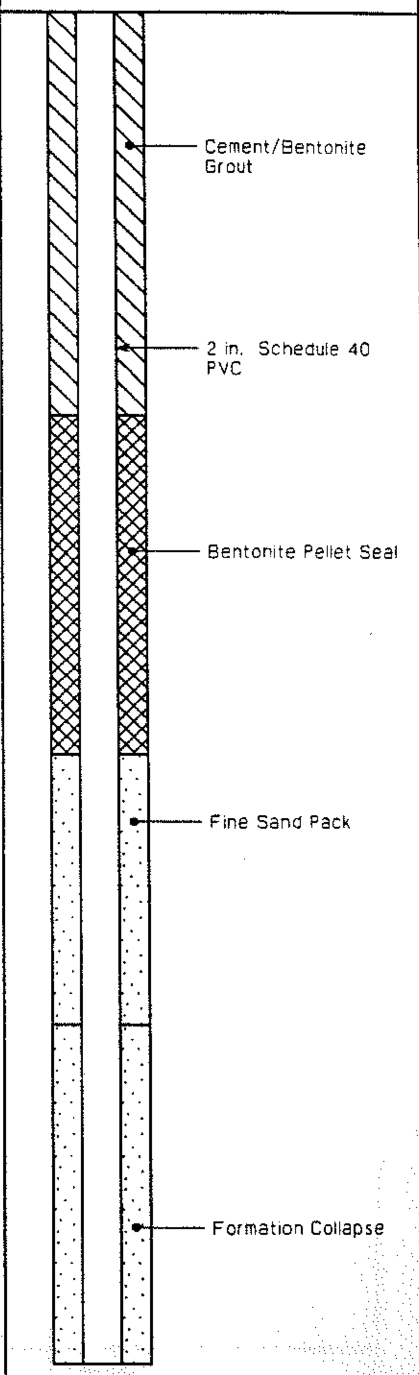
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-29-95
HOLE DIA.: 6 in.
GW DEPTH: Not Measured ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 494.41 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Same as above			20–25	15-2 (21–23)
Brown uniform silt w/ organic matter			25–26	15-3 (25–26)
White gravel w/ sand and gravels up to 1.5"			26–27	15-4 (27–28)
Brown gravel w/ silty, fine-med. sand, rounded to subrounded			27–40	15-5 (28–35); 15-6 (35–40)

WELL CONSTRUCTION DETAIL



STMI

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Notes:

Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

Monitoring Well No. 15

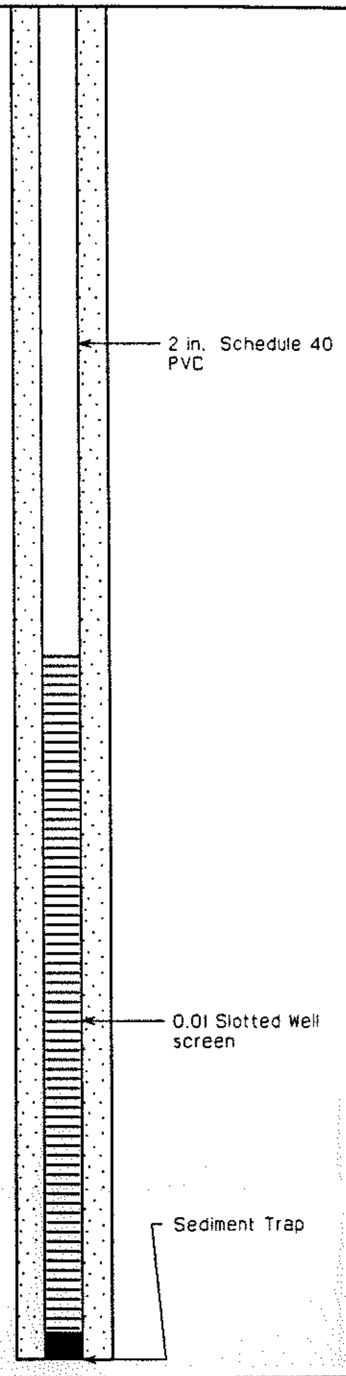
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-29-95
HOLE DIA.: 6 in.
GW DEPTH: Not Measured ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 494.41 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Same as above			40–50	15-6
Olive fine sand and silt, platy structure, well sorted			50–51	15-7
Gravel w/ some sand, some silt, generally finer gravel than above			51–60	15-8

WELL CONSTRUCTION DETAIL



STMI
2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

Monitoring Well No. 16

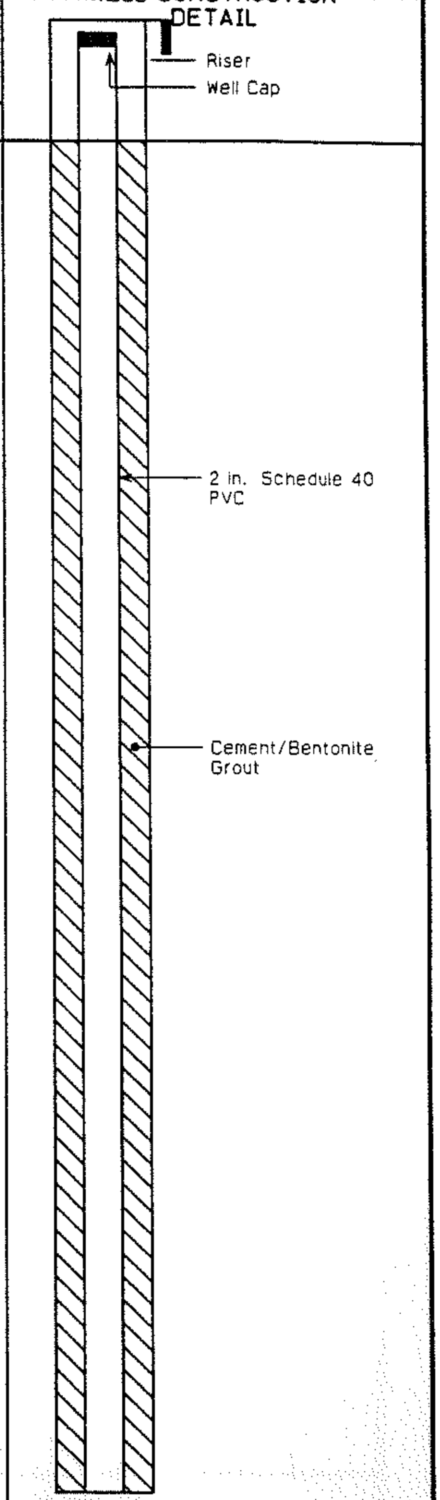
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-30-95
HOLE DIA.: 6 in.
GW DEPTH: 53 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 502.09 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Possible fill, consisting of brown, well-sorted, fine-med. sand			0–3	
Brown, dry gravel w/ fine-coarse sands, gravels up to 2", well-rounded, poorly sorted			3–20	16-1 (5–10)
Same as above, cobbles up to 4", rust stain at 22 ft.				16-2 (15–20)

WELL CONSTRUCTION DETAIL



STMI

2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No. 135-1.21

Monitoring Well No. 16

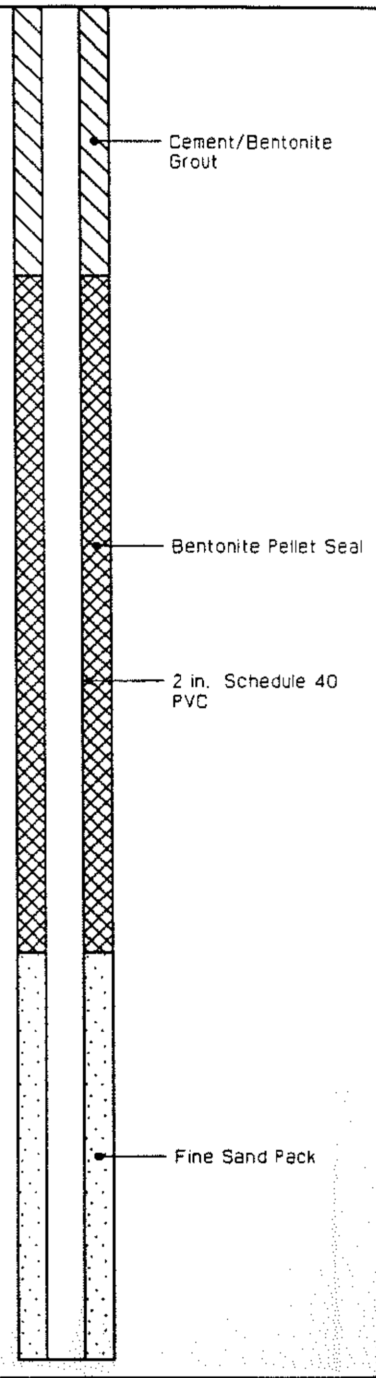
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-30-95
HOLE DIA.: 6 in.
GW DEPTH: 53 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 502.09 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
			20	
			21	
			22	
			23	
			24	
			25	
Same as above			26	
			27	
			28	16-3
			29	
			30	
			31	
			32	
			33	
			34	
			35	
			36	
Gravel becomes finer at 35'			37	
			38	16-4
			39	
			40	

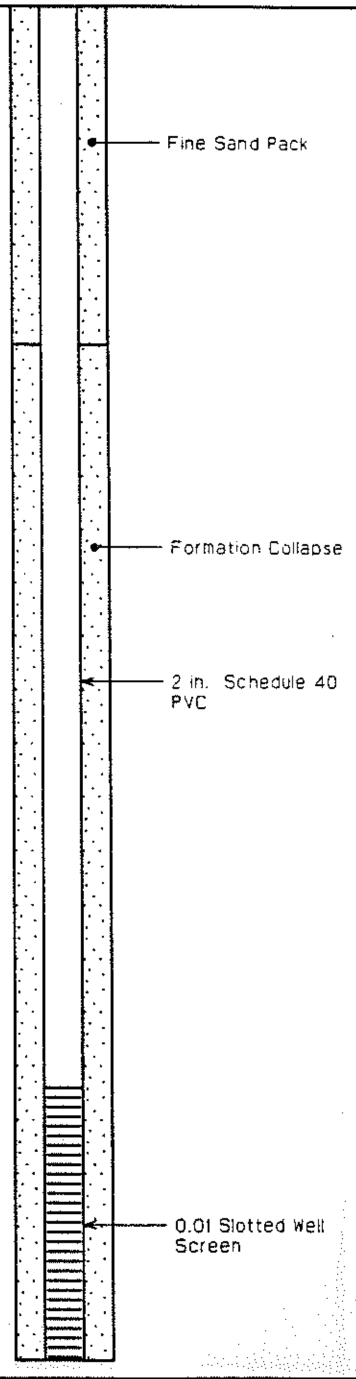
WELL CONSTRUCTION DETAIL



Monitoring Well No. 16

PROJECT: Hennepin East Ash Impoundment	**DATE:** 03-30-95	**LOGGED BY:** Hensel/Tu
DRILL RIG: Rotosonic Drill	**HOLE DIA.:** 6 in.	**SAMPLER:** Core barrel
DRILLER: Boart Longyear	**GW DEPTH:** 53 ft.	**HOLE ELEV.:** 502.09 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE	WELL CONSTRUCTION DETAIL
			40		
			41		
			42		
			43	16-5	
			44		
Brown gravel w/ fine to med. sand and silt (more sand than above), poorly sorted			45		
			46		
			47		
			48		
			49		
			50		
			51		
			52		
	▼		53	16-6	
			54		
			55		
			56		
			57		
			58		
			59		
			60		



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2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:

Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No. 135-1.21

Monitoring Well No. 16

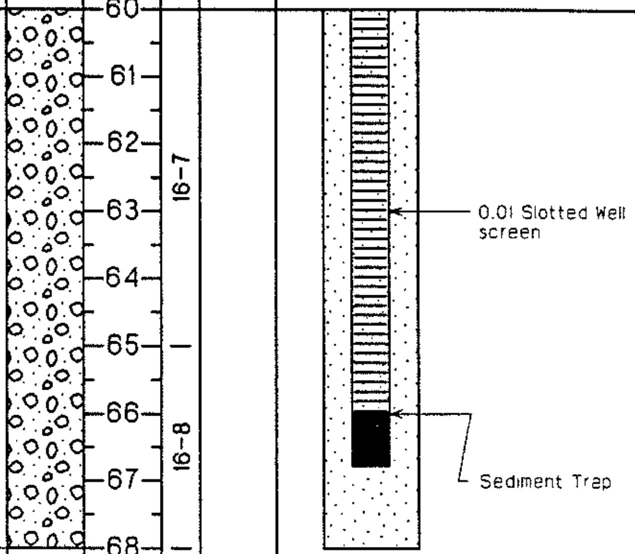
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-30-95
HOLE DIA.: 6 in.
GW DEPTH: 53 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 502.09 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Same as above w/ more silt			60–68	16-7, 16-8		

DEPTH: 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80



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Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No. 135-1.21

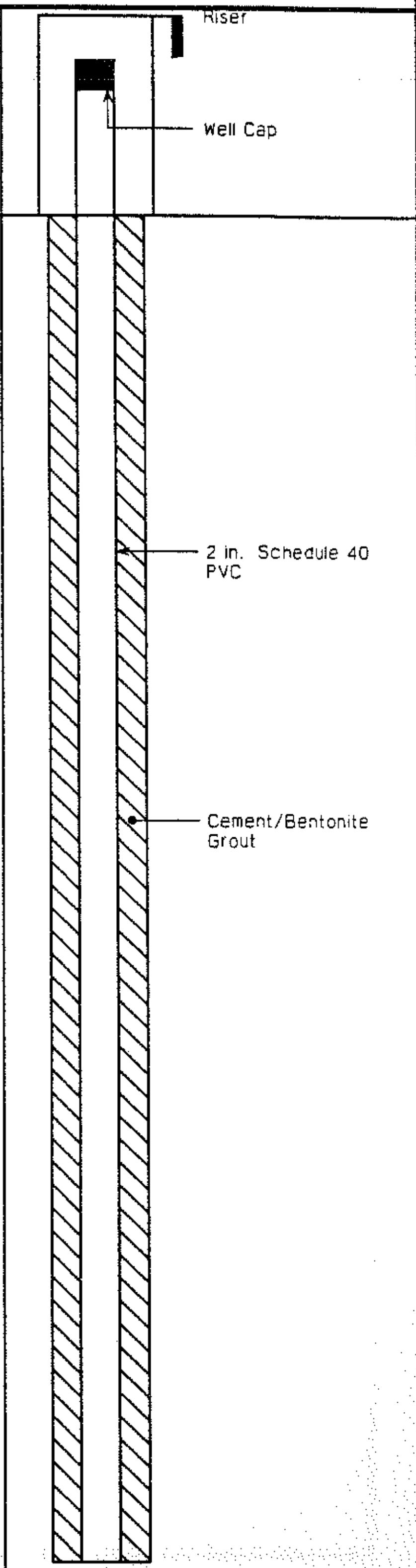
Monitoring Well No. 17

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-30-95
HOLE DIA.: 6 in.
GW DEPTH: 56 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 507.34 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
Silt, dark brown, no structure or pebbles, organic material to 2 ft.			0–3	17-1
Light brown, gravel w/ sand and silt, gravels up to 3", subrounded to angular, poorly sorted			3–5	
White gravel w/ sand, angular to subangular			5–20	17-2



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Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

Monitoring Well No. 17

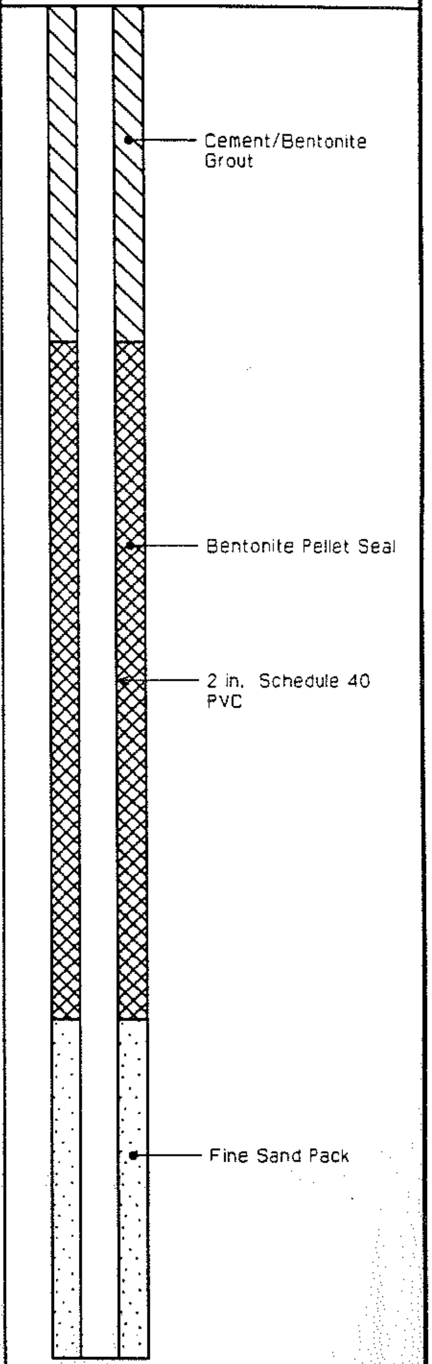
PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-30-95
HOLE DIA.: 6 in.
GW DEPTH: 56 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 507.34 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE
			20	
			21	
Brown gravel w/ sand, some silt, poorly sorted, subangular to rounded			22	17-3
			23	
			24	
			25	
			26	
			27	
			28	
			29	
			30	
			31	
Same as above w/ more silt			32	17-4
			33	
			34	
			35	
2" lens of gray sand and gravel at 36 ft.			36	17-5
			37	
Brownish-red gravel w/ sand and silt, poorly sorted, gravels up 1.5", rounded			38	17-6
			39	
			40	

WELL CONSTRUCTION DETAIL



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2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

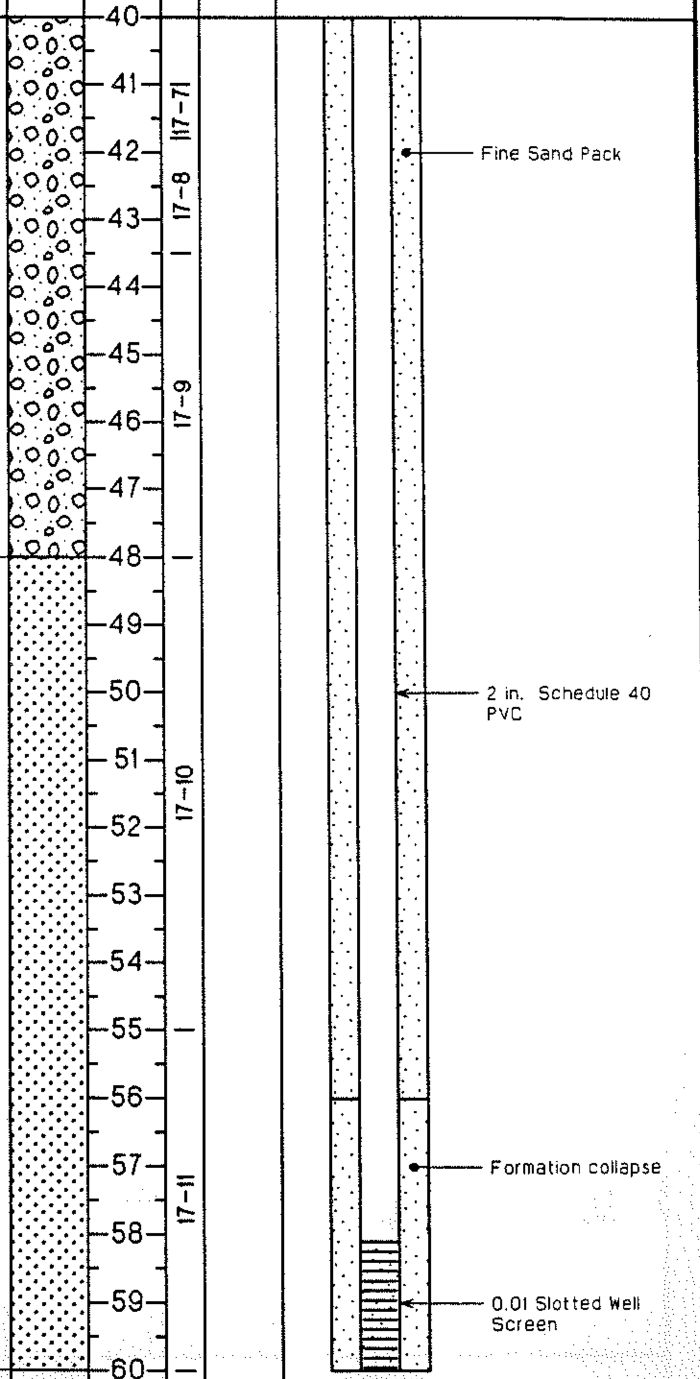
Monitoring Well No. 17

PROJECT: Hennepin East Ash Impoundment
DRILL RIG: Rotosonic Drill
DRILLER: Boart Longyear

DATE: 03-30-95
HOLE DIA.: 6 in.
GW DEPTH: 56 ft.

LOGGED BY: Hensel/Tu
SAMPLER: Core barrel
HOLE ELEV.: 507.34 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
Sequence of black and yellow sand and gravel			40–48	17-7, 17-8, 17-9		Fine Sand Pack
Brown gravel w/ sand and silt, poorly sorted, gravels up to 1.5"						
Brown, med. sand, well-sorted, dry			48–60	17-10		2 in. Schedule 40 PVC
Becomes wet at 56 ft. Same as above w/ few gravels				17-11		Formation collapse; 0.01 Slotted Well Screen



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Brookfield, Wisconsin 53005-8208

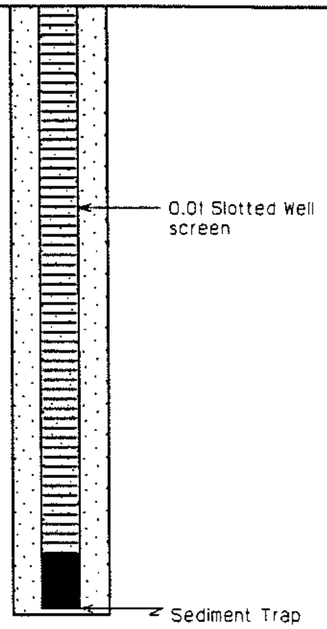
Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No. 135-1.21

Monitoring Well No. 17

PROJECT: Hennepin East Ash Impoundment
DATE: 03-30-95
LOGGED BY: Hensel/Tu
DRILL RIG: Rotosonic Drill
HOLE DIA.: 6 in.
SAMPLER: Core barrel
DRILLER: Boart Longyear
GW DEPTH: 56 ft.
HOLE ELEV.: 507.34 ft. MSL

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		WELL CONSTRUCTION DETAIL
			60			
			61			
Same as above			62	17-12		
			63			
			64			
			65			
			66			
			67			
			68			
			69			
			70			
			71			
			72			
			73			
			74			
			75			
			76			
			77			
			78			
			79			
			80			



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2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208

Notes:
Continuously sampled bore-hole. Sample numbers refer to saved samples

Project No.
135-1.21

Appendix A3

NRT Boring Logs and Well Details

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Hennepin Power Station - New East Ash Landfill		08D

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Hansen Boart Longyear Company	4/16/2009	4/17/2009	sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
08D	448.4 Feet (Site)	499.2 Feet (Site)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐
State Plane 1,688,932 N, 2,533,463 E S/C/N
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E
Feet ☐ S Feet ☐ W

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

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
CS	60 60		2.5	0 - 7' **FILL, SILTY SAND:** SM, very dark brown (7.5YR 2.5/3), well graded, mostly sand [mostly fine, little coarse], few gravel [mostly fine], some silt, moist.	(FILL) SM								Relative Density by visual inspection, not SPT
CS	120 120		5.0 7.5	7 - 15' **FILL, WELL-GRADED SAND WITH GRAVEL:** (SW)g, brown (7.5YR 4/4), well graded, mostly sand [mostly medium, few coarse], some gravel [mostly fine], moist, trace brick pieces.	(FILL) (SW)g								
			10.0 12.5										
CS	120 120		15.0 17.5 20.0 22.5	15 - 40' **FILL, POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), poorly graded, mostly sand [mostly medium, trace coarse], few subangular gravel [mostly coarse], moist, loose.	(FILL) SP								
CS	120 120		25.0 27.5 30.0										

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

Signature Rachel Wilberding

Firm Natural Resource Technology, Inc.
23713 W. Paul Road, St D. Pewaukee, WI 53072
Tel: 262.523.9000
Fax: 262.532.9001

NATURAL RESOURCE TECHNOLOGY

Boring Number 08D

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			32.5	15 - 40' **FILL, POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), poorly graded, mostly sand [mostly medium, trace coarse], few subangular gravel [mostly coarse], moist, loose. *(continued)*									
CS	120 120		35.0		(FILL) SP								
			37.5										
			40.0	40 - 52' **FILL, POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), poorly graded, mostly sand [mostly medium], few silt, moist, trace bottom ash, loose.									
			42.5										
CS	120 120		45.0	46' wet.	(FILL) SP								
			47.5										
			50.0										
			52.5	52 - 55' **CLAYEY SAND:** SC, yellowish brown (10YR 5/4), well graded, mostly sand [mostly medium, little coarse], few gravel [mostly coarse], some clay.	SC								
CS	120 0		55.0	55 - 65' No Recovery. Some black fine sand on outside of core barrel, possible peat.									
			57.5										
			60.0										
			62.5										
CS	120 120		65.0	65 - 66' **CLAYEY GRAVEL:** GC, dark yellowish brown (10YR 4/6), high plasticity, mostly gravel [mostly fine, few coarse], some clay.	GC								
			67.5	66 - 67' **WELL-GRADED SAND:** SW, dark brown (10YR 3/3), well graded, mostly sand [mostly medium].	SW								
			70.0	67 - 83' **WELL-GRADED GRAVEL WITH CLAY AND SAND:** (GW-GC)s, yellowish brown (10YR 5/6), well graded, some sand [mostly medium], mostly gravel [mostly fine, few coarse], little clay.									
			72.5		(GW-GC)s								
CS	120 120		75.0	75' 12-inch medium sand seam.									
			77.5										
			80.0										

NATURAL RESOURCE TECHNOLOGY

Boring Number 08D

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			82.5		(GW-GC)s									
				83 - 84' **LEAN CLAY:** CL, gray), hard, dry.	CL									
CS	120 120		85.0	84 - 87' **WELL-GRADED GRAVEL WITH CLAY AND SAND:** (GW-GC)s, brownish yellow (10YR 5/8), well graded, some sand [mostly medium], mostly gravel [mostly fine, few coarse], little clay.	(GW-GC)s									
			87.5	87 - 90' **CLAYEY SAND:** SC, yellowish brown), well graded, mostly sand [mostly medium], some clay, medium dense.	SC									
			90.0	90 - 104' **WEATHERED BEDROCK** BDX (SH), gray (7/5B), Weathered Shale. Samples expanded in core sleeve with addition of water.	BDX (SH)									
			92.5											
CS	120 120		95.0											
			97.5											
			100.0											
			102.5											
CORE	60 60		105.0	104 - 120' **SHALE:** BDX (SH), gray (7/5B), drilling more difficult.	BDX (SH)									RQD = 66%
			107.5											
CORE	120 120		110.0											RQD = 63%
			112.5											
			115.0											
			117.5											
			120.0	120' EOB.										

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name: Hennepin Power Station - New East Ash Landfill		License/Permit/Monitoring Number:	Boring Number: 18D	
Boring Drilled By: Name of crew chief (first, last) and Firm: Mike Hansen, Boart Longyear Company		Date Drilling Started: 4/14/2009	Date Drilling Completed: 4/14/2009	Drilling Method: sonic
Common Well Name: 18D		Final Static Water Level: 451.3 Feet (Site)	Surface Elevation: 485.2 Feet (Site)	Borehole Diameter: 6.0 inches
Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐ State Plane 1,690,429 N, 2,532,742 E S/C/N; 1/4 of 1/4 of Section , T N, R		Lat ___° ___' ___"; Long ___° ___' ___"	Local Grid Location: Feet ☐ N ☐ S	Feet ☐ E ☐ W
Facility ID:	County:	State: IL	Civil Town/City/ or Village: Hennepin	

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
CS	60 60		1.5	0 - 2' FILL, WELL-GRADED SAND WITH SILT: SW-SM, strong brown (7.5YR 4/6), well graded, mostly sand [mostly medium, few coarse], trace subrounded gravel [mostly medium], some silt, moist.	(FILL) SW-SM								Relative Density by visual inspection, not SPT
			3.0	2 - 4.5' FILL, WELL-GRADED SAND: SW, dark gray (2.5Y 4/1), well graded, mostly sand [trace fine, little medium, mostly coarse], some gravel [mostly medium], very dense.	(FILL) SW								
CS	120 120		4.5, 6.0, 7.5, 9.0	4.5 - 10' FILL, WELL-GRADED GRAVEL WITH SAND: (GW)s, strong brown (7.5YR 4/6), well graded, some sand [some medium, few coarse], mostly gravel [mostly medium, little coarse], trace clay, dry, medium dense.	(FILL) (GW)s								
			10.5, 12.0, 13.5	10 - 15' FILL, WELL-GRADED SAND WITH SILT: SW-SM, very dark brown (2.5Y 2.5/1), 50% dark olive brown (2.5Y 3/3) mottling, well graded, mostly sand [mostly fine, little coarse], few gravel [mostly medium], some silt, trace bottom ash.	(FILL) SW-SM								
CS	120 120		15.0, 16.5	15 - 17' POORLY-GRADED GRAVEL: GP, poorly graded, mostly gravel [mostly coarse], with limestone cobbles (2 - 4 inches diameter).	GP								
			18.0, 19.5	17 - 22' WELL-GRADED SAND WITH GRAVEL: (SW)g, very dark grayish brown (2.5Y 3/2), well graded, mostly sand [mostly fine, few coarse], little gravel [mostly medium], moist, medium dense.	(SW)g								

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

Signature: Rachel Wilberding

Firm: Natural Resource Technology, Inc.
23713 W. Paul Road, St D. Pewaukee, WI 53072
Tel: 262.523.9000
Fax: 262.532.9001

NATURAL RESOURCE TECHNOLOGY

Boring Number 18D

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			21.0		(SW)g									
			22.5	22 - 32' **WELL-GRADED SAND:** SW, strong brown (7.5YR 5/6), well graded, mostly sand [mostly fine, some medium, trace coarse].										
			24.0											
CS	120 120		25.5											grain size @ 25'
			27.0		SW									
			28.5											
			30.0											
			31.5											
			33.0	32 - 35' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, strong brown (7.5YR 5/6), well graded, some sand [mostly coarse], mostly gravel [mostly fine, few coarse].	(GW)s									
			34.5											
CS	120 120		36.0	35 - 43' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, strong brown (7.5YR 5/6), well graded, mostly sand [mostly fine], little gravel [little fine, few medium], medium dense, trace cobbles.										
			37.5											
			39.0		(SW)g									
			40.5											
			42.0											
			43.5	43 - 45' **SILT:** ML, very pale brown (10YR 8/2), dry, very loose.	ML									
CS	120 120		45.0	45 - 58' **WELL-GRADED GRAVEL WITH CLAY:** GW-GC, yellowish brown (10YR 5/4), very soft, well graded, mostly subrounded gravel [mostly fine, few coarse], little clay, wet, trace cobbles.										grain size @ 45'
			46.5											
			48.0											
			49.5		GW-GC									
			51.0											
			52.5											

NATURAL RESOURCE TECHNOLOGY

Boring Number 18D

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
CS	120 120		54.0 55.5 57.0	45 - 58' **WELL-GRADED GRAVEL WITH CLAY:** GW-GC, yellowish brown (10YR 5/4), very soft, well graded, mostly subrounded gravel [mostly fine, few coarse], little clay, wet, trace cobbles. *(continued)*	GW-GC								grain size @ 55'
			58.5 60.0 61.5	58 - 62' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), medium toughness, medium plasticity, firm, laminated, PP = 1.5.	CL								PP = Pocket Pen
			63.0 64.5	62 - 65' **WELL-GRADED GRAVEL WITH CLAY:** GW-GC, yellowish brown (10YR 5/4), very soft, well graded, mostly subrounded gravel [mostly fine, few coarse], little clay, wet, trace cobbles.	GW-GC								
CS	120 120		66.0 67.5 69.0	65 - 70' **LEAN CLAY:** CL, dark gray (2.5Y 4/1), medium toughness, medium to high plasticity, soft, PP = 0.5.	CL								
			70.5 72.0	70 - 72.5' **POORLY-GRADED SAND:** SP, dark gray (2.5Y 4/1), poorly graded, mostly sand [mostly fine], wet.	SP								
			73.5	72.5 - 75' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), poorly graded, mostly sand [mostly medium].	SP								
CS	120 120		75.0 76.5 78.0 79.5 81.0	75 - 82' **CLAYEY GRAVEL:** GC, dark yellowish brown (10YR 3/4), well graded, little sand [mostly coarse], mostly subrounded gravel [mostly medium], some clay, dense. 80' gray (N 5/), Dolomite Boulder.	GC								grain size @ 77'
			82.5	82 - 84' **SILT:** ML, gray (N 5/), dry, medium dense.	ML								
CS	120 120		84.0 85.5	84 - 86' **LEAN CLAY WITH GRAVEL:** (CL)g, gray (N 5/), some gravel [mostly coarse], dense, Till.	(CL)g								

NATURAL RESOURCE TECHNOLOGY

Boring Number 18D

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			87.0 88.5 90.0 91.5 93.0 94.5	86 - 95' **WEATHERED BEDROCK** BDX (SH), gray (N 5/), very hard, dry, Weathered Shale. *(continued)*	BDX (SH)									
				95' EOB.										

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Hennepin Power Station - New East Ash Landfill		18S

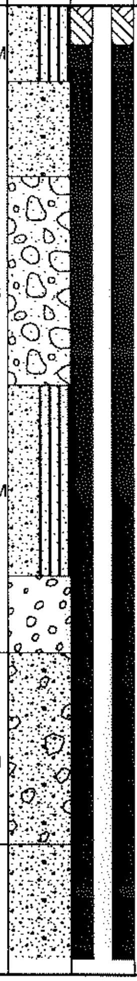
Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Hansen Boart Longyear Company	4/14/2009	4/15/2009	sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
18S	450.7 Feet (Site)	485.2 Feet (Site)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐
State Plane 1,690,428 N, 2,532,740 E S/C/N
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location
☐ N ☐ E
Feet ☐ S Feet ☐ W

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

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0 - 2' SW-SM, Blind Drilled to 52'. See log for 18D.	(FILL) SW-SM								
			2	2 - 4.5' SW.	(FILL) SW								
			4	4.5 - 10' (GW)s.	(FILL) (GW)s								
			6										
			8										
			10	10 - 15' SW-SM.	(FILL) SW-SM								
			12										
			14										
			16	15 - 17' GP.	GP								
			18	17 - 22' (SW)g.	(SW)g								
			20										
			22	22 - 32' SW.	SW								
			24										



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

Signature Rachel Wilberding

Firm Natural Resource Technology, Inc.
23713 W. Paul Road, St D. Pewaukee, WI 53072
Tel: 262.523.9000
Fax: 262.532.9001

NATURAL RESOURCE TECHNOLOGY

Boring Number 18S

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			26–32	22 - 32' SW. *(continued)*	SW								
			32–35	32 - 35' (GW)s.	(GW)s								
			35–43	35 - 43' (SW)g.	(SW)g								
			43–45	43 - 45' ML.	ML								
			45–52	45 - 52' GW-GC.	GW-GC								
			52	52' EOB.									

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Hennepin Power Station - New East Ash Landfill		19D	
Boring Drilled By: Name of crew chief (first, last) and Firm	**Date Drilling Started**	**Date Drilling Completed**	**Drilling Method**
Mike Hansen Boart Longyear Company	4/15/2009	4/15/2009	sonic
Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
19D	450.8 Feet (Site)	483.9 Feet (Site)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐
State Plane 1,690,632 N, 2,533,812 E S/C/N
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N Feet ☐ S ☐ E Feet ☐ W

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

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
CS	60 60		2	0 - 10' **FILL, WELL-GRADED GRAVEL WITH CLAY AND SAND:** (GP-GC)s, dark yellowish brown (10YR 4/4), well graded, some sand [few medium, mostly coarse], mostly gravel [mostly fine, trace coarse], little clay.									Relative Density by visual inspection, not SPT
			4	4' 5 - 10% bottom ash to 5'.	(FILL) (GP-GC)s								
CS	120 120		6 8 10										
			12	10 - 14' **FILL, WELL-GRADED SAND:** SW, dark yellowish brown (10YR 3/6), 35% black) mottling, well graded, mostly sand [mostly fine], some bottom ash.	(FILL) SW								
			14	14 - 17' **FILL, ASH (Coal):** ASH (Coal), fine grained, gray.	(FILL) ASH (Coal)								
CS	120 120		16										
			18 20 22 24	17 - 30' **FILL, POORLY-GRADED SAND:** SP, dark yellowish brown (10YR 3/6), poorly graded, mostly sand [mostly fine, few coarse], moist, trace bottom ash, cohesive.	(FILL) SP								

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

Signature Rachel Wilberding

Firm Natural Resource Technology, Inc.
23713 W. Paul Road, St D. Pewaukee, WI 53072
Tel: 262.523.9000
Fax: 262.532.9001

NATURAL RESOURCE TECHNOLOGY

Boring Number 19D

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
CS	120 / 120		25–35	17 - 30' **FILL, POORLY-GRADED SAND:** SP, dark yellowish brown (10YR 3/6), poorly graded, mostly sand [mostly fine, few coarse], moist, trace bottom ash, cohesive. *(continued)*	(FILL) SP								
				30 - 35' **WELL-GRADED SAND WITH SILT:** SW-SM, yellowish brown (2.5Y 6/3), well graded, mostly sand [mostly coarse], little angular to subangular gravel [mostly fine, few coarse], some silt, dry, loose.	SW-SM								
CS	120 / 120		35–45	35 - 37' **WELL-GRADED GRAVEL WITH CLAY AND SAND:** (GW-GC)s, yellowish brown (10YR 5/6), well graded, some sand [mostly coarse], mostly subrounded to rounded gravel [mostly fine, few coarse], little clay, wet, loose.	(GW-GC)s								
				37 - 73' **CLAYEY SAND WITH GRAVEL:** (SC)g, yellowish brown (10YR 5/6), soft, well graded, mostly sand [few fine, mostly coarse], little gravel [mostly coarse], some clay, wet.	(SC)g								
CS	120 / 60		45–55	45' - 55' Poor Recovery.									
CS	120 / 120		55–65										
CS	120 / 120		65–										

Depth scale: 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66

NATURAL RESOURCE TECHNOLOGY

Boring Number 19D

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
CS	120 120		68–72	37 - 73' **CLAYEY SAND WITH GRAVEL:** (SC)g, yellowish brown (10YR 5/6), soft, well graded, mostly sand [few fine, mostly coarse], little gravel [mostly coarse], some clay, wet. *(continued)*	(SC)g									
			74–82	73 - 83' **WEATHERED BEDROCK** BDX (SH), dark gray (N 4/), dry, Weathered Shale.	BDX (SH)									
			84	83 - 85' **SHALE:** BDX (SH), dark gray (N 4/), dry, samples were pulverized, drilling more difficult.	BDX (SH)									
				85' EOB.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Hennepin Power Station - New East Ash Landfill		19S	

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Hansen Boart Longyear Company	4/16/2009	4/16/2009	sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
19S	450.6 Feet (Site)	483.9 Feet (Site)	6.0 inches

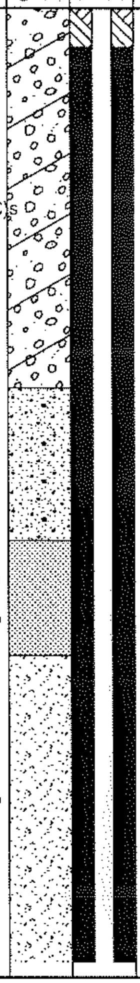
Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐
State Plane 1,690,631 N, 2,533,810 E S/C/N
1/4 of 1/4 of Section , T N, R

Lat ° ' "
Long ° ' "

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

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

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	0 - 10' (GW-GC)s, Blind drilled to 52'. See log for 19D.	(FILL) (GW-GC)s								
			10	10 - 14' SW.	(FILL) SW								
			14	14 - 17' ASH (Coal).	(FILL) ASH (Coal)								
			17	17 - 30' SP.	(FILL) SP								



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

Signature: Rachel Wilberding

Firm: Natural Resource Technology, Inc.
23713 W. Paul Road, St D. Pewaukee, WI 53072
Tel: 262.523.9000
Fax: 262.532.9001

NATURAL RESOURCE TECHNOLOGY

Boring Number 19S

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			26 28	17 - 30' SP. *(continued)*	(FILL) SP									
			30 32 34	30 - 35' SW-SM.	SW-SM									
			36	35 - 37' GW-GC.	GW-GC									
			38 40 42 44 46 48 50	37 - 52' (SC)g.	(SC)g									
			52	52' EOB.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Hennepin Power Station - New East Ash Landfill		40S	
Boring Drilled By: Name of crew chief (first, last) and Firm	**Date Drilling Started**	**Date Drilling Completed**	**Drilling Method**
Jerry Hancock PSC Drilling	10/25/2010	10/26/2010	hollow stem auger
Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
40S	473.8 Feet (Site)	485.8 Feet (Site)	8.3 inches

Local Grid Origin ☐ (estimated: ☒) or Boring Location ☒
State Plane 1,690,567 N, 2,533,492 E S/C/N
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

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

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 42		0–5	0 - 10.5' FILL, WELL-GRADED GRAVEL WITH SAND: (GW)s, brown (7.5YR 5/4), well graded, dry, Gravel is composed of lithics (granite and dolomite). 16-30% lean clay.	(FILL) (GW)s									
2 CS	60 42		5–10											10-15 ft. dense. A lot of hammer blows
3 CS	60 60		10–12	10.5 - 28' FILL, ASH (Coal): ASH (Coal), black (5YR 2.5/1), dry, Coarse like bottom ash to 15 ft.	(FILL) ASH (Coal)									15-20 ft. softer. Few hammer blows

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

Signature	Firm	
	Natural Resource Technology	Tel: Fax:

Template: SOIL BORING - Project: 1940 GINT.GPJ

NATURAL RESOURCE TECHNOLOGY

Boring Number 40S

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				10.5 - 28' FILL, ASH (Coal): ASH (Coal), black (5YR 2.5/1), dry, Coarse like bottom ash to 15 ft. *(continued)*										
			13											
			14											
4 CS	60 60		15	15' very dark grayish brown (10YR 3/2), Fine like fly ash. Horizontally laminated in alternating layers of fine and coarse ash.										
			16											
			17	17' moist.										
			18											
			19											
5 CS	60 60		20		(FILL) ASH (Coal)									
			21	21' wet, Very soft to 24 ft.										
			22											
			23											
			24	24' moist.										
6 CS	60 52		25	25 - 28' wet, Soft. Very fine ash.										
			26											
			27											
			28	28 - 30' WELL-GRADED SAND: SW, dark yellowish brown (10YR 4/4), moist to wet, Native, buried terrace. Well graded fine to medium sand. 5-10% silt. Trace fine gravel (rounded) and root fibers.	SW									
			29											
7 CS	60 48		30	30 - 33.5' LEAN CLAY WITH SAND: (CL)s, dark grayish brown (2.5Y 4/2), slow dilatency, medium toughness, medium plasticity, moist to wet, 5-10% fine sand. Trace organics (black, woody).	(CL)s									
			31											
			32											

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number 40S

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	30 - 33.5' LEAN CLAY WITH SAND: (CL)s, dark grayish brown (2.5Y 4/2), slow dilatency, medium toughness, medium plasticity, moist to wet, 5-10% fine sand. Trace organics (black, woody). *(continued)*	(CL)s									
8 CS	60 27		34, 35, 36	33.5 - 37' WELL-GRADED GRAVEL WITH SAND: (GW)s, strong brown (7.5YR 5/6), well graded, wet, Fine to coarse gravel.	(GW)s									Poor recovery
			37, 38, 39	37 - 40' WELL-GRADED GRAVEL: GW, very pale brown (10YR 7/3), well graded, Fine to coarse angular gravel. 5-10% medium sand.	GW									
9 CS	60 27		40, 41, 42, 43, 44	40 - 45' WELL-GRADED GRAVEL WITH CLAY: GW-GC, light yellowish brown (10YR 6/4), wet, Fine sand to coarse gravel. 15-25% lean clay. 5-10% sand (well graded). 20% lean clay. Occasionally gravelly layers ~3 in. thick.	GW-GC									
10 CS	60 18		45, 46, 47, 48, 49, 50	45 - 50.5' WELL-GRADED GRAVEL WITH SAND: (GW)s, light yellowish brown (10YR 6/4), wet, Fine to coarse gravel. 15-25% well graded sand (fine to coarse). <5% silt.	(GW)s									Poor recovery
				50.5' EOB.										

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Hennepin Power Station		45S

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	6/23/2015	6/24/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
45S	Feet (NAVD88)	465.70 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,689,993.67 N, 2,531,896.69 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 41° 18' 13.503"
Long -89° 18' 36.702"
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Putnam	Illinois	Hennepin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 20	2 5 4 3	0.5 – 2.0	0 - 2.5' **SILT:** ML, very dark grayish brown (10YR 3/2), mostly silt, some very fine sand, trace roots and gravel, cohesive, nonplastic, dry to moist.	ML								
2 SS	24 6	2 10 6 4	2.5 – 4.5	2.5 - 5' **SILT WITH SAND:** (ML)s, very dark grayish brown (10YR 3/2) to dark reddish gray (5YR 4/2), trace clay.	(ML)s								
3 ST	18 17.5		5.0 – 6.0	5 - 6.5' Shelby Tube.									ST3: 18" at 550 lbs of pressure.
			6.5 – 7.0	6.5 - 7.5' **SILT WITH SAND:** (ML)s, very dark grayish brown (10YR 3/2) to dark reddish gray (5YR 4/2), trace clay.	(ML)s								
4 SS	24 18	6 12 20 18	7.5 – 9.5	7.5 - 10.5' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, brown (7.5YR 4/3), subangular gravel, trace clay, moist, top 2" of unit is fine poorly-graded sand. 8.2' thin layer of black material.	(SW)g								
5 SS	24 16	7 3 3	10.0 – 10.5										

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

Signature Patrick M Hoff

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

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
		7	10.5	10.5 - 13.4' **POORLY-GRADED SAND:** SP, brown (7.5YR 5/4), fine sand, trace to little clay, trace silt, cohesive, decreasing cohesiveness and clay content with depth, moist to wet.	SP									
6 SS	24 24	8 19 22 9	12.5											
			13.4	13.4 - 15' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, brown (7.5YR 5/3), subangular to rounded gravel, fine sand, trace clay and silt, wet.	(GW)s									
7 SS	24 19	8 23 40 25	15.0	15 - 15.4' **POORLY-GRADED SAND:** SP, brown (7.5YR 5/4), fine sand, trace clay and silt, wet.	SP									
			15.4	15.4 - 32.5' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, yellowish brown (10YR 5/4), rounded to subangular gravel, fine sand, trace clay and silt, wet.	(GW)s									
8 SS	24 12	2 10 17 15	17.5											
9 SS	24 10	10 31 25 3	20.0											
10 SS	24 8	9 14 12 13	22.5	22.7' brown (7.4YR 4/2), thin layer of poorly-graded fine sand.										
11 SS	24 11	5 8 10 9	25.0											
12 SS	24 8	10 11 11	27.5	27.5' increase in clay content.										

NATURAL RESOURCE TECHNOLOGY

Boring Number 45S

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
		10	28.5 29.0 29.5	15.4 - 32.5' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, yellowish brown (10YR 5/4), rounded to subangular gravel, fine sand, trace clay and silt, wet. *(continued)*	(GW)s								
13 SS	24 19	7 8 6 6	30.0 30.5 31.0 31.5 32.0										
14 SS	24 8	5 6 11 12	32.5 33.0 33.5 34.0 34.5	32.5 - 37.5' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, yellowish brown (10YR 5.4), medium to coarse sand, fine subangular to rounded gravel, fine gravel, trace silt and clay, wet.	(SW)g								
15 SS	24 9	4 5 9 11	35.0 35.5 36.0 36.5 37.0										
16 SS	24 14	7 10 9 9	37.5 38.0 38.5 39.0 39.5	37.5 - 40.5' **WELL-GRADED SAND:** SW, yellowish brown (10YR 5/4), fine to coarse sand, few to little subangular to subrounded gravel, trace clay, wet, layer of fine sand at top 1" of unit.	SW								
17 SS	24 19	9 6 7 8	40.0										
			40.5 41.0 41.5 42.0	40.5 - 42.5' **SILT:** ML, yellowish brown (10YR 5/4), little to some clay, trace medium sand, cohesive, nonplastic, moist.	ML								
18 SS	24 16	3 13 11 13	42.5 43.0 43.5 44.0 44.5	42.5 - 45' **WELL-GRADED SAND WITH GRAVEL:** to **POORLY-GRADED SAND WITH GRAVEL:** (SW)g, yellowish brown (10YR 5/4), mostly fine sand, subangular to rounded gravel, little to some medium to coarse sand, trace clay and silt, wet.	(SW)g								
			45.0	45' End of Boring.									

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Hennepin Power Station		46	
Boring Drilled By: Name of crew chief (first, last) and Firm	**Date Drilling Started**	**Date Drilling Completed**	**Drilling Method**
Jason Drabek Cascade Drilling	8/11/2015	8/11/2015	Sonic
Common Well Name	**Final Static Water Level**	**Surface Elevation**	**Borehole Diameter**
46	Feet (NAVD88)	496.44 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,690,085.24 N, 2,533,743.42 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 41° 18' 14.23"
Long -89° 18' 12.5"

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

Facility ID	County	State	Civil Town/City/ or Village
	Putnam	Illinois	Hennepin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 41.5		0–5	0 - 5' **FILL, TOPSOIL:** GM, dark yellowish brown (10YR 4/4), mostly fine to coarse gravel, silt (<50%), roots (<10%). 2' ash (30-50%). 3' - 3.5' fine to coarse gravel layer.	(FILL) GM									
2 CS	60 42		5–11	5 - 11' **FILL, SILT:** ML, yellowish brown (10YR 5/8) mottling, fine to coarse gravel (<40%), clay (<20%), ash (5-15%), ash content increases with depth, dry.	(FILL) ML									
3 CS	30 30		10	10' decrease in fine gravel content (<10%), decrease in ash content (<10%), increase in clay content with depth, low plasticity, moist.										
			11–12.5	11 - 12.5' **FILL, ASH (Coal):** very dark brown (10YR 2/2), clay (30-50%), fine gravel (5-15%), low plasticity, moist.	(FILL)									

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

Signature Andrea Salus

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

NATURAL RESOURCE TECHNOLOGY

Boring Number 46

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
4 CS	30 30		13, 14	12.5 - 15' **FILL, LEAN CLAY:** CL, very dark grayish brown (10YR 3/2), silt-sized ash (30-50%), cobbles (15-30%), fine subrounded gravel (10-15%), very fine sand (10-15%), trace silt-sized ash, medium plasticity, cohesive, wet.	(FILL) CL									
				14.8' wood fragments (5-15%).										
5 CS	60 58		15, 16, 17	15 - 18' **FILL, SILTY CLAY** CL/ML, very dark gray (10YR 3/1), fine gravel (5-10%), very fine sand (10-15%), cohesive, medium plasticity, soft, wet. 16' - 16.5' dark brown (10YR 3/3). 16.5' - 17.0' mostly silt [very soft, wet].	(FILL) CL/ML									
			18, 19	18 - 19.9' **FILL, CLAYEY SILT** ML/CL, pale brown (10YR 6/3), fine to coarse angular gravel (>15%), fine sand (10-20%), dry.	(FILL) ML/CL									
6 CS	60 60		20, 21, 22	20 - 23' **FILL, ASH (Coal):** very dark brown (10YR 2/2), clay to silt-sized ash, wood fragments (5-10%), seams of very dark gray (10YR 3/1) material.	(FILL)									
			23, 24	23 - 30' **CLAYEY SILT** ML/CL, very dark grayish brown (10YR 3/2), fine to medium sand (30-50%), subangular to subrounded gravel (>15%), dry. 24' grayish brown (10YR 5/2).	ML/CL									
7 CS	60 60		25, 26, 27, 28, 29	25' cobbles (15-30%).										
8 CS	60 58		30, 31, 32, 33	30 - 50' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, grayish brown (10YR 5/2), dark yellowish brown (10YR 4/6), and yellowish brown (10YR 5/8), subangular to subrounded gravel, coarse sand, clay (5-15%), dry.	(GW)s									

NATURAL RESOURCE TECHNOLOGY

Boring Number 46

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			34	30 - 50' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, grayish brown (10YR 5/2), dark yellowish brown (10YR 4/6), and yellowish brown (10YR 5/8), subangular to subrounded gravel, coarse sand, clay (5-15%), dry. *(continued)*									
9 CS	60 23		35										
10 CS	60 54		40	40' clay (5-10%) , clay content increasing with depth, trace silt and very fine sand, moist.									
			42		(GW)s								
11 CS	60 54		45	45' increase in clay content (10-15%), trace fine sand.									
			47.5	47.5' - 49.0' pulverized cobble (white, rock flour and gravel-sized fragments).									
12 CS	120 72		50	50 - 60' **WELL-GRADED GRAVEL:** GW, subrounded to rounded gravel, clay (15-20%), trace fine sand and silt, wet.									
			52		GW								
			54										

NATURAL RESOURCE TECHNOLOGY

Boring Number 46

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			55 56 57 58 59	50 - 60' **WELL-GRADED GRAVEL:** GW, subrounded to rounded gravel, clay (15-20%), trace fine sand and silt, wet. *(continued)* 55' - 56' yellowish brown (10YR 5/5).	GW									
			60	60' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Hennepin Power Station		47	
Boring Drilled By: Name of crew chief (first, last) and Firm	**Date Drilling Started**	**Date Drilling Completed**	**Drilling Method**
Jason Drabek Cascade Drilling	8/10/2015	8/10/2015	Sonic
Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
47	Feet (NAVD88)	502.13 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,689,837.69 N, 2,533,052.86 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 41° 18' 11.85"
Long -89° 18' 21.579"

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

Facility ID	County	State	Civil Town/City/ or Village
	Putnam	Illinois	Hennepin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 26		0 - 5	0 - 5' **FILL, TOPSOIL:** ML, brown (7.5YR 4/2), silt, trace roots, trace angular to subangular gravel dry. 0.7' grayish brown (10YR 5/2), subangular gravel (5-10%). 1' very dark gray (5YR 3/1), trace rounded to subrounded gravel, trace sand-sized ash, dry.	(FILL) ML								
2 CS	60 43		5.0 - 10.0	5 - 11.5' **FILL, ASH (Coal):** black (5YR 2.5/1), clay (5-15%), trace subrounded to subangular gravel, moist. 7' very dark brown (7.5YR 2.5/2), cohesive, dry to moist. 8.6' increased clay content.	(FILL)								
3 CS	60 32		10.0 - 10.5	10' increase in clay content (15-25%).									

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

Signature

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

NATURAL RESOURCE TECHNOLOGY

Boring Number 47

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			11.0	5 - 11.5' **FILL, ASH (Coal):** black (5YR 2.5/1), clay (5-15%), trace subrounded to subangular gravel, moist. *(continued)*	(FILL)									
4 CS	60 60		11.5 - 16.0	11.5 - 16.3' **FILL, CLAYEY SILT** ML/CL, dark reddish gray (5YR 4/2), gravel (>5%), dry.	(FILL) ML/CL									
			16.5 - 19.5	16.3 - 20' **FILL, ASH (Coal):** dark gray (10YR 4/1), mostly silt-sized ash, clay (0-10%), dry to moist.	(FILL)									
5 CS	60 60		20.0 - 21.5	20 - 21.8' **FILL, CLAYEY SILT** ML/CL, dark reddish gray (5YR 4/2), strong brown mottling, gravel (>5%), moist to wet.	(FILL) ML/CL									
			22.0 - 24.5	21.8 - 30' **FILL, SILT:** ML, dark gray (10YR 4/1) to very dark brown (7.5YR 2.5/2), clay, trace sand and gravel-sized bottom ash, moist to wet. 22.7' wood chips (<1" layer).	(FILL) ML									
6 CS	60 60		25.0 - 28.0	25' - 26.6' very dark brown (7.5YR 2.5/2), moist to wet.										

NATURAL RESOURCE TECHNOLOGY

Boring Number 47

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			28.5–30.0	21.8 - 30' **FILL, SILT:** ML, dark gray (10YR 4/1) to very dark brown (7.5YR 2.5/2), clay, trace sand and gravel-sized bottom ash, moist to wet. *(continued)*	(FILL) ML									
7 CS	60 60		30.0–33.5	30 - 33.5' **POORLY-GRADED SAND:** SP, light brown (10YR 5/4), clay (5-15%), subrounded gravel (5-10%), dry. 31.2' - 33.5' white cobble pulverized by drilling method into angular to subangular gravel-sized pieces, dry.	SP									
			33.5–35.0	33.5 - 35' **SILT WITH GRAVEL:** (ML)g, light brown (10YR 7/3), subangular to subrounded gravel, noncohesive, dry.	(ML)g									
8 CS	60 18		35.0–40.9	35 - 40.9' **WELL-GRADED GRAVEL:** GW, very pale brown (10YR 7/3), gravel and cobbles (50%), sand (10-20%), trace clay. 36.5' cobble (>6" diameter) pulverized by drilling method into gravel-sized, sand-sized, and silt-sized pieces.	GW									
9 CS	60 60		40.0	40' piece of cobble.										
			40.9–45.0	40.9 - 45' **POORLY-GRADED SAND WITH CLAY AND GRAVEL:** (SC)g, sand (20-40%), subangular gravel (25-30%), clay (15-25%). 43.7' - 45' increased clay content.	(SC)g									
10 CS	60 42		45.0–45.5	45 - 55' **CLAYEY SILT** ML/CL, light brown (10YR 5/4), moist.	ML/CL									

NATURAL RESOURCE TECHNOLOGY

Boring Number 47

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			46.0	45 - 55' **CLAYEY SILT** ML/CL, light brown (10YR 5/4), moist. *(continued)* 45.6' - 45.7 ' trace black silt-sized material. 45.8' - 46.7' wet.										
11 CS	60 34		50.0		ML/CL									
			51.5	51.4' wet.										
12 CS	60 33		55.0	55 - 60' **CLAYEY GRAVEL:** GC, subrounded gravel, clay (5-15%), trace silt and sand, decreasing silt and sand content with depth, wet.	GC									
			60.0	60' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Hennepin Power Station		48

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jason Drabek Cascade Drilling	8/11/2015	8/11/2015	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
48	Feet (NAVD88)	485.19 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,690,545.64 N, 2,533,337.84 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 41° 18' 18.816"
Long -89° 18' 17.753"

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

Facility ID	County	State	Civil Town/City/ or Village
	Putnam	Illinois	Hennepin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 60		0 - 1.9	0 - 1.9' **FILL, TOPSOIL:** ML, brown (7.5YR 4/2), gravel (5-10%), trace roots, clay, and sand, dry.	(FILL) ML								
			1.9 - 3.4	1.9 - 3.4' **FILL, SILTY SAND WITH GRAVEL:** (SM)g, very pale brown (10YR 7/3), very fine sand, dry.	(FILL) (SM)g								
			3.4 - 7.9	3.4 - 7.9' **FILL, CLAYEY SILT** ML/CL, very dark brown (7YR 2/2), gravel (>15%), cohesive, dry.	(FILL) ML/CL								
			4.2	4.2' cobbles.									
2 CS	60 42		5.0	5' - 7.9' decreased cobble content.									
			6.6	6.6' ash seam (2" layer, color changes from gray to reddish brown with depth).									

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

Signature

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

Template: ILLINOIS BORING LOG - Project: HENNEPIN 2015 GINT LOGS.GPJ

NATURAL RESOURCE TECHNOLOGY

Boring Number 48

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			8.0	7.9 - 11.4' **FILL, SANDY SILT WITH GRAVEL:** s(ML)g, silt (>50%), cobbles (20-40%), sand (10-20%), trace clay, noncohesive, dry.										
			9.5		(FILL) s(ML)g									
3 CS	60 56		10.0											
			11.5	11.4 - 23.4' **FILL, ASH (Coal):** dark gray, (10YR 4/1), cohesive, dry.										
			13.0	13' - 13.4' very dark brown (7.5YR 2.5/2).										
4 CS	60 55		15.0	15' - 20' trace gravel-sized ash.										
			16.5		(FILL)									
			17.0	16.9' moist.										
5 CS	60 60		20.0	20' - 23.4' trace white particles, wet.										
			21.0											

NATURAL RESOURCE TECHNOLOGY

Boring Number 48

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			21.5	11.4 - 23.4' **FILL, ASH (Coal):** dark gray, (10YR 4/1), cohesive, dry. *(continued)*	(FILL)									
			23.0	23.2' white particles (0.2" layer).										
			23.5	23.4 - 24.5' **FILL, SILT:** ML, trace subangular to subrounded gravel, cohesive, dry.	(FILL) ML									
			24.5	24.5 - 25' **FILL, SANDY SILT WITH GRAVEL:** s(ML)g, silt (>50%), gravel (30-40%), very fine sand (5-10%), dry.	(FILL) s(ML)g									
6 CS	60 52		25.0	25 - 40.4' **FILL, SILTY SAND WITH GRAVEL:** (SM)g, very fine sand (30-40%), gravel (20-40%), silt (20-30%), dry.	(FILL) (SM)g									
7 CS	60 36		30.0	30' - 33' decrease in silt content (0-10%), trace clay, dry.										
			32.0	31.9' brown (10YR 4/3), trace ash.										
			34.0											

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number 48

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			34.5	25 - 40.4' **FILL, SILTY SAND WITH GRAVEL:** (SM)g, very fine sand (30-40%), gravel (20-40%), silt (20-30%), dry. *(continued)*									
8 CS	60 36		35.0	35' - 40' clay content increases with depth, iron oxidation.									
			35.5										
			36.0										
			36.5										
			37.0		(FILL) (SM)g								
			37.5	37.3' wet.									
			38.0										
			38.5										
			39.0										
			39.5										
9 CS	120 78		40.0										
			40.5	40.4 - 54' **WELL-GRADED GRAVEL:** GW, brown (10YR 4/3), gravel (>50%), clay (10-30%), increase in clay content (20-40%) with depth, sand (10-20%).									
			41.0										
			41.5										
			42.0										
			42.5										
			43.0										
			43.5										
			44.0		GW								
			44.5										
			45.0										
			45.5										
			46.0										
			46.5										
			47.0										

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number 48

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
10 CS	48 28		47.5 – 54.0	40.4 - 54' **WELL-GRADED GRAVEL:** GW, brown (10YR 4/3), gravel (>50%), clay (10-30%), increase in clay content (20-40%) with depth, sand (10-20%). *(continued)*	GW									
			54.0	54' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Hennepin Power Station		49

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/2/2015	7/6/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
49	Feet (NAVD88)	465.76 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,689,022.19 N, 2,528,297.09 E E/W
1/4 of 1/4 of Section , T N, R

Lat 41° 18' 4.255"
Long -89° 19' 23.987"

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

Facility ID	County	State	Civil Town/City/ or Village
	Putnam	Illinois	Hennepin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 13	3 4 7 10	0–1	0 - 5.3' **FILL, SILT WITH GRAVEL:** (ML)g, very dark grayish brown (10YR 3/2), trace sand and roots, rounded to subangular fine gravel, noncohesive, nonplastic, dry.										
2 SS	24 10.5	4 6 5 3	2–3	2.5' increase in gravel content and gravel size to fine to coarse, coarse sand (5-15%), dry.	(FILL) (ML)g									
3 SS	24 19	2 3 9 10	5–6	5' moist. 5.3 - 20.2' **FILL, ASH (Coal):** very dark gray (10YR 3/1), mostly silt sized particles, few interbedded sand sized layers, trace coarse ash, noncohesive, nonplastic, moist to wet.										
4 SS	24 22	5 27 30 50 for 5"	7.5–9	7.5' black (10YR 2/1). 8.2' mostly medium sand-sized particles with some coarse sand to fine gravel-sized ash.	(FILL)									
5 SS	24 24	5 11 20 50 for 5"	10–11	10' mostly silt sized particles, trace fine gravel to coarse sand sized ash, trace fine sand sized ash.										
6	24	4 22	12–13											

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

Signature

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

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number 49

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
SS	24	26 24		5.3 - 20.2' **FILL, ASH (Coal):** very dark gray (10YR 3/1), mostly silt sized particles, few interbedded sand sized layers, trace coarse ash, noncohesive, nonplastic, moist to wet. *(continued)*										
			14											
7 SS	24 22	4 9 38 16	15	15' wet.										
			16	16.4' seam of sand-sized particles (2" thick).	(FILL)									
			17											
8 SS	10 7.5	22 50 for 4"	18	17.5' mostly sand sized particles, trace gravel, trace silt.										
			19											
9 SS	24 14	2 2 2 2	20	20.2 - 22.5' **LEAN CLAY:** CL, black (10YR 2/1), cohesive, medium plasticity, wet.	CL									
			21											
			22											
10 ST	24 0		23	22.5 - 24.5' Shelby Tube Sample. No Recovery.										ST10: 24" push at 150lbs of pressure. No Recovery.
			24											
11 SS	24 2	4 4 4 4	25	24.5 - 27.8' **LEAN CLAY:** CL, Low Recovery, trace gravel, cohesive, low plasticity, wet.	CL									
			26											
			27	27.5' very dark gray (10YR 3/1).										
12 SS	24 21.5	1 1 4 7	28	27.8 - 30' **SILTY SAND:** SM, mostly fine sand, coarse to fine gravel (5-15%), wet.	SM									
			29											
13 SS	24 14	6 15 18 14	30	30 - 45' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, yellowish brown (10YR 5/4), fine to medium sand, fine to coarse rounded to subangular gravel, silt decreasing to trace silt with depth (5-15%), trace clay, wet.	(SW)g									
			31											
14 SS	24 15	16 16 14 12	32											
			33	33.2' piece of gravel (2" diameter).										
15 SS	24 5	8 3 2	34	34' fine to coarse sand.										

SOIL BORING LOG INFORMATION SUPPLEMENT

Natural Resource Technology

Boring Number 49

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
		5	35	30 - 45' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, yellowish brown (10YR 5/4), fine to medium sand, fine to coarse rounded to subangular gravel, silt decreasing to trace silt with depth (5-15%), trace clay, wet. *(continued)*										
16 SS	24 9	3 3 4 11	36	36' increased gravel content with depth. 36.3' - 36.4' layer of increased clay content [15-30%].										
			37											
17 SS	24 18	11 10 8 22	38	38.3' trace very dark brown silt nodules (10YR 2/2).										
			39											
18 SS	24 14.5	9 16 15 16	40	40' trace very dark brown (10YR 2/2) and light brown (7.5YR 6/3) mottling.	(SW)g									
			41											
19 SS	24 17.5	12 21 21 17	42	42' no light brown (7.5YR 6/3) mottling.										
			43											
20 SS	12 9.5	10 14	44											
			45	45' End of Boring.										

Appendix B

Statistical Procedure for Background

APPENDIX B
STATISTICAL PROCEDURE FOR CALCULATION OF BACKGROUND
Hennepin Ash Pond No. 2 and No. 4
Groundwater Monitoring Plan
Hennepin Power Station, Putnam County, IL

Introduction

The purpose of the statistical calculations documented in this appendix is to define the procedure to determine the maximum background concentrations likely to occur upgradient of Hennepin Ash Pond No. 2 and No. 4 within sand and gravel aquifer. High predicted background concentrations relative to the Illinois Class I groundwater quality standards may suggest that downgradient concentrations for those parameters in groundwater are due to a background source.

The statistical analysis procedures used here are consistent with procedures described in the document: 2009 Unified Guidance. "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities—Unified Guidance," March 2009, EPA 530/R-09-2007 (USEPA, 2009).

Compliance Data Operations - Limit Calculations

Background concentrations were calculated using either a parametric upper tolerance limit (UTL), a parametric upper prediction limit (UPL) for a mean, or a non-parametric UPL for a median. Each statistical method chosen will complies with the performance standards, as appropriate, based on the test method used.

Table B-1 outlines the logic for calculation of limits.

As required in 40 CFR Part 257.93, statistical analyses were performed to determine whether a statistically significant increase over a background value has occurred for each constituent and at each well. Groundwater standards were determined for each parameter detected in the downgradient monitoring wells. Groundwater Standards used to determine exceedances in downgradient wells are located in the IAC Title 35, Part 620.410, Groundwater Quality Standards for Class I: Potable Resource Groundwater Standard unless; 1) the background concentration is greater than the established IEPA Standard or 2) the constituent does not have an established IEPA Standard, such as for calcium, lithium, and molybdenum. For these exceptions, the background concentrations were used to determine the applicable groundwater standard by using either a parametric upper tolerance limit (UTL), a parametric upper prediction limit (UPL) for a mean, or a non-parametric UPL for a median. Each statistical method chosen complies with the performance standards, as appropriate, based on the test method used. The full description of statistical methods and summary report for results is provided in Appendix B.

The UTL was used to calculate the groundwater standard when pooled background data were normally distributed, with a non-detect frequency of 15% or less. When non-detect frequency was 15% or less, half the RL was substituted for non-detects. The Unified Guidance recommends 95% confidence level and 95% coverage (95/95 tolerance interval). The non-detect data were replaced (simple substitution) with half the reporting limit (RL), and the normal mean and standard deviation were calculated. When the GWPS is based on an established IEPA Groundwater Standard, or a UTL derived from the background dataset, the confirmation of an exceedance in downgradient compliance wells relative to the GWPS was determined 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 downgradient data were handled similarly to upgradient analyses, with half the RL substituted for non-detects when the frequency is 15% or less. The Kaplan-Meier method was used when the detection frequency is between 15% and 50% to compute estimates of the mean and standard deviation adjusted for the presence of left-censored values. These estimates were then substituted for the sample mean and standard deviation. Once the groundwater standard was established for pooled background data, either parametric or non-parametric confidence intervals were computed for each constituent in downgradient wells to determine an exceedance.

The parametric UPL for a mean was used to calculate the groundwater standard if the pooled background data contain 50-70% non-detects, and normality could be achieved. The Kaplan-Meier or ROS methods were used to estimate the mean and standard deviation. An exceedance was deemed to have occurred at a compliance well when the *mean* calculated using the last three sampling events exceeded the UPL.

The non-parametric UPL for a median was used to calculate the groundwater standard if the pooled background data contain greater than 70% non-detects, and normality could not be achieved. An exceedance was deemed to have occurred at a compliance well when the *median* calculated using the last three sampling events exceeded the UPL. The last RL was used when for parameters with 100 percent non-detects in the background dataset.

If a significant trend was detected, in either background or downgradient data for a constituent, confidence bands accounting for trends were constructed to account for the trend-induced variation. Linear regression was used when background or downgradient data were approximately normally distributed, with a constant sample variance around the mean, and the frequency of non-detects was low. For background data, the upper confidence band (UCB) around the linear regression line was used as the groundwater standard for the trending constituent. And exceedance was confirmed when the lower confidence band (LCB) around the trend line in the downgradient data exceeded the background UCB used as the groundwater standard. The confidence bands around the Thiel-Sen trend line were similarly used as a non-parametric alternative to linear regression when trend residuals could not be normalized, or if there was a higher percentage of non-detects in either background or downgradient data.

Statistical Data Evaluation and Results

The input dataset for background calculations includes the monitoring data from monitoring wells 07, 08, and 08D following collection of 8 rounds, for a subset of the inorganic parameters listed in 35 IAC 620.410(a), as described in Section 4.1 of the Groundwater Monitoring Plan to which this Appendix is attached. All water quality data was stored, prepared, and statistically analyzed using MANAGES^{TM} Version 4.0 software (EPRI, 2017).

Exceedances of the groundwater standard occurred for the following wells and parameters:

- Lithium and Molybdenum at downgradient well 03R
- Lithium and Molybdenum at downgradient well 18D
- Boron, Lithium, and Molybdenum at downgradient well 18S
- Molybdenum at downgradient well 45S

The full statistical summary of downgradient well exceedances is attached, as well as a summary of the background water quality data for wells 07, 08, and 08D.

Table B-1. Statistical Analysis Flowchart

Significant Trend?	Background			Downgradient		
	% NDs	Distribution	GWPS Determination	% NDs	Distribution	Test to Determine SSL
No	0 ≤ 50%	Normal	MCL or The Upper Tolerance Limit	≤75%	Normal	Parametric Lower Confidence Interval around a Normal Mean
				≤75%	Log-Normal	Parametric Lower Confidence Interval around a Lognormal Geometric Mean
				NA	Non-Normal	Non-Parametric Lower Confidence Interval around a Median
				>75%	Unknown/Cannot be determined	
	50 ≤ 70%	Normal	The Upper Prediction Limit for a Mean	NA	NA	Mean of last 3 samples
	>70%	Non-Normal	Upper Prediction Limit for a Median	NA	NA	Median of last 3 samples
	100%	Non-Normal	Last reporting limit	NA	NA	Median of last 3 samples
Yes	0 ≤ 50%	Normal	UCL of Confidence Band around Linear Regression	≤75%	Residuals after subtracting trend are normal, equal variance	Lower Confidence Band around Linear Regression
	50 ≤ 100%	Non-Normal	UCL of Confidence Band around Thiel-Sen trend line	≤75%	Residuals not normal	Lower Confidence Band around Thiel-Sen

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Assessment Monitoring Summary

Location Id: **03R**

Background Data Information					Compliance Data Information											
Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
Run Id: 1		Parameter: As, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0100	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 2		Parameter: B, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	1.0426	2.0000	NO
Run Id: 3		Parameter: Ba, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	0.0561	2.0000	NO
Run Id: 4		Parameter: Be, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.000	0.004	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 5		Parameter: Ca, tot mg/L														
11/01/2015	10/01/2017	24	0.00	Y / Y	12/01/2015	06/30/2017	8	0	None	Y / Y	PARA TI	CI-Nrml Mean	LCL	80.787	296.717	NO
Background-based GWPS higher than limit-based GWPS.																
Run Id: 6		Parameter: Cd,tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	75	None	N / N	Class I	CI-NPAR	LCL	0.0010	0.0050	NO
Run Id: 7		Parameter: Cl, tot mg/L														
11/01/2015	10/01/2017	24	0.00	Y / N	12/01/2015	06/30/2017	8	0	None	Y / Y	PARA TI	CI-Nrml Mean	LCL	59.330	434.661	NO
Background-based GWPS higher than limit-based GWPS.																
Run Id: 8		Parameter: Co, tot mg/L														
12/01/2015	10/01/2017	24	33.33	N / N	02/01/2017	06/30/2017	3	0	N/A	---	NPPI	N/A	Median	0.0010	0.0385	NO

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Assessment Monitoring Summary

Location Id: **03R**

Background Data Information					Compliance Data Information											
Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL

Required number of background samples for non-parametric tolerance interval not met(24). Switched to Two Sample test.
Background-based GWPS higher than limit-based GWPS.

Run Id: 9 Parameter: Cr, tot mg/L

Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
---	---	---	---	---	12/01/2015	06/30/2017	8	88	None	N / N	Class I	CI-NPAR	LCL	0.0010	0.1000	NO

Run Id: 10 Parameter: F, tot mg/L

Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
---	---	---	---	---	12/01/2015	06/30/2017	8	0	Upward	Y / Y	Class I	CB-LinReg	LCB	0.28	4.00	NO

Trend & Residuals after subtracting trend are normal, with equal variance.

Run Id: 11 Parameter: Hg, tot mg/L

Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	N / Y	Class I	100%ND	LCL	0.0000	0.0020	NO

Confidence interval not calculated because all compliance data are non-detect.

Run Id: 12 Parameter: Li, tot mg/L

Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
11/01/2015	10/01/2017	24	0.00	N / Y	12/01/2015	06/30/2017	8	0	None	Y / Y	PARA TI	CI-Nrml Mean	LCL	0.0224	0.0187	YES

Background-based GWPS higher than limit-based GWPS.

Run Id: 13 Parameter: Mo, tot mg/L

Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
12/01/2015	10/01/2017	24	29.17	N / N	02/01/2017	06/30/2017	3	0	N/A	---	NPPI	N/A	Median	0.2200	0.0017	YES

Required number of background samples for non-parametric tolerance interval not met(24). Switched to Two Sample test.
Background-based GWPS higher than limit-based GWPS.

Run Id: 14 Parameter: Pb, tot mg/L

Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0075	NO

Confidence interval not calculated because all compliance data are non-detect.

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Assessment Monitoring Summary

Location Id: **03R**

Background Data Information					Compliance Data Information											
Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
Run Id: 15		Parameter: pH (field) STD														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	7.14	9.00	NO
Run Id: 16		Parameter: Ra-226,228, tot pCi/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	-0.075	5.000	NO
Run Id: 17		Parameter: Sb, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0060	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 18		Parameter: Se, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	Upward	Y / Y	Class I	CB-LinReg	LCB	0.0068	0.0500	NO
					Trend & Residuals after subtracting trend are normal, with equal variance.											
Run Id: 19		Parameter: SO4, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	86.218	400.000	NO
Run Id: 20		Parameter: TDS mg/L														
11/01/2015	10/01/2017	24	0.00	Y / Y	12/01/2015	06/30/2017	8	0	None	Y / Y	PARA TI	CI-Nrml Mean	LCL	457.570	1,622.659	NO
Background-based GWPS higher than limit-based GWPS.																
Run Id: 21		Parameter: Tl, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0020	NO
					Confidence interval not calculated because all compliance data are non-detect.											

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Assessment Monitoring Summary

Location Id: 18D

Background Data Information					Compliance Data Information											
Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
Run Id: 22		Parameter: As, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0100	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 23		Parameter: B, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	1.7447	2.0000	NO
Run Id: 24		Parameter: Ba, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	0.0815	2.0000	NO
Run Id: 25		Parameter: Be, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.000	0.004	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 26		Parameter: Ca, tot mg/L														
11/01/2015	10/01/2017	24	0.00	Y / Y	12/01/2015	06/30/2017	8	0	Downward	Y / Y	PARA TI	CB-LinReg	LCB	98.658	296.717	NO
Background-based GWPS higher than limit-based GWPS.					Trend & Residuals after subtracting trend are normal, with equal variance.											
Run Id: 27		Parameter: Cd,tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	75	None	N / N	Class I	CI-NPAR	LCL	0.0010	0.0050	NO
Run Id: 28		Parameter: Cl, tot mg/L														
11/01/2015	10/01/2017	24	0.00	Y / N	12/01/2015	06/30/2017	8	0	None	Y / Y	PARA TI	CI-Nrml Mean	LCL	74.363	434.661	NO
Background-based GWPS higher than limit-based GWPS.																
Run Id: 29		Parameter: Co, tot mg/L														
12/01/2015	10/01/2017	24	33.33	N / N	02/01/2017	06/30/2017	3	0	N/A	---	NPPI	N/A	Median	0.0072	0.0385	NO

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Assessment Monitoring Summary

Location Id: 18D

Background Data Information					Compliance Data Information											
Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
Required number of background samples for non-parametric tolerance interval not met(24). Switched to Two Sample test. Background-based GWPS higher than limit-based GWPS.																
Run Id: 30		Parameter: Cr, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.1000	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 31		Parameter: F, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	0.14	4.00	NO
Run Id: 32		Parameter: Hg, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	N / Y	Class I	100%ND	LCL	0.0000	0.0020	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 33		Parameter: Li, tot mg/L														
11/01/2015	10/01/2017	24	0.00	N / Y	12/01/2015	06/30/2017	8	0	None	Y / Y	PARA TI	CI-Nrml Mean	LCL	0.0282	0.0187	YES
Background-based GWPS higher than limit-based GWPS.																
Run Id: 34		Parameter: Mo, tot mg/L														
12/01/2015	10/01/2017	24	29.17	N / N	02/01/2017	06/30/2017	3	0	N/A	---	NPPI	N/A	Median	0.0314	0.0017	YES
Required number of background samples for non-parametric tolerance interval not met(24). Switched to Two Sample test. Background-based GWPS higher than limit-based GWPS.																
Run Id: 35		Parameter: Pb, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0075	NO
					Confidence interval not calculated because all compliance data are non-detect.											

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Assessment Monitoring Summary

Location Id: **18D**

Background Data Information					Compliance Data Information											
Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
Run Id: 36		Parameter: pH (field) STD														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	7.07	9.00	NO
Run Id: 37		Parameter: Ra-226,228, tot pCi/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	Upward	Y / Y	Class I	CB-LinReg	LCB	0.529	5.000	NO
					Trend & Residuals after subtracting trend are normal, with equal variance.											
Run Id: 38		Parameter: Sb, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0060	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 39		Parameter: Se, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0500	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 40		Parameter: SO4, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	122.732	400.000	NO
Run Id: 41		Parameter: TDS mg/L														
11/01/2015	10/01/2017	24	0.00	Y / Y	12/01/2015	06/30/2017	8	0	None	N / N	PARA TI	CI-NPAR	LCL	266.000	1,622.659	NO
Background-based GWPS higher than limit-based GWPS.																
Run Id: 42		Parameter: Tl, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0020	NO
					Confidence interval not calculated because all compliance data are non-detect.											

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Assessment Monitoring Summary

Location Id: **18S**

Background Data Information					Compliance Data Information											
Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
Run Id: 43		Parameter: As, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0100	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 44		Parameter: B, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	2.5881	2.0000	YES
Run Id: 45		Parameter: Ba, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	0.0624	2.0000	NO
Run Id: 46		Parameter: Be, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.000	0.004	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 47		Parameter: Ca, tot mg/L														
11/01/2015	10/01/2017	24	0.00	Y / Y	12/01/2015	06/30/2017	8	0	None	Y / Y	PARA TI	CI-Nrml Mean	LCL	85.824	296.717	NO
Background-based GWPS higher than limit-based GWPS.																
Run Id: 48		Parameter: Cd,tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	63	Downward	N / N	Class I	CB-LinReg	LCB	0.0004	0.0050	NO
					Trend & Residuals after subtracting trend are normal, with equal variance.											
Run Id: 49		Parameter: Cl, tot mg/L														
11/01/2015	10/01/2017	24	0.00	Y / N	12/01/2015	06/30/2017	8	0	None	Y / Y	PARA TI	CI-Nrml Mean	LCL	52.310	434.661	NO
Background-based GWPS higher than limit-based GWPS.																
Run Id: 50		Parameter: Co, tot mg/L														
12/01/2015	10/01/2017	24	33.33	N / N	02/01/2017	06/30/2017	3	0	N/A	---	NPPI	N/A	Median	0.0010	0.0385	NO

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Assessment Monitoring Summary

Location Id: **18S**

Background Data Information					Compliance Data Information											
Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
Required number of background samples for non-parametric tolerance interval not met(24). Switched to Two Sample test. Background-based GWPS higher than limit-based GWPS.																
Run Id: 51		Parameter: Cr, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	13	None	N / Y	Class I	CI-Log	LCL	0.0003	0.1000	NO
Run Id: 52		Parameter: F, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	0.11	4.00	NO
Run Id: 53		Parameter: Hg, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	N / Y	Class I	100%ND	LCL	0.0000	0.0020	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 54		Parameter: Li, tot mg/L														
11/01/2015	10/01/2017	24	0.00	N / Y	12/01/2015	06/30/2017	8	0	None	Y / Y	PARA TI	CI-Nrml Mean	LCL	0.0624	0.0187	YES
Background-based GWPS higher than limit-based GWPS.																
Run Id: 55		Parameter: Mo, tot mg/L														
12/01/2015	10/01/2017	24	29.17	N / N	02/01/2017	06/30/2017	3	0	N/A	---	NPPI	N/A	Median	0.3710	0.0017	YES
Required number of background samples for non-parametric tolerance interval not met(24). Switched to Two Sample test. Background-based GWPS higher than limit-based GWPS.																
Run Id: 56		Parameter: Pb, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0075	NO
					Confidence interval not calculated because all compliance data are non-detect.											

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Assessment Monitoring Summary

Location Id: **18S**

Background Data Information					Compliance Data Information											
Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
Run Id: 57		Parameter: pH (field) STD														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	7.24	9.00	NO
Run Id: 58		Parameter: Ra-226,228, tot pCi/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	N / N	Class I	CI-NPAR	LCL	0.000	5.000	NO
Run Id: 59		Parameter: Sb, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0060	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 60		Parameter: Se, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	0.0268	0.0500	NO
Run Id: 61		Parameter: SO4, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	N / Y	Class I	CI-Log	LCL	148.266	400.000	NO
Run Id: 62		Parameter: TDS mg/L														
11/01/2015	10/01/2017	24	0.00	Y / Y	12/01/2015	06/30/2017	8	0	None	Y / Y	PARA TI	CI-Nrml Mean	LCL	516.010	1,622.659	NO
Background-based GWPS higher than limit-based GWPS.																
Run Id: 63		Parameter: Tl, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0020	NO
					Confidence interval not calculated because all compliance data are non-detect.											

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Assessment Monitoring Summary

Location Id: **45S**

Background Data Information					Compliance Data Information											
Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
Run Id: 64		Parameter: As, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0100	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 65		Parameter: B, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	0.3892	2.0000	NO
Run Id: 66		Parameter: Ba, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	0.0630	2.0000	NO
Run Id: 67		Parameter: Be, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.000	0.004	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 68		Parameter: Ca, tot mg/L														
11/01/2015	10/01/2017	24	0.00	Y / Y	12/01/2015	06/30/2017	8	0	None	Y / Y	PARA TI	CI-Nrml Mean	LCL	86.970	296.717	NO
Background-based GWPS higher than limit-based GWPS.																
Run Id: 69		Parameter: Cd,tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	0.0013	0.0050	NO
Run Id: 70		Parameter: Cl, tot mg/L														
11/01/2015	10/01/2017	24	0.00	Y / N	12/01/2015	06/30/2017	8	0	None	Y / Y	PARA TI	CI-Nrml Mean	LCL	67.910	434.661	NO
Background-based GWPS higher than limit-based GWPS.																
Run Id: 71		Parameter: Co, tot mg/L														
12/01/2015	10/01/2017	24	33.33	N / N	02/01/2017	06/30/2017	3	0	N/A	---	NPPI	N/A	Median	0.0042	0.0385	NO

Hennepin

Assessment Monitoring Summary

Location Id: **45S**

Background Data Information					Compliance Data Information											
Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
Required number of background samples for non-parametric tolerance interval not met(24). Switched to Two Sample test. Background-based GWPS higher than limit-based GWPS.																
Run Id: 72		Parameter: Cr, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	88	None	N / N	Class I	CI-NPAR	LCL	0.0010	0.1000	NO
Run Id: 73		Parameter: F, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	0.31	4.00	NO
Run Id: 74		Parameter: Hg, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	N / Y	Class I	100%ND	LCL	0.0000	0.0020	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 75		Parameter: Li, tot mg/L														
11/01/2015	10/01/2017	24	0.00	N / Y	12/01/2015	06/30/2017	8	0	None	Y / Y	PARA TI	CI-Nrml Mean	LCL	0.0148	0.0187	NO
Background-based GWPS higher than limit-based GWPS.																
Run Id: 76		Parameter: Mo, tot mg/L														
12/01/2015	10/01/2017	24	29.17	N / N	02/01/2017	06/30/2017	3	0	N/A	---	NPPI	N/A	Median	0.0883	0.0017	YES
Required number of background samples for non-parametric tolerance interval not met(24). Switched to Two Sample test. Background-based GWPS higher than limit-based GWPS.																
Run Id: 77		Parameter: Pb, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	88	None	Y / N	Class I	CI-NPAR	LCL	0.0010	0.0075	NO

Hennepin

Assessment Monitoring Summary

Location Id: **45S**

Background Data Information					Compliance Data Information											
Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL
Run Id: 78		Parameter: pH (field) STD														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	7.05	9.00	NO
Run Id: 79		Parameter: Ra-226,228, tot pCi/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	0.338	5.000	NO
Run Id: 80		Parameter: Sb, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0060	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 81		Parameter: Se, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0500	NO
					Confidence interval not calculated because all compliance data are non-detect.											
Run Id: 82		Parameter: SO4, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	0	None	Y / Y	Class I	CI-Nrml Mean	LCL	73.984	400.000	NO
Run Id: 83		Parameter: TDS mg/L														
11/01/2015	10/01/2017	24	0.00	Y / Y	12/01/2015	06/30/2017	8	0	None	Y / Y	PARA TI	CI-Nrml Mean	LCL	492.997	1,622.659	NO
Background-based GWPS higher than limit-based GWPS.																
Run Id: 84		Parameter: Tl, tot mg/L														
---	---	---	---	---	12/01/2015	06/30/2017	8	100	None	Y / N	Class I	100%ND	LCL	0.0000	0.0020	NO
					Confidence interval not calculated because all compliance data are non-detect.											

Hennepin

Assessment Monitoring Summary

Location Id: **45S**

Background Data Information					Compliance Data Information											
Start	End	Count	Percent ND	Normal/ Lognormal	Start	End	Count	Percent ND	Trend	Normal/ Lognormal	GWPS Basis	Comparison Test	Compare To	Comparison Value	GWPS	SSL

UCL - Upper Confidence Level Value
UCB - Upper Confidence Band Value at Last Sample Date
LCL - Lower Confidence Level Value
LCB - Lower Confidence Band Value at Last Sample Date
Mean - Compliance Data Mean
Median - Compliance Data Median
Each - When background is based on Last, Median, Minimum Detection Limit
PARA TI - Parametric Tolerance Interval
NPARA TI - Non Parametric Tolerance Interval
CI-Nrml - Confidence Interval around Normal Mean
CI-Log - Confidence Interval around Log Normal Mean
CI-NPARA - Non Parametric Confidence Interval around Median
CB-LinReg - Confidence Band around Linear Regression
CB-TheilSen - Confidence Band around Theil-Sen line

Hennepin
Statistical Summary for Pooled Locations

User Supplied Information

Date Range: 12/08/2015 to 10/01/2017 **Option for LT Pts:** **x 1.00**

Pooled Locations: **07,08,08D**

Parameter	Units	Count	Mean	Median	Maximum	Minimum	Std Dev	Sen Slope Units/yr	Normal / Log Normal	% of Non-Detects
As, tot	mg/L	24	0.0010	0.0010	0.0010	0.0010	0.0000	0.0000	No / No	100.00
B, tot	mg/L	24	0.0990	0.1001	0.1420	0.0544	0.0279	0.0486	Yes / Yes	0.00
Ba, tot	mg/L	24	0.1368	0.1300	0.2300	0.0992	0.0324	0.0189	No / Yes	0.00
Be, tot	mg/L	24	0.001	0.001	0.001	0.001	0.000	0.000	No / No	100.00
Ca, tot	mg/L	24	185.292	179.500	299.000	118.000	48.251	23.778	Yes / Yes	0.00
Cd,tot	mg/L	24	0.0011	0.0010	0.0023	0.0010	0.0003	0.0000	No / No	87.50
Cl, tot	mg/L	24	182.208	205.500	366.000	46.000	109.320	126.571	No / No	0.00
Co, tot	mg/L	24	0.0089	0.0035	0.0385	0.0010	0.0100	0.0105	No / No	33.33
Cr, tot	mg/L	24	0.0010	0.0010	0.0010	0.0010	0.0000	0.0000	No / No	95.83
F, tot	mg/L	24	0.102	0.100	0.120	0.100	0.006	0.000	No / No	58.33
Hg, tot	mg/L	24	0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	No / No	100.00
Li, tot	mg/L	24	0.0110	0.0095	0.0171	0.0079	0.0029	0.0032	No / No	0.00
Mo, tot	mg/L	24	0.0012	0.0013	0.0017	0.0010	0.0002	0.0000	No / No	29.17
Pb, tot	mg/L	24	0.0010	0.0010	0.0015	0.0010	0.0001	0.0000	No / No	95.83
pH (field)	STD	24	6.784	6.740	7.500	6.590	0.193	-0.082	No / No	0.00
Ra-226,228,	pCi/L	24	0.717	0.765	1.410	0.120	0.342	0.141	Yes / No	0.00
Sb, tot	mg/L	24	0.0010	0.0010	0.0010	0.0010	0.0000	0.0000	No / No	100.00
Se, tot	mg/L	24	0.0010	0.0010	0.0014	0.0010	0.0001	0.0000	No / No	79.17
SO4, tot	mg/L	24	120.375	123.500	209.000	66.000	40.804	11.171	Yes / Yes	0.00
TDS	mg/L	24	980.167	1,055.000	1,370.000	536.000	278.220	250.974	No / No	0.00
Tl, tot	mg/L	24	0.0010	0.0010	0.0010	0.0010	0.0000	0.0000	No / No	100.00

Shapiro-Wilk Normality test performed at 0.05 significance level.

Appendix C

Groundwater Quality Monitoring Data

Appendix C1

IEPA Program Monitoring Results

Appendix C1: Illinois EPA Program Monitoring Results
Inorganic Parameters - Downgradient Wells
Groundwater Monitoring Plan
Ash Pond No. 2, Hennepin Power Station

Legend:
Value exceeds 35 IAC 620 Class I groundwater standard
Value below detection limit

Well No	sample date	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Chloride, total (mg/L)	Chloride, dissolved (mg/L)	Sulfate, total (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Fluoride, total (mg/L)	Boron, dissolved (mg/L)	Boron, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	pH (field) (SU)	Residue, total filtrable (mg/L)
3	3/26/2008									1.1						7.15	
3	5/15/2008									0.93						7	
3	8/25/2008									1.5						6.9	
3	10/27/2008									1.2						6.85	
3	12/29/2008	9.94	0.056							0.935	0.956	0.388	0.044	0.01	0.013		633
3	12/29/2008			88	97	79	80	0.148	0.152							7.12	
3	3/25/2009	7.49	0.07							0.822	0.872	0.109	0.035	0.008	0.006		
3	3/25/2009			80	75	90	90.3	0.12	0.11							6.91	635
3	6/18/2009	14.70	0.098							0.766	0.804	8.9	0.052	0.3	0.009		
3	6/18/2009			92	92.6	109	117.2	0.133	0.105							6.72	735
3	9/29/2009	8.84	0.044							1.23	1.31	0.158	0.025	0.012	0.005		
3	9/29/2009			62	89	109	109.1	0.162	0.194							7.15	627
3	12/22/2009	8.86	0.056							0.706	0.724	0.034	0.02	0.007	0.006		
3	12/22/2009			82	83	95	94.7	0.099	0.089							6.5	596
3	3/16/2010	9.62	0.043							0.725	0.769	0.129	0.028	0.007	0.006		
3	3/16/2010			103	99.2	86	93.6	0.081	0.098							7.23	568
3	6/7/2010		0.124														
3	8/31/2010	11.00	0.052	89		130		0.14		1.1			0.025		0.006	7.11	690
3	12/28/2010	10.00	0.1	100		100		0.16		0.73			0.045		0.01	7.11	710
3	3/16/2011									0.73						7.13	
3	6/29/2011	13.00	0.06		97		100	0.138		0.58			0.025		0.01	7.02	710
3	8/23/2011	13.00	0.048		79		140	0.141		0.99			0.028		0.01	6.79	700
3	10/18/2011	9.10	0.045		77		130	0.106		1.1			0.025		0.009	6.92	690
3	3/1/2012	11.00	0.069		120		110	0.124		0.54			0.036		0.012	7.23	730
3	5/30/2012	8.60	0.058		110		100	0.128		0.67			0.028		0.011	6.73	730
3	8/29/2012	7.10	0.063		110		120	0.138		0.93			0.03		0.009	7.13	730
3	11/27/2012	9.16	0.075		94		109	0.14		0.826			0.046		0.014	7.26	714
3	3/7/2013	10.80	0.072		104		110	0.14		0.561			0.049		0.016	7.13	734
3	6/6/2013	9.23	0.045		88		78	0.15		0.632			0.053		0.009	7.23	628
3	9/3/2013	6.96	0.045		73		188	0.16		1.26			0.039		0.009	7.2	758
3	12/11/2013	10.30	0.034		78		65	0.14		1.04			0.033		0.009	7.2	744
3	3/26/2014	8.32	0.027		69		87	0.11		0.863			0.034		0.008	7.11	632
3	6/17/2014	6.90	0.032		88		108	0.18		0.721			0.029		0.01	7.98	728
3	8/20/2014	9.71	0.021		75		142	0.19		1.16			0.024		0.009	7.17	644
03R	3/18/2015	2.78	0.007		77		93	0.23		0.947			0.02		0.017	7.29	556
03R	6/23/2015	3.07	0.007		69		113	0.26		0.866			0.02		0.01	7.28	518
03R	9/16/2015	4.61	0.007		77		131	0.27		1.56			0.02		0.006	7.23	560
03R	12/9/2015	3.50	0.007		71		84	0.25		1.18			0.02		0.005	7.23	572
03R	3/9/2016	1.83	0.007		72		122	0.26		1.3			0.02		0.005	7.26	476
03R	6/8/2016	3.42	0.005		77		108	0.3		1.33			0.02		0.005	7.27	562
03R	8/31/2016	3.66	0.005		89		100	0.26		0.938			0.02		0.005	7.5	476
03R	12/8/2016	2.31	0.005		67		95	0.29		1.24			0.02		0.005	7.25	464
6	3/26/2008									0.69						6.98	
6	5/15/2008									0.59						6.91	
6	8/25/2008									1.1						6.77	
6	10/27/2008									0.71						6.41	
6	12/29/2008	13.30	0.102							1.02	1.05	0.081	0.053	0.005	0.005	6.66	
6	12/29/2008			77	77	126	139	0.159	0.167								736
6	3/25/2009	9.33	0.098							0.724	0.736	0.058	0.046	0.005	0.005		
6	3/25/2009			101	96	103	98.8		0.142							6.74	692
6	6/18/2009	18.00	0.121							0.644	0.672	0.158	0.055	0.005	0.005		
6	6/18/2009			118	119.1	138	144.4	0.18	0.161							6.57	794
6	9/29/2009	9.91	0.065							1.17	1.24	0.066	0.036	0.005	0.005		
6	9/29/2009			73	94.7	128	124.4	0.199	0.224							6.98	674
6	12/22/2009	10.20	0.101							0.761	0.796	0.078	0.037	0.005	0.005		
6	12/22/2009			116	113	110	109	0.119	0.119							6.86	699
6	3/16/2010	12.00	0.108							0.653	0.739	0.076	0.042	0.005	0.005		
6	3/16/2010			121	118.9	122	120.5	0.11	0.124							6.99	735
6	6/7/2010		0.051														
6	8/31/2010	16.00	0.061	100		160		0.18		0.75			0.025		0.005	6.89	750
6	12/28/2010	11.00	0.093	110		120		0.2		0.72			0.046		0.005	6.97	760
6	3/16/2011									0.63						6.98	
6	6/29/2011	13.00	0.064		109		120	0.193		0.55			0.031		0.005	6.79	740
6	8/23/2011	13.00	0.054		79		150	0.195		0.72			0.03		0.005	6.61	730
6	10/18/2011	13.00	0.059		91		130	0.143		0.9			0.028		0.005	6.61	730
6	3/1/2012	7.40	0.067		130		120	0.171		0.57			0.03		0.005	7.3	760
6	5/30/2012	7.80	0.077		120		120	0.195		0.58			0.033		0.005	6.66	770

Natural Resource Technology AN OBG COMPANY

Appendix C1: Illinois EPA Program Monitoring Results
Inorganic Parameters - Downgradient Wells
Groundwater Monitoring Plan
Ash Pond No. 2, Hennepin Power Station

Legend:
Value exceeds 35 IAC 620 Class I groundwater standard
Value below detection limit

Well No	sample date	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Chloride, total (mg/L)	Chloride, dissolved (mg/L)	Sulfate, total (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Fluoride, total (mg/L)	Boron, dissolved (mg/L)	Boron, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	pH (field) (SU)	Residue, total filtrable (mg/L)
6	8/29/2012	8.50	0.083		120		120	0.168		0.6			0.037		0.005	6.96	760
6	11/27/2012	9.79	0.076		115		112	0.21		0.62			0.05		0.005	7.19	752
6	3/7/2013	11.20	0.066		108		118	0.22		0.508			0.058		0.005	7.1	750
6	6/6/2013	9.94	0.067		108		88	0.21		0.41			0.05		0.005	7.15	754
6	9/3/2013	11.60	0.053		84		154	0.24		0.812			0.039		0.005	7.07	876
6	12/11/2013	10.60	0.031		76		110	0.21		0.884			0.026		0.005	7.18	688
6	3/26/2014	9.15	0.039		93		94	0.18		0.685			0.03		0.005	6.97	680
6	6/17/2014	7.84	0.045		112		125	0.26		0.552			0.034		0.005	7.39	802
6	8/20/2014	9.03	0.031		92		184	0.23		0.84			0.027		0.005	7.01	748
6	12/9/2014	3.99	0.007		85		86	0.27		0.418			0.02		0.005	7.09	562
6	3/18/2015	4.27	0.007		80		79	0.28		0.428			0.02		0.005	7.27	480
6	3/19/2015	11.00	0.007		46		61	0.1		0.059			0.02		0.005	7.26	564
6	6/22/2015	5.23	0.007		52		46	0.32		0.292			0.02		0.005	7.19	364
6	9/16/2015	5.97	0.007		82		103	0.31		0.639			0.02		0.005	7.32	546
6	12/9/2015	3.79	0.007		73		69	0.32		0.47			0.02		0.005	7.03	510
6	3/9/2016	4.35	0.007		80		93	0.32		0.551			0.02		0.005	7.2	512
6	6/8/2016	4.79	0.015		99		103	0.37		0.458			0.02		0.005	7.32	610
6	8/31/2016	5.20	0.006		93		89	0.34		0.417			0.02		0.005	7.2	526
6	12/8/2016	3.25	0.005		64		66	0.39		0.354			0.02		0.005	6.88	482
18D	6/18/2009	10.60	0.167							3.51	3.76	7.49	0.082	0.827	0.659		
18D	6/18/2009			93	94.9	169	180.2	0.152	0.141							6.79	737
18D	9/29/2009	7.95	0.161							3.5	4.03	0.644	0.064	0.313	0.281		
18D	9/29/2009			81	97.4	164	162	0.182	0.207							7.15	756
18D	12/22/2009	7.52	0.165							3.37	3.69	0.208	0.058	0.299	0.255		
18D	12/22/2009			98	97	152	154	0.099	0.103							6.5	696
18D	3/16/2010	3.37	0.053							1.38	1.11	0.561	0.025	0.082	0.079		
18D	3/16/2010			31	48.4	63	83.5	0.088	0.093							7.26	474
18D	6/7/2010		0.078														
18D	8/31/2010	4.70	0.112	79		150		0.16		3.2			0.043		0.18	7.04	730
18D	12/28/2010	5.90	0.09	98		160		0.17		3.5			0.055		0.21	7.19	640
18D	6/29/2011	1.50	0.008		20		68	0.126		1.3			0.069		0.12	7.22	400
18D	8/23/2011	4.20	0.059		57		150	0.187		2.8			0.044		0.16	7.09	610
18D	10/18/2011	5.80	0.072		71		160	0.138		2.9			0.045		0.23	6.98	680
18D	3/1/2012	5.00	0.007		83		160	0.158		2.9			0.027		0.19	7.27	640
18D	5/30/2012	4.50	0.046		72		130	0.171		2.3			0.025		0.13	6.84	600
18D	8/29/2012	4.60	0.044		80		150	0.16		2.7			0.046		0.2	7.1	670
18D	11/27/2012	6.50	0.068		81		134	0.15		2.17			0.038		0.171	7.2	720
18D	3/7/2013	5.54	0.06		74		139	0.16		1.75			0.047		0.09	7.13	592
18D	6/6/2013	5.30	0.076		75		105	0.16		1.69			0.032		0.149	7.16	696
18D	9/3/2013	4.02	0.038		72		135	0.2		2.23			0.033		0.186	7.38	718
18D	12/11/2013	5.77	0.049		68		162	0.16		2.6			0.023		0.181	7.28	618
18D	3/26/2014	0.27	0.007		11		40	0.1		1.96			0.025		0.011	7.18	252
18D	6/17/2014	2.76	0.046		66		123	0.17		2.2			0.079		0.291	7.58	750
18D	8/20/2014	5.30	0.053		74		140	0.16		2.18			0.092		0.212	7.12	728
18D	3/18/2015	3.65	0.011		83		134	0.16		1.86			0.024		0.124	7.16	702
18D	6/23/2015	4.06	0.039		84		115	0.14		1.58			0.026		0.077	7.1	640
18D	9/16/2015	4.71	0.039		80		138	0.15		1.94			0.038		0.156	7.19	648
18D	12/9/2015	4.23	0.037		82		132	0.14		1.73			0.022		0.107	7.2	650
18D	3/9/2016	3.88	0.03		84		134	0.14		1.79			0.025		0.131	7.17	622
18D	6/8/2016	3.46	0.027		82		141	0.16		1.95			0.028		0.164	7.17	672
18D	8/31/2016	2.89	0.027		86		136	0.14		1.76			0.02		0.103	7.43	654
18D	12/8/2016	2.41	0.026		85		143	0.17		1.9			0.025		0.158	7.16	592
18S	6/18/2009	11.50	0.101							2.33	2.51	1.19	0.059	0.101	0.054		
18S	6/18/2009			95	93.3	170	164.1	0.109	0.097							6.73	770
18S	9/29/2009	8.17	0.067							2.97	3.17	0.955	0.039	0.072	0.037		
18S	9/29/2009			77	92.4	178	170.8	0.142	0.15							7.15	719
18S	12/22/2009	8.30	0.066							2.99	3.19	0.233	0.022	0.047	0.033		
18S	12/22/2009			89	89	169	166	0.077	0.079							6.8	679
18S	3/16/2010	7.46	0.038							2.43	2.59	0.199	0.021	0.029	0.021		
18S	3/16/2010			103	103.4	113	105.8	0.079	0.08							7.23	586
18S	6/7/2010		0.048														
18S	8/31/2010	10.00	0.039	89		220		0.12		3.6			0.025		0.017	7.18	840
18S	12/28/2010	8.60	0.082	110		150		0.13		2.2			0.036		0.027	7.08	740
18S	6/29/2011	9.60	0.055		98		190	0.1		2.5			0.03		0.025	6.98	760
18S	8/23/2011	8.90	0.048		79		210	0.139		3.4			0.046		0.13	6.93	780
18S	10/18/2011	9.50	0.049		83		190	0.104		2.9			0.031		0.024	6.83	770
18S	3/1/2012	7.00	0.062		110		130	0.116		1.6			0.029		0.023	7.22	740

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Appendix C1: Illinois EPA Program Monitoring Results
Inorganic Parameters - Downgradient Wells
Groundwater Monitoring Plan
Ash Pond No. 2, Hennepin Power Station

Legend:
Value exceeds 35 IAC 620 Class I groundwater standard (pink)
Value below detection limit (blue)

Well No	sample date	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Chloride, total (mg/L)	Chloride, dissolved (mg/L)	Sulfate, total (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Fluoride, total (mg/L)	Boron, dissolved (mg/L)	Boron, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	pH (field) (SU)	Residue, total filtrable (mg/L)
18S	5/30/2012	7.20	0.05		110		170	0.135		2.4			0.025		0.021	6.78	750
18S	8/29/2012	7.00	0.056		100		130	0.124		1.9			0.025		0.024	7.04	740
18S	11/27/2012	8.71	0.06		93		136	0.13		2.03			0.031		0.024	7.23	762
18S	3/7/2013	9.94	0.074		98		141	0.15		1.45			0.079		0.027	7.14	738
18S	6/6/2013	7.33	0.025		61		129	0.15		2.92			0.036		0.012	7.3	648
18S	9/3/2013	8.71	0.048		77		224	0.16		4.38			0.029		0.017	7.1	930
18S	12/11/2013	8.08	0.041		77		188	0.15		2.97			0.03		0.016	7.23	750
18S	3/26/2014	8.26	0.031		76		134	0.1		2.39			0.043		0.016	7.12	702
18S	6/17/2014	8.43	0.028		77		186	0.15		2.81			0.03		0.016	7.45	858
18S	8/20/2014	9.63	0.025		77		192	0.14		3.24			0.023		0.014	7.17	790
18S	3/18/2015	4.77	0.026		74		161	0.13		2.87			0.02		0.009	7.31	644
18S	6/23/2015	3.84	0.007		72		159	0.13		3.01			0.02		0.009	7.33	634
18S	9/16/2015	4.71	0.007		64		238	0.14		5.34			0.02		0.007	7.4	640
18S	12/9/2015	4.40	0.007		74		163	0.15		3.46			0.02		0.007	7.47	538
18S	3/9/2016	4.23	0.007		71		206	0.14		4.44			0.02		0.007	7.37	628
18S	6/8/2016	3.80	0.005		67		213	0.15		4.56			0.02		0.006	7.58	660
18S	8/31/2016	3.92	0.005		69		188	0.12		4.57			0.02		0.005	7.5	668
18S	12/8/2016	3.11	0.005		71		180	0.15		3.49			0.02		0.008	7.28	546
Class I Standard	--	10.00	2	200	200	400	400	4	4	2	2	5	5	0.15	0.15	9	1200
Class I Standard (pH Lower Limit)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.5	--
# of Exceedances	--	22	0	0	0	0	0	0	0	40	7	2	0	4	17	0	0
# of Exceedances (pH Lower Limit)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--
Minimum Value	--	0.27	0.005	31	11	63	40	0.077	0.079	0.059	0.67	0.034	0.02	0.005	0.005	6.41	252
Maximum Value	--	18.00	0.17	121	130	220	238	0.39	0.22	5.34	4.03	8.90	0.09	0.83	0.66	7.98	930
# of Samples Analyzed	--	118	122	28	110	28	110	117	20	128	20	20	118	20	118	128	118

Appendix C1: Illinois EPA Program Monitoring Results
Inorganic Parameters - Upgradient Wells
Groundwater Monitoring Plan
Ash Pond No. 2, Hennepin Power Station

Legend:
- (pink) Value exceeds 35 IAC 620 Class I groundwater standard
- (blue) Value below detection limit

Well No.	sample date	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Chloride, total (mg/L)	Chloride, dissolved (mg/L)	Sulfate, total (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Fluoride, total (mg/L)	Boron, dissolved (mg/L)	Boron, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	pH (field) (SU)	Residue, total filtrable (mg/L)
7	3/27/2008									0.05						6.89	
7	5/15/2008									0.05						6.7	
7	8/25/2008									0.05						6.54	
7	10/27/2008									0.052						6.51	
7	12/29/2008	9.54	0.007							0.04	0.04	0.026	0.02	0.005	0.01		615
7	12/29/2008			30	33	67	71	0.113	0.115							6.52	
7	3/25/2009	9.21	0.007							0.041	0.046	0.02	0.02	0.005	0.005		
7	3/25/2009			33	31	61	63.6	0.091	0.086							6.74	638
7	6/18/2009	9.70	0.007							0.036	0.037	0.658	0.02	0.031	0.005		
7	6/18/2009			35	36.8	64	62	0.101	0.089							6.3	680
7	9/29/2009	9.63	0.007							0.035	0.038	0.063	0.02	0.005	0.005		
7	9/29/2009			33	46.3	75	72.2	0.121	0.147							6.66	628
7	12/29/2009	10.40	0.007							0.048	0.051	0.046	0.02	0.005	0.005		
7	12/29/2009			42	42	75	76.5	0.078	0.073							7	624
7	3/16/2010	10.50	0.007							0.052	0.058	0.021	0.02	0.005	0.005		
7	3/16/2010			43	41.4	76	71.5	0.07	0.081							6.82	587
7	6/7/2010		0.007														
7	8/31/2010	11.00	0.007	29		85		0.1		0.05			0.025		0.005	6.57	660
7	12/29/2010	6.80	0.007	46		80		0.13		0.05			0.025		0.005	6.98	790
7	3/16/2011									0.054						6.92	
7	6/29/2011	7.50	0.007		37		94	0.1		0.05			0.025		0.005	6.85	660
7	8/24/2011	14.00	0.007		29		94	0.128		0.05			0.025		0.005	6.58	660
7	10/19/2011	8.10	0.007		27		170	0.088		0.05			0.025		0.005	6.61	700
7	3/1/2012	13.00	0.007		41		89	0.106		0.05			0.025		0.005	6.9	560
7	5/31/2012	12.00	0.007		39		78	0.122		0.05			0.025		0.005	7.16	610
7	8/29/2012	12.00	0.007		35		80	0.107		0.05			0.025		0.005	6.84	650
7	11/27/2012	12.20	0.007		34		101	0.12		0.052			0.02		0.005	7.15	672
7	3/7/2013	9.62	0.007		30		118	0.12		0.045			0.02		0.005	7.02	588
7	6/6/2013	10.30	0.009		36		63	0.13		0.026			0.02		0.005	7.04	576
7	9/4/2013	6.15	0.007		18		61	0.13		0.034			0.02		0.005	7.19	692
7	12/11/2013	8.23	0.008		25		56	0.1		0.037			0.02		0.005	7.24	592
7	3/26/2014	7.51	0.007		22		49	0.1		0.043			0.02		0.005	6.96	576
7	6/18/2014	6.48	0.007		21		57	0.12		0.037			0.02		0.005	7.22	674
7	8/20/2014	11.00	0.007		38		63	0.1		0.037			0.02		0.005	6.81	670
7	12/9/2014	10.20	0.007		48		67	0.1		0.052			0.02		0.005	6.89	718
7	3/19/2015	7.44	0.007		47		68	0.1		0.056			0.02		0.005	7.06	638
7	6/23/2015	7.35	0.007		53		69	0.11		0.067			0.02		0.005	6.78	552
7	9/17/2015	7.92	0.007		43		69	0.12		0.059			0.02		0.005	7.06	560
7	12/9/2015	7.89	0.007		44		76	0.11		0.068			0.02		0.005	6.99	662
7	3/10/2016	9.21	0.007		47		69	0.1		0.055			0.02		0.005	6.9	504
7	6/8/2016	14.20	0.005		57		77	0.11		0.07			0.02		0.005	6.64	728
7	9/1/2016	9.65	0.005		49		71	0.1		0.066			0.02		0.005	6.94	572
7	12/9/2016	14.80	0.005		62		89	0.1		0.067			0.02		0.005	6.75	682
8	3/26/2008									0.14						6.83	
8	5/15/2008									0.095						6.68	
8	8/25/2008									0.099						6.49	
8	10/27/2008									0.083						6.53	
8	12/29/2008	8.31	0.007							0.078	0.079	0.02	0.02	0.005	0.005		779
8	12/29/2008			80	83	83	79	0.114	0.117							6.64	
8	3/25/2009	6.92	0.007							0.081	0.087	0.02	0.02	0.005	0.005		
8	3/25/2009			109	107	84	82.2	0.094	0.09							6.5	800
8	6/18/2009	4.24	0.01							0.054	0.055	0.169	0.02	0.005	0.005		
8	6/18/2009			32	32.2	82	88.6	0.107	0.098							6.27	718
8	9/29/2009	6.81	0.009							0.071	0.075	0.033	0.02	0.005	0.005		
8	9/29/2009			66	82.7	117	117.5	0.123	0.146							6.6	822
8	12/29/2009	9.58	0.023							0.113	0.116	0.021	0.02	0.005	0.005		
8	12/29/2009			140	140	140	134	0.078	0.074							7.07	945
8	3/16/2010	7.91	0.022							0.086	0.096	0.024	0.02	0.005	0.005		
8	3/16/2010			131	130.6	113	116.1	0.071	0.079							6.74	856
8	6/7/2010		0.029														
8	8/31/2010	7.20	0.011	65		110		0.11		0.055			0.025		0.005	6.49	750
8	12/29/2010	7.40	0.007	170		130		0.12		0.097			0.025		0.005	6.72	860
8	3/16/2011	8.90	0.008			110		0.13		0.14						6.83	1100
8	6/29/2011	2.60	0.026	120	130	110	130	0.1	0.1	0.11	0.1	0.025	0.025		0.005	6.76	980
8	8/24/2011	6.30	0.017		100		110	0.126		0.077			0.025		0.005	6.98	860
8	10/19/2011	8.10	0.007		170		130	0.09		0.087			0.025		0.005	6.56	950
8	3/1/2012	7.70	0.009		210		120	0.106		0.11			0.025		0.005	6.95	960
8	5/30/2012	8.30	0.007	190	220	130	120	0.121	0.134	0.11	0.12	0.025	0.025		0.005	6.68	1100

Appendix C1: Illinois EPA Program Monitoring Results
Inorganic Parameters - Upgradient Wells
Groundwater Monitoring Plan
Ash Pond No. 2, Hennepin Power Station

Legend:
- (pink) Value exceeds 35 IAC 620 Class I groundwater standard
- (blue) Value below detection limit

Well No.	sample date	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Chloride, total (mg/L)	Chloride, dissolved (mg/L)	Sulfate, total (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Fluoride, total (mg/L)	Boron, dissolved (mg/L)	Boron, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	pH (field) (SU)	Residue, total filtrable (mg/L)
8	8/29/2012	9.60	0.008		280		120	0.107		0.12			0.025		0.005	6.71	1100
8	11/27/2012	10.60	0.012		321		155	0.1		0.13			0.02		0.005	6.99	1230
8	3/7/2013	12.20	0.008		351		149	0.11		0.148			0.02		0.005	7.02	1200
8	6/6/2013	3.26	0.007	92	89	73	67	0.16	0.15	0.113	0.126	0.025	0.02		0.005	7.75	832
8	9/3/2013	7.41	0.007		186		127	0.12		0.087			0.02		0.005	7.05	1100
8	12/11/2013	9.66	0.015		220		118	0.12		0.111			0.02		0.005	7.06	996
8	3/26/2014	9.70	0.008		173		105	0.1		0.139			0.02		0.005	7.15	968
8	6/18/2014	7.04	0.008	127	129	137	120	0.12	0.11	0.095	0.09	0.031	0.02		0.005	7.08	958
8	8/20/2014	7.34	0.017		146		164	0.1		0.096			0.02		0.005	6.8	1010
8	12/9/2014	15.90	0.08		228		218	0.1		0.095			0.026		0.005	6.78	1230
8	3/19/2015	9.01	0.011		216		120	0.1		0.113			0.02		0.005	6.9	1110
8	6/22/2015	7.20	0.024	269	245	108	107	0.1	0.1	0.124	0.141	0.034	0.02		0.003	6.74	1080
8	9/16/2015	8.56	0.021		162		145	0.1		0.093			0.02		0.005	6.84	978
8	12/8/2015	14.60	0.066		220		177	0.1		0.116			0.023		0.005	6.82	1080
8	3/10/2016	10.20	0.04		142		141	0.1		0.077			0.02		0.005	6.73	896
8	6/7/2016	6.68	0.034	170	178	129	142	0.1	0.1	0.081	0.089	0.044	0.02		0.003	6.6	1030
8	9/1/2016	17.30	0.1		304		196	0.1		0.117			0.034		0.005	6.69	1420
8	12/9/2016	14.60	0.08		242		198	0.1		0.099			0.027		0.005	6.63	1230
08D	6/18/2009	11.50	0.025							0.141	0.15	5.48	0.02	0.396	0.206		
08D	6/18/2009			159	162.1	133	129.5	0.158	0.143							6.27	1004
08D	9/29/2009	6.74	0.016							0.132	0.135	0.301	0.02	0.154	0.107		
08D	9/29/2009			130	182.2	118	126.2	0.142	0.164							6.7	978
08D	12/29/2009	8.16	0.02							0.16	0.178	0.051	0.02	0.108	0.11		
08D	12/29/2009			166	169	120	118	0.094	0.096							6.76	1008
08D	3/16/2010	8.65	0.019							0.154	0.161	0.02	0.02	0.09	0.092		
08D	3/16/2010			184	182.1	113	104	0.094	0.106							6.69	1001
08D	6/7/2010		0.034														
08D	8/31/2010	6.70	0.009	180		120		0.15		0.12			0.025		0.043	6.57	1000
08D	12/29/2010	8.30	0.013	170		130		0.15		0.12			0.025		0.033	6.6	970
08D	3/16/2011	7.60	0.014			110		0.16		0.14						6.68	1000
08D	6/29/2011	9.90	0.022	210	230	120	130	0.1	0.112	0.12	0.12	0.26	0.025		0.044	6.67	1100
08D	8/23/2011	8.60	0.007		240		120	0.158		0.13			0.025		0.028	6.51	1100
08D	10/19/2011	8.60	0.007		190		130	0.111		0.13			0.025		0.029	6.6	1100
08D	3/1/2012	7.50	0.007		270		120	0.114		0.084			0.025		0.023	7.02	930
08D	5/30/2012	8.30	0.01	240	290	130	130	0.122	0.135	0.084	0.092	0.31	0.025		0.016	6.69	1000
08D	8/29/2012	9.00	0.007		340		120	0.115		0.082			0.025		0.009	6.86	1100
08D	11/27/2012	6.22	0.007		296		146	0.11		0.094			0.02		0.011	7.01	1080
08D	3/7/2013	10.80	0.01		245		147	0.12		0.098			0.02		0.022	7.05	1020
08D	6/6/2013	8.44	0.075	250	262	126	127	0.16	0.17	0.124	0.136	0.5	0.045		0.053	6.95	1130
08D	9/4/2013	5.88	0.007		180		130	0.14		0.105			0.071		0.054	7.15	1040
08D	12/11/2013	7.05	0.014		154		118	0.14		0.11			0.032		0.032	7.33	948
08D	3/26/2014	8.71	0.029		140		99	0.1		0.119			0.02		0.012	6.96	1010
08D	6/18/2014	10.70	0.026	189	206	143	168	0.14	0.13	0.113	0.128	0.965	0.02		0.015	7.61	1200
08D	8/20/2014	8.83	0.021		215		173	0.12		0.105			0.02		0.017	6.69	1190
08D	12/10/2014	9.31	0.081		204		142	0.12		0.142			0.047		0.066	6.69	1060
08D	3/19/2015	8.95	0.079		223		143	0.1		0.186			0.047		0.053	6.87	1190
08D	6/22/2015	9.62	0.034	236	238	142	155	0.12	0.11	0.133	0.13	0.25	0.03		0.012	6.71	1090
08D	9/16/2015	8.17	0.011		114		103	0.11		0.102			0.02		0.018	6.82	1040
08D	12/8/2015	7.84	0.03		211		124	0.11		0.124			0.02		0.021	6.89	1090
08D	3/10/2016	8.48	0.019		238		128	0.11		0.11			0.02		0.013	6.73	1040
08D	6/7/2016	7.78	0.016	231	228	118	129	0.11	0.11	0.107	0.106	0.02	0.02		0.027	6.64	1020
08D	9/1/2016	13.00	0.058		317		155	0.11		0.123			0.029		0.01	6.63	1380
08D	12/9/2016	9.87	0.031		325		171	0.1		0.103			0.02		0.005	6.59	1340
Class I Standard	--	10.00	2	200	200	400	400	4	4	2	2	5	5	0.15	0.15	9	1200
Class I Standard (pH Lower Limit)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.5	--
# of Exceedances	--	24	0	6	30	0	0	0	0	0	0	1	0	2	1	0	6
# of Exceedances (pH Lower Limit)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	--
Minimum Value	--	2.60	0.005	29.00	18.00	61.00	49.00	0.070	0.073	0.026	0.037	0.02	0.02	0.005	0.003	6.270	504
Maximum Value	--	17.30	0.10	269.00	351.00	####	#####	0.16	0.17	0.19	0.18	5.48	0.07	0.40	0.21	7.75	1420
# of Samples Analyzed	--	93	96	34	85	36	85	93	28	102	28	28	91	16	91	102	93

Appendix C1: Illinois EPA Program Monitoring Results
Trace Metal Parameters - Downgradient Wells
Groundwater Monitoring Plan
Ash Pond No. 2, Hennepin Power Station

Legend:
Value exceeds 35 IAC 620 Class I groundwater standard
Value below detection limit

Well No.	sample date	Antimony, dissolved (mg/L)	Antimony, total (mg/L)	Arsenic, dissolved (mg/L)	Arsenic, total (mg/L)	Barium, dissolved (mg/L)	Barium, total (mg/L)	Beryllium, dissolved (mg/L)	Beryllium, total (mg/L)	Cadmium, dissolved (mg/L)	Cadmium,total (mg/L)	Chromium, dissolved (mg/L)	Chromium, total (mg/L)	Cobalt, dissolved (mg/L)	Cobalt, total (mg/L)	Copper, dissolved (mg/L)	Copper, total (mg/L)	Lead, dissolved (mg/L)	Lead, total (mg/L)	Mercury, dissolved (mg/L)	Mercury, total (mg/L)	Nickel, dissolved (mg/L)	Nickel, total (mg/L)	Selenium, dissolved (mg/L)	Selenium, total (mg/L)	Silver, dissolved (mg/L)	Silver, total (mg/L)	Thallium, dissolved (mg/L)	Thallium, total (mg/L)	Vanadium, dissolved (mg/L)	Vanadium, total (mg/L)	Zinc, dissolved (mg/L)	Zinc, total (mg/L)
3	12/29/2008	0.005	0.005	0.003	0.003	0.077	0.082	0.001	0.001	0.004	0.005	0.01	0.01	0.0164	0.013	0.016	0.018	0.002	0.002	0.0002	0.0002	0.039	0.039	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.016	0.017
3	3/25/2009	0.005	0.005	0.003	0.003	0.085	0.09	0.001	0.001	0.007	0.006	0.01	0.01	0.0126	0.013	0.024	0.024	0.002	0.002	0.0002	0.0002	0.049	0.051	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.016	0.018
3	6/18/2009	0.005	0.005	0.003	0.004	0.098	0.133	0.001	0.001	0.006	0.007	0.01	0.014	0.0186	0.022	0.024	0.038	0.002	0.008	0.0002	0.0002	0.073	0.087	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.012	0.018	0.064
3	9/29/2009	0.005	0.005	0.003	0.003	0.084	0.089	0.001	0.001	0.006	0.006	0.01	0.01	0.0129	0.012	0.023	0.026	0.002	0.002	0.0002	0.0002	0.043	0.045	0.007	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.018	0.02
3	12/22/2009	0.005	0.005	0.003	0.003	0.083	0.085	0.001	0.001	0.005	0.006	0.01	0.01	0.0117	0.013	0.019	0.021	0.002	0.002	0.0002	0.0002	0.039	0.038	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.015	0.017
3	3/16/2010	0.005	0.005	0.003	0.003	0.084	0.086	0.001	0.001	0.005	0.005	0.01	0.01	0.0115	0.012	0.024	0.023	0.002	0.002	0.0002	0.0002	0.052	0.05	0.006	0.008	0.01	0.01	0.002	0.002	0.01	0.01	0.016	0.018
3	8/31/2010	0.005		0.005		0.074		0.002		0.002		0.01		0.005		0.029		0.005		0.0002		0.051		0.016		0.002				0.002		0.021	
3	12/28/2010	0.005		0.007		0.096		0.002		0.009		0.01		0.011		0.046		0.005		0.0002		0.059		0.01		0.002				0.002		0.031	
3	6/29/2011	0.005		0.01		0.076		0.004		0.005		0.005		0.005		0.005		0.005		0.002		0.054		0.014		0.002		0.002				0.026	
3	8/23/2011	0.005		0.01		0.08		0.004		0.006		0.005		0.01		0.033		0.005		0.0002		0.054		0.012		0.002		0.002				0.025	
3	10/18/2011	0.005		0.003		0.085		0.004		0.007		0.005		0.01		0.031		0.004		0.0002		0.046		0.013		0.002		0.002				0.023	
3	3/1/2012	0.005		0.003		0.086		0.004		0.007		0.005		0.01		0.034		0.004		0.0002		0.062		0.011		0.002		0.002				0.023	
3	5/30/2012	0.005		0.003		0.089		0.004		0.007		0.005		0.01		0.037		0.004		0.0002		0.058		0.015		0.002		0.002				0.023	
3	8/29/2012	0.005		0.003		0.083		0.004		0.009		0.005		0.012		0.043		0.004		0.0002		0.062		0.014		0.002		0.002				0.032	
3	11/27/2012	0.005		0.003		0.093		0.001		0.01		0.005		0.0112		0.052		0.002		0.0002		0.066		0.006		0.002		0.002				0.036	
3	3/7/2013	0.005		0.003		0.104		0.001		0.011		0.005		0.014		0.058		0.002		0.0002		0.086		0.006		0.002		0.002				0.036	
3	6/6/2013	0.005		0.003		0.072		0.001		0.006		0.005		0.0102		0.027		0.002		0.0002		0.06		0.006		0.002		0.002				0.021	
3	9/3/2013	0.005		0.003		0.093		0.001		0.009		0.005		0.011		0.042		0.002		0.0002		0.07		0.011		0.002		0.002				0.033	
3	12/11/2013	0.005		0.003		0.096		0.001		0.007		0.005		0.0081		0.035		0.002		0.0002		0.057		0.006		0.002		0.002				0.027	
3	3/26/2014	0.005		0.003		0.093		0.001		0.006		0.005		0.0093		0.034		0.002		0.0002		0.051		0.006		0.002		0.002				0.024	
3	6/17/2014	0.005		0.003		0.094		0.001		0.007		0.005		0.0106		0.035		0.002		0.0002		0.06		0.006		0.002		0.002				0.026	
3	8/20/2014	0.001		0.001		0.084		0.001		0.006		0.005		0.0067		0.029		0.001		0.0002		0.041		0.004		0.002		0.001				0.026	
03R	3/18/2015	0.001		0.001		0.063		0.001		0.003		0.005		0.005		0.012		0.001		0.0002		0.007		0.003		0.002		0.001				0.013	
03R	6/23/2015	0.001		0.001		0.072		0.001		0.002		0.005		0.005		0.012		0.001		0.0002		0.011		0.006		0.002		0.001				0.011	
03R	9/16/2015	0.001		0.001		0.073		0.001		0.002		0.005		0.005		0.007		0.001		0.0002		0.009		0.005		0.002		0.001				0.008	
03R	12/9/2015	0.001		0.001		0.063		0.001		0.002		0.005		0.005		0.008		0.001		0.0002		0.004		0.005		0.002		0.001				0.007	
03R	3/9/2016	0.001		0.001		0.062		0.001		0.002		0.005		0.005		0.006		0.001		0.0002		0.005		0.005		0.002		0.001				0.006	
03R	6/8/2016	0.001		0.001		0.064		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.008		0.007		0.002		0.001				0.005	
03R	8/31/2016	0.001		0.001		0.061		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.005		0.006		0.002		0.001				0.005	
03R	12/8/2016	0.001		0.001		0.056		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.005		0.002		0.001				0.005	
6	12/29/2008	0.005	0.005	0.003	0.003	0.083	0.089	0.001	0.001	0.005	0.006	0.01	0.01	0.0181	0.018	0.028	0.029	0.002	0.002	0.0002	0.0002	0.059	0.064	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.032	0.033
6	3/25/2009	0.005	0.005	0.003	0.003	0.078	0.085	0.001	0.001	0.004	0.004	0.01	0.01	0.0177	0.018	0.019	0.018	0.002	0.002	0.0002	0.0002	0.064	0.064	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.03	0.033
6	6/18/2009	0.005	0.005	0.003	0.003	0.085	0.087	0.001	0.001	0.005	0.005	0.01	0.01	0.0238	0.024	0.022	0.028	0.002	0.002	0.0002	0.0002	0.086	0.088	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.034	0.034
6	9/29/2009	0.005	0.005	0.003	0.003	0.069	0.073	0.001	0.001	0.005	0.005	0.01	0.01	0.0205	0.022	0.026	0.029	0.002	0.002	0.0002	0.0002	0.065	0.061	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.036	0.031
6	12/22/2009	0.005	0.005	0.003	0.003	0.073	0.078	0.001	0.001	0.006	0.006	0.01	0.01	0.029	0.031	0.03	0.029	0.002	0.002	0.0002	0.0002	0.082	0.085	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.04	0.044
6	3/16/2010	0.005	0.005	0.003	0.003	0.079	0.087	0.001	0.001	0.007	0.008	0.01	0.01	0.0282	0.032	0.036	0.041	0.002	0.002	0.0002	0.0002	0.101	0.114	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.047	0.051
6	8/31/2010	0.005		0.005		0.065		0.002		0.006		0.01		0.016		0.033		0.005		0.0002		0.06		0.005		0.002				0.002		0.044	
6	12/28/2010	0.005		0.005		0.079		0.002		0.009		0.01		0.018		0.05		0.005		0.0002		0.074		0.005		0.002				0.002		0.063	
6	6/29/2011	0.005		0.01		0.063		0.004		0.006		0.005		0.014		0.036		0.005		0.002		0.061		0.01		0.002		0.002				0.05	
6	8/23/2011	0.005		0.01		0.066		0.004		0.005		0.005		0.012		0.031		0.005		0.0002		0.054		0.01		0.002		0.002				0.042	
6	10/18/2011	0.005		0.003		0.067		0.004		0.005		0.005		0.01		0.032		0.004		0.0002		0.053		0.01		0.002		0.002				0.041	
6	3/1/2012	0.005		0.003		0.064		0.004		0.005		0.005		0.011		0.033		0.004		0.0002		0.066		0.01		0.002		0.002				0.041	
6	5/30/2012	0.005		0.003		0.069		0.004		0.006		0.005		0.013		0.036		0.004		0.0002		0.078		0.01		0.002		0.002				0.043	
6	8/29/2012	0.005		0.003		0.063		0.004		0.007		0.005		0.014		0.04		0.004		0.0002		0.071		0.01		0.002		0.002				0.052	
6	11/27/2012	0.005		0.003		0.071		0.001		0.011		0.005		0.0145		0.063		0.002		0.0002		0.078		0.006		0.002		0.002				0.075	
6	3/7/2013	0.005		0.003		0.076		0.001		0.011		0.005		0.0157		0.061		0.002		0.0002		0.085		0.006		0.002		0.002				0.071	
6	6/6/2013	0.005		0.003		0.073		0.001		0.009		0.005		0.0177		0.043		0.002		0.0002		0.089		0.006		0.002		0.002				0.054	
6	9/3/2013	0.005		0.003		0.078		0.001		0.009		0.005		0.0128		0.044		0.002		0.0002		0.076		0.006		0.002		0.002				0.059	
6	12/11/2013	0.005		0.003		0.072		0.001		0.007		0.005		0.0093		0.039		0.002		0.0002		0.051		0.006		0.002		0.002				0.05	
6	3/26/2014	0.005		0.003		0.074		0.001		0.007		0.005		0.0123		0.038		0.002		0.0002		0.059		0.006		0.002		0.002				0.048	
6	6/17/2014	0.005		0.003		0.076		0.001		0.008		0.005		0.0142		0.04		0.002		0.0002		0.075		0.006		0.002		0.002				0.055	
6	8/20/2014	0.001		0.001		0.073		0.001		0.007		0.005		0.0112		0.036		0.001		0.0002		0.06		0.002		0.002		0.001				0.051	
6	12/9/2014	0.001		0.001		0.054		0.001		0.004		0.005		0.005		0.018		0.001		0.0002		0.007		0.001		0.002		0.001				0.032	
6	3/18/2015	0.001		0.001		0.053		0.001		0.004		0.005		0.005		0.016		0.001		0.0002		0.009		0.001		0.002		0.001				0.026	
6	3/19/2015	0.001		0.001		0.066		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.001		0.002		0.001				0.005	
6	6/22/2015	0.001		0.001		0.04		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.006		0.001		0.002		0.001				0.01	
6	9/16/2015	0.001		0.001		0.066		0.001		0.003		0.005		0.005		0.012		0.001		0.0002		0.013		0.003		0.002		0.001				0.019	
6	12/9/2015	0.001		0.001		0.057		0.001		0.002		0.005		0.005		0.009		0.001		0.0002		0.005		0.001		0.002		0.001				0.016	
6	3/9/2016	0.001		0.001		0.064		0.001		0.002		0.005		0.005		0.008		0.001		0.0002		0.007		0.003		0.002		0.001				0.013	
6	6/8/2016	0.001		0.001		0.068		0.001		0.002		0.005		0.0066		0.008		0.001		0.0002		0.026		0.001		0.002		0.001				0.014	
6	8/31/2016	0.001		0.001		0.058		0.001		0.002		0.005		0.005		0.007		0.001		0.0002		0.01		0.001		0.002		0.001				0.01	
6	12/8/2016	0.001		0.001		0.052		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.003		0.001		0.002		0.001				0.007	

Appendix C1: Illinois EPA Program Monitoring Results
Trace Metal Parameters - Downgradient Wells
Groundwater Monitoring Plan
Ash Pond No. 2, Hennepin Power Station

Legend:
Value exceeds 35 IAC 620 Class I groundwater standard
Value below detection limit

Well No.	sample date	Antimony, dissolved (mg/L)	Antimony, total (mg/L)	Arsenic, dissolved (mg/L)	Arsenic, total (mg/L)	Barium, dissolved (mg/L)	Barium, total (mg/L)	Beryllium, dissolved (mg/L)	Beryllium, total (mg/L)	Cadmium, dissolved (mg/L)	Cadmium,total (mg/L)	Chromium, dissolved (mg/L)	Chromium, total (mg/L)	Cobalt, dissolved (mg/L)	Cobalt, total (mg/L)	Copper, dissolved (mg/L)	Copper, total (mg/L)
18D	6/18/2009	0.005	0.005	0.003	0.004	0.103	0.127	0.001	0.001	0.002	0.002	0.01	0.012	0.0139	0.016	0.01	0.014
18D	9/29/2009	0.005	0.005	0.003	0.003	0.08	0.087	0.001	0.001	0.002	0.002	0.01	0.01	0.0125	0.014	0.01	0.01
18D	12/22/2009	0.005	0.005	0.003	0.003	0.095	0.1	0.001	0.001	0.002	0.002	0.01	0.01	0.0129	0.015	0.01	0.01
18D	3/16/2010	0.005	0.005	0.003	0.003	0.088	0.086	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01
18D	8/31/2010	0.005		0.005		0.092		0.002		0.002		0.01		0.0096		0.01	
18D	12/28/2010	0.005		0.005		0.076		0.002		0.002		0.01		0.012		0.004	
18D	6/29/2011	0.005		0.01		0.066		0.004		0.005		0.005		0.005		0.005	
18D	8/23/2011	0.005		0.01		0.08		0.004		0.005		0.005		0.0094		0.005	
18D	10/18/2011	0.005		0.003		0.091		0.004		0.005		0.005		0.012		0.005	
18D	3/1/2012	0.005		0.003		0.071		0.004		0.005		0.005		0.0094		0.005	
18D	5/30/2012	0.005		0.003		0.091		0.004		0.005		0.005		0.0094		0.005	
18D	8/29/2012	0.005		0.003		0.089		0.004		0.005		0.005		0.01		0.005	
18D	11/27/2012	0.005		0.003		0.094		0.001		0.002		0.005		0.0129		0.006	
18D	3/7/2013	0.005		0.003		0.094		0.001		0.002		0.005		0.0117		0.007	
18D	6/6/2013	0.005		0.003		0.104		0.001		0.002		0.005		0.0114		0.008	
18D	9/3/2013	0.005		0.003		0.097		0.001		0.002		0.005		0.0134		0.007	
18D	12/11/2013	0.005		0.003		0.096		0.001		0.002		0.005		0.0093		0.005	
18D	3/26/2014	0.005		0.003		0.086		0.001		0.002		0.005		0.0118		0.005	
18D	6/17/2014	0.005		0.003		0.106		0.001		0.002		0.005		0.0149		0.005	
18D	8/20/2014	0.001		0.001		0.099		0.001		0.002		0.005		0.016		0.005	
18D	3/18/2015	0.001		0.001		0.091		0.001		0.002		0.005		0.0103		0.006	
18D	6/23/2015	0.001		0.001		0.093		0.001		0.002		0.005		0.008		0.007	
18D	9/16/2015	0.001		0.001		0.091		0.001		0.002		0.005		0.0126		0.005	
18D	12/9/2015	0.001		0.001		0.082		0.001		0.002		0.005		0.0087		0.005	
18D	3/9/2016	0.001		0.001		0.085		0.001		0.002		0.005		0.0091		0.005	
18D	6/8/2016	0.001		0.001		0.088		0.001		0.002		0.005		0.0112		0.005	
18D	8/31/2016	0.001		0.001		0.084		0.001		0.002		0.005		0.0078		0.005	
18D	12/8/2016	0.001		0.001		0.083		0.001		0.002		0.005		0.0089		0.005	
18S	6/18/2009	0.005	0.005	0.003	0.003	0.108	0.121	0.001	0.001	0.005	0.005	0.01	0.01	0.0192	0.021	0.024	0.033
18S	9/29/2009	0.005	0.005	0.003	0.003	0.098	0.111	0.001	0.001	0.004	0.005	0.01	0.01	0.0112	0.012	0.018	0.022
18S	12/22/2009	0.005	0.005	0.003	0.003	0.095	0.106	0.001	0.001	0.004	0.004	0.01	0.01	0.0118	0.014	0.02	0.02
18S	3/16/2010	0.005	0.005	0.003	0.003	0.081	0.087	0.001	0.001	0.003	0.003	0.01	0.01	0.01	0.01	0.012	0.013
18S	8/31/2010	0.005		0.005		0.089		0.002		0.004		0.01		0.0093		0.024	
18S	12/28/2010	0.005		0.005		0.085		0.002		0.006		0.01		0.01		0.041	
18S	6/29/2011	0.005		0.01		0.077		0.004		0.005		0.005		0.0093		0.034	
18S	8/23/2011	0.005		0.01		0.098		0.004		0.005		0.005		0.0081		0.026	
18S	10/18/2011	0.005		0.003		0.099		0.004		0.005		0.005		0.0092		0.029	
18S	3/1/2012	0.005		0.003		0.087		0.004		0.005		0.005		0.0084		0.035	
18S	5/30/2012	0.005		0.003		0.098		0.004		0.005		0.005		0.008		0.032	
18S	8/29/2012	0.005		0.003		0.092		0.004		0.005		0.005		0.01		0.036	
18S	11/27/2012	0.005		0.003		0.1		0.001		0.006		0.005		0.0105		0.041	
18S	3/7/2013	0.005		0.003		0.11		0.001		0.007		0.005		0.013		0.053	
18S	6/6/2013	0.005		0.003		0.072		0.001		0.003		0.005		0.0069		0.014	
18S	9/3/2013	0.005		0.003		0.113		0.001		0.006		0.009		0.0095		0.035	
18S	12/11/2013	0.005		0.003		0.108		0.001		0.005		0.005		0.0077		0.033	
18S	3/26/2014	0.005		0.003		0.102		0.001		0.005		0.005		0.0087		0.032	
18S	6/17/2014	0.005		0.003		0.104		0.001		0.005		0.005		0.009		0.03	
18S	8/20/2014	0.001		0.001		0.1		0.001		0.004		0.005		0.0078		0.027	
18S	3/18/2015	0.001		0.001		0.086		0.001		0.003		0.005		0.005		0.017	
18S	6/23/2015	0.001		0.001		0.086		0.001		0.002		0.005		0.005		0.013	
18S	9/16/2015	0.001		0.001		0.082		0.001		0.002		0.005		0.005		0.008	
18S	12/9/2015	0.001		0.001		0.078		0.001		0.002		0.005		0.005		0.009	
18S	3/9/2016	0.001		0.001		0.079		0.001		0.002		0.005		0.005		0.006	
18S	6/8/2016	0.001		0.001		0.079		0.001		0.002		0.005		0.005		0.005	
18S	8/31/2016	0.001		0.001		0.076		0.001		0.002		0.005		0.005		0.005	
18S	12/8/2016	0.001		0.001		0.067		0.001		0.002		0.005		0.005		0.005	
Class I Standard		0.006	0.006	0.01	0.01	2	2	0.004	0.004	0.005	0.005	0.1	0.1	1	1	0.65	0.65
# of Exceedances		0	0	0	0	0	0	0	0	36	7	0	0	0	0	0	0
Minimum Value		0.001	0.005	0.001	0.003	0.040	0.073	0.001	0.001	0.002	0.002	0.005	0.010	0.005	0.010	0.004	0.010
Maximum Value		0.005	0.005	0.010	0.004	0.113	0.127	0.004	0.001	0.011	0.008	0.010	0.012	0.029	0.032	0.063	0.041
# of Samples Analyzed		118	20	118	20	118	20	118	20	118	20	118	20	118	20	118	20

Well No.	sample date	Lead, dissolved (mg/L)	Lead, total (mg/L)	Mercury, dissolved (mg/L)	Mercury, total (mg/L)	Nickel, dissolved (mg/L)	Nickel, total (mg/L)	Selenium, dissolved (mg/L)	Selenium, total (mg/L)	Silver, dissolved (mg/L)	Silver, total (mg/L)	Thallium, dissolved (mg/L)	Thallium, total (mg/L)	Vanadium, dissolved (mg/L)	Vanadium, total (mg/L)	Zinc, dissolved (mg/L)	Zinc, total (mg/L)
18D	6/18/2009	0.002	0.007	0.0002	0.0002	0.078	0.088	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.039
18D	9/29/2009	0.002	0.002	0.0002	0.0002	0.071	0.08	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
18D	12/22/2009	0.002	0.002	0.0002	0.0002	0.063	0.067	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
18D	3/16/2010	0.002	0.002	0.0002	0.0002	0.032	0.025	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
18D	8/31/2010	0.005		0.0002		0.049		0.005		0.002				0.002		0.005	
18D	12/28/2010	0.005		0.0002		0.056		0.009		0.002				0.002		0.006	
18D	6/29/2011	0.005		0.002		0.016		0.01		0.002		0.002				0.005	
18D	8/23/2011	0.005		0.0002		0.046		0.013		0.002		0.002				0.005	
18D	10/18/2011	0.004		0.0002		0.055		0.01		0.002		0.002				0.006	
18D	3/1/2012	0.004		0.0002		0.045		0.01		0.002		0.002				0.005	
18D	5/30/2012	0.004		0.0002		0.046		0.01		0.002		0.002				0.005	
18D	8/29/2012	0.004		0.0002		0.05		0.01		0.002		0.002				0.005	
18D	11/27/2012	0.002		0.0002		0.059		0.006		0.002		0.002				0.012	
18D	3/7/2013	0.002		0.0002		0.057		0.006		0.002		0.002				0.01	
18D	6/6/2013	0.002		0.0002		0.064		0.006		0.002		0.002				0.011	
18D	9/3/2013	0.002		0.0002		0.061		0.006		0.002		0.002				0.009	
18D	12/11/2013	0.002		0.0002		0.042		0.006		0.002		0.002				0.005	
18D	3/26/2014	0.002		0.0002		0.044		0.006		0.002		0.002				0.005	
18D	6/17/2014	0.002		0.0002		0.064		0.006		0.002		0.002				0.007	
18D	8/20/2014	0.001		0.0002		0.059		0.001		0.002		0.001				0.01	
18D	3/18/2015	0.001		0.0002		0.056		0.001		0.002		0.001				0.011	
18D	6/23/2015	0.001		0.0002		0.049		0.001		0.002		0.001				0.011	
18D	9/16/2015	0.001		0.0002		0.05		0.001		0.002		0.001				0.008	
18D	12/9/2015	0.001		0.0002		0.043		0.001		0.002		0.001				0.008	
18D	3/9/2016	0.001		0.0002		0.043		0.001		0.002		0.001				0.006	
18D	6/8/2016	0.001		0.0002		0.045		0.001		0.002		0.001				0.006	
18D	8/31/2016	0.001		0.0002		0.039		0.001		0.002		0.001				0.005	
18D	12/8/2016	0.001		0.0002		0.039		0.001		0.002		0.001				0.005	
18S	6/18/2009	0.002	0.002	0.0002	0.0002	0.081	0.089	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.012	0.015	0.021
18S	9/29/2009	0.002	0.002	0.0002	0.0002	0.059	0.06	0.008	0.009	0.01	0.01	0.002	0.002	0.01	0.012	0.011	0.016
18S	12/22/2009	0.002	0.002	0.0002	0.0002	0.046	0.05	0.009	0.01	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.017
18S	3/16/2010	0.002	0.002	0.0002	0.0002	0.033	0.033	0.006	0.008	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
18S	8/31/2010	0.005		0.0002		0.046		0.029		0.002				0.009		0.013	
18S	12/28/2010	0.005		0.0002		0.06		0.014		0.002				0.008		0.021	
18S	6/29/2011	0.005		0.002		0.006		0.024		0.002		0.002				0.02	
18S	8/23/2011	0.005		0.0002		0.053		0.045		0.002		0.002				0.015	
18S	10/18/2011	0.004		0.0002		0.057		0.026		0.002		0.002				0.016	
18S	3/1/2012	0.004		0.0002		0.054		0.017		0.002		0.002				0.019	
18S	5/30/2012	0.004		0.0002		0.056		0.041		0.002		0.002				0.016	
18S	8/29/2012	0.004		0.0002		0.063		0.031		0.002		0.002				0.021	
18S	11/27/2012	0.002		0.0002		0.069		0.018		0.002		0.002				0.023	
18S	3/7/2013	0.002		0.0002		0.087		0.01		0.002		0.002				0.028	
18S	6/6/2013	0.002		0.0002		0.035		0.02		0.002		0.002				0.007	
18S	9/3/2013	0.002		0.0002		0.077		0.079		0.002		0.002				0.02	
18S	12/11/2013	0.002		0.0002		0.062		0.033		0.002		0.002				0.019	
18S	3/26/2014	0.002		0.0002		0.061		0.019		0.002		0.002				0.02	
18S	6/17/2014	0.002		0.0002		0.06		0.028		0.002		0.002				0.019	
18S	8/20/2014	0.001		0.0002		0.055		0.034		0.002		0.002				0.019	
18S	3/18/2015	0.001		0.0002		0.024		0.035		0.002		0.001				0.011	
18S	6/23/2015	0.001		0.0002		0.017		0.034		0.002		0.001				0.008	
18S	9/16/2015	0.001		0.0002		0.011		0.059		0.002		0.001				0.005	
18S	12/9/2015	0.001		0.0002		0.012		0.033		0.002		0.001				0.006	
18S	3/9/2016	0.001		0.0002		0.009		0.056		0.002		0.001				0.005	
18S	6/8/2016	0.001		0.0002		0.006		0.059		0.002		0.001				0.005	
18S	8/31/2016	0.001		0.0002		0.005		0.045		0.002		0.001				0.005	
18S	12/8/2016	0.001		0.0002		0.004		0.051		0.002		0.001				0.005	
Class I Standard		0.0075	0.0075	0.002	0.002	0.1	0.1	0.05	0.05	0.05	0.05	0.002	0.002	0.049	0.049	5	5
# of Exceedances		0	1	0	0	1	1	5	0	0	0	0	0	0	0	0	0
Minimum Value		0.001	0.002	0.0002	0.0002	0.002	0.025	0.001	0.006	0.002	0.010	0.001	0.002	0.002	0.010	0.005	0.010
Maximum Value		0.005	0.007	0.0020	0.0002	0.101	0.114	0.079	0.010	0.010	0.010	0.002	0.002	0.010	0.012	0.075	0.051
# of Samples Analyzed		118	20	118	20	118	20	118	20	118	20	110	20	28	20	118	20

Natural Resource Technology
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Appendix C1: Illinois EPA Program Monitoring Results
Trace Metal Parameters - Upgradient Wells
Groundwater Monitoring Plan
Hennepin Power Station

Legend:
- (pink) Value exceeds 35 IAC 620 Class I groundwater standard
- (blue) Value below detection limit

Well No.	sample_date	Antimony, dissolved (mg/L)	Antimony, total (mg/L)	Arsenic, dissolved (mg/L)	Arsenic, total (mg/L)	Barium, dissolved (mg/L)	Barium, total (mg/L)	Beryllium, dissolved (mg/L)	Beryllium, total (mg/L)	Cadmium, dissolved (mg/L)	Cadmium,total (mg/L)	Chromium, dissolved (mg/L)	Chromium, total (mg/L)	Cobalt, dissolved (mg/L)	Cobalt, total (mg/L)	Copper, dissolved (mg/L)	Copper, total (mg/L)	Lead, dissolved (mg/L)	Lead, total (mg/L)	Mercury, dissolved (mg/L)	Mercury, total (mg/L)	Nickel, dissolved (mg/L)	Nickel, total (mg/L)	Selenium, dissolved (mg/L)	Selenium, total (mg/L)	Silver, dissolved (mg/L)	Silver, total (mg/L)	Thallium, dissolved (mg/L)	Thallium, total (mg/L)	Vanadium, dissolved (mg/L)	Vanadium, total (mg/L)	Zinc, dissolved (mg/L)	Zinc, total (mg/L)
7	12/29/2008	0.005	0.005	0.003	0.003	0.09	0.094	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.01	0.01	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
7	3/25/2009	0.005	0.005	0.003	0.003	0.106	0.112	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.01	0.01	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
7	6/18/2009	0.005	0.005	0.003	0.003	0.095	0.102	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.01	0.01	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
7	9/29/2009	0.005	0.005	0.003	0.003	0.088	0.096	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.01	0.01	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
7	12/29/2009	0.005	0.005	0.003	0.003	0.091	0.099	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.01	0.01	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
7	3/16/2010	0.005	0.005	0.003	0.003	0.088	0.095	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.01	0.01	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
7	8/31/2010	0.005		0.005		0.079		0.002		0.002		0.01		0.005		0.01		0.005		2		0.005		0.005		0.002				0.002		0.005	
7	12/29/2010	0.005		0.005		0.087		0.002		0.002		0.01		0.005		0.008		0.005		2		0.002		0.008		0.002				0.002		0.015	
7	6/29/2011	0.005		0.01		0.075		0.004		0.005		0.005		0.005		0.005		0.005		0.002		0.005		0.01		0.002		0.002				0.005	
7	8/24/2011	0.005		0.01		0.079		0.004		0.005		0.005		0.005		0.005		0.005		0.0002		0.005		0.01		0.002		0.002				0.005	
7	10/19/2011	0.005		0.003		0.092		0.004		0.005		0.005		0.005		0.005		0.004		0.0002		0.002		0.01		0.002		0.002				0.005	
7	3/1/2012	0.005		0.003		0.067		0.004		0.005		0.005		0.005		0.005		0.004		0.0002		0.002		0.01		0.002		0.002				0.005	
7	5/31/2012	0.005		0.003		0.038		0.004		0.005		0.005		0.005		0.005		0.004		0.0002		0.002		0.01		0.002		0.002				0.005	
7	8/29/2012	0.005		0.003		0.072		0.004		0.005		0.005		0.005		0.005		0.004		0.0002		0.002		0.01		0.002		0.002				0.005	
7	11/27/2012	0.005		0.003		0.082		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.002		0.006		0.002		0.002				0.005	
7	3/7/2013	0.005		0.003		0.089		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.002		0.006		0.002		0.002				0.005	
7	6/6/2013	0.005		0.003		0.071		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.002		0.006		0.002		0.002				0.005	
7	9/4/2013	0.005		0.003		0.089		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.002		0.006		0.002		0.002				0.005	
7	12/11/2013	0.005		0.003		0.087		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.002		0.006		0.002		0.002				0.005	
7	3/26/2014	0.005		0.003		0.087		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.002		0.006		0.002		0.002				0.005	
7	6/18/2014	0.005		0.003		0.092		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.003		0.006		0.002		0.002				0.005	
7	8/20/2014	0.001		0.001		0.092		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.001		0.002		0.001				0.005	
7	12/9/2014	0.001		0.001		0.108		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.005		0.001		0.002		0.001				0.005	
7	3/19/2015	0.001		0.001		0.095		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.001		0.002		0.001				0.005	
7	6/23/2015	0.001		0.001		0.093		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.001		0.002		0.001				0.005	
7	9/17/2015	0.001		0.001		0.095		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.001		0.002		0.001				0.005	
7	12/9/2015	0.001		0.001		0.132		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.006		0.001		0.002		0.001				0.005	
7	3/10/2016	0.001		0.001		0.098		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.001		0.002		0.001				0.005	
7	6/8/2016	0.001		0.001		0.129		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.001		0.002		0.001				0.005	
7	9/1/2016	0.001		0.001		0.106		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.002		0.001		0.002		0.001				0.014	
7	12/9/2016	0.001		0.001		0.124		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.017		0.001		0.002		0.001				0.005	
8	12/29/2008	0.005	0.005	0.003	0.003	0.131	0.132	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.01	0.012	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
8	3/25/2009	0.005	0.005	0.003	0.003	0.143	0.153	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.011	0.011	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
8	6/18/2009	0.005	0.005	0.003	0.003	0.141	0.147	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.013	0.013	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
8	9/29/2009	0.005	0.005	0.003	0.003	0.124	0.13	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.01	0.012	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
8	12/29/2009	0.005	0.005	0.003	0.003	0.134	0.141	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.038	0.039	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
8	3/16/2010	0.005	0.005	0.003	0.003	0.114	0.123	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0002	0.0002	0.019	0.023	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
8	8/31/2010	0.005		0.005		0.11		0.002		0.002		0.01		0.005		0.01		0.005		2		0.013		0.008		0.002				0.002		0.005	
8	12/29/2010	0.005		0.008		0.12		0.002		0.002		0.01		0.005		0.001		0.005		2		0.007		0.008		0.002				0.002		0.005	
8	3/16/2011			0.005		0.15				0.002		0.01						0.005		2				0.016								0.005	
8	6/29/2011	0.005		0.01	0.01	0.11	0.11	0.004		0.005	0.005	0.005	0.005	0.005		0.005	0.005	0.005	0.005	0.002	0.002	0.037		0.01	0.01	0.002		0.002		0.005	0.005	0.005	0.005
8	8/24/2011	0.005		0.01		0.12		0.004		0.005		0.005		0.005		0.005		0.005		0.0002		0.021		0.01		0.002		0.002				0.005	
8	10/19/2011	0.005		0.003		0.13		0.004		0.005		0.005		0.005		0.005		0.004		0.0002		0.009		0.01		0.002		0.002				0.005	
8	3/1/2012	0.005		0.003		0.12		0.004		0.005		0.005		0.005		0.005		0.004		0.0002		0.021		0.01		0.002		0.002				0.005	
8	5/30/2012	0.005		0.005	0.003	0.15	0.13	0.004		0.005	0.005	0.005	0.005	0.005		0.005	0.005	0.004	0.004	0.0002	0.0002	0.019		0.01	0.01	0.002		0.002		0.005	0.005	0.005	0.005
8	8/29/2012	0.005		0.004		0.13		0.004		0.005		0.005		0.005		0.005		0.004		0.0002		0.021		0.01		0.002		0.002				0.005	
8	11/27/2012	0.005		0.003		0.161		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.032		0.006		0.002		0.002				0.005	
8	3/7/2013	0.005		0.003		0.173		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.032		0.006		0.002		0.002				0.005	
8	6/6/2013	0.005		0.003	0.003	0.11	0.127	0.001		0.002	0.002	0.005	0.005	0.005		0.005	0.005	0.002	0.002	0.0002	0.0002	0.01		0.006	0.006	0.003		0.002		0.01	0.01	0.005	0.007
8	9/3/2013	0.005		0.003		0.165		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.037		0.006		0.002		0.002				0.005	
8	12/11/2013	0.005		0.003		0.167		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.03		0.006		0.002		0.002				0.005	
8	3/26/2014	0.005		0.003		0.154		0.001		0.002		0.005		0.005		0.005		0.002		0.0002		0.024		0.006		0.002		0.002				0.005	
8	6/18/2014	0.005		0.003	0.003	0.146	0.164	0.001		0.002	0.002	0.005	0.005	0.005		0.005	0.005	0.002	0.002	0.0002	0.0002	0.024		0.006	0.006	0.003		0.002		0.01	0.01	0.005	0.005
8	8/20/2014	0.001		0.001		0.142		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.048		0.001		0.002		0.001				0.007	
8	12/9/2014	0.001		0.001		0.126		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.121		0.001		0.002		0.001				0.005	
8	3/19/2015	0.001		0.001		0.119		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.04		0.001		0.002		0.001				0.005	
8	6/22/2015	0.001		0.001	0.001	0.125	0.136	0.0005		0.002	0.002	0.005	0.005	0.005		0.005	0.005	0.001	0.001	0.0002	0.0002	0.051		0.001	0.001	0.003		0.001		0.01	0.01	0.005	0.005
8	9/16/2015	0.001		0.001		0.124		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.055		0.001		0.002		0.001				0.005	
8	12/8/2015	0.001		0.001		0.111		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.104		0.001		0.002		0.001				0.005	
8	3/10/2016	0.001		0.001		0.132		0.001		0.002		0.005		0.005		0.005		0.001		0.0002		0.066		0.001		0.002		0.001				0.005	
8	6/7/2016	0.001		0.001	0.001	0.115	0.123	0.0005		0.002	0.002	0.005	0.005	0.005		0.005	0.005	0.001	0.001	0.0002	0.0002	0.086		0.001	0.001	0.003		0.001		0.01	0.01	0.005	0.005
8	9/1/2016	0.001		0.001		0.144		0.001		0.002		0.005		0.0244		0.005		0.001		0.0002		0.234		0.001		0.002		0.001				0.005	
8	12/9/2016	0.001		0.001		0.109		0.001		0.002		0.005		0.0205		0.005		0.001		0.0002		0.183		0.001		0.002		0.001				0.005	

Appendix C1: Illinois EPA Program Monitoring Results
Trace Metal Parameters - Upgradient Wells
Groundwater Monitoring Plan
Hennepin Power Station

Legend:
Value exceeds 35 IAC 620 Class I groundwater standard
Value below detection limit

Well No.	sample_date	Antimony, dissolved (mg/L)	Antimony, total (mg/L)	Arsenic, dissolved (mg/L)	Arsenic, total (mg/L)	Barium, dissolved (mg/L)	Barium, total (mg/L)	Beryllium, dissolved (mg/L)	Beryllium, total (mg/L)	Cadmium, dissolved (mg/L)	Cadmium,total (mg/L)	Chromium, dissolved (mg/L)	Chromium, total (mg/L)	Cobalt, dissolved (mg/L)	Cobalt, total (mg/L)
08D	6/18/2009	0.005	0.005	0.003	0.003	0.117	0.143	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01
08D	9/29/2009	0.005	0.005	0.003	0.003	0.095	0.098	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01
08D	12/29/2009	0.005	0.005	0.003	0.003	0.121	0.135	0.001	0.001	0.002	0.002	0.01	0.01	0.01	0.01
08D	3/16/2010	0.005	0.005	0.003	0.003	0.125	0.131	0.001	0.001	0.002	0.002	0.011	0.01	0.01	0.01
08D	8/31/2010	0.005		0.005		0.098		0.002		0.002		0.01		0.005	
08D	12/29/2010	0.005		0.008		0.1		0.002		0.002		0.01		0.005	
08D	3/16/2011			0.005		0.11				0.002		0.01			
08D	6/29/2011	0.005		0.01	0.01	0.1	0.11	0.004		0.005	0.005	0.005	0.005	0.005	
08D	8/23/2011	0.005		0.01		0.11		0.004		0.005		0.005		0.005	
08D	10/19/2011	0.005		0.003		0.11		0.004		0.005		0.005		0.005	
08D	3/1/2012	0.005		0.003		0.077		0.004		0.005		0.005		0.005	
08D	5/30/2012	0.005		0.003	0.003	0.1	0.092	0.004		0.005	0.005	0.005	0.005	0.005	
08D	8/29/2012	0.005		0.003		0.11		0.004		0.005		0.005		0.005	
08D	11/27/2012	0.005		0.003		0.104		0.001		0.002		0.005		0.005	
08D	3/7/2013	0.005		0.003		0.105		0.001		0.002		0.005		0.005	
08D	6/6/2013	0.005		0.003	0.003	0.116	0.13	0.001		0.002	0.002	0.005	0.005	0.0324	
08D	9/4/2013	0.005		0.003		0.106		0.001		0.002		0.005		0.005	
08D	12/11/2013	0.005		0.003		0.117		0.001		0.002		0.005		0.005	
08D	3/26/2014	0.005		0.003		0.121		0.001		0.002		0.005		0.005	
08D	6/18/2014	0.005		0.003	0.003	0.143	0.164	0.001		0.002	0.002	0.005	0.005	0.005	
08D	8/20/2014	0.001		0.001		0.134		0.001		0.002		0.005		0.005	
08D	12/10/2014	0.001		0.001		0.119		0.001		0.002		0.005		0.0188	
08D	3/19/2015	0.001		0.001		0.127		0.001		0.002		0.005		0.0264	
08D	6/22/2015	0.001		0.001	0.001	0.137	0.144	0.0005		0.002	0.002	0.005	0.005	0.0223	
08D	9/16/2015	0.001		0.001		0.141		0.001		0.002		0.005		0.005	
08D	12/8/2015	0.001		0.001		0.128		0.001		0.002		0.005		0.0149	
08D	3/10/2016	0.001		0.001		0.142		0.001		0.002		0.005		0.005	
08D	6/7/2016	0.001		0.001	0.001	0.134	0.138	0.0005		0.002	0.002	0.005	0.005	0.005	
08D	9/1/2016	0.001		0.001		0.175		0.001		0.002		0.005		0.0123	
08D	12/9/2016	0.001		0.001		0.168		0.001		0.002		0.005		0.0102	
Class I Standard		0.006	0.006	0.01	0.01	2	2	0.004	0.004	0.005	0.005	0.1	0.1	1	1
# of Exceedances		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Value		0.001	0.005	0.001	0.001	0.038	0.092	0.0005	0.001	0.002	0.002	0.005	0.005	0.0050	0.010
Maximum Value		0.005	0.005	0.010	0.010	0.175	0.164	0.0040	0.001	0.005	0.005	0.011	0.010	0.0324	0.010
# of Samples Analyzed		91	16	93	28	93	28	91	16	93	28	93	28	91	16

Well No.	sample_date	Copper, dissolved (mg/L)	Copper, total (mg/L)	Lead, dissolved (mg/L)	Lead, total (mg/L)	Mercury, dissolved (mg/L)	Mercury, total (mg/L)	Nickel, dissolved (mg/L)	Nickel, total (mg/L)	Selenium, dissolved (mg/L)	Selenium, total (mg/L)	Silver, dissolved (mg/L)	Silver, total (mg/L)	Thallium, dissolved (mg/L)	Thallium, total (mg/L)	Vanadium, dissolved (mg/L)	Vanadium, total (mg/L)	Zinc, dissolved (mg/L)	Zinc, total (mg/L)
08D	6/18/2009	0.01	0.01	0.002	0.004	0.0002	0.0002	0.029	0.035	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.024
08D	9/29/2009	0.01	0.01	0.002	0.002	0.0002	0.0002	0.025	0.026	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
08D	12/29/2009	0.01	0.01	0.002	0.002	0.0002	0.0002	0.027	0.03	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
08D	3/16/2010	0.01	0.01	0.002	0.002	0.0002	0.0002	0.027	0.028	0.006	0.006	0.01	0.01	0.002	0.002	0.01	0.01	0.01	0.01
08D	8/31/2010	0.01		0.005		2		0.012		0.01		0.002				0.002		0.005	
08D	12/29/2010	0.001		0.005		2		0.02		0.01		0.002				0.002		0.005	
08D	3/16/2011			0.005		2				0.016								0.005	
08D	6/29/2011	0.005	0.005	0.005	0.005	0.002	0.002	0.026		0.01	0.01	0.002		0.002		0.005	0.005	0.005	0.007
08D	8/23/2011	0.005		0.005		0.0002		0.013		0.014		0.002		0.002				0.005	
08D	10/19/2011	0.005		0.004		0.0002		0.011		0.01		0.002		0.002				0.005	
08D	3/1/2012	0.005		0.004		0.0002		0.012		0.01		0.002		0.002				0.005	
08D	5/30/2012	0.005	0.005	0.004	0.004	0.0002	0.0002	0.024		0.01	0.01	0.002		0.002		0.005	0.005	0.005	0.005
08D	8/29/2012	0.005		0.004		0.0002		0.019		0.01		0.002		0.002				0.005	
08D	11/27/2012	0.005		0.002		0.0002		0.015		0.006		0.002		0.002				0.005	
08D	3/7/2013	0.005		0.002		0.0002		0.029		0.006		0.002		0.002				0.005	
08D	6/6/2013	0.015	0.017	0.002	0.002	0.0002	0.0002	0.139		0.006	0.006	0.003		0.002		0.01	0.01	0.018	0.028
08D	9/4/2013	0.005		0.002		0.0002		0.039		0.006		0.002		0.002				0.005	
08D	12/11/2013	0.005		0.002		0.0002		0.032		0.006		0.002		0.002				0.005	
08D	3/26/2014	0.005		0.002		0.0002		0.044		0.006		0.002		0.002				0.008	
08D	6/18/2014	0.005	0.005	0.002	0.002	0.0002	0.0002	0.061		0.006	0.006	0.003		0.002		0.01	0.01	0.005	0.01
08D	8/20/2014	0.005		0.001		0.0002		0.056		0.001		0.002		0.001				0.011	
08D	12/10/2014	0.035		0.001		0.0002		0.11		0.001		0.002		0.001				0.018	
08D	3/19/2015	0.047		0.001		0.0002		0.144		0.001		0.002		0.001				0.02	
08D	6/22/2015	0.017	0.012	0.001	0.001	0.0002	0.0002	0.095		0.001	0.001	0.003		0.001		0.01	0.01	0.013	0.012
08D	9/16/2015	0.005		0.001		0.0002		0.028		0.001		0.002		0.001				0.006	
08D	12/8/2015	0.01		0.001		0.0002		0.066		0.001		0.002		0.001				0.011	
08D	3/10/2016	0.005		0.001		0.0002		0.05		0.001		0.002		0.001				0.006	
08D	6/7/2016	0.005	0.005	0.001	0.001	0.0002	0.0002	0.062		0.001	0.001	0.003		0.001		0.01	0.01	0.005	0.006
08D	9/1/2016	0.009		0.001		0.0002		0.113		0.001		0.002		0.001				0.012	
08D	12/9/2016	0.005		0.001		0.0002		0.089		0.001		0.002		0.001				0.008	
Class I Standard		0.65	0.65	0.0075	0.0075	0.002	0.002	0.1	0.1	0.05	0.05	0.05	0.05	0.002	0.002	0.049	0.049	5	5
# of Exceedances		0	0	0	0	8	0	8	0	0	0	0	0	0	0	0	0	0	0
Minimum Value		0.001	0.005	0.001	0.001	0.0002	0.0002	0.002	0.010	0.001	0.001	0.002	0.010	0.001	0.002	0.002	0.005	0.005	0.005
Maximum Value		0.047	0.017	0.005	0.005	2.0	0.002	0.234	0.039	0.016	0.010	0.010	0.010	0.002	0.002	0.010	0.010	0.020	0.028
# of Samples Analyzed		91	28	93	28	93	28	91	16	93	28	91	16	85	16	34	28	93	28

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Appendix C2

CCR Rule Program Monitoring Results

Appendix C2: CCR Rule Program Monitoring Results
Groundwater Monitoring Plan
Ash Pond No. 2, Hennepin Power Station

Parameters (total)			Wells	Upgradient											
				07				08				08D			
Appendix III	**Units**	**Class I Standard**	**Sample Date**	not sampled first round	3/10/2016	6/7/2016	9/1/2016	12/8/2015	3/9/2016	6/7/2016	9/1/2016	12/8/2015	3/9/2016	6/7/2016	9/1/2016
Boron	mg/L	2.0		- - - -	0.0629	0.0673	0.0697	0.0972	0.0878	0.075	0.142	0.109	0.122	0.111	0.139
Calcium	mg/L	NS		- - - -	126	154	150	198	213	191	299	174	187	177	287
Chloride	mg/L	200		- - - -	51	55	49	**216**	145	**202**	**312**	184	**209**	**217**	**325**
Fluoride	mg/L	4.0		- - - -	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.12	0.10	0.10	0.12
Sulfate	mg/L	400		- - - -	70	82	75	164	133	129	209	119	130	113	161
TDS	mg/L	1,200		- - - -	536	758	574	1170	918	1060	**1370**	1050	1060	1090	**1340**
pH-Field	S.U.	6.5-9.0		- - - -	6.90	6.64	6.94	6.82	6.73	6.60	6.69	6.89	6.73	6.64	6.63
Appendix IV															
Antimony	mg/L	0.006		- - - -	<0.0002	0	<0.0002	<0.0002	0.0003	0.0003	<0.0002	<0.0002	0.0003	0.0003	<0.0002
Arsenic	mg/L	0.010		- - - -	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Barium	mg/L	2.0		- - - -	0.104	0.13	0.13	0.118	0.148	0.127	0.146	0.133	0.155	0.138	0.23
Beryllium	mg/L	0.004		- - - -	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	mg/L	0.005		- - - -	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0005	0.0005	0.0003	0.0011
Chromium	mg/L	0.1		- - - -	0.0005	0.0005	0.0005	0.0004	<0.0003	<0.0003	<0.0003	0.0004	<0.0003	<0.0003	<0.0003
Cobalt	mg/L	1.0		- - - -	<0.0002	<0.0002	<0.0002	0.0029	0.0017	0.0034	0.0285	0.0122	0.0036	0.0028	0.013
Fluoride	mg/L	4.0		- - - -	0.10	0.10	0.1	0.09	0.09	0.09	0.09	0.12	0.10	0.10	0.12
Lead	mg/L	0.0075		- - - -	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	<0.0002	0.0005
Lithium	mg/L	NS		- - - -	0.0079	0.0085	0.0091	0.01	0.0091	0.0092	0.0127	0.0121	0.0143	0.0108	0.0164
Mercury	mg/L	0.002		- - - -	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Molybdenum	mg/L	NS		- - - -	0.0008	0.0006	0.0008	0.0015	0.0016	0.0013	0.0014	0.0014	0.0013	0.0011	0.0014
Selenium	mg/L	0.05		- - - -	0.001	0.0011	0.0014	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009
Thallium	mg/L	0.002		- - - -	<0.0002	<0.0002	<0.0002	0.0004	<0.0002	<0.0002	<0.0002	0.0003	<0.0002	<0.0002	<0.0002
Radium 226/228	pCi/L	20		- - - -	0.12	1.09	0.36	0.89	0.72	0.74	0.33	0.94	0.12	0.35	0.55
Groundwater Elevation	feet			- - - -	451.59	452.75	453.4	449.20	447.80	448.93	450.35	447.92	447.52	447.60	450.19

Parameters (total)	Downgradient								Downgradient							
	03R				18D				18S				45S			
Appendix III	12/9/2015	3/9/2016	6/8/2016	8/31/2016	12/9/2015	3/9/2016	6/8/2016	8/31/2016	12/9/2015	3/9/2016	6/8/2016	8/31/2016	12/9/2015	3/9/2016	6/8/2016	8/31/2016
Boron	1.24	1.38	1.25	1.03	1.98	1.93	1.82	1.86	**3.40**	**4.74**	**4.18**	**5.11**	0.400	0.436	0.544	0.497
Calcium	82.4	84.6	85.6	85.8	114	116	110	108	99.7	101	98.3	118	87.8	97.2	97.2	95.4
Chloride	66	78	84	89	74	81	90	83	68	69	70	70	70	80	104	96
Fluoride	0.20	0.26	0.26	0.27	0.13	0.15	0.14	0.14	0.14	0.13	0.13	0.12	0.29	0.33	0.33	0.34
Sulfate	85	136	107	101	133	141	136	123	153	229	204	187	83	93	99	98
TDS	548	566	532	560	680	686	648	608	656	670	654	678	534	594	574	542
pH-Field	7.23	7.26	7.27	7.50	7.20	7.17	7.17	7.43	7.47	7.37	7.58	7.5	7.00	7.15	7.26	7.31
Appendix IV																
Antimony	0.0004	0.0004	0.0006	<0.0002	0.0003	0.0003	0.0003	<0.0002	0.0005	0.0005	0.0006	0.0004	0.0003	0.0003	0.0004	<0.0002
Arsenic	0.0005	0.0005	0.0006	0.0003	0.0005	0.0006	0.0005	0.0004	0.0007	0.0006	0.0007	0.0007	0.0007	0.0004	0.0004	0.0003
Barium	0.0656	0.067	0.0658	0.0617	0.0891	0.0937	0.0875	0.0873	0.0833	0.0813	0.0768	0.0861	0.0664	0.0709	0.0717	0.0691
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	0.0016	0.0013	0.001	0.0008	0.0011	0.0011	0.001	0.0008	0.0018	0.0014	0.0011	0.0007	0.0023	0.0022	0.0021	0.002
Chromium	0.0006	0.0008	0.0008	<0.0003	0.0004	<0.0003	<0.0003	<0.0003	0.0016	0.0029	0.0014	0.0009	0.0013	0.0004	0.0004	<0.0003
Cobalt	0.0007	0.0007	0.0011	0.0007	0.0093	0.0106	0.0088	0.008	0.0016	0.0012	0.0008	0.0006	0.0024	0.0028	0.006	0.0041
Fluoride	0.20	0.26	0.26	0.27	0.13	0.15	0.14	0.14	0.14	0.13	0.13	0.12	0.29	0.33	0.33	0.34
Lead	<0.0002	0.0004	0.0003	<0.0002	<0.0002	0.0003	<0.0002	<0.0002	0.0004	<0.0002	<0.0002	<0.0002	0.001	0.0007	0.0005	0.0004
Lithium	0.0239	0.0289	0.0278	0.0219	0.0318	0.0306	0.0293	0.0317	0.0711	0.0806	0.0797	0.0844	0.0175	0.0165	0.0169	0.0178
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Molybdenum	0.208	0.22	0.212	0.15	0.0299	0.0312	0.0292	0.0281	0.315	0.32	0.333	0.354	0.0972	0.0911	0.0847	0.0847
Selenium	0.0055	0.0054	0.0075	0.0071	<0.0009	<0.0009	<0.0009	<0.0009	0.0338	**0.0596**	**0.0506**	0.0462	<0.0009	<0.0009	<0.0009	<0.0009
Thallium	0.0004	<0.0002	0.0003	0.0004	0.0003	<0.0002	<0.0002	0.0003	0.0004	<0.0002	0.0003	0.0004	0.0004	0.0003	0.0003	0.0003
Radium 226/228	0.68	0.392	2.45	-0.05	0.41	0.388	0.64	0.44	0.91	0	1.22	0.75	1.09	0.706	1.27	0.37
Groundwater Elevation	448.75	447.33	448.25	450.05	448.78	447.23	448.05	450.12	448.84	447.32	448.22	450.13	448.85	447.62	448.37	450.07

[O: KLT 7/11/16, C: ANS 7/12/16, U: ANS 8/8/16, C: KLT 8/8/16, U: ANS 10/6/16, C: KJS 10/7/16, U: Y_Z 11/3/16, C: DLB 11/9/16]

Notes:
All parameters collected and measured as totals

NS	no USEPA MCL established for parameter
pCi/L	pico Curies per Liter
S.U.	Standard Units
TDS	Total Dissolved Solids
Red Value	Parameter concentration exceeds USEPA MCL
<	Below reporting limit for parameter
- - - -	not sampled

Groundwater level data as collected on December 8, 2015 for R1,
March 8, 2016 for R2, June 7, 2016 for R3, and August 31, 2016 for R4

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Appendix D

Groundwater Sampling Protocol

Groundwater Sampling Protocol

The following procedures shall be used in sampling groundwater at the site. This sampling protocol shall apply to the routine quarterly (or modified semi-annual or annual) sampling events. A sample collector's worksheet, comparable to the one located in Exhibit 1, may be used for noting relevant information in regard to each well.

Water Levels

Water levels shall be taken in each well prior to purging and/or sampling. Water levels should be taken as close together as practical, to prevent any time distortion of the water surface data. The following steps shall be followed to obtain accurate water level readings:

1. Note the general condition of the monitoring well on the worksheet. This shall include, but is not limited to the condition of the casing, the lock, evidence of tampering, condition of the pad, and any standing water.
2. Remove the lock and open the monitoring well. Note the condition of the interior of the casing and the condition of the well cap and riser. Open the cap, taking care not to allow dirt or foreign material into the monitoring well.
3. The technician shall rinse the probe and cable of the water level meter with decon water.
4. Slowly lower the probe into the monitoring well until the meter indicates the water surface has been reached.
5. Note the depth to water (to the nearest 0.01 ft) and the time on the worksheet.
6. Lower the probe to the bottom of well. (If a dedicated pump is installed in the well, skip this step). Note the well depth on the worksheet. The depth of the well will be measured on an annual basis, at wells that do not contain dedicated pumps. The depth of wells with dedicated pumps will be measured at least once every 5 years, or whenever the pump is removed.
7. Slowly remove the probe from the well. Rinse the probe and line with decon water.
8. Replace cap. Close and lock the well. Proceed to the next well, and repeat.

Purging of Monitoring Well – Pump Method

After all water level measurements have been taken, the monitoring wells shall be purged to provide a representative sample. Each groundwater monitoring well shall be purged by using a dedicated pump. The pump construction shall consist of inert materials consistent with the monitoring well construction (e.g., stainless steel pump bodies installed in stainless steel wells).

Purging shall be conducted utilizing a "low-flow" or minimal drawdown technique. Flow rates for this technique will typically fall below 0.5 liters/minutes, with an overall goal of not reducing the water level in the monitoring well by more than 0.3 ft during purging. Water levels should be checked frequently to ensure that the drawdown in the well does not exceed the 0.3-ft limits. Every 3 minutes to 5 minutes, readings shall be taken on the following water quality indicators to determine if a representative water sample is available.

- pH (in SU),
- Specific Conductance (in µmhos/cm or µS/cm),
- Temperature (in ºF),
- And, it is suggested, at least one of the following:
  - Redox Potential (in mV);
  - Dissolved Oxygen (in mg/L); and/or
  - Turbidity (in NTU).

The water quality indicators will be considered stabilized when the following tolerances are reached after three consecutive readings:

- pH.................................... ±0.05 SU
- Specific Conductance ...... ±5 percent
- Temperature..................... ±0.5ºF
- Redox Potential .... ±10 percent
- Dissolved Oxygen........... ±10 percent
- Turbidity.......................... ±10 percent

Slow recovering wells require special consideration. If a well is dry, or is purged below the bottom of the pump intake, the well will be allowed to recharge for at least 12 hours. Samples shall be collected until all sample containers have been filled or the well becomes dry. Notes shall be kept on the worksheet with regard to water levels, times, volume of water removed, and any other parameters considered to be relevant.

Purging of Monitoring Well – Bailer Method

Purging and sample collection with a bailer shall be performed in the event of a non-functioning pump or from a well that does not have a dedicated pump installed. A sample shall be collected utilizing a factory packaged, clean, disposable bailer with an appropriate length of new, clean rope attached.

Calculate the number of bailer volumes of water needed to remove one (1) well volume of water.

Well Volume Calculations (2-inch well):

Schedule 40 PVC has an inside diameter of 2.067 inches.

$\therefore$ ((2.067 inches/12 inches/ft)/2)^2 • π • 1 ft of water = 0.0233 ft^3/ft of water.

0.0233 ft^3/ft • 7.48 gallons/ft^3 = 0.174 gallon/ft

Schedule 5 Stainless Steel (304 or 316) has an inside diameter of 2.245 inches.

$\therefore$ ((2.245 inches/12 inches/ft)/2)^2 • π • 1 ft of water = 0.0275 ft^3/ft of water.

0.0275 ft^3/ft • 7.48 gallons/ft^3 = 0.206 gallon/ft

Volume of well (in gallons) = well type gallon/ft • (DTB - DTW); where,
DTB $\equiv$ depth to bottom of well (from measuring point), and
DTW $\equiv$ depth to water (from measuring point)

Bailer Volumes:

Disposable bailer volumes will vary by type and manufacturer. Volume information should be obtained before going to the site. For comparison, a 3 ft stainless steel bailer has a volume of approximately 1220 cc or 0.322 gallon and a 5 ft PVC bailer of approximately 1085 cc or 0.287 gallon.

Open monitoring well, being careful that no potential contaminant enters the well.

Remove one (1) bailer volume of water from the monitoring well. Test pH, specific conductance and temperature. Note values on worksheet. (Turbidity, redox potential and dissolved oxygen will vary considerably due to the agitation a bailer will cause in the well. Testing for these parameters is not recommended with this method.)

Remove one-half (½) gallon of water from the monitoring well. Test pH, specific conductance and temperature. Note values on worksheet.

Remove ½ to 1 gallon of water. Test pH, specific conductance and temperature. Record data on worksheet.

Repeat until pH, specific conductance and temperature stabilize or three (3) well volumes of water have been removed.

If the monitoring well becomes dry, or there is insufficient water to obtain all necessary samples, the monitoring well will be allowed to recharge for 24 hours. Samples shall be collected until all sample containers are filled or the well becomes dry. Notes shall be kept on the worksheet regarding water levels, times, volume of water removed, and any other parameters considered by the technician to be relevant.

If there is sufficient water volume in the monitoring well to obtain all samples, sample collection shall begin at this time.

Sample Collection Order

Samples shall be collected starting at the monitoring well with the least likelihood for contamination. Sampling shall proceed from the well with the lowest potential for contamination to the well with the highest potential for contamination.

Field Measurements

General

Upon arrival at each groundwater monitoring well, the technician shall note on the sampler's worksheet or in a field notebook the date, time, ambient air temperature, general weather conditions, and individuals present, including sample team members and any observers. (Note: Any observers shall need at a minimum, the same personal protective gear as the members of the sample team.)

Establish a "clean area" near the monitoring well where the sample containers and equipment can be stored while not in use. Every effort should be made to keep the sampling equipment and containers from contacting the ground surface. If necessary, a disposable, plastic tarp can be used as a ground cover to prevent potential contamination of the sample containers and equipment. Typically, the back of the field vehicle will be used as the "clean area".

Any non-dedicated sampling equipment (meter probes, thermometers, etc.) shall be washed in a commercial, laboratory cleaner (Alconox®, Liquinox®, or equivalent), and thoroughly rinsed in decon water before each use. Calibration shall be performed at each new monitoring location after the initial decontamination. After use, each device shall be powered down (if necessary) decontaminated, and stored in its manufacturer-approved container.

Temperature

Obtain a water sample from the well. Place the sample aliquot in a disposable container, insert the thermometer (or electronic probe), wait until the readings have stabilized, and record the temperature on the worksheet. Temperature for a glass thermometer should be noted to the nearest degree Fahrenheit (1ºF). For electronic thermometers (thermocouples), temperature should be noted to the nearest tenth degree Fahrenheit (0.1ºF). The thermometer or probe shall be cleaned and rinsed with decon water after use.

pH

Confirm calibration of the instrument by comparing with an appropriate buffer solution. Adjust for temperature compensation (if meter is not self-compensating). Rinse probe with decon water. Obtain a sample from the well and place the probe in sample aliquot. Note the pH and record on the sample worksheet. Note pH readings to the nearest tenth unit (0.1).

Specific Conductance

Confirm calibration of the instrument by comparing against an appropriate buffer solution. Adjust for temperature compensation (if meter is not self-compensating). Rinse the probe with decon water. Obtain a sample from the well and place the probe in sample aliquot. Note the specific conductance and record on the sample worksheet. Specific conductance should be noted to the nearest micromhos per centimeter (µmhos/cm) or microSiemens per centimeter (µS/cm).

Sample Collection Procedures

Jars and vials may ship pre-labeled from the laboratory, identifying the analysis and preservative for each type of sample. Dependent upon circumstances, sample containers may be prepared by non-laboratory personnel. If so, this should be noted on the sample worksheet or in the field notebook.

A technician shall remove a sample container from the cooler, affix a label, and in indelible, waterproof ink write the well number and/or sample I.D., the facility name, the sample collection date and time, the type of sample in the container, and the sample collector's name. A technician shall organize the containers in the following sampling order:

- Filtered, non-preserved samples (sulfate, TDS, fluoride, chloride, etc.)
- Filtered, preserved samples (combined Radium 226/228 and metals)
- Non-filtered, non-preserved samples (sulfate, TDS, fluoride, chloride, etc.)
- Non-filtered, preserved samples Cyanides (combined Radium 226/228 and metals)

Dissolved parameters include dissolved metals and minerals, total dissolved solids (TDS), and nitrogen should be field filtered. Samples should be filtered using a 0.45-micron filter attached to the sample pump line. Other filter apparatus may be utilized as long as Illinois EPA guidelines are followed. Filters should be replaced no less frequently than at each new well, and may need to be replaced more often if flow is restricted due to particulate matter in the sample water.

Transportation of Monitoring Samples

<u>*Sample Preservation Techniques*</u>

The preservation techniques utilized in the groundwater samples will typically adhere to those listed in *Handbook for Sampling and Sample Preservation of Water and Wastewater*, U.S. EPA, EPA-600/4-82-029, September 1982 and/or *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods*, EPA/530/SW-846, $3^{rd.}$ Edition, Final Update IV (January 2008).

<u>*Transportation of Samples*</u>

Samples shall be transported to the laboratory in sealed, insulated shipping containers, ice chests, or coolers. The shipping containers should be sturdy, and if samples are contained in glass bottles, dividers and/or bubble wrap should be used to restrict potential breakage. All samples will be packed in ice or a packaged refrigerant as necessary for proper preservation. Samples should be packed to maintain sample temperatures as close to 4ºC (degrees Celsius) or 39ºF as possible from the time the samples are collected to the time the samples are received by the laboratory. The samples should be shipped/delivered to the laboratory as soon as practical, preferably within 24 hours of sample collection.

All samples shall be accompanied by a chain-of-custody record. The sampler shall retain a copy of the record and forward the original with the samples to the analytical laboratory. Once the laboratory has received the samples, a representative from the laboratory is to complete the record, retain the original and return a copy with the chemical analysis reports to the sampler. The chain-of-custody shall contain the facility name, the wells sampled, time and date of sampling, members of the sampling party, type of samples (i.e. water, soil, leachate, etc.), number of sample bottles, requested analysis, overnight courier, etc. A sample chain-of-custody record is provided in Exhibit 2.

Attachments
Exhibit 1: Groundwater Sampling Worksheet
Exhibit 2: Example Chain-of-Custody Record

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Part of Ramboll

ATTACHMENT J

Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 I.A. C. Section 845.430 – Slope Maintenance Documentation for Ash Ponds No. 2 & No. 4 at Hennepin Power Plant

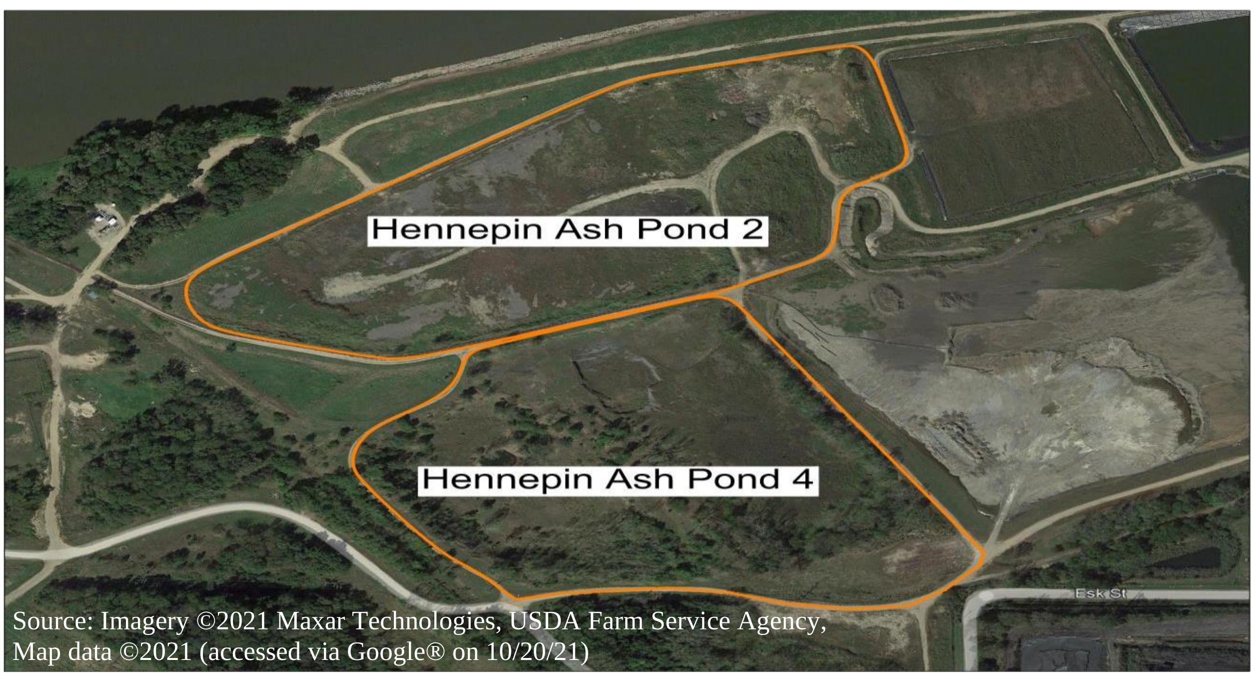
Dynegy Midwest Generation, LLC (DMG) operates the coal-fired Hennepin Power Plant located in Putnam County, Illinois. The Ash Ponds No. 2 & No. 4 are closed inactive surface impoundments storing coal combustion residuals (CCR). The requirements for the Ash Ponds No. 2 & No. 4 are found in 35 Ill. Admin. Code Part 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

Pursuant to Part 845, Section 845.230(d)(3)(C), the initial operating permit application for inactive closed CCR surface impoundments that have 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 Hennepin Ash Ponds No. 2 & No. 4, 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.



Excerpt from the Hennepin AP 2&4 Operations and Maintenance Manual

1.0 MAINTENANCE

1.1 Vegetation

Dikes shall be maintained to protect the structural integrity of the disposal facility. Damaged and barren areas shall be repaired as soon as appropriate after being discovered. Damaged areas shall be filled with topsoil. Limed, fertilized, and seeded with appropriate vegetation. Trees and shrubs observed during periodic inspections shall be cut and removed from the dikes and discharge channel. This shall be done as frequently as is necessary to ensure that no tree reaches a size where the root structure would require removal and filling. Woody vegetation, shrubs, and trees shall be removed during the early stages of growth before reaching a three-inch diameter.

Low growing vegetation shall be planted and maintained to facilitate inspections.

1.2 Discharge Structure

The discharge structure shall be inspected periodically for significant corrosion, spalling, and cracking. Any defects discovered shall be promptly repaired.

1.3 Animal Damage and Repairs

Animal burrows discovered during inspections shall be promptly repaired by filling with grout.

1.4 Restriction of Unauthorized Vehicles

Facility approaches shall be posted with signs restricting unauthorized travel on the roadways and slopes.

1.5 Inspections/Remedial Measures

1.5.1 Weekly Inspections

Weekly inspections of the perimeter berms shall be conducted, looking for seepage and slumping, and unusual seepage at and/or blockage of the outfall structures in each cell. All findings shall be entered into the weekly inspection checklist, discussed in Section 4.0. Maintenance activities shall be initiated, if required. Refer to Section 4.0 for the recommended inspection checklist to be used for the weekly inspections.

1.5.2 Quarterly Inspections

Inspections shall be made quarterly by Station personnel to determine the general condition of the dam and embankments. During these inspections, embankment erosion, tree growth, and embankment seepage shall be monitored. Seepage shall be observed for change in quantity and coloration. Refer to Section 4.0, for the recommended inspection checklist to be used for documenting the quarterly inspections.

1.5.3 Five-Year Inspections

Every five years, an inspection shall be made by a licensed professional engineer. This inspection shall follow the Illinois Department of natural Resources (IDNR) *Guidelines and Forms for Inspection of Illinois Dams* and shall be followed by verbal and written reports by the consulting engineer. Based on the findings of the inspection, the Station Manager shall implement corrective action as required to promote dam safety. Procedures and methods for corrective action shall be performed in accordance with recommendations of the consulting engineer and as outlined above. Copies of the engineer's report, along with corrective action taken, shall be reported to the IDNR.

1.6 Annual Statement

An annual statement on forms furnished by IDNR, certifying compliance with this maintenance plan, shall be submitted to IDNR.

Dam Inspection Report

Name of Dam: Hennepin East Ash Pond — Dam ID No. IL 50363

Permit Number: DS2004119 — Class of Dam: III

Location: NE 1/4 Section 26 Township 33N Range 2W

Owner: Dynegy Midwest Generation (Name) — 815-339-9210 (Telephone Number (Day))

RR1, Box 200AA (Street) — 815-339-9215 (Telephone Number (Night))

Hennepin (City) — 61327 (Zip Code) — County: Putnam

Type of Dam: Earth embankment with geosynthetic-clay liner

Type of Spillway: Drop structure and stop logs

Date(s) Inspected: 11-Nov-20

Weather When Inspected: Pt. Cloudy

Temperature When Inspected: 38 F

Pool Elevation When Inspected: Primary 481.4, Secondary 479.5

Tailwater Elevation When Inspected: N.A.

LICENSED PROFESSIONAL ENGINEER
JAMES P. KNUTELSKI
062-054206
OF ILLINOIS

12/30/2020

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
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	MM	Minor erosion bench on west end adjacent to river. Minor erosion feature near crest adjacent to river.	Add riprap to this area and other areas where flood on river was above riprap. Fill erosion feature, seed areas and monitor.
Upstream Face Slope Protection	NE		
Seepage	NE		
Filter and Filter Drains	NA		

EARTH EMBANKMENT
(Continued)

ITEM	CONDITION CODE	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE
Animal Damage	MM	North side animal burrow.	Fill and reseed animal damage.
Embankment Drainage Ditches	GC		
Vegetative Cover	GC	Woody vegetation in riprap at outlet structure in secondary pond.	Remove woody vegetation in riprap in secondary pond.
Riprap	NE		
Articulated blocks	MM	Loss of aggregate between articulated concrete blocks	Replace aggregate between blocks.
Other			
Other			

PRINCIPAL SPILLWAY

X Drop Inlet Spillway ☐ Overflow Spillway Structure ☐ Gated

ITEM	CONDITION CODE	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE
Erosion, Spalling, Cavitation	OB	Spalling at pedestrian bridge seat on Polishing Pond Riser	Condition has not deteriorated - observe this area and repair if condition deteriorates.
Structure to Embankment Junction	NI	Underwater	
Drains	NA		
Seepage Around or Into Structure	NI	Underwater	
Surface Cracks	NI	Underwater	
Structural Cracks	NI	Underwater	

IF THE SPILLWAY IS GATED FILL OUT THE GATES SECTION

PRINCIPAL SPILLWAY

(Continued)

☒ Drop Inlet Spillway ☐ Overflow Spillway Structure ☐ Gated

ITEM	CONDITION CODE	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE
Alignment of Abutment Walls	NA		
Construction Joints	NA		
Filter and Filter Drains	NA		
Trash Racks	NA		
Bridge and Piers	NE		
Differential Settlement	NE		
Other (Name)			

IF THE SPILLWAY IS GATED FILL OUT THE GATES SECTION

PRINCIPAL SPILLWAY

(Continued)

X Conduit ☐ Gated

ITEM	CONDITION CODE	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE
Erosion, Spalling, Cavitation	NE		
Joint Separation	NI	Underwater	
Seepage Around of Into Conduit	NI	Underwater	
Surface Cracks	NI	Underwater	
Structural Cracks	NI	Underwater	
Trash Racks	NA		
Differential Settlement	NI	Underwater	
Alignment	NI	Underwater	
Other (Name)			

IF THE SPILLWAY IS GATED FILL OUT THE GATES SECTION

PRINCIPAL SPILLWAY

X Principal Spillway ☐ Dewatering ☐ Other: ______________________

ITEM	CONDITION CODE	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE
Gate Sill	NI	Underwater	
Gate Seals	NI	Underwater	
Gate and Frame (Stoplogs)	GC		
Operating Machinery	NA		
Emergency Operating Machinery	NA		
Outlet Flume	GC		
Outlet Discharge	GC		Note: Outlets to river backwater area.

SUMMARY OF MAINTENANCE DONE AND/OR

REPAIRS MADE SINCE THE LAST INSPECTION

DATE OF PRESENT INSPECTION	11-Nov-20
DATE OF LAST INSPECTION	6-Nov-19

1. EARTH EMBANKMENT DAMS
   Slopes and interior of closed pond regraded and reseeded.

2. CONCRETE MASONRY DAMS
   NA

3. PRINCIPAL SPILLWAY
   None

4. OUTLET WORKS
   None.

5. EMERGENCY SPILLWAY
   NA

North side exterior

North side exterior

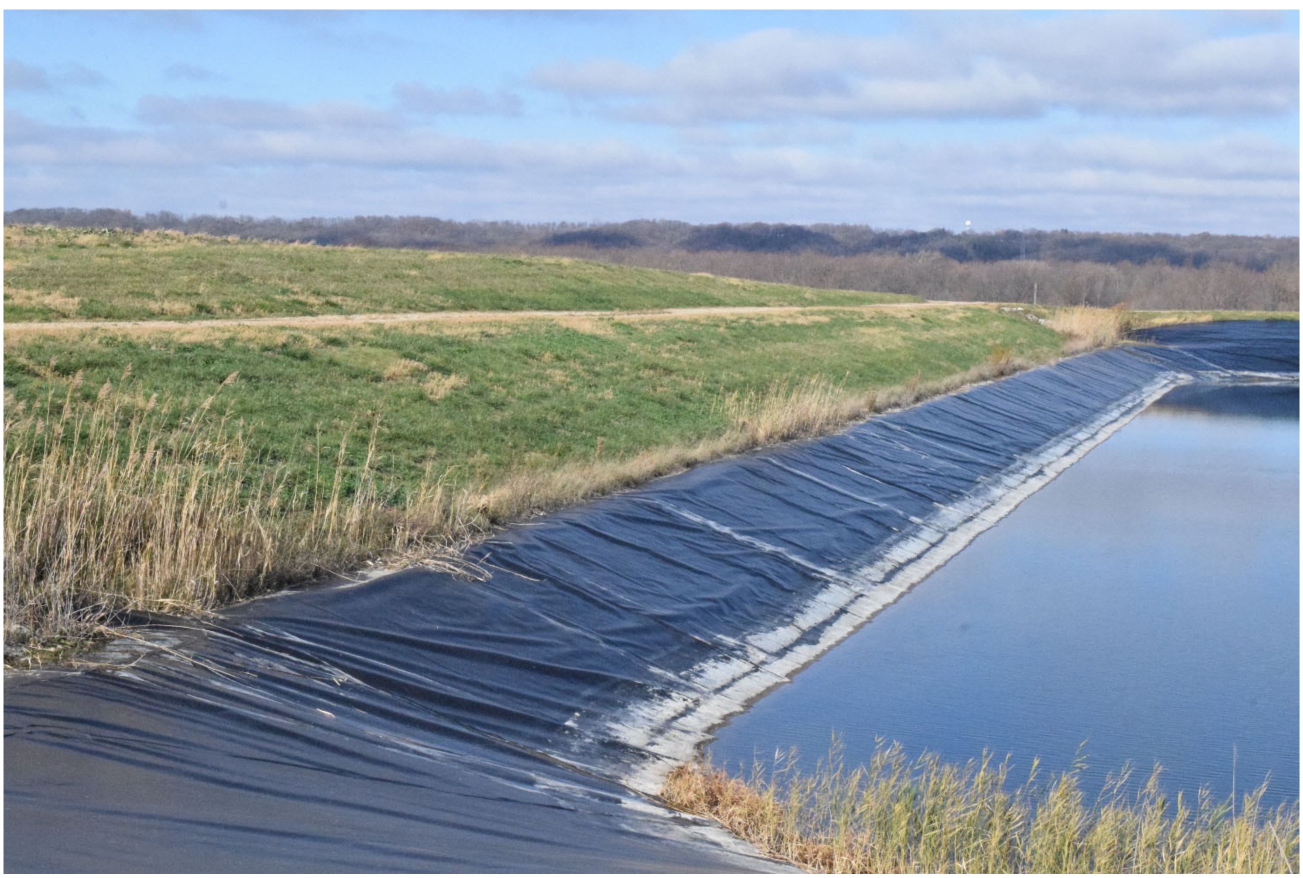
North side adjacent to river – repair erosion

North side adjacent to river

North side erosion feature – repair and reseed

North side let down structure - typical

East exterior slope



Old pond – new pond separator berm

New pond interior

Primary pond – secondary pond separator berm

Primary pond – secondary pond separator berm

South side new pond – aggregate missing – fill voids between blocks

Secondary pond outlet structure and bridge

Secondary pond and outlet structure to river – spray/remove vegetation in riprap

West side crest – west interior filled

West downstream slope – filled area

ATTACHMENT K

POST-CLOSURE PLAN FOR EXISTING CCR SURFACE IMPOUNDMENT
40 CFR § 257.104 and 35 I.A.C. 845.780
REV 0 – 10/30/2021

SITE INFORMATION			
Site Name / Address	Hennepin Power Plant / 13498 East 800th Street, Hennepin, IL 61327		
Owner Name / Address	Dynegy Midwest Generation, LLC / 6555 Sierra Drive Irving, Texas 75039		
CCR Unit	Ash Pond No. 2/4	Closure Method and Final Cover Type	Closed In-Place Clayey Soil with Vegetation

POST-CLOSURE PLAN DESCRIPTION	
40 CFR § 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 CFR § 257.104(c)(1) and 35 I.A.C. 845.780(c)(1), except as provided by 40 CFR § 257.104(c)(2) and 35 I.A.C. 845.780(c)(2).
40 CFR § 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 CFR § 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 CFR § 257.104(b) and 35 I.A.C. 845.780(b), and the frequency at which these activities will be performed, to maintain the integrity and effectiveness of the final cover system, maintain the groundwater monitoring system and monitor the groundwater.	Pursuant to § 257.104(b)(1) and 35 I.A.C. 845.780(b)(1), throughout the post-closure care period, periodic visual observations of the final cover system and stormwater management system will be performed at least annually for evidence of settlement, subsidence, erosion, or other damage that may adversely affect the integrity and effectiveness of the final cover system. When practical, visual observations of the final cover will be made concurrent with groundwater monitoring activities. Noted evidence of damage, such as rills, surface cracks and settlement, will be repaired to maintain the integrity and effectiveness of the final cover system. Vegetation will be established and maintained on the final cover system, including storm drainage areas, where appropriate, to provide long-term erosion control. Established vegetation and the slope design of the final cover system will prevent potential erosion and damage that may be caused by run-on and run-off. Repair activities may include, but are not limited to, replacing and compacting soil cover, repairing drainage channels that have been eroded, filling in depressions with soil, regrading, and reseeding areas of failed vegetation, as necessary. Pursuant to § 257.104(b)(3) and 35 I.A.C. 845.780(b)(3), the

	groundwater monitoring system will be maintained, and groundwater will be monitored as required by 40 CFR § 257.90 through 40 CFR § 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 CFR § 257.94(d) and 35 I.A.C. 845.650(b)(4).
40 CFR § 257.104(d)(1)(ii) and 35 I.A.C. 845.780(d)(1)(B) – The name, address, telephone number and email address of the person or office to contact about the facility during the post-closure care period.	Dynegy Midwest Generation, LLC 6555 Sierra Drive Irving, Texas 75039 800.633.4704 ccr@dynegy.com
40 CFR § 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 CFR 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 CFR § 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. This CCR unit is closed. 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 CFR § 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 CFR § 257.104(d)(1)(iii) and 35 I.A.C. 845.780(d)(1)(C) or groundwater monitoring requirements per 35 I.A.C. 845.740(b). Within 30 days of recording the deed notation, a notification stating that the notation has been recorded will be submitted to the IEPA and placed in the facility's operating record per 35 I.A.C. 845.760(h)(3). The notification will be placed on the owner or operator's publicly accessible CCR Web site in accordance with 40 CFR § 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 CFR § 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 Hennepin Ash Pond 2/4 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 CFR § 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 CFR § 257.104 (d)(4) and 35 I.A.C. 845.780(d)(4) – Amended/Initial Written Post Closure Plan for a CCR Surface Impoundment

CCR Unit: Dynegy Midwest Generation, LLC; Hennepin Power Plant; Ash Pond No.2/4

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 CFR § 257.104 and 35 I.A.C. 845.780.

John R. Hesemann

Printed Name

9/29/2021

Date

JOHN ROBERT HESEMANN
062-058523
LICENSED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

Exp.: 11/30/2021

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)(3)(G) for the Hennepin Power Plant Ash Pond No. 2 and Ash Pond No. 4, Illinois Environmental Protection Agency (IEPA) ID Nos. W1550100002-04 and W1550100002-07.

Note

Groundwater concentrations observed from 2015 to 2021 in monitoring wells included in an existing groundwater monitoring program for this specific CCR multi-unit have been evaluated and summarized in the following tables. These concentrations 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 07, 08, and 08D.

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.

Corrective Action

A Corrective Measures Assessment (CMA) was completed to address statistically significant levels of total lithium and total molybdenum, as required by 40 C.F.R. § 257.96. The CMA indicated the source control measure consists of closure in place with a final cover system of earthen material in accordance with the Closure and Post Closure Care Plan submitted to the IEPA in February 2018 with final revisions submitted in January 2020. IEPA approved the Closure and Post Closure Care Plan on February 26, 2020. Closure construction began in May 2020 and was completed in November 2020.

Activities completed associated with the selection of a groundwater remedy include review of existing groundwater and source water data, and collection of additional samples to support analysis of natural attenuation mechanisms, rates, and aquifer capacity. Preliminary results indicate that site-specific conditions are favorable for implementation of monitored natural attenuation (MNA) in combination with the recently completed closure referenced above.

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
HENNEPIN POWER PLANT
ASH POND NO. 2 AND ASH POND NO. 4
HENNEPIN, ILLINOIS

Sample Location	HSU	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
03R	UA	Antimony, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
03R	UA	Arsenic, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.001	0.010	0.001	0.01	Standard
03R	UA	Barium, total	mg/L	12/09/2015 - 06/25/2021	CI around mean	0.061	2.0	0.21	2	Standard
03R	UA	Beryllium, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
03R	UA	Boron, total	mg/L	12/09/2015 - 06/25/2021	CI around mean	1.1	2.0	0.15	2	Standard
03R	UA	Cadmium,total	mg/L	12/09/2015 - 06/25/2021	CI around median	0.001	0.005	0.0023	0.005	Standard
03R	UA	Chloride, total	mg/L	12/09/2015 - 06/25/2021	CI around mean	68	396	396	200	Background
03R	UA	Chromium, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	0.00132	0.10	0.001	0.1	Standard
03R	UA	Cobalt, total	mg/L	12/09/2015 - 06/25/2021	Future median	0.001	0.038	0.038	0.006	Background
03R	UA	Fluoride, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	0.28	4.0	0.12	4	Standard
03R	UA	Lead, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.001	0.0075	0.0015	0.0075	Standard
03R	UA	Lithium, total	mg/L	12/09/2015 - 06/25/2021	CI around mean	0.026	0.040	0.019	0.04	Standard
03R	UA	Mercury, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
03R	UA	Molybdenum, total	mg/L	12/09/2015 - 06/25/2021	CI around mean	0.17	0.10	0.0017	0.1	Standard
03R	UA	pH (field)	SU	03/18/2015 - 06/25/2021	CI around mean	7.2	6.5/9.0	6.6/7.5	6.5/9	Standard/Standard
03R	UA	Radium-226 + Radium 228, tot	pCi/L	12/09/2015 - 03/18/2021	CI around geomean	0.30	5.0	1.5	5	Standard
03R	UA	Selenium, total	mg/L	12/09/2015 - 06/25/2021	CI around mean	0.00514	0.050	0.0014	0.05	Standard
03R	UA	Sulfate, total	mg/L	12/09/2015 - 06/25/2021	CI around mean	91	400	200	400	Standard
03R	UA	Thallium, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.002	0.002	0.001	0.002	Standard
03R	UA	Total Dissolved Solids	mg/L	12/09/2015 - 06/25/2021	CI around mean	504	1520	1520	1200	Background
18S	UA	Antimony, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
18S	UA	Arsenic, total	mg/L	12/09/2015 - 06/25/2021	CI around median	0.001	0.010	0.001	0.01	Standard
18S	UA	Barium, total	mg/L	12/09/2015 - 06/25/2021	CI around mean	0.063	2.0	0.21	2	Standard
18S	UA	Beryllium, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
18S	UA	Boron, total	mg/L	12/09/2015 - 06/25/2021	CI around geomean	3.5	2.0	0.15	2	Standard
18S	UA	Cadmium,total	mg/L	12/09/2015 - 06/25/2021	CB around T-S line	0.000301	0.005	0.0023	0.005	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
HENNEPIN POWER PLANT
ASH POND NO. 2 AND ASH POND NO. 4
HENNEPIN, ILLINOIS

Sample Location	HSU	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
18S	UA	Chloride, total	mg/L	12/09/2015 - 06/25/2021	CI around mean	61	396	396	200	Background
18S	UA	Chromium, total	mg/L	12/09/2015 - 06/25/2021	CI around median	0.0015	0.10	0.001	0.1	Standard
18S	UA	Cobalt, total	mg/L	12/09/2015 - 06/25/2021	Future median	0.001	0.038	0.038	0.006	Background
18S	UA	Fluoride, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	0.15	4.0	0.12	4	Standard
18S	UA	Lead, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.001	0.0075	0.0015	0.0075	Standard
18S	UA	Lithium, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	0.046	0.040	0.019	0.04	Standard
18S	UA	Mercury, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
18S	UA	Molybdenum, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	0.13	0.10	0.0017	0.1	Standard
18S	UA	pH (field)	SU	03/18/2015 - 06/25/2021	CI around median	7.3	6.5/9.0	6.6/7.5	6.5/9	Standard/Standard
18S	UA	Radium-226 + Radium 228, tot	pCi/L	12/09/2015 - 03/18/2021	CI around mean	0.20	5.0	1.5	5	Standard
18S	UA	Selenium, total	mg/L	12/09/2015 - 06/25/2021	CI around geomean	0.031	0.050	0.0014	0.05	Standard
18S	UA	Sulfate, total	mg/L	12/09/2015 - 06/25/2021	CI around geomean	142	400	200	400	Standard
18S	UA	Thallium, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.002	0.002	0.001	0.002	Standard
18S	UA	Total Dissolved Solids	mg/L	12/09/2015 - 06/25/2021	CI around mean	575	1520	1520	1200	Background
18D	UA	Antimony, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
18D	UA	Arsenic, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.001	0.010	0.001	0.01	Standard
18D	UA	Barium, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	0.068	2.0	0.21	2	Standard
18D	UA	Beryllium, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
18D	UA	Boron, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	1.5	2.0	0.15	2	Standard
18D	UA	Cadmium,total	mg/L	12/09/2015 - 06/25/2021	CI around median	0.001	0.005	0.0023	0.005	Standard
18D	UA	Chloride, total	mg/L	12/09/2015 - 06/25/2021	CI around mean	74	396	396	200	Background
18D	UA	Chromium, total	mg/L	12/09/2015 - 06/25/2021	CB around T-S line	0.001	0.10	0.001	0.1	Standard
18D	UA	Cobalt, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	0.00132	0.038	0.038	0.006	Background
18D	UA	Fluoride, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	0.16	4.0	0.12	4	Standard
18D	UA	Lead, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.001	0.0075	0.0015	0.0075	Standard
18D	UA	Lithium, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	0.025	0.040	0.019	0.04	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
HENNEPIN POWER PLANT
ASH POND NO. 2 AND ASH POND NO. 4
HENNEPIN, ILLINOIS

Sample Location	HSU	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
18D	UA	Mercury, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
18D	UA	Molybdenum, total	mg/L	12/09/2015 - 06/25/2021	CI around mean	0.031	0.10	0.0017	0.1	Standard
18D	UA	pH (field)	SU	03/18/2015 - 06/25/2021	CI around median	7.2	6.5/9.0	6.6/7.5	6.5/9	Standard/Standard
18D	UA	Radium-226 + Radium 228, tot	pCi/L	12/09/2015 - 03/18/2021	CI around geomean	0.28	5.0	1.5	5	Standard
18D	UA	Selenium, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.001	0.050	0.0014	0.05	Standard
18D	UA	Sulfate, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	90	400	200	400	Standard
18D	UA	Thallium, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.002	0.002	0.001	0.002	Standard
18D	UA	Total Dissolved Solids	mg/L	12/09/2015 - 06/25/2021	CB around T-S line	465	1520	1520	1200	Background
45S	UA	Antimony, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
45S	UA	Arsenic, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.001	0.010	0.001	0.01	Standard
45S	UA	Barium, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	0.074	2.0	0.21	2	Standard
45S	UA	Beryllium, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
45S	UA	Boron, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	0.23	2.0	0.15	2	Standard
45S	UA	Cadmium,total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	0.000295	0.005	0.0023	0.005	Standard
45S	UA	Chloride, total	mg/L	12/09/2015 - 06/25/2021	CI around mean	72	396	396	200	Background
45S	UA	Chromium, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	0.00138	0.10	0.001	0.1	Standard
45S	UA	Cobalt, total	mg/L	12/09/2015 - 06/25/2021	Future median	0.002	0.038	0.038	0.006	Background
45S	UA	Fluoride, total	mg/L	12/09/2015 - 06/25/2021	CI around mean	0.31	4.0	0.12	4	Standard
45S	UA	Lead, total	mg/L	12/09/2015 - 06/25/2021	Most recent sample	0.001	0.0075	0.0015	0.0075	Standard
45S	UA	Lithium, total	mg/L	12/09/2015 - 06/25/2021	CI around mean	0.015	0.040	0.019	0.04	Standard
45S	UA	Mercury, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
45S	UA	Molybdenum, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	0.048	0.10	0.0017	0.1	Standard
45S	UA	pH (field)	SU	12/09/2015 - 06/25/2021	CI around mean	7.1	6.5/9.0	6.6/7.5	6.5/9	Standard/Standard
45S	UA	Radium-226 + Radium 228, tot	pCi/L	12/09/2015 - 03/18/2021	CI around mean	0.44	5.0	1.5	5	Standard
45S	UA	Selenium, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.001	0.050	0.0014	0.05	Standard
45S	UA	Sulfate, total	mg/L	12/09/2015 - 06/25/2021	CI around median	69	400	200	400	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
HENNEPIN POWER PLANT
ASH POND NO. 2 AND ASH POND NO. 4
HENNEPIN, ILLINOIS

Sample Location	HSU	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
45S	UA	Thallium, total	mg/L	12/09/2015 - 06/25/2021	All ND - Last	0.002	0.002	0.001	0.002	Standard
45S	UA	Total Dissolved Solids	mg/L	12/09/2015 - 06/25/2021	CI around mean	515	1520	1520	1200	Background

Notes:
Potential exceedance of GWPS
HSU = hydrostratigraphic unit:
UA = Uppermost Aquifer
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
CB around T-S line = Confidence band around Thiel-Sen line
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
HENNEPIN POWER PLANT
ASH POND NO. 2 AND ASH POND NO. 4
HENNEPIN, ILLINOIS

Sample Location	HSU	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
03R	UA	Molybdenum, total	mg/L	12/09/2015 - 06/25/2021	CI around mean	0.17	0.10	0.0017	0.1	Standard
18S	UA	Boron, total	mg/L	12/09/2015 - 06/25/2021	CI around geomean	3.5	2.0	0.15	2	Standard
18S	UA	Lithium, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	0.046	0.040	0.019	0.04	Standard
18S	UA	Molybdenum, total	mg/L	12/09/2015 - 06/25/2021	CB around linear reg	0.13	0.10	0.0017	0.1	Standard

Notes:
HSU = hydrostratigraphic unit:
UA = Uppermost Aquifer
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:
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
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, Dynegy Midwest Generation, LLC provided financial assurance in the form of performance bonds to the Illinois Environmental Protection Agency in the amount of $ 9,382,670 for the West Ash Pond System, East Ash Pond 2, East New Primary Pond, and East Pond 4 at the Hennepin Power Plant.[1]

I, Matthew A. Goering, Senior Vice President of Dynegy Midwest Generation, 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.

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Matthew A. Goering
Senior Vice President
Dynegy Midwest Generation, LLC

[1] In the operating permit applications, the West Ash Pond System is referred to as the Old West Ash Pond (Pond No. 1 and No. 3) and Old West Polishing Pond, the East Ash Pond 2 and East Pond 4 are referred to as Ash Ponds 2 & 4, and the East New Primary Pond is referred to as the East Ash Pond.

October 2021